TECHNICAL SPECIFICATIONS AND DRAWINGS

FOR

KUMC Cambridge Garage Topping Repairs

Kansas City, KS

KUMC Project #17048
A-013332
KIDS # WY24K1X20

WALTER P MOORE PROJECT NUMBER D08.17003.00
100% CD – For Owner Review
June 30, 2017
TECHNICAL SPECIFICATIONS AND DRAWINGS

FOR

KUMC Cambridge Garage Topping Repairs
Kansas City, KS

WALTER P. MOORE AND ASSOCIATES, INC.

920 Main Street, 10th Floor
Kansas City, MO 64105
816-701-2100

WPM PROJECT NUMBER: D08.17003.00
PROJECT:

KUMC Cambridge Garage Topping Repairs

WPM PROJECT NUMBER:

Walter P Moore Project No. D08.17003.00

ENGINEER:

Walter P. Moore and Associates, Inc.
920 Main Street, 10th Floor
Kansas City, MO
Fax: 816-701-2200

Project Manager / Engineer of Record
David T. Ford, PE, RRC, RWC, LEED AP
Walter P. Moore and Associates, Inc.
816-701-2100

END OF SECTION 000105
I HEREBY CERTIFY THAT THESE PLANS AND TECHNICAL SPECIFICATIONS WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF KANSAS.

DRAWING SHEETS:

S0.0, S0.1, S0.2, S0.3, S0.4
D1.0, D1.1, D1.2, D1.3, D1.4, D1.5, D1.6, D1.7, D1.8, D1.9, D1.10, D1.11, D1.12, D1.13
S1.0, S1.1, S1.2, S1.3, S1.4, S1.5, S1.6, S1.7, S1.8, S1.9, S1.10, S2.0, S2.1, S2.2, S3.0, S3.1, S3.2, S4.0, S4.1, S4.2, S4.3, S4.4, S4.5
R1.0, R1.1, R1.2, R1.3, R1.4, R1.5, R1.6, R1.7, R1.8, R1.9, R1.10, R1.11, R1.12, R1.13, R1.14, R1.15, R1.16, R1.17

SPECIFICATIONS:

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000107 – Seals Page
000110 – Table of Contents
001153 – Contractor’s Qualifications
004143 – Bid Form

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011100 – Summary of Work
012513 – Project Substitutions Procedures
012900 – Payment Procedures
013100 – Project Management and Coordination
013300 – Submittal Procedures
014500 – Quality Control
014529 – Structural Testing and Inspections
017329 – Cutting and Patching
017423 – Final Cleaning
017700 – Closeout Procedures
017836 – Product Warranties
017839 – Project Record Documents

DIVISION 02 – SELECTIVE DEMOLITION

020700 – Selective Demolition

DIVISION 03 – CONCRETE

030101 – Surface Preparation for Patching
030105 – Concrete Repair Materials
030190 – Embedded Galvanic Anodes
031000 – Concrete Forming and Accessories
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033000 – Cast-in-Place Concrete
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DIVISION 05 – METALS

050110 – Steel Field Re-Coating

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

071800 – Traffic Coatings
071916 – Concrete Penetrating Sealers
079200 – Joint Sealants
079513 – Expansion Joints

DIVISION 08 – OPENINGS

081113 – Hollow Metal Doors and Frames

Division 09 – FINISHES

099653 – Elastomeric Coating
099600 – High-Performance Coatings

END OF SECTION 000107
SECTION 000107
SEALS PAGE

I HEREBY CERTIFY THAT THESE PLANS AND TECHNICAL SPECIFICATIONS WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF KANSAS.

DRAWING SHEETS:

   E0.0, E0.1, E1.1, E1.2, E1.3, E1.4, E2.0.

SPECIFICATIONS:

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   260519 - Low-Voltage Electrical Power
   260526 - Grounding and Bonding for Electrical Systems
   260529 - Hangers and Supports for Electrical Systems
   260533 - Raceways and Boxes for Electrical Systems
   260544 - Sleeves and Sleeve Seals
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Craig Keith Brewster, P.E.

END OF SECTION 000107
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END OF SECTION 000110
SECTION 001116

INVITATION TO BID AND INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1. PROJECT IDENTIFICATION AND DEFINITIONS

A. Engineer will receive sealed Bids for: KUMC Cambridge Garage Topping Repairs

B. Owner is: University of Kansas Medical Center

C. Engineer is: Walter P. Moore and Associates, Inc.

920 Main Street, 10th Floor
Kansas City, MO 64105

D. Project consists of:

1. Project consists of providing all materials, labor, equipment, supervision, permits and services required to perform repairs in the KUMC Cambridge Parking Garage in accordance with the Contract Documents.

E. Pre-bid meeting:

F. Bids will be due on:

In the office of: Walter P. Moore and Associates. Attention: David T. Ford

1.2. DOCUMENTS

A. Contract between Owner and Contractor: Contract Documents listed in Agreement. Also see Section "Agreement Form."

B. Complete sets of Contract Documents may be obtained at office of Engineer. All sets shall remain property of Engineer and shall be returned upon request.

C. Complete sets of Bidding Documents shall be used in preparing Bids. Neither Owner nor Engineer assume any responsibility for errors or misinterpretations resulting from use of incomplete sets of Bidding Documents.

D. Owner and Engineer in making copies of Bidding Documents available on above terms do so only for purpose of obtaining Bids on Work and do not confer license or grant for any other use.

1.3. QUALIFICATIONS OF BIDDERS

A. Owner may make such investigation as it deems necessary to determine ability of Bidder to perform Work, and Bidder shall furnish to Owner all such information and data for this purpose.
as Owner may request. Owner reserves right to reject any Bid if evidence submitted by, or investigation of, such Bidder fails to satisfy Owner that such Bidder is properly qualified to carry out obligations of Contract and to complete Work contemplated therein. Conditional Bids and voluntary alternates will not be accepted.

B. Bidding firms will not be considered qualified if:

1. Firm, or principals thereof, have defaulted on any contract, bid or bond within preceding 36 months, or;
2. Firm has had no previous experience in performance of Work being bid, or;
3. Firm, as name entitled, has not been in operation in this type of Work for period of 24 months prior to this bid date, or;
4. Firm has not been awarded any prior contracts of similar amount and kind, or;
5. Firm, or principals thereof, have failed in faithful performance during warranty or guarantee period on previous Work.
6. Firm is found to have misstated or omitted any material fact in this prequalification statement.

C. Each Bidder may be called upon to provide Owner with following information:

1. Comprehensive financial statement showing current balance of unencumbered net worth equal to at least 10% of value of anticipated bid price.
2. Comprehensive list of personnel and equipment available for performance of Work to be bid.
3. Complete list of all contract work performed, or under construction if contract(s) awarded within previous 5 yr period prior to bidding.

1.4. EXAMINATION OF CONTRACT DOCUMENTS AND SITE

A. Bidders shall carefully examine contract documents and site to obtain first-hand knowledge of existing conditions. No subsequent extras will be allowed due to any claim of lack of knowledge for conditions which can be determined by examining site and contract documents.

B. Extent of repairs is approximately represented on Drawings. Actual locations and extent of repair may deviate from that represented on Drawings based on field conditions.

C. Submission of Bid shall constitute warranty that:

1. Bidder and all Subcontractors it intends to use have carefully and thoroughly reviewed Contract Documents and have found them complete and free from ambiguities and sufficient for purposes intended; further that,
2. Bidder and all workers, employees and Subcontractors it intends to use are skilled and experienced in type of construction represented by Contract Documents bid upon; further that,
3. Neither Bidder nor any of its employees, agents, suppliers or Subcontractors have relied on any verbal representations from Owner, Engineer, or any of their employees, agents, or consultant, in assembling Bid figure; and further that,
4. Bid figure is based solely on Contract Documents, including properly issued written addenda, and not upon any other written representation.

D. Bidder shall identify, prior to bid, all errors and/or discrepancies in Contract Documents that would be apparent to reasonably diligent Bidder. In no case shall Bidder, if selected as Contractor, be permitted any extra amount of time or money to complete project, or expenses incurred as result of such errors or discrepancies.
1.5. RESOLUTION OF DISCREPANCIES AND AMBIGUITIES

A. All questions about meaning or intent of Contract Documents shall be submitted to Engineer in writing. Address written inquiries to: David T. Ford, Project Manager, 920 Main Street, 10th Floor, Kansas City, MO 64105 Tel. 806-701-2100 Fax 816-701-2100

Replies will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received Contract Documents for Bidding. Questions received less than 5 days prior to date for opening of Bids will not be answered. Only answers contained in formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

B. Any Addendum issued during prebid period shall be included in Bid, shall become part of Contract Documents, and shall be acknowledged on Bid Form.

1.6. SUBSTITUTED MATERIAL AND EQUIPMENT

A. Contract, if awarded, will be on basis of material and equipment described in Drawings or specified in Specifications without consideration of possible substitute or "or-equal" items. Whenever it is indicated in Drawings or specified in the Specifications that substitute or "or-equal" item of material or equipment may be furnished or used by Contractor if acceptable to Engineer, application for such acceptance will not be considered by Engineer until after "effective date of Agreement."

1.7. BASIS FOR BIDS

A. Bids are based on lump sum contract at unit prices.

1.8. PREPARATION OF BIDS

A. Bid Form is bound herewith. Bid Forms must be completed in ink or by typewriter.

B. Bids must be made in form given in this Project Manual. No oral, telephonic or telegraphic Bids will be considered. Bids shall be signed by Bidder giving full name and business address. State whether Bidder is individual, partnership or corporation.

C. Each Bidder shall fill in all blanks on Bid Forms and quote on all alternates required. State all quotations in words and figures. In case of discrepancy between amount stated in words and amount stated in figures, amount stated in words shall govern. Entire Bid shall be without interlineation, alteration or erasure.

D. Bids by corporations shall be executed in corporate name by president, vice-president or other corporate officer (accompanied by evidence of authority to sign) and corporate seal shall be affixed and attested by secretary or assistant secretary. Corporate address and state of incorporation shall be shown below signature.

E. Bids by partnerships shall be executed in partnership name and signed by partner. Partner's title must appear under partner's signature and official address of partnership must be shown below signature.

F. Bids not signed by individuals making them shall have attached thereto power of attorney evidencing authority to sign Bid in name of person for whom it is signed.
G. All names must be typed or printed legibly below signature.

1.9. SUBCONTRACTOR LISTING

A. If Supplementary Conditions require identity of certain Subcontractors and other persons and organizations to be submitted to Owner in advance of Notice of Award, apparent successful Bidder, and any other Bidder so requested, shall within seven days after day of Bid opening submit to Owner list of all Subcontractors and other persons and organizations (including those who are to furnish principal items of material and equipment) proposed for those portions of Work as to which such identification is so required. Such list shall be accompanied by experience statement with pertinent information as to similar projects and other evidence of qualification for each such Subcontractor, person and organization if requested by Owner.

B. If Owner or Engineer after due investigation has reasonable objection to any proposed Subcontractor, other person or organization, either may request apparent Successful Bidder to submit acceptable substitute before giving Notice of Award. If apparent successful Bidder declines to make any such substitution, contract shall not be awarded to such Bidder, but Bidder's declining to make any such substitution will not constitute grounds for sacrificing its Bid Security. Any Subcontractor, other person or organization so listed and to whom Owner or Engineer does not make written objection prior to the giving of Notice of Award will be deemed acceptable to Owner and Engineer.

C. In contracts where Contract Price is on basis of Cost-of-the-Work Plus a Fee, apparent Successful Bidder, prior to Notice of Award, shall identify in writing to Owner those portions of Work that such Bidder proposes to subcontract and after Notice of Award may only subcontract other portions of Work with Owner's written consent.

D. No Contractor shall be required to employ any Subcontractor, other person or organization against whom it has reasonable objection.

1.10. IDENTIFICATION AND SUBMISSION OF BIDS

A. Bids shall be submitted in duplicate at time and place indicated in Invitation to Bid and shall be placed in opaque sealed envelope, marked with Project title, and name and address of Bidder, and accompanied by Bid Security and other required documents.

1.11. MODIFICATION OR WITHDRAWAL OF BIDS

A. Bids may be withdrawn by written or telegraphic request dispatched by Bidder in time for delivery, in normal course of business, prior to time fixed for opening of Bids, provided that written confirmation of any telegraphic withdrawal, over signature of Bidder, is placed in mail and postmarked prior to time set for opening Bids.

1.12. GOVERNING LAWS AND REGULATIONS

A. No Contractor shall discriminate against any employee or applicant for employment, to be employed in performance of contract, with respect to their hire, tenure, terms, conditions or privileges of employment, because of their race, color, religion, gender, national origin or age pursuant to requirements of all applicable federal and state statutes.
B. Each Bidder shall make affidavit that its Bid is genuine and not sham or collusive or made in interests or on behalf of any person not therein named and that Bidder has not directly or indirectly induced or solicited any Bidder to put in sham Bid or any other person or corporation to refrain from Bidding, and that Bidder has not in any manner sought by collusion to secure itself an advantage over other Bidders.

1.13. CONTRACT TIME
A. Time is of essence in performance of Work under this Contract. Please indicate time to complete this project in the Bid Form. Consideration will be given to time in evaluating Bids.

1.14. DISQUALIFICATION OF BIDDERS
A. Prior to opening of Bids Owner reserves right to conduct investigations into qualifications and experience of any or all persons or organizations wishing to submit Bid for Project.
B. Based upon findings of such investigations, Owner reserves right to deny any or all persons or organizations opportunity to submit Bid for Project.
C. In evaluating Bids after Bids are opened and prior to Award of Contract, Owner shall consider qualifications of Bidders, whether or not Bids comply with prescribed requirements, and alternates and unit prices if requested in Bid Forms.
D. Owner may consider qualifications and experience of Subcontractors and other persons and organizations (including those who are to furnish principal items of material or equipment) proposed for those portions of Work as to which identity of Subcontractors and other persons and organizations must be submitted as provided in Section "Supplementary Conditions." Operating costs, and maintenance considerations, performance data and guarantees of materials and equipment may also be considered by Owner.
E. Owner may conduct such investigations as it deems necessary to assist in evaluation of any Bid and to establish responsibility, qualifications and financial ability of Bidders, proposed Subcontractors and other persons and organizations to do Work in accordance with Contract Documents to Owner's satisfaction within prescribed time.
F. Owner reserves right to reject Bid of any Bidder who does not pass any such evaluation to Owner's satisfaction.
G. Owner reserves right to disqualify Bids before or after opening, upon evidence of collusion with intent to defraud or other illegal practices upon part of Bidder.

1.15. BIDS TO REMAIN OPEN
A. All Bids shall remain open for 21 days after Bid opening.

1.16. AWARD OF CONTRACT
A. Owner reserves right to reject any and all Bids, to waive any and all informalities and to negotiate contract terms with Successful Bidder, and right to disregard all nonconforming, nonresponsive or conditional Bids and to make award in any manner deemed in best interest of Owner.
Discrepancies between words and figures will be resolved in favor of words. Discrepancies between indicated sum of any column of figures and correct sum thereof will be resolved in favor of correct sum.

B. In evaluating Bids, Owner shall consider qualifications of Bidders, whether or not Bids comply with prescribed requirements, and alternates and unit prices if requested in Bid Forms.

C. It is Owner's intent to accept alternates (if any are accepted) in order in which they are listed in Bid Form but Owner may accept them in any order or combination.

D. If contract is to be awarded it will be awarded to Bidder whose evaluation by Owner indicates to Owner that award will be in best interests of Project.

E. If contract is to be awarded, Owner will give Successful Bidder Notice of Award within 60 days after day of Bid opening.

1.17. EXECUTION OF CONTRACT

A. When Owner gives Notice of Award to Successful Bidder, it will be accompanied by at least 3 unsigned counterparts of Agreement and all other Contract Documents. Within 15 days thereafter Contractor shall sign and deliver at least 3 counterparts of Agreement to Owner with all other Contract Documents attached. Within 10 days thereafter Owner will deliver all fully signed counterparts to Contractor. Engineer will identify those portions of Contract Documents not fully signed by Owner and Contractor and such identification shall be binding on all parties.

1.18. CONTRACT PRICE

A. Proposals are solicited on basis of unit prices and/or lump sum prices which are to be clearly set forth in Bid Form. Final Contract price on accepted Proposal will be determined by multiplying number, or fraction thereof, units of Work actually performed, or labor, material or appliances actually supplied, by price designated for such item in Proposal. Total Bid figure on Proposal Form is merely for purposes of estimating and comparing costs and under no circumstances on unit price contracts does it constitute or imply total Contract price.

END OF SECTION 001116
SECTION 001153

CONTRACTOR'S QUALIFICATION STATEMENT FOR STRUCTURAL RESTORATION WORK

This statement is required in advance of consideration of application to bid or as a qualification statement in advance of a restoration contract.

SUBMITTED TO: University of Kansas Medical Center
Attn: Nan Josephson
3901 Rainbow Blvd.
Kansas City, KS 66160

SUBMITTED BY: ____________________________________________

ADDRESS: ________________________________________________

PHONE: (___) ____________________________

CONTACT: ________________________________________________

___ Corporation
___ Partnership
___ Individual
___ Joint Venture
___ Other (Explain)

__________________________________________________________

__________________________________________________________
STRUCTURAL RESTORATION CONTRACTOR'S QUALIFICATION QUESTIONNAIRE

1. How many years has your organization been in business as a structural restoration contractor?
2. How many years has your organization been in business as a general contractor?
3. How many years has your organization been in business under its present business name?
4. List states in which your organization is legally qualified to do business.
5. What percentage of the work do you normally perform with your own work forces?
6. List on Table I the last five parking facility structural restoration projects your firm has completed.
7. A. List on Table II the last five concrete topping replacement projects your firm has completed.
   B. Does your firm have over 1,000,000 square feet of concrete topping replacement? (y/n) ________
8. List on Table III the structural restoration projects your organization has in progress at this time.
9. Have you ever failed to complete any work awarded to you? If so, attach a separate sheet of explanation.
10. Has any officer or partner of your organization ever been an officer or partner of another organization that failed to complete a construction contract? If so, attach a separate sheet of explanation.
11. List on Table IV the last five traffic coating installation projects your firm has completed.
12. List on Table V the construction experience of the principals and superintendents of your company.
13. What is your present bonding capacity? $______
14. Who is your bonding agent?
   NAME:__________________________________________________________
   ADDRESS:_____________________________________________________
   PHONE: (____) _________________________________________________
   CONTACT: _____________________________________________________
15. List on Table VI the equipment you own that is available for restoration work.
16. Are there any liens against the above? ________ If so, total amount $______
17. Attach your company's most recent audited Balance Sheet, prepared in accordance with generally accepted accounting principles.
   Date of Balance Sheet:_____________________________________________
   Name of firm Balance Sheet:________________________________________
   DATED AT ______ THIS _____ DAY OF ________, 20____.
Name of Organization: __________________________________________________________

By:  _____________________________________________________________

TITLE:  __________________________________________________________

STATE OF:  ______________________________________________________

COUNTY OF:  ______________________________________________________

being duly sworn, deposes and says that he/she is __________ of the above organization and that the answers to the questions in the foregoing questionnaire and all statements therein contained are true and correct.

SUBSCRIBING AND SWORN TO BEFORE ME THIS ________ DAY OF ________ 20____.

NOTARY PUBLIC: ______________________________________________________

MY COMMISSION EXPIRES: ________________________________________________
<table>
<thead>
<tr>
<th>Name and Address of Contractor:</th>
<th>Date:</th>
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</thead>
<tbody>
<tr>
<td>Name, Address, and Phone</td>
<td>Contract Amount</td>
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<tr>
<td>Number of Owner</td>
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<tr>
<td>Name, Address, and Phone Number of Owner</td>
<td>Square Footage/Contract Amount</td>
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<td>Name and Address of Contractor:</td>
<td>Date:</td>
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<tr>
<td><strong>Name, Address, and Phone Number of Owner</strong></td>
<td><strong>Type of Work</strong></td>
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### TABLE IV - LIST OF PAST TRAFFIC COATING INSTALLATION PROJECTS

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<thead>
<tr>
<th>Name and Address of Contractor:</th>
<th>Date:</th>
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<tbody>
<tr>
<td>Name, Address, and Phone Number of Owner</td>
<td>Type of Work</td>
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</tbody>
</table>
## TABLE V - CONSTRUCTION EXPERIENCE OF PRINCIPALS AND SUPERINTENDENTS

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Years Experience</th>
<th>Type of Work</th>
<th>Contract Amount</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Construction</td>
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<td></td>
<td>Concrete</td>
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<td></td>
<td></td>
<td></td>
<td>Restoration</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE VI - LIST OF EQUIPMENT INTENDED TO BE USED ON JOB

<table>
<thead>
<tr>
<th>Description of Equipment</th>
<th>Quantity</th>
<th>Years of Service</th>
<th>Current Book Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

PLEASE PROVIDE A LISTING OF ALL CERTIFICATIONS FOR EXTERIOR COATING SYSTEMS.

END OF SECTION 001153
SECTION 004143

BID FORM

PROJECT IDENTIFICATION:

KUMC Cambridge Garage Topping Repairs

THIS BID IS SUBMITTED TO: University of Kansas Medical Center, 3901 Rainbow Blvd., Kansas City, KS 66160

1. The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter into an agreement with OWNER to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.

2. This Bid shall remain subject to acceptance for thirty (30) days after the day of Bid opening.

3. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:

   3.1 BIDDER has examined copies of all the Bidding Documents and of the following Addenda (receipt of all which is hereby acknowledged):

   Date ____________ Number ____________

   3.2 BIDDER has familiarized itself with the nature and extent of the Contract Documents proposed Work, site, locality, and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance or furnishing of the Work.

   3.3 BIDDER has given ENGINEER written notice of all conflicts, errors or discrepancies that it has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to BIDDER.

   3.4 This Bid is genuine and not made in the interest of, or on behalf of, any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for itself any advantage over any other Bidder or over OWNER.

4. POSSIBLE CHANGES IN QUANTITY OF WORK

   4.1 BIDDER understands that the quantities specified herein for the repairs are approximate and that actual quantities in the field may increase or decrease from the quantities estimated. BIDDER hereby agrees to perform all quantities of Work
as either increased or decreased, as required by the Engineer in accordance with the provisions of the Construction Documents. The final payment to the BIDDER shall be based on the Lump Sum/Unit Prices bid and the actual quantities completed (for items that are not lump sum).

Table 4.1 – Base Bid for KUMC Cambridge Garage Topping Repairs shall be based on Phasing Plans provided within the Repair Drawings.

<table>
<thead>
<tr>
<th>TASK ITEM</th>
<th>DESCRIPTION</th>
<th>UNITS</th>
<th>QUANTITY</th>
<th>UNIT PRICE</th>
<th>EXTENSION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>STRUCTURAL &amp; WATERPROOFING</strong></td>
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<tr>
<td>1.1</td>
<td>Project Mobilization</td>
<td>L.S.</td>
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<tr>
<td>1.2</td>
<td>Concrete Formwork</td>
<td>Incidental</td>
<td></td>
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<td>1.3</td>
<td>Reinforcement Steel</td>
<td>LBS</td>
<td>180,000</td>
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<td>1.4</td>
<td>Galvanic Anode Cathodic Protection</td>
<td>EA</td>
<td>750</td>
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<tr>
<td>1.5</td>
<td>Shoring and Bracing</td>
<td>Incidental</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6</td>
<td>Interior and Exterior Egress Plans</td>
<td>Incidental</td>
<td></td>
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<tr>
<td>2.1</td>
<td>Concrete Topping Repairs – Removal and Replacement</td>
<td></td>
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<tr>
<td>2.1.1</td>
<td>Concrete Topping Removal at Roof Level in Garage – Conventional Chipping</td>
<td>S.F.</td>
<td>55,000</td>
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<tr>
<td>2.1.2</td>
<td>Concrete Topping Replacement at Elevated Levels in Garage</td>
<td>S.F.</td>
<td>55,000</td>
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<td>2.1.3</td>
<td>Concrete Topping Removal at Elevated Levels Below Roof Level in Garage – Conventional Chipping</td>
<td>S.F.</td>
<td>120,000</td>
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<td>2.1.4</td>
<td>Concrete Topping Replacement at Elevated Levels Below Roof Level in Garage</td>
<td>S.F.</td>
<td>120,000</td>
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<td>2.1.5</td>
<td>Concrete Topping Removal at Stair Landings – Conventional Chipping</td>
<td>S.F.</td>
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<tr>
<td>2.1.6</td>
<td>Concrete Topping Replacement at Stair Landings</td>
<td>S.F.</td>
<td>350</td>
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<td>2.1.7</td>
<td>Concrete Topping Removal at Elevated Walkway on Level 5 Adjacent to Northwest Stairwell – Conventional Chipping</td>
<td>S.F.</td>
<td>150</td>
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<tr>
<td>2.1.8</td>
<td>Concrete Topping Replacement at Elevated Walkway on Level 5 Adjacent to Northwest Stairwell</td>
<td>S.F.</td>
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<td>2.3</td>
<td>Concrete Stair Repair</td>
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<td>2.3.1</td>
<td>Concrete Stair Repair - Horizontal Surface</td>
<td>S.F.</td>
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<td>2.3.2</td>
<td>Concrete Stair Repair - Vertical Surface</td>
<td>S.F.</td>
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<tr>
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<td>Concrete Curb Repair</td>
<td>L.F.</td>
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<td>2.7</td>
<td>Dowel/Coil Rod Replacement</td>
<td>EA</td>
<td>250</td>
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<td>Quantity</td>
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<tr>
<td>2.8</td>
<td>Precast Double Tee - Full Depth Flange Repair at Edge of Flanges</td>
<td>S.F.</td>
<td>10,000</td>
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<tr>
<td>3.1</td>
<td>Overhead Slab Repair</td>
<td>S.F.</td>
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<td>3.2</td>
<td>Precast Double Tee Stem Repair</td>
<td>S.F.</td>
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<td>3.5</td>
<td>Precast Beam Repair</td>
<td>S.F.</td>
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<td>Precast Ledger Beam Repair</td>
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<td>3.5.2</td>
<td>Precast Inverted Tee Beam Repair</td>
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<td>4.1</td>
<td>Concrete Wall Repair</td>
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<td>5.1</td>
<td>Column Repair</td>
<td>S.F.</td>
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<td>6.2</td>
<td>Expansion Joint Replacement - Elastomeric Concrete Edged</td>
<td>L.F.</td>
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<td>Expansion Joint Replacement - Premolded</td>
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<td>6.7</td>
<td>Shear Transfer Connection Installation/Repair</td>
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<td>6.8</td>
<td>Double Tee Flange-to-Flange Repair</td>
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<td>6.8.1</td>
<td>Double Tee Flange-to-Flange Repair – Clean &amp; Coat Connection</td>
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<td>6.8.2</td>
<td>Double Tee Flange-to-Flange Connection Strengthening</td>
<td>EA</td>
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<td>Crack Repair</td>
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<td>7.2</td>
<td>Joint Sealant Installation</td>
<td>Incidental to T.I.’s 7.7.1, 7.7.2, &amp; 7.10</td>
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<td>New Topping Control Joint</td>
<td>Incidental to T.I. 2.1</td>
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<td>Joint Sealant Replacement – Vertical Surfaces (Between Spandrel Panels and Stair Tower Walls)</td>
<td>L.F.</td>
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<td>Cove Sealant Installation</td>
<td>Incidental to T.I.’s 7.7.1, 7.7.2, &amp; 7.10</td>
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<td>Epoxy Injection</td>
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<td>7.7</td>
<td>Traffic Coating – New System</td>
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<td>7.7.1</td>
<td>Traffic Coating – New Heavy Duty System at Roof Level</td>
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<td>35,000</td>
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<td>7.7.2</td>
<td>Traffic Coating – New Extra Heavy Duty System at Crossovers on Roof Level</td>
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<td>21,000</td>
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<td>7.7.3</td>
<td>Traffic Coating – New Heavy Duty System at Primary Landings in Stairwells</td>
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<td>Striping – In Kind Replacement</td>
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<td>Clean Floor Drains</td>
<td>L.F.</td>
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<td>7.12</td>
<td>Seal Pipe Penetration</td>
<td>Incidental to T.I.’s 7.7.1, 7.7.2, &amp; 7.10</td>
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<td>7.13</td>
<td>Elastomeric Waterproofing Coating</td>
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<td>7.14</td>
<td>Corrosion Inhibitor</td>
<td>S.F.</td>
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<td>Unit</td>
<td>Quantity</td>
<td>Amount</td>
<td>Description</td>
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<tr>
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<tr>
<td>9.6</td>
<td>New Handrails at Elevated Walkway on Level 5 Adjacent to Stair Tower #1</td>
<td>L.F.</td>
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<td>10.5</td>
<td>Clean and Coat Corroded Steel</td>
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<td>Incidental to Repair Work in Stair Towers</td>
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<td>12.1</td>
<td>Removal and Replacement of Hollow Metal Doors, Hollow Metal Frames and Hardware at Stair Towers</td>
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<td>12.1.1</td>
<td>Removal of Existing Hollow Metal Doors, Hollow Metal Frames, and Hardware</td>
<td>EA</td>
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<td>12.1.2</td>
<td>Installation of New Hollow Metal Frames</td>
<td>EA</td>
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<td>12.4</td>
<td>Temporary Removal of Wall Mounted Emergency Notification System Equipment</td>
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<td></td>
<td></td>
<td>Coordinate with Owner at Beginning and End of Each Phase – Owner to Arrange Temporary Removal and Reinstall with Separate Subcontract</td>
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<td>12.5</td>
<td>Precast Concrete Panels - Removal and Replacement</td>
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<td>Concrete Repairs Allowance</td>
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<td>13.2</td>
<td>Reinforcement Steel Allowance</td>
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<td>Plumbing Allowance</td>
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<td>Electrical Allowance</td>
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<td>13.5</td>
<td>Galvanic Anode Allowance</td>
<td>L.S.</td>
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<td>$10,000</td>
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<tr>
<td>13.6</td>
<td>Waterproofing Allowance</td>
<td>L.S.</td>
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<td></td>
<td>$10,000</td>
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<td><strong>Grand Total for Base Bid</strong></td>
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<td></td>
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<tr>
<td>14.1</td>
<td>Removal of Existing Electrical Conduit in Stairwells</td>
<td>L.S.</td>
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<td></td>
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<tr>
<td>14.2</td>
<td>Removal of Existing Electrical Conduit in Garage</td>
<td>L.S.</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>14.3</td>
<td>Remove, Protect, and Maintain Existing Lighting Fixtures and Hardware in Garage</td>
<td>L.S.</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>14.4</td>
<td>Removal of Existing Lighting Fixtures in Stairwells</td>
<td>L.S.</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>14.5</td>
<td>Installation of New Electrical Conduit in Stairwells</td>
<td>L.S.</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.6</td>
<td>Installation of New Electrical Conduit in Garage</td>
<td>L.S.</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>14.7</td>
<td>Installation of New and Existing Salvaged Lighting Fixtures and Hardware in Garage</td>
<td>L.S.</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.8</td>
<td>Installation of New Lighting Fixtures and Hardware in Stairwells</td>
<td>L.S.</td>
<td>1</td>
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<td><strong>Subtotal</strong></td>
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<tr>
<td></td>
<td><strong>Subtotal</strong></td>
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<tr>
<td></td>
<td><strong>Grand Total for Base Bid</strong></td>
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</tbody>
</table>
The Total Base Bid for the KUMC Cambridge Parking Garage based upon the above estimated quantities is:

TOTAL BID ________________________________________________________________

________________________________________________________(Use words)

$ ______________________(Use figures)

Table 4.2 – Alternates for KUMC Cambridge Parking Garage

<table>
<thead>
<tr>
<th>TASK ITEM</th>
<th>ALTERNATE TYPE</th>
<th>DESCRIPTION</th>
<th>UNITS</th>
<th>QUANTITY (1)</th>
<th>UNIT PRICE (2)</th>
<th>EXTENSION (1) x (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>ADD</td>
<td>Replace Handrails in Stairwells with New Galvanized Handrails</td>
<td>L.F.</td>
<td>750</td>
<td></td>
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<tr>
<td>-</td>
<td>ADD</td>
<td>Install New Hollow Metal Doors at Locations Where Existing Hollow Metal Doors were Removed</td>
<td>EA</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>ADD</td>
<td>Concrete Sealer on New Topping at Elevated Levels below Roof Level</td>
<td>S.F.</td>
<td>100,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>ADD</td>
<td>Corrosion Inhibitor on Entire Top Surface of All Exposed Precast Double Tee Flanges</td>
<td>S.F.</td>
<td>175,000</td>
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<td>1.A</td>
<td>DEDUCT</td>
<td>50% of parking spaces available for Contractor’s use</td>
<td>L.S.</td>
<td>1</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>1.B</td>
<td>DEDUCT</td>
<td>100% of parking spaces available for Contractor’s use</td>
<td>L.S.</td>
<td>1</td>
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</tr>
<tr>
<td>1.C</td>
<td>DEDUCT</td>
<td>Voluntary Phasing Alternate – (No Hydro Demolition)</td>
<td>L.S.</td>
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Table 4.3 – Unit Pricing for selective Incidental Task Items of repair

<table>
<thead>
<tr>
<th>TASK ITEM</th>
<th>DESCRIPTION</th>
<th>UNITS</th>
<th>UNIT PRICE</th>
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<tr>
<td>7.1</td>
<td>Crack Repair</td>
<td>L.F.</td>
<td></td>
</tr>
<tr>
<td>7.2</td>
<td>Joint Sealant</td>
<td>L.F.</td>
<td></td>
</tr>
<tr>
<td>7.3</td>
<td>New Topping Control</td>
<td>L.F.</td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>Cove Sealant</td>
<td>L.F.</td>
<td></td>
</tr>
<tr>
<td>7.12</td>
<td>Seal Pipe Penetration</td>
<td>EA</td>
<td></td>
</tr>
</tbody>
</table>

BID SCHEDULES

BASE BID SCHEDULE

BIDDER agrees that the Work on this building will be complete within _______ calendar days after receiving the notice to proceed. Contractor should bid this project assuming that OWNER requires that at least two crews working on the repair project simultaneously. The contractor should submit a schedule for the repair project at the time of bid submission.

ALTERNATE BID SCHEDULE WITH 50% OF PARKING SPACES AVAILABLE FOR CONTRACTOR’S USE

BIDDER agrees that the Work on this building will be complete within _______ calendar days after receiving the notice to proceed. Contractor should bid this project assuming that OWNER requires that at least two crews working on the repair project simultaneously. The contractor should submit a schedule for the repair project at the time of bid submission.

ALTERNATE BID SCHEDULE WITH 100% OF PARKING SPACES AVAILABLE FOR CONTRACTOR’S USE

BIDDER agrees that the Work on this building will be complete within _______ calendar days after receiving the notice to proceed. Contractor should bid this project assuming that OWNER requires that at least two crews working on the repair project simultaneously. The contractor should submit a schedule for the repair project at the time of bid submission.

ALTERNATE VOLUNTARY PHASING

BIDDER agrees that the Work on this building will be complete within _______ calendar days after receiving the notice to proceed. Contractor should bid this project assuming that OWNER requires that at least two crews working on the repair project simultaneously. The contractor should submit a schedule for the repair project at the time of bid submission.

6.    Communications concerning this Bid shall be addressed to (Contractor):

______________________________________________

______________________________________________

______________________________________________

______________________________________________

SUBMITTED on ____________________, 20__
7. The terms used in this Bid which are defined in the General Conditions of the Construction Contract included as part of the Contract Documents have the meanings assigned to them in the General Conditions provided by the Owner.

8. We plan to sub-contract the following items of work (please list):

<table>
<thead>
<tr>
<th>Description</th>
<th>Sub-contractor</th>
<th>Value</th>
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</thead>
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</tr>
</tbody>
</table>

If BIDDER is:

An Individual

By ________________________________ (Individual's Name) (SEAL)

doing business as ________________________________

Business Address:

Phone No.: ________________________________

A Partnership

By ________________________________ (Firm Name) (SEAL)

______________________________ (General Partner)

Business Address:

Phone No.: ________________________________
A Corporation
By __________________________ (Corporate Seal)

(Corporation Name)

____________________________
(State of Incorporation)

By __________________________
(Name of Person Authorized to Sign)

____________________________
(Title)

Attest __________________________
(Secretary)

Business Address: __________________________

____________________________
____________________________

Phone No.: __________________________

END OF DOCUMENT 004143
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division - 01 Specification sections, apply to work of this section.

1.2 TASK ITEM (T.I.) DESCRIPTION

T.I. 1.1 PROJECT MOBILIZATION

A. Scope of Work

1. Work consists of coordinating, scheduling, temporarily demobilizing, remobilizing, 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.

T.I. 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 or trowel applied materials. Refer to Section “Concrete Forming and Accessories” for specific requirements.

B. Materials

1. Materials and equipment for formwork shall be as specified in the Section “Concrete Forming and Accessories”.

C. Execution

1. The contractor shall safely form and support existing construction and repairs wherever required to allow for the installation of new Work and/or repairs of exist construction. All formwork methods and sequencing shall be the responsibility of the contractor and his engineer.

T.I. 1.3 REINFORCING STEEL

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to install reinforcing steel as required for cast-in-place concrete or trowel applied materials. Non-metallic reinforcement chairs shall be considered incidental. Refer to Section “Concrete Reinforcing” for specific requirements.
B. Materials

1. Acceptable mild reinforcing steel shall be in accordance with Section "Concrete Reinforcing".

C. Execution

1. Install reinforcement in accordance with the requirement of Section "Concrete Reinforcing" and the details.

2. Contractor shall restore concrete cover at repair locations to the original design intent for steel reinforcement as follows:
   
   (1) Slab minimum concrete cover shall be 1-1/2" unless dimensioned
   
   (2) Beam minimum concrete cover shall be 1-1/2" to ties
   
   (3) Column minimum concrete cover shall be 1-1/2" to ties
   
   (4) Walls minimum concrete cover shall be 1-1/2" Interior Face
   
   (5) Walls minimum concrete cover shall be 2" Exterior Face (Façade)
   
   (6) Consult with Engineer for locations where existing reinforcement placement does not meet the minimum concrete cover specified.

T.I. 1.4 GALVANIC ANODE INSTALLATION

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to install galvanic anode cathodic protection as required for concrete repairs with cast-in-place concrete or trowel applied materials. Refer to Section "Galvanic Anode Cathodic Protection" and 1/S4.4 for additional requirements.

2. This Task Item shall apply as required by Task Items 2.3, 2.6, 2.8, 3.1, 3.2, 3.5, 4.1, and 5.1.

3. For bidding purposes, assume spacing of anodes to be 12".

B. Materials

1. Acceptable embedded galvanic anodes for attachment to mild reinforcement shall be in accordance with Section "Galvanic Anode Cathodic Protection".

C. Execution

1. Install embedded galvanic anodes to bare metal steel reinforcement around the perimeter of the concrete patch areas as required by the concrete repair task items.

2. Confirm electrical connection between anode tie wire and reinforcing steel by measuring DC resistance (ohm) with a multimeter. Electrical continuity is acceptable if the DC resistance measured with multi-
meter is less than 1 ohm. Discontinuities can be corrected by wiring the “unconnected” bar to adjacent bars using standard tie wire. Report results to Engineer for EACH anode. Reported results should identify as-built location of anode and corresponding resistance measured after installation.

3. Do no coat anode or tie wire with epoxy bonding agents.

T.I. 1.5 SHORING AND BRACING

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, staging, signage, bracing, shoring, supervision, and incidentals necessary to install and protect shoring and bracing as required for repairs and member replacement. This Task Item is incidental and shall apply as required to complete the Repair Tasks within the scope of this project.

B. Materials

1. Materials and equipment for shoring and bracing shall be as specified in the signed and sealed shoring and bracing shop drawings submitted to the Engineer.

C. Execution

1. The contractor shall safely shore and/or brace existing construction wherever existing supports are removed to allow the installation of new Work or repair of existing construction. All shoring and/or bracing methods and sequencing of demolition and repair shall be the responsibility of the contractor and his engineer.

2. Contractor shall submit to the Engineer shop drawings for shoring and bracing at repair and strengthening locations, signed and sealed by a licensed professional engineer in the state of Kansas.

T.I. 1.6 INTERIOR AND EXTERIOR EGRESS PLANS

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to create and submit an interior and exterior egress plan that corresponds to the phasing of the Work. This Task Item is incidental and shall apply as required to complete the Work within the scope of this project.

B. Materials

1. None

C. Execution

1. The contractor shall submit an interior and exterior egress plan that identifies modifications of egress routes resulting from construction
at locations that impacts egress. The contractor shall coordinate with the Engineer and Owner.

T.I. 2.1 CONCRETE TOPPING REPAIRS – REMOVAL AND REPLACEMENT

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, staging, formwork, supervision, and incidentals necessary to locate existing spalls, locate and remove full delaminated and unsound concrete topping from double tees, prepare cavities, and install new concrete to restore concrete floor topping to original condition and appearance. Refer to 2/4.2 for additional requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Material for repair areas shall be as specified in Section “Concrete Repair Materials.”

C. Execution

1. Contractor shall submit interior and exterior egress plan prior to starting work.

2. Contractor shall provide extensive signage at all locations where vehicular traffic is restricted during topping removal and replacement. Signage shall include flashing lights to enhance patron awareness. Contractor shall coordinate with owner regarding acceptable signage. Additional signage requested by Owner shall be provided at no additional cost to Owner.

3. Contractor shall locate and mark all Work areas as specified in Section “Surface Preparation for Patching.” All concrete topping slabs on elevated surfaces within the parking garage are to be included within the scope of Work. Contractor shall identify all critical repair Work areas and coordinate phasing of Work with Engineer and Owner before starting the Work.

4. Contractor shall provide full height, solid walls around all work areas to mitigate sound and control dust.

5. Contractor shall provide dust ventilation system.

6. Contractor shall providing continuous misting/wetting of concrete during demolition to mitigate dust.

7. All steel reinforcement within topping slab shall be replaced as specified on drawings.

8. Contractor shall ensure that removal of concrete topping slab does not damage nor extend into the structural precast framing members.
9. Contractor shall not damage existing embedded dowels and precast connections.

10. Exposed steel shall be epoxy coated with an approved epoxy product as specified in Section “Surface Preparation for Patching.”

11. Contractor shall prepare exposed substrates for repair placement as specified in Section “Surface Preparation for Patching.”

12. Patch installation procedures shall be in accordance with referenced specifications for selected material.

T.I. 2.3 CONCRETE STAIR REPAIR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, staging, formwork, supervision, and incidentals necessary to locate existing spalls, locate and remove full delaminated and unsound concrete from pre-tensioned slab, conventionally cast-in-place slab or slab-on-grade, prepare cavities, and install repair materials to restore concrete floor slab to original condition and appearance. In-kind replacement of non-slip nosing is also incidental to this task item, which may include additional surface preparation. Refer to 3/S4.2 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Material for repair areas shall be as specified in Section “Concrete Repair Materials.”

C. Execution

1. Contractor shall locate and mark all Work areas as specified in Section “Surface Preparation for Patching.” Marking will be done with methods approved by Engineer and Owner. Contractor shall identify all critical repair Work areas before starting the Work.

2. Procedure for delaminated, spalled, and unsound concrete removal shall be as specified in Section “Surface Preparation for Patching.”

3. All steel exposed within cavities shall be cleaned to bare metal by abrasive methods or other approved methods as specified in Section “Surface Preparation for Patching.”

4. Exposed steel shall be epoxy coated with an approved epoxy product as specified in Section “Surface Preparation for Patching.”

5. Contractor shall prepare cavities for repair placement as specified in Section “Surface Preparation for Patching.”

6. Patch installation procedures shall be in accordance with referenced specifications for selected material.
T.I. 2.6 CONCRETE CURB REPAIR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, staging, formwork, supervision, and incidentals necessary to locate existing spalls, locate and remove full delaminated and unsound concrete from curbs, prepare cavities, and install repair materials to restore concrete floor slab to original condition and appearance. Refer to 4/S4.2 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Material for repair areas shall be as specified in Section “Concrete Repair Materials.”

C. Execution

1. Contractor shall locate and mark all Work areas as specified in Section “Surface Preparation for Patching.” Marking will be done with methods approved by Engineer and Owner. Contractor shall identify all critical repair Work areas before starting the Work.

2. Procedure for delaminated, spalled, and unsound concrete removal shall be as specified in Section “Surface Preparation for Patching.”

3. All steel exposed within cavities shall be cleaned to bare metal by abrasive methods or other approved methods as specified in Section “Surface Preparation for Patching.”

4. Exposed steel shall be epoxy coated with an approved epoxy product as specified in Section “Surface Preparation for Patching.”

5. Contractor shall prepare cavities for repair placement as specified in Section “Surface Preparation for Patching.”

6. Patch installation procedures shall be in accordance with referenced specifications for selected material.

T.I. 2.7 DOWEL/COIL ROD REPLACEMENT

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, staging, formwork, supervision, and incidentals necessary to locate existing coil rods connecting precast spandrel beams to the topping slab that are in need of repair, removing and replacing coil rods from embedment of precast panel, preparation of cavities for new dowels/coil rods within precast panels, and installation of repair materials to as required to surrounding areas that may be in need of repair after dowels have been replaced. Refer to Plan Sheets for potential locations of where Work could take place.

B. Materials
1. Acceptable epoxy for doweling mild reinforcement into existing concrete shall be HIT-RE 500 V3 by Hilti or Engineer approved equal.

2. Material for repairs shall be as specified in Section "Concrete Repair Materials."

C. Execution

1. Contractor shall locate and mark all Work areas for this task item. Marking will be done with methods approved by Engineer and Owner. Contractor shall identify all critical repair Work areas before starting the Work.

2. Steel dowels exposed after topping removal shall be cleaned to bare metal by abrasive methods or other approved methods as specified in Section “Surface Preparation for Patching.”

3. Steel coil rods that exhibit more than 10% of section loss that be marked. Contractor shall notify the Engineer of locations identified to have 10% or greater section loss. Engineer will determine whether existing coil rods need to be replaced.

4. New coil rods will be installed in existing, embedded precast inserts if existing embedded inserts are not damaged. If existing, embedded precast inserts are damaged and not able to be used Contractor shall post install dowels with epoxy in accordance with the requirements of the epoxy manufacturer. Embedment depth of new dowels shall be 6 inches. Contractor shall locate existing embedded reinforcement prior to installing dowels to ensure that existing reinforcement is not damaged during installation of new dowels.

5. If adjacent areas of precast beam exhibit distress in the form of cracks, delamination, or spalls then Contractor shall prepare the area as specified in Section “Surface Preparation for Patching.”

6. Patch installation procedures shall be in accordance with referenced specifications for selected patching material.

T.I. 2.8 PRECAST DOUBLE TEE - FULL DEPTH FLANGE REPAIR AT EDGE OF FLANGES

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, scaffolding, shoring, and incidentals necessary to locate and remove delaminated/spalled concrete, prepare cavities, and install patching materials to restore precast double tee flange to original condition and appearance. Any slab blow-outs which occur as a result of contractor’s negligence shall not be covered under this task item and shall be repaired at no additional cost to the Owner. Refer to 6/S4.2 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials
C. Execution

1. Contractor shall locate and mark all Work areas as specified in Section “Surface Preparation for Patching.” Contractor shall identify all critical repair Work areas before starting the Work.

2. Procedure for delaminated, spalled, and unsound concrete removal shall be as specified in Section “Surface Preparation for Patching.”

3. All steel exposed within cavities shall be cleaned to bare metal by abrasive methods as specified in Section “Surface Preparation for Patching.”

4. Exposed steel shall be epoxy coated with an approved epoxy product as specified in Section “Surface Preparation for Patching.”

5. Contractor shall prepare cavities for repair placement as specified in Section “Surface Preparation for Patching.”

6. Patch installation procedures shall be in accordance with referenced specifications for selected material.

7. Contractor may elect to form and place new topping monolithically with flange repairs if formwork prevents flanges of adjacent double tees from being cast monolithically. Surface finish of soffit of double tee flanges shall match existing finish.

T.I. 3.1 OVERHEAD SLAB REPAIR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, scaffolding, shoring, and incidentals necessary to locate existing spalls, locate and remove delaminated and unsound concrete, prepare cavities, and install patching materials to restore slab to original condition and appearance. Any slab blow-outs which occur as a result of contractor’s negligence shall not be covered under this task item and shall be repaired at no additional cost to the Owner. Refer to 7/S4.2 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Material for repairs shall be as specified in Section “Concrete Repair Materials.”

C. Execution

1. Contractor shall locate and mark all Work areas as specified in Section “Surface Preparation for Patching.” Contractor shall identify all critical repair Work areas before starting the Work.
2. Procedure for delaminated, spalled, and unsound concrete removal shall be as specified in Section “Surface Preparation for Patching.”

3. All steel exposed within cavities shall be cleaned to bare metal by abrasive methods as specified in Section “Surface Preparation for Patching.”

4. Exposed steel shall be epoxy coated with an approved epoxy product as specified in Section “Surface Preparation for Patching.”

5. Contractor shall form concrete with approved materials and prepare cavities for repair placement as specified in Section “Surface Preparation for Patching.”

6. Patch installation procedures shall be in accordance with referenced specifications for selected material.

T.I. 3.2 PRECAST DOUBLE TEE STEM REPAIR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, scaffolding, shoring, and incidentals necessary to locate and remove delaminated/spalled concrete, prepare cavities, and install patching materials to restore precast double tee stems to original condition and appearance. Refer to 8/S4.2 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Material for repairs shall be as specified in Section “Concrete Repair Materials.”

C. Execution

1. Contractor shall locate and mark all Work areas as specified in Section “Surface Preparation for Patching.” Contractor shall identify all critical repair Work areas before starting the Work.

2. Procedure for delaminated, spalled, and unsound concrete removal shall be as specified in Section “Surface Preparation for Patching.”

3. All steel exposed within cavities shall be cleaned to bare metal by abrasive methods as specified in Section “Surface Preparation for Patching.”

4. Exposed steel shall be epoxy coated with an approved epoxy product as specified in Section “Surface Preparation for Patching.”

5. Contractor shall prepare cavities for repair placement as specified in Section “Surface Preparation for Patching.”

6. Patch installation procedures shall be in accordance with referenced specifications for selected material.
T.I.  3.5 PRECAST BEAM REPAIR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, scaffolding, shoring, and incidentals necessary to provide full-height, solid wall enclosure around Work areas, locate and remove delaminated/spalled concrete, prepare cavities, and install patching materials to restore concrete beams to original condition and appearance. Refer to 9/S4.2 and 10/S4.2 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Material for repairs shall be as specified in Section “Concrete Repair Materials.”

C. Execution

1. Contractor shall locate and mark all Work areas as specified in Section “Surface Preparation for Patching.” Contractor shall identify all critical repair Work areas before starting the work.

2. Contractor shall coordinate with Owner regarding sequence and timing of repairs.

3. Contractor shall ensure code compliant pedestrian egress is maintained throughout duration of Work.

4. Contractor shall provide a full-height, solid wall enclosure system around Work area to protect patrons from excessive noise and dust exposure.

5. Procedure for delaminated, spalled, and unsound concrete removal shall be as specified in Section “Surface Preparation for Patching.”

6. All steel exposed within cavities shall be cleaned to bare metal by abrasive methods as specified in Section “Surface Preparation for Patching.”

7. Exposed steel shall be epoxy coated with an approved epoxy product as specified in Section “Surface Preparation for Patching.”

8. Contractor shall prepare cavities for repair placement as specified in Section “Surface Preparation for Patching.”

9. Patch installation procedures shall be in accordance with referenced specifications for selected material.

T.I.  4.1 CONCRETE WALL REPAIR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, staging, shoring, bracing, and incidentals necessary to locate and remove unsound concrete from walls, prepare cavities,
and install patching materials to restore walls to original condition and appearance. Refer to 1/S4.3 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Material for repairs shall be as specified in Section “Concrete Repair Materials.”

C. Execution

1. Contractor shall locate and mark all Work areas as specified in Section “Surface Preparation for Patching.” Contractor shall identify all critical repair Work areas before starting the Work.

2. Procedure for delaminated, spalled, and unsound concrete removal shall be as specified in Section “Surface Preparation for Patching.”

3. All steel exposed within cavities shall be cleaned to bare metal by abrasive methods as specified in Section “Surface Preparation for Patching.”

4. Exposed steel shall be epoxy coated with an approved epoxy product as specified in Section “Surface Preparation for Patching.”

5. Contractor shall prepare cavities for repair placement as specified in Section “Surface Preparation for Patching.”

6. Patch installation procedures shall be in accordance with referenced specifications for selected material.

T.I. 5.1 COLUMN REPAIR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, staging, signage, bracing, formwork, supervision, and incidentals necessary to locate existing spalls, locate and remove delaminated, unsound concrete, prepare cavities, and place patching materials to restore concrete column to original condition and appearance. Refer to 2/S4.3 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Material for repair areas shall be as specified in Section “Concrete Repair Materials.”

C. Execution

1. Contractor shall locate and mark all Work areas as specified in Section “Surface Preparation for Patching.” Marking will be done with methods approved by Engineer and Owner. Contractor shall identify all critical repair Work areas before starting Work.
2. Procedure for delaminated, spalled, and unsound concrete removal shall be as specified in Section “Surface Preparation for Patching.”

3. All steel exposed within cavities shall be cleaned and coated in accordance with Section “Surface Preparation for Patching.”

4. Contractor shall prepare cavities for repair placement as specified in Section “Surface Preparation for Patching.”

5. Install formwork and place patch material in accordance with referenced specifications for selected material.

T.I. 6.2 EXPANSION JOINT REPLACEMENT – ELASTOMERIC CONCRETE EDGED

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipments, staging, traffic control, formwork, supervision, and incidentals necessary to locate Work area, remove existing expansion joint system, and miscellaneous accessories, repair existing concrete blockout to conform to expansion joint manufacturer and install a new elastomeric concrete edged expansion joint system. Refer to Detail 1/S4.4 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Expansion joint systems specified in Section “Expansion Joints”.

2. Materials for concrete repairs shall be specified in Section “Concrete Repair Materials.”

C. Execution

1. Contractor shall remove existing expansion joint materials in manner that minimizes damage to adjacent concrete. Alterations and repairs to existing expansion joint blockout required for installation of new expansion joint system shall be performed in accordance with manufacturer recommendations and Section “Surface Preparation for Patching” and are incidental to this Task Item.

2. Coordinate this task item with owner representative in order to produce minimum disruptions to the patrons.

3. Contractor shall remove any interfering materials (i.e. PVC conduits). Contractor shall ensure that interfering materials are not operational or functional (i.e. conduits feeding electrical power) before removal.

4. Installation procedures shall be in accordance with referenced specifications for selected material.

5. Control joints shall be tooled and formed in plastic concrete. Sawcutting joints after concrete sets will not be allowed.

6. Tooled joints shall be of proper dimension in plastic concrete.
7. Install new expansion joint system in strict accordance by manufacturer’s instructions.

T.I. 6.4 EXPANSION JOINT REPLACEMENT - PREMOLDED

A. Scope of Work
1. Work consists of furnishing all labor, materials, equipments, staging, formwork, supervision, and incidentals necessary to locate Work area, remove existing expansion joint system, and miscellaneous accessories, repair existing concrete blockout to conform to expansion joint manufacturer and install a new premolded expansion joint system. Refer to Plan Sheets for location of Work.

B. Materials
1. Materials for Expansion joint systems shall be specified in Section “Expansion Joints”.
2. Materials for concrete repairs shall be specified in Section “Concrete Repair Materials.”

C. Execution
1. Contractor shall locate and mark all Work areas. Contractor shall identify all critical repair Work areas and coordinate Work and lane closures before starting the Work.
2. Coordinate this task item with owner representative in order to produce minimum disruptions to the patrons.
3. Contractor shall remove existing expansion joint materials in manner that minimizes damage to adjacent concrete. Alterations and repairs to existing expansion joint blockout required for installation of new expansion joint system shall be performed in accordance with manufacturer recommendations and Section “Surface Preparation for Patching” and are incidental to this Task Item.
4. Contractor shall contact Engineer prior to removing any interfering materials (i.e. PVC conduits). Contractor shall ensure that interfering materials are not operational or functional (i.e. conduits feeding electrical power) before removal.
5. Installation procedures shall be in accordance with referenced specifications for selected material.

T.I. 6.7 SHEAR TRANSFER CONNECTION INSTALLATION / REPAIR

A. Scope of Work
1. Work consists of furnishing all labor, materials, equipment, staging, shoring, supervision, and incidentals to remove old shear transfer devices and install pairs of shear transfer connections along the construction joint concrete blockout or expansion joint. Refer to 3/S4.3. See Plan Sheets for location of Work.
B. Materials

1. Structural steel angles shall be ASTM A36 steel, hot-dipped galvanized with standard holes in horizontal leg.

2. Anchor bolts shall be corrosion resistant.

3. Slide bearing pads shall be Elastomeric (Neoprene) structural pads with Shore A durometer hardness of 60 ± 5 and having a minimum thickness of 1/2". Acceptable manufactures are: Con-Serv Inc., JVI, Inc., Tulsa Rubber Company.

C. Execution

1. Contractor shall locate and mark all Work areas.

2. Contractor shall remove existing shear transfer devices including angles and bolts in a manner that minimizes damage to the surrounding concrete.

3. Contractor shall ensure thru bolts maintain vertical alignment during placement of new topping. Additional Work resulting from misalignment of thru bolts cast into new topping shall be repaired at no additional cost to Owner.

4. Contractor shall layout and install shear transfer devices as shown on 3/S4.3.

5. Provide Neoprene bearing pad between soffit of concrete blockout and the non-anchored end of the angle to provide uniform bearing.

6. Any gap between anchored end of the angle and soffit of concrete blockout shall be filled with galvanized steel shims to provide uniform bearing.

T.I. 6.8 DOUBLE TEE FLANGE-TO-FLANGE REPAIRS

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, staging, shoring, supervision, and incidentals to clean and coat existing flange to flange shear transfer connections as well as providing supplemental strengthening as required. Refer to 4/S4.3. Work encompasses all flange to flange repairs at embedded shear transfer connections.

B. Materials

1. Materials for concrete repairs shall be specified in Section “Concrete Repair Materials.”

2. Electrodes for welding processes shall be as specified below:

   (a) SMAW:

   i. E70XX low hydrogen.
(b) SAW:
   i. F7X-EXXX.

(c) GMAW:
   i. ER70S-X.

(d) FCAW:
   i. E7XT-X.

(e) Electrodes shall be compatible with parent metal joined.

C. Execution

1. Contractor shall locate and mark all Work areas.

2. Contractor shall clean each connection by abrasively blasting the entire flange to flange joint from below and above. Prepare surfaces in strict accordance with manufacture’s specifications. Steel surfaces to be coated shall be clean, i.e. devoid of grease, oil, mill scale, oxidation, loosely adherent rust, paint, etc. Abrasive blast steel surfaces to SSPC-SP6.

3. Contractor shall determine if existing connection is exhibiting greater than 10% section loss. If section loss greater than 10% is encountered Contractor shall mark location and notify Engineer.

4. If existing weld is found to be fractured Contractor shall mark location and notify Engineer prior to performing repairs. Contractor shall re-weld connection as shown in 4/S4.3.

5. After Engineer has review all cleaned connections Contractor shall then apply epoxy coating system (primer and finish coat) in strict accordance with manufacturer’s specifications.

T.I. 7.1 CRACK REPAIR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate, prepare, rout and seal random cracks in concrete floor slab. Refer to 3/S4.4 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Approved materials to be used in this Work are specified in Section “Joint Sealants.”

2. Joint sealant material shall be compatible with traffic coating materials specified in Section “Traffic Coatings.”

C. Execution
1. Contractor shall thoroughly inspect concrete slabs for cracks in the areas shown in the drawings. Those identified as either greater than 1/32 in. wide or showing evidence of water and/or salt staining on ceiling below shall be sealed.

2. All cracks identified for repair shall be marked to aid in precision routing. Obtain depths to top reinforcing bars in area of repair by use of non-destructive methods.

3. Determine depth of electrical conduit (if applicable). Do not exceed ½ of this depth of routing where the crack to be repaired crosses the embedded items. Damage to embedded items will require repair or replacement at no cost to the Owner.

4. Cracks shall be ground or saw-cut to an adequate width and depth as required by Detail. Routing shall be performed by mechanized device that has positive mechanical control over depth and alignment of cut.

5. Cavities shall be thoroughly cleaned by either abrasive methods or grinding to remove all laitance, unsound concrete and curing compounds which may interfere with adhesion. Groove shall be air blasted to remove remaining debris.

6. Sealant materials and associated reference specifications are listed in Section “Joint Sealants.” Sealant installation procedures shall be in accordance with referenced specifications for selected material.

T.I. 7.2 JOINT SEALANT INSTALLATION

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate, prepare, and seal joints in concrete floor slab and other concrete members. Refer to 3/S4.4 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Approved materials to be used in this Work are specified in Section “Joint Sealants.”

2. Closed cell backer rod as required.

C. Execution

1. Contractor shall thoroughly clean opening in areas to receive joint sealant.

2. Determine depth of electrical conduit (if applicable). Do not exceed ½ of this depth of routing where the crack to be repaired crosses the embedded items. Damage to embedded items will require repair or replacement at no cost to the Owner.
3. Joints shall be ground or saw-cut to an adequate width and depth as required by Detail. Routing shall be performed by mechanized device that has positive mechanical control over depth and alignment of cut.

4. Cavities shall be thoroughly cleaned by either abrasive methods or grinding to remove all laitance, unsound concrete and curing compounds which may interfere with adhesion. Groove shall be air blasted to remove remaining debris.

5. Install backer rod at wide joints in strict accordance with manufacturer's instructions.

6. Sealant materials and associated reference specifications are listed in Section "Joint Sealants." Sealant installation procedures shall be in accordance with referenced specifications for selected material.

T.I. 7.3 NEW TOPPING CONTROL JOINT

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate, prepare, and install new tooled control joints within new topping slab. Refer to Detail 4/S4.4 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Approved materials to be used in this Work are specified in Section "Joint Sealants."

C. Execution

1. Contractor shall be located directly above all precast joints within structure below. Joints shall be straight and continuous.

2. Contractor shall locate and provide layout strategy for all control joints prior to placing topping in a specific area. Contractor shall confirm with Engineer the layout prior to starting Work. Joints between topping slab and column shall also include a compressible filler as shown in 4N/S4.1.

3. Control joints shall be tooled and formed in plastic concrete. Sawcutting joints after concrete sets will not be permitted.

4. Tool used to create joint shall have a ¼” radius. Joint depth shall be ¾” and joint width shall be ½”.

5. Tooled joints shall be thoroughly cleaned with dry, oil-free compressed air prior priming and subsequently installing joint sealant. Do not begin installing joint sealant until primer is tack-free.

6. Sealant materials and associated reference specifications are listed in Section "Joint Sealants." Sealant installation procedures shall be in accordance with referenced specifications for selected material.
T.I. 7.4 JOINT SEALANT REPLACEMENT – VERTICAL SURFACES (BETWEEN SPANDREL PANELS AND STAIR TOWER WALLS)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate, remove, prepare, and re-seal vertical joints at the Stair Towers #2 and #3. Refer to Detail 5/S4.4 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Approved materials to be used in this Work are specified in Section “Joint Sealants.”

2. Closed cell backer rod as required.

C. Execution

1. Contractor shall locate and identify all location of Work.

2. Remove existing joint sealant with minimal damage to adjacent concrete surfaces.

3. Determine depth of electrical conduit (if applicable). Do not exceed ½ of this depth of routing where the crack to be repaired crosses the embedded items. Damage to embedded items will require repair or replacement at no cost to the Owner.

4. Cavities shall be thoroughly cleaned by either abrasive methods or grinding to remove all laitance, unsound concrete and curing compounds which may interfere with adhesion. Groove shall be air blasted to remove remaining debris.

5. Install backer rod at wide joints in strict accordance with manufacturer’s instructions.

6. Sealant materials and associated reference specifications are listed in Section “Joint Sealants.” Sealant installation procedures shall be in accordance with referenced specifications for selected material.

T.I. 7.5 COVE SEALANT INSTALLATION

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to prepare surfaces and install cove sealant between floor and vertical surfaces as shown on Drawings. Refer to 6/S4.4 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Approved materials to be used in this Work are specified in Section “Joint Sealants.”
2. Joint sealant material shall be compatible with traffic coating materials specified in Section “Traffic Coatings.”

C. Execution

1. Wall-floor intersection to be sealed shall be thoroughly cleaned by abrasive blasting to remove all contaminants, existing sealant, 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 ¾” 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 ½” is maintained.

6. Remove excess sealant and allow to cure.

7. Apply coating on horizontal and vertical surfaces where shown on drawings in even layers in strict accordance with manufacturer’s recommendations.

T.I. 7.6 EPOXY INJECTION

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, staging, supervision, and incidentals necessary to locate cracks, prepare and inject approved cracks with epoxy resin.

B. Materials

1. Material for crack repairs shall be as specified in Section “Epoxy Related Work.”

C. Execution

1. Contractor shall locate all cracks to receive injection and report them to Engineer for verification.

2. Install repair materials in strict accordance with manufacturer’s recommendations and referenced specifications for selected material.

3. At completion of the injection Work, contractor shall remove injection ports, and repair the concrete profile to match existing conditions.
T.I. 7.7 TRAFFIC COATING – NEW SYSTEM

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to locate existing spalls, locate and remove unsound concrete from floor surfaces, prepare cavities and install patching material in order to obtain a sound concrete surface to receive new traffic coating system. This task item includes crack repairs, installation of joint sealants and traffic coating including coating and detailing around drains.

2. Traffic coating is to be installed on wall elevations and all column faces at horizontal/vertical joint intersections only within stair towers and at elevated walkway leading to Stair #1. Application to vertical surfaces shall be in accordance to drawings and Section “Traffic Coatings.”

3. Refer to Details 7, 8, and 9 on S4.4 for specific requirements. Refer to Plan Sheets for location of Work.

B. Materials

1. Approved “Heavy Duty” materials for use in this Task Item are as specified in Section “Traffic Coatings.”

2. Approved “Extra Heavy Duty” materials for use in this Task Item are as specified in Section “Traffic Coatings.” “Extra Heavy Duty” system shall be applied at crossovers as indicated on the Plan Sheets.

C. Execution

1. Floor surface preparation shall be performed by coating system applicator or under its direct supervision. Shotblast surface preparation is required for floors.

2. Remove existing stripes using methods that will not cause damage to the concrete surface.

3. Traffic coating shall be installed by licensed applicators in strict accordance with manufacturer’s recommendations.

4. Crack and construction joint preparation including installation of joint and cove sealants were required, is incidental to traffic coating Work.

5. Coating systems shall be thoroughly cured prior to Work areas being returned to service.

6. Floor surfaces: Locate layout and paint parking stall stripes and traffic marking matching existing pattern. Color of paint to be selected by owner.

T.I. 7.8 STRIPING – IN-KIND REPLACEMENT

A. Scope of Work
1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to install temporary and permanent traffic markings. Pavement marking shall include but not limited to parking stall stripes, traffic arrows, crosswalks, accessible stall access aisles, curbs, symbols, stop bars and all other existing pavement markings.

B. Materials

1. Temporary traffic marking paint shall be high contrast.

2. Approved chlorinated rubber paint for permanent traffic markings used in this Task Item are as specified in Section "Traffic Coatings."

C. Execution

1. **The contractor shall field measure and document the existing line striping.**

2. The contractor shall submit the existing traffic markings with typical dimensions noted on plan sheets to the Engineer. Contractor shall be provided the location and dimension of the accessible stalls and the access aisles for these stalls. This information shall be incorporated in the shop drawings.

3. Apply temporary traffic markings as needed to direct the flow of traffic during construction. The following guidelines apply for application of temporary traffic markings:

   (1) Temporary pavement markings shall be preformed tape, conforming to ASTM D4592, type 1, removable.

   (2) Temporary pavement markings shall be applied after paving, but before being opened to traffic and parking. Markings that are improperly applied and come loose shall be replaced at Contractor’s expense, as directed by Engineer.

   (3) Temporary pavement markings on finished pavement surface shall be installed allowing for lateral tolerance of ±2 in. center to center. Temporary pavement markings that are installed outside specified lateral tolerances shall be removed and replaced, as directed by Engineer, at Contractor’s expense.

   (4) All marking shall have width of 4 in. unless otherwise specified. Markings shall be either white or yellow.

   (5) Preformed tape shall be applied and removed per manufacturer’s instructions.

   (6) All temporary pavement markings shall be removed prior to placing permanent pavement markings.

4. Coordinate permanent traffic marking such that it is sequenced after other specified repairs.
5. Locate layout and apply permanent paint parking stall stripes and traffic markings to match the existing pattern and incorporation of accessible parking stall. Color of paint to be selected by owner.

T.I. 7.10 CONCRETE PENETRATING SEALER (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to removing any traffic floor markings, clean the existing concrete floor surface, installing penetrating sealer.

B. Materials

1. Approved materials to be used in this Work are specified in Section “Concrete Penetrating Sealers.”

C. Execution

1. Contractor shall identify and mark all locations of Work.
2. Contractor shall remove existing traffic floor markings using shotblasting. The floor surface shall be porous to allow penetrating sealer to penetrate concrete.
3. Clean concrete surface to remove dirt and debris, leaving the concrete surface porous.
4. Install sealer in strict accordance to manufacture’s recommendations.
5. Replace traffic floor markings to match original. Consult owner for product.

T.I. 7.11 CLEAN FLOOR DRAINS

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, scaffolding, supervision, and incidentals necessary to prepare concrete surface and clean floor drains. Refer to Plan Sheets for location of Work.

B. Materials

1. Sealants, mastics, and other assemblies shall be included and specified in Section “Joint Sealants”.

C. Execution

1. Work consists of cleaning existing drains.
2. Work is to be complete before the Contractor applies new sealants.
T.I. 7.12 SEAL PIPE PENETRATION

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, scaffolding, supervision, and incidentals necessary to locate pipe penetration, clean and coat steel pipes, and install joint sealant around edge. Refer to Plan Sheets for location of Work.

B. Materials

1. Approved materials to be used in this Work are specified in Section “Joint Sealants.”

2. Joint sealant material shall be compatible with traffic coating materials specified in Section “Traffic Coatings.”

3. Closed cell backer rod.

C. Execution

1. Pipe-floor intersection to be sealed shall be thoroughly cleaned by abrasive blasting to remove all contaminants and foreign material.

2. Clean and coat steel pipe as required. Refer to Task Item 10.5.

3. Install backer rod at wide joints in strict accordance with manufacturer’s instructions.

4. Sealant installation procedures shall be in accordance with referenced specifications for selected material.

5. Work sealant so that all air is removed and tool to concave shape such that minimum throat dimension of no less than $\frac{1}{2}$” is maintained.

6. Remove excess sealant and allow to cure.

T.I. 7.13 ELASTOMERIC WATERPROOFING COATING

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to cleaning the existing concrete surface, and installing elastomeric coating. Refer to 1/S4.5 for additional requirements.

B. Materials

1. Approved materials to be used in this Work are specified in Section “Elastomeric Coatings”.

C. Execution

1. Contractor shall identify and mark all locations of Work. Engineer shall review and approve identified and marked areas.
2. Clean concrete surface to remove dirt and debris, leaving the concrete surface porous. Contractor shall clean and prepare surface per manufacturer’s recommendations.

T.I. 7.14 CORROSION INHIBITOR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to apply corrosion inhibitor to the concrete substrate. Incidentals to this Work shall also include labor, materials, equipment, supervision, and additional time/effort required to temporarily remove and/or relocate any existing obstructions that may interfere with application of the corrosion inhibitor.

B. Materials

1. Approved materials to be used in this Work are specified in Section “Concrete Penetrating Sealers.”

C. Execution

1. Contractor shall identify and mark all locations of Work.

2. Clean concrete surface to remove dirt and debris, leaving the concrete surface porous. Contractor shall prepare the existing substrate using an abrasive blast method. The surface shall be porous to allow proper penetration of the surface applied penetrating corrosion inhibitor.

3. Install sealer in strict accordance to manufacture’s recommendations (2 coat application, minimum).

4. Replace surface markings on substrate to match original if applicable. Consult owner for product.

T.I. 9.6 NEW HANDRAILS AT ELEVATED WALKWAY ON LEVEL 5 ADJACENT TO STAIR TOWER #1

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, staging, shoring, bracing, and incidentals necessary to remove existing pedestrian handrails, repair damage to existing embedment plates and install new pedestrian handrail with in-kind connections. Refer to 5/S4.3. Refer to Plan Sheets for Location of Work.

B. Materials

1. New steel rails shall be 1½” diameter, ASTM A 53 Grade B, hot dipped galvanized after fabrication.

2. Material for concrete repairs shall be as specified in Section “Concrete Repair Materials.”
3. Electrodes for welding processes shall be as specified below:

(a) SMAW:
   i. E70XX low hydrogen.

(b) SAW:
   i. F7X-EXXX.

(c) GMAW:
   i. ER70S-X.

(d) FCAW:
   i. E7XT-X.

(e) Electrodes shall be compatible with parent metal joined.

C. Execution

1. Contractor shall locate and mark all Work areas. Engineer shall review and approve identified and marked areas.

2. Contractor shall remove existing pedestrian rails and posts using methods which do not damage the surrounding concrete and existing embedded connections that are anchored to the vertical face of the precast walkway.

3. Existing post connections to remain shall be cleaned.

4. Contractor shall submit shop drawings of the new pedestrian rail to the Engineer for review and approval.

5. Install new pedestrian rails and connect to existing connection plates anchored on the vertical face of the precast walkway.

6. Touch up any damages to galvanized surfaces after welding is complete.

T.I. 10.5 CLEAN AND COAT CORRODED STEEL

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, staging, shoring, bracing, and incidentals necessary to clean corroded steel plates, angles, or miscellaneous steel members. Provide surface preparation by abrasive blasting of steel plates or miscellaneous steel members, and apply an epoxy coating. This Task Item is incidental to Task Item 6.8.

B. Materials

1. Primer: Pre-Prime 167 by ICI Devoe Coatings.

C. Execution

1. Prepare steel surfaces in strict accordance with manufacture’s specifications. Steel surfaces to be coated shall be clean, i.e. devoid of grease, oil, mill scale, oxidation, loosely adherent rust, paint, etc. Abrasive blast steel surfaces to SSPC-SP6.

2. Apply epoxy coating system (primer and finish coat) in strict accordance with manufacturer’s specifications.

T.I. 12.1 REMOVAL OF HOLLOW METAL DOORS, HOLLOW METAL FRAMES AND HARDWARE AND INSTALLATION OF NEW HOLLOW METAL FRAMES

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, staging, and incidentals necessary to remove stairwell doors, door frames, and hardware as well as install new hollow metal frames. Refer to sheets 10/S4.4 and 11/S4.4 for additional information. See Plan Sheets for location of Work.

B. Materials

1. Approved materials to be used in this Work are specified in Sections “Hollow Metal Doors and Frames”.

2. Material for concrete repairs shall be as specified in Section “Concrete Repair Materials.”

3. Joint sealant shall be as specified in Section “Joint Sealants”.

C. Execution

1. Contractor shall install pedestrian blockades to prevent public from accessing stairwell where Work is to be performed. Blockades shall include flashing lights and signage redirecting pedestrian traffic.

2. Remove existing door, door frame, and hardware. Contractor shall take special precautions to prevent damage to existing precast walls. Extent of door frame removal shall only involve adjacent grout (demo shall not damage precast concrete panels).

3. Prepare existing substrate as specified in Section “Surface Preparation for Patching” to all for plumb installation of new door assembly.

4. Install new hollow metal door frames as specified in Section 081113 “Hollow Metal Doors and Frames.” Contractor shall install joint sealant between interface of new frame and existing concrete wall.

5. Contractor shall prime and paint new frames to match existing.
6. Contractor shall provide new ID graphics on interior and exterior of entry ways. New ID graphics to match existing. Paint to be gloss finish.

7. After completion of installation contact Engineer and Owner to review installation.

T.I. 12.4 TEMPORARY REMOVAL OF WALL MOUNTED EMERGENCY NOTIFICATION SYSTEM EQUIPMENT

A. Scope of Work

1. Work consists of furnishing all labor, materials, supervision, and incidentals necessary to coordinate with Owner at the start and end of each phase regarding temporary removal and reinstallation of emergency notification equipment with Work area.

B. Materials

1. None

C. Execution

1. Contractor shall coordinate with Owner regarding construction schedule updates to allow Owner a minimum of 2 weeks to coordinate the temporary removal and/or reinstallation of the emergency notification equipment. Temporary removal and reinstallation will be performed by independent subcontractor provided by Owner.

T.I. 12.5 PRECAST CONCRETE PANELS - REMOVAL AND REPLACEMENT

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, staging, shoring, bracing, and incidentals necessary to remove and replace precast concrete panels. Work shall also include any miscellaneous steel, welding and corresponding labor required to install the panels. The new panels shall be installed as shown in the drawings. Provide shop drawings of the precast panels as well as the steel members and connections. Refer to Sheets S5.0 and S5.1 for additional information.

B. Materials

1. Material for concrete replacement shall be as specified in Section “Cast-in-Place Concrete.”

2. Material for steel reinforcement shall be as specified in Section “Concrete Reinforcing.”

3. Electrodes for welding processes shall be as specified below:

   (a) SMAW:

   i. E70XX low hydrogen.
(b) SAW:
   i. F7X-EXXX.

(c) GMAW:
   i. ER70S-X.

(d) FCAW:
   i. E7XT-X.

(e) Electrodes shall be compatible with parent metal joined.

4. Refer to sheets S0.1, S5.0, and S5.1 within the drawings for additional information.

C. Execution

1. Contractor shall remove the existing precast concrete panels.
2. Contractor shall install the new precast concrete panels.

T.I. 13.1 CONCRETE REPAIR ALLOWANCE

A. Scope of Work

1. Concrete Repair Allowance relates to concrete repairs which are concealed and will become apparent during construction. This allowance shall not be related to any Work associated with or documented in the existing Task Items of the project. Work ineligible for allowance includes Work covered by or incidental to Task Items within this Specification or for Work required through Contractor's negligence.

B. Materials

1. None

C. Method of Payment

1. Concrete Repair Allowance, as approved in writing by Owner and Engineer prior to implementation, shall be paid per amount of concrete repair implemented. Contractor shall forward actual invoices for approved Work to Owner with each pay request. Contractor shall attach actual invoices to written authorization. At completion of project, any variation between allowance and actual payment receipts will be reflected in an adjustment of the allowance amount.

T.I. 13.2 REINFORCEMENT STEEL ALLOWANCE

A. Scope of Work

1. Reinforcement Steel Allowance relates to corroded steel reinforcement which was concealed and will become apparent during
construction. This allowance shall not be related to any Work associated with or documented in the existing Task Items of the project. Work ineligible for allowance includes Work covered by or incidental to Task Items within this Specification or for Work required through Contractor's negligence.

B. Materials

1. None

C. Method of Payment

1. Reinforcement Steel Allowance, as approved in writing by Owner and Engineer prior to implementation, shall be paid per amount of reinforcement steel implemented. Contractor shall forward actual invoices for approved Work to Owner with each pay request. Contractor shall attach actual invoices to written authorization. At completion of project, any variation between allowance and actual payment receipts will be reflected in an adjustment of the allowance amount.

T.I. 13.3 PLUMBING ALLOWANCE

A. Scope of Work

1. Plumbing Allowance relates to repair of plumbing items beyond the installation of new drains. This allowance shall not be related to any Work associated with or documented in the existing Task Items of the project. Work ineligible for allowance includes Work covered by or incidental to Task Items within this Specification or for Work required through Contractor's negligence.

2. Temporary protection and support for existing drain pipes and hangers during the concrete repairs shall not be covered under this task item but instead are incidental to the corresponding concrete repair task item impacting the plumbing components.

B. Materials

1. None

C. Method of Payment

2. Plumbing Allowance, as approved in writing by Owner and Engineer prior to implementation, shall be paid per amount of plumbing Work implemented. Contractor shall forward actual invoices for approved Work to Owner with each pay request. Contractor shall attach actual invoices to written authorization. At completion of project, any variation between allowance and actual payment receipts will be reflected in an adjustment of the allowance amount.

T.I. 13.4 ELECTRICAL ALLOWANCE

A. Scope of Work
1. Electrical Allowance relates to repair of electrical items surrounding the planned concrete repairs. This allowance shall not be related to any Work associated with or documented in the existing Task Items of the project. Work ineligible for allowance includes Work covered by or incidental to Task Items within this Specification or for Work required through Contractor's negligence.

2. Removal of dead or abandoned electrical conduits or boxes during the concrete repairs shall not be covered under this task item but instead is incidental to the corresponding concrete repair task item.

B. Materials

1. None

C. Method of Payment

1. Electrical Allowance, as approved in writing by Owner and Engineer prior to implementation, shall be paid per amount of electrical Work implemented. Contractor shall forward actual invoices for approved Work to Owner with each pay request. Contractor shall attach actual invoices to written authorization. At completion of project, any variation between allowance and actual payment receipts will be reflected in an adjustment of the allowance amount.

T.I. 13.5 GALVANIC ANODE ALLOWANCE

A. Scope of Work

1. Galvanic Anode Allowance relates to protection or reinforcement surrounding the planned concrete repairs. This allowance shall not be related to any work associated with or documented in the existing Task Items of the project. Work ineligible for allowance includes Work covered by or incidental to Task Items within this Specification or for Work required through Contractor's negligence.

B. Materials

1. None

C. Method of Payment

1. Galvanic Anode Allowance, as approved in writing by Owner and Engineer prior to implementation, shall be paid per amount of galvanic anodes implemented. Contractor shall forward actual invoices for approved Work to Owner with each pay request. Contractor shall attach actual invoices to written authorization. At completion of project, any variation between allowance and actual payment receipts will be reflected in an adjustment of the allowance amount.

T.I. 13.6 WATERPROOFING ALLOWANCE

A. Scope of Work
1. Waterproofing Allowance relates to routing and sealing of slab cracks, installation of cove sealant and installation of sealant at pipe penetrations as required by the “Owner”. This allowance shall not be related to any Work associated with or documented in the existing Task Items of the project. Work ineligible for allowance includes Work covered by or incidental to Task Items within this Specification or for Work required through Contractor’s negligence.

B. Materials

1. None

C. Method of Payment

1. Waterproofing Allowance, as approved in writing by Owner and Engineer prior to implementation, shall be paid per amount of waterproofing Work implemented in accordance with the provided unit pricing table in the bid form. Contractor shall forward actual invoices for approved Work to Owner with each pay request. Contractor shall attach actual invoices to written authorization. At completion of project, any variation between allowance and actual payment receipts will be reflected in an adjustment of the allowance amount.

T.I. 1.1A 50% OF PARKING SPACES AVAILABLE FOR CONTRACTOR’S USE – (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, staging, formwork, shoring, bracing, supervision, and incidentals necessary to complete the task items included in the Base Bid of this project with 50% of parking spaces in the structure being available for contractor’s use.

2. Task Item 12.1A is a “DEDUCT” Alternate for “Base Bid based on Phasing Plans provided within the Repair Drawings”. Contractor shall provide a negative cost number over “Grand Total for Base Bid” price.

3. Hydro demolition is prohibited as an alternate means of demolition.

B. Materials

1. None

C. Execution

1. Contractor shall limit the work area to occupy only 50% of total parking spaces in the structure. Contractor shall ensure that the remaining 50% of parking spaces shall be available for owner to maintain the parking operations.
2. Contractor shall coordinate the construction sequencing with the Owner to provide entrance, exit, passage way and safe parking areas for the owner occupied spaces.

3. Contractor shall also provide access to entrance/exit to the stairs, elevators and to the adjoining building.

4. Owner occupied area may be available for contractor's use during off hours and/or weekends.

T.I. 1.1B 100% OF PARKING SPACES AVAILABLE FOR CONTRACTOR'S USE – (ALTERNATE)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, staging, formwork, shoring, bracing, supervision, and incidentals necessary to complete the task items covered in the base bid of this project with 100% of parking spaces in the structure being available for contractor's use.

2. Task Item 12.2A is a “DEDUCT” Alternate for “Base Bid based on Phasing Plans provided within the Repair Drawings”. Contractor shall provide a negative cost number over “Grand Total for Base Bid” price.

3. Hydro demolition is prohibited as an alternate means of demolition.

B. Materials

1. None

C. Execution

1. No parking operations will be conducted during the duration of the project.

2. Contractor shall have full access to the parking structure with minor exceptions. These exceptions include but not limited to owner’s access to electrical room on slab-on-grade. Exit/entrance to the occupied space areas connected to the garage for pedestrian egress purposes (i.e. entrances to the Sutherland Building and the Skywalk that connects to the Hospital at Stair Tower #1). Contactor shall coordinate with Owner to provide this access, as needed.

T.I. 1.1C VOLUNTARY PHASING ALTERNATE – (NO HYDRO DEMOLITION)

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, staging, formwork, shoring, bracing, supervision, and incidentals necessary to complete the task items covered in the base bid of this project using alternative phasing proposed by Contractor.

2. Hydro demolition is prohibited as an alternate means of demolition.
B. Materials

1. None

C. Execution

1. Operations of the facility shall be considered within the Contractor’s proposed phasing.

2. Contractor shall explicitly express extent of access to the parking structure with minor exceptions of certain areas within the garage. These exceptions include but not limited to owner’s access to electrical room on slab-on-grade. Exit/entrance to the occupied space areas connected to the garage for pedestrian egress purposes (i.e. entrances to the Sutherland Building and the Skywalk that connects to the Hospital at Stair Tower #1). Contractor shall coordinate with Owner to provide this access, as needed.
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including conditions included by Owner.

1.2 GENERAL DESCRIPTION OF WORK:
   A. The Work of this Contract will be performed in the facility as shown on Drawings.
   B. Contractor shall furnish all material, labor, tools, plant, supplies, permits, equipment, transportation, superintendence, barricades, temporary construction of every nature, insurance, taxes, contributions and all services and facilities, unless specifically excepted, and install all materials, items, and equipment required to complete the construction of the Project, as set forth in the Contract Documents.
   C. Refer to Section “Task Items” for a description of work. Task Item specifications, details, and drawings shall govern all repair operations. Locations where Task Items apply are shown on Drawings as symbols.
   D. Final Payment shall be made on basis of actual approved Work performed as measured in place.

1.3 MEASUREMENTS:
   A. Before ordering any material or doing any Work, Contractor shall verify all measurements at Project Site and shall be responsible for correctness of same.
   B. Before proceeding with each Task Item, Contractor shall locate, mark, and measure quantity of each item and report quantities to Engineer. If measured quantities exceed Engineer’s estimate, Contractor shall obtain written authorization to proceed from Owner before executing Work required for that Task Item.
   C. Cost of Work included in each Task Item for quantities as indicated in Contract Documents shall be included in Base Bid.

1.4 WORK SEQUENCE:
   A. Prior to commencement of Work, meet with Engineer and Owner representatives to establish sequence and schedule of Work. Contractor shall give Owner notice of areas to be cleared at least 7 working days in advance of actual Work.
   B. Contractor shall notify Owner’s representative at least 24 hrs. prior to commencing any abrasive blasting such as sandblasting, etc. operations.
   C. Work will be conducted in phases to provide least possible interference to activities of Owner’s personnel and facility users.
1. Contractor’s work hours shall be limited to comply with noise ordinances. Contractor is allowed to work as necessary to complete work within Owner’s time schedule and conditions conducive to temperature sensitive materials.

D. Contractor shall remove debris from Work area on daily basis and dispose of same at authorized sites.

E. Contractor shall remove dust and air transported material from remainder of facility at conclusion of operations in Work area.

1.5 CONTRACTOR’S USE OF PREMISES:

A. Contractor shall limit his use of adjacent premises for Work, construction operations and for storage to allow for:

1. Public use, including parking.

2. Owner Occupancy:
   
   a. Where it is necessary for the Contractor to use portions of existing buildings and/or grounds for operations, such use shall be strictly in accordance with requirements and approval of the Owner.

   b. Contractor shall organize his work in order that inconvenience to the people in the facility is minimized.

   c. Keep driveways and entrances serving the premises clear and available to the Owner and Owner’s employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

   d. Unless otherwise indicated or specified, or unless otherwise directed by Owner; water, gas, lighting, power and telephone conduits and wires, sewer lines, and other surface and subsurface structures and lines, shall be maintained by Contractor and shall not be disturbed, disconnected or damaged by him during progress of Work; provided that should Contractor in performance of Work disturb, disconnect or damage any of above, expenses arising from disturbance or in replacing or repair shall be borne by Contractor.

   e. Elevators shall not be used for transfer of materials or equipment.

3. Contractor shall:

   a. Not unreasonably encumber Site with materials and equipment.

   b. Not load structure with weight that will endanger structure.

   c. Assume full responsibility for protection and safekeeping of stored products.

   d. Move stored products which interfere with operations of Owner.
e. Obtain and pay for use of additional storage and work areas needed for operations.

4. Contractor Parking:

a. Contractor’s personal vehicles shall park outside of construction area. Only vehicles equipment or delivering materials should be in zone. Coordinate with owner’s representative.

1.6 OWNER OCCUPANCY:

A. Cooperate with the Owner’s Representative in all construction operations to minimize conflict and to facilitate Owner usage.

B. Contractor shall at all times conduct his operations as to ensure the least inconvenience to the general public.

1.7 SURVEY OF EXISTING CONDITIONS:

A. Contractor acknowledges by submitting a Bid, that he has visited and inspected the Project Site in which the Work is to be performed, that he has satisfied himself as to the nature and location of the Work, including any obstructions, amount of work, actual levels, the equipment and facilities needed preliminary to and during the prosecution of the Work, and all other matters which can in any way affect the Work or the cost thereof under this Contract.

B. Failure by Contractor to have acquainted himself with available information concerning Site conditions, including factors affecting costs and liabilities, shall not relieve Contractor of responsibility for performance of Work in accordance with requirements of Contract Documents, and for amount of consideration named or otherwise determined.

1.8 INFORMATION OR CLARIFICATION OF CONDITIONS

A. When Contractor encounters a condition requiring further information or a clarification, Contractor shall submit to Walter P. Moore and Associates a written Request For Information (R.F.I.) numbered sequentially. Walter P. Moore and Associates will respond in writing to all R.F.I.’s.

END OF SECTION 011100
SECTION 012513
PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of Contract.

B. Contractor's Construction Schedule and Schedule of Submittals are included under Section "Submittal Procedures."

C. Engineer's policy is to reject requests for substitution. Vendors wishing inclusion in Engineer's master specification: contact Engineer for procedure.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify meaning of other terms used in Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by Contractor after award of Contract are considered requests for "substitutions." Following are not considered substitutions:

   1. Revisions to Contract Documents requested by Owner or Engineer.
   2. Specified options of products and construction methods included in Contract Documents.
   3. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if received within 15 days after commencement of Work. Requests received more than 15 days after commencement of Work may be considered or rejected at discretion of Engineer.

   1. Submit 3 copies of each request for substitution for consideration. Submit requests on forms included at end of this Section and in accordance with procedures required for Change Order proposals.
   2. Identify product, or fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete
documentation showing compliance with requirements for substitutions, and the following information, as appropriate:

a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
b. Samples, where applicable or requested.
c. Detailed comparison of significant qualities of proposed substitution with those of Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
d. Coordination information, including list of changes or modifications needed to other parts of Work and to construction performed by Owner and separate Contractors, that will become necessary to accommodate proposed substitution.
e. Statement indicating substitution's effect on Contractor's Construction Schedule compared to schedule without approval of substitution. Indicate effect of proposed substitution on overall Contract Time.
f. Cost information, including proposal of net change, if any in Contract Sum.
g. Certification by Contractor that substitution proposed is equal-to or better in every significant respect to that required by Contract Documents, and that it will perform adequately in application indicated. Include Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of failure of substitution to perform adequately.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: Contractor's substitution request will be received and considered by Engineer when one or more of following conditions are satisfied, as determined by Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

1. Specified product or method of construction cannot be provided within Contract Time. Specified product or method of construction cannot receive necessary approval by governing authority, and requested substitution can be approved.
2. Substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities Owner may be required to bear. Additional responsibilities for Owner may include additional compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner or separate Contractors, and similar considerations.
3. Specified product or method of construction cannot be provided in manner that is compatible with other materials, and where Contractor certifies that substitution will overcome incompatibility.
4. Specified product or method of construction cannot be coordinated with other materials, and where Contractor certifies that proposed substitution can be coordinated.
5. Specified product or method of construction cannot provide warranty required by Contract Documents and where Contractor certifies that proposed substitution provide required warranty.

B. Contractor's submittal and Engineer's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.
REQUEST FOR SUBSTITUTION

To: WALTER P. MOORE

Attention:

From: __________________________

Name of Company

______________________________

Address

______________________________

City, State, Zip Code

______________________________

Phone

Fully answer all information requested below. Failure to answer any item may cause rejection of request for substitution. If requested by Engineer, submit information about manufacturer and vendor history, financial stability, distribution and support systems. Use one form for each product requested. Only first product listed will be considered on forms with more than one product listed.

Specification Section Number: __________ Drawing Number: __________

Para Number: _______ Detail Number: _______

Specified Product: ________________________________________________________

Proposed Substitution: _____________________________________________________

Answer the following questions. Attach an explanation sheet on your company’s letterhead when required.

Does the proposed substitution affect dimensions indicated on Drawings?

No _____ Yes _____ (If yes, explain below).

_______________________________________________________________________

_______________________________________________________________________

_______________________________________________________________________

Does the proposed substitution require changes in Drawings and/or design or installation changes?

No _____ Yes _____

If yes, is the cost of these changes included in the proposed amount?  No ____ Yes ____

Does the proposed substitution affect other trades?     No _____ Yes __________
(If yes, explain who and how)

________________________________________________________________________

________________________________________________________________________

If the proposed product does affect the work of other trades, has the cost impact on their work been included in the price of the proposed substitution?

No _____ Yes _____

Does the proposed product's guarantee differ from that of the specified product's?

No _____ Yes _____ (If yes, explain below).

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Why is this proposal for substitution being submitted? List reasons below.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Attach a listing of 3 projects using proposed substitution completed within the past 5 yrs in geographic and climatic region of Project. One of applications shall have been in service for at least 3 yrs.

Attach product data/brochures and Vendor Qualification Form for the specified and substitute product.

Undersigned has examined Construction Documents, is familiar with specified product, understands indicated application of product, and understands design intent of Engineer. Undersigned states that proposed substitution complies with Construction Documents and will perform at least equally to specified product within limitations stated above. Undersigned accepts responsibility for coordinating application and installation of proposed substitution and waives all claims for additional costs resulting from incorporation of proposed substitution into Project or its subsequent failure to perform according to specified requirements.

Submitted By: ___________________________    ___________________________ Signature

Typed               Signature

Date: ___________________________
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

   a. Application for Payment forms with Continuation Sheets.
   b. Submittals Schedule.

2. Submit the Schedule of Values to Engineer at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual Bid Form Task Items as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:

   a. Project name and location.
   b. Name of Engineer.
   c. Engineer's project number.
   d. Contractor's name and address.
   e. Date of submittal.
2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

a. Related Specification Section or Division.
b. Description of the Work.
c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders (numbers) that affect value.
g. Dollar value.

1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

6. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is the [15th] day of each month. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends 15 days before the date for each progress payment.

C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment or owner’s approved forms.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.

2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item, if applicable.
2. When an application shows completion of an item, submit final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.
   a. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products list.
5. Schedule of unit prices.
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
11. Initial progress report.
13. Certificates of insurance and insurance policies.
14. Initial settlement survey and damage report if required.

H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
6. Evidence that claims have been settled.
7. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 012900
SECTION 013100
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Coordination Drawings.
3. Administrative and supervisory personnel.
4. Project meetings.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 01 Section "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Preinstallation conferences.
6. Project closeout activities.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
   1. Indicate relationship of components shown on separate Shop Drawings.
   2. Indicate required installation sequences.

B. Staff Names: Within 15 days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
   1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1.6 PROJECT MEETINGS

A. General: Coordinate with the Engineer and Owner’s Representatives in the scheduling and participation in meetings and conferences at Project site, unless otherwise indicated.
   1. Attendees: Inform the Owner’s Representative, Engineer, and Contractor of the date and time of each meeting. Contractor and Owner’s Representative shall inform others involved, and individuals whose presence is required, of date and time of each meeting.
   2. Agenda: Engineer or Owner’s Representative will prepare the meeting agenda and distribute the agenda to all invited attendees.
   3. Minutes: Engineer or Owner’s Representative will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Engineer, and Contractor, within 3 days of the meeting.

B. Preconstruction Conference: Coordinate with the Engineer and Owner’s Representatives in the scheduling of a preconstruction conference before starting construction, at a time acceptable to the Contractor and convenient to Owner and Engineer but no later than 15 days after execution of the Agreement. Hold the conference at the Project site or another convenient location. The Engineer or Owner’s Representative will conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including the following:
   
a. Tentative construction schedule.
   b. Phasing.
   c. Critical work sequencing.
   d. Designation of responsible personnel.
   e. Procedures for processing field decisions and Change Orders.
   f. Procedures for processing Applications for Payment.
   g. Distribution of the Contract Documents.
   h. Submittal procedures.
   i. Preparation of Record Documents.
   j. Use of the premises.
   k. Responsibility for temporary facilities and controls.
   l. Parking availability.
   m. Office, work, and storage areas.
   n. Equipment deliveries and priorities.
   o. First aid.
   q. Progress cleaning.
   r. Working hours.

C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   
   b. Options.
   c. Related Change Orders.
   d. Deliveries.
   e. Submittals.
   f. Compatibility problems.
   g. Time schedules.
   h. Weather limitations.
   i. Manufacturer's written recommendations.
   j. Warranty requirements.
   k. Compatibility of materials.
   l. Acceptability of substrates.
   m. Temporary facilities and controls.
   n. Space and access limitations.
   o. Testing and inspecting requirements.
   p. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements.
4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Engineer or Owner’s Representative will conduct progress meetings at weekly intervals. Contractor shall coordinate preparation of payment requests with dates of meetings.

1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

   b. Review present and future needs of each entity present, including the following:

      1) Sequence of operations.
      2) Status of submittals.
      3) Access.
      4) Site utilization.
      5) Temporary facilities and controls.
      6) Work hours.
      7) Hazards and risks.
      8) Progress cleaning.
      9) Quality and work standards.
     10) Change Orders.
     11) Documentation of information for payment requests.

3. Reporting: Engineer or Owner’s Representative will distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

   a. Schedule Updating: Revise Contractor’s Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
SECTION 013300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

B. Related Sections include the following:

1. Division 01 Section "Payment Procedures."
2. Division 01 Section "Project Management and Coordination" for submitting Coordination Drawings.
3. Division 01 Section "Quality Control" for submitting test and inspection reports and Delegated-Design Submittals.
4. Division 01 Section "Closeout Procedures" for submitting warranties.
5. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Engineer's responsive action.

B. Informational Submittals: Written information that does not require Engineer's approval. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. Resubmittals: Engineer will review each of Contractor's shop drawings and/or submittal data 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. 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 the cost of Engineer's services made necessary to review such additional resubmittals. Owner will in turn reimburse Engineer.

B. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Engineer for Contractor's use in preparing submittals.
C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal.

1. Initial Review: Allow 7 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
3. Include the following information on label for processing and recording action taken:
   a. Project name.
   b. Date.
   c. Name and address of Engineer.
   d. Name and address of Contractor.
   e. Name and address of subcontractor.
   f. Name and address of supplier.
   g. Name of manufacturer.
   h. Unique identifier, including revision number.
   i. Number and title of appropriate Specification Section.
   j. Drawing number and detail references, as appropriate.
   k. Other necessary identification.

F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Engineer [or Construction Manager] observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Engineer [and Construction Manager].
2. Additional copies submitted for maintenance manuals will [not] be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer will return submittals, without review, received from sources other than Contractor.
1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.

2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.

3. Transmittal Form: Provide locations on form for the following information:
   
   a. Project name.
   b. Date.
   c. Destination (To:).
   d. Source (From:).
   e. Names of subcontractor, manufacturer, and supplier.
   f. Category and type of submittal.
   g. Submittal purpose and description.
   h. Submittal and transmittal distribution record.
   i. Remarks.
   j. Signature of transmitter.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating action taken by Engineer in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

   1. Number of Copies: Submit three copies of each submittal, unless otherwise indicated. Engineer will return two copies. Mark up and retain one returned copy as a Project Record Document.

   2. Number of Copies: Submit copies of each submittal, as follows, unless otherwise indicated:

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

   1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.

   2. Mark each copy of each submittal to show which products and options are applicable.

   3. Include the following information, as applicable:

      a. Manufacturer's written recommendations.
      b. Manufacturer's product specifications.
      c. Manufacturer's installation instructions.
      d. Standard color charts.
      e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operating and maintenance manuals.
k. Compliance with recognized trade association standards.
l. Compliance with recognized testing agency standards.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Include the following information, as applicable:
   a. Dimensions.
   b. Identification of products.
   c. Fabrication and installation drawings.
   d. Roughing-in and setting diagrams.
   e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
   f. Shopwork manufacturing instructions.
   g. Templates and patterns.
   h. Schedules.
   i. Design calculations.
   j. Compliance with specified standards.
   k. Notation of coordination requirements.
   l. Notation of dimensions established by field measurement.

D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit three copies of each submittal, unless otherwise indicated. Engineer will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Control."

B. Contractor's Construction Schedule: Provide Level 3 Schedule with progress monitoring and project control level unless Owner has more stringent scheduling requirements.

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of Engineers and owners, and other information specified.

D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

J. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.

K. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

L. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

M. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

N. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

O. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures."
P. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

Q. Signage: Contractor shall prepare and provide written proposal of signage pertaining to pedestrian and vehicular traffic signage at and nearby work areas. Contractor shall coordinate signage with Owner and shall provide additional signage as requested by Owner at no additional expense to Owner. Contractor may reuse signage as needed throughout the duration of the project.

R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

2.3 REQUESTS FOR INFORMATION

A. Engineer reserves the right to reject, unprocessed, any RFI that the Engineer, at its sole discretion, deems already answered in the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date
of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

END OF SECTION 013300
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY
   A. This Section specifies administrative and procedural requirements for quality control services.
   B. Quality control services include inspections, tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by Engineer.
   C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
   D. Related Sections: Following Sections contain requirements that relate to this Section:
      1. Division 01 Section "Cutting and Patching" specifies requirements for repair and restoration of construction disturbed by inspection and testing activities.
      2. Division 01 Section "Submittal Procedures" specifies requirements for development of a schedule of required tests and inspections.

1.3 RESPONSIBILITIES
   A. Contractor Responsibilities:
      1. Retesting: Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
         a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
      2. Associated Services: Cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
         a. Provide access to the Work.
b. Furnish incidental labor and facilities necessary to facilitate inspections and tests.

c. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.

d. Provide facilities for storage and curing of test samples.

e. Deliver samples to testing laboratories.

f. Provide the agency with a preliminary design mix proposed for use for material mixes that require control by the testing agency.

g. Provide security and protection of samples and test equipment at the Project Site.

B. Owner Responsibilities: Owner will provide inspections, tests and similar quality control services specified to be performed by independent agencies and not by the Contractor, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity. Costs for these services are not included in the Contract Sum.

1. Owner will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform services which are the Owner's responsibility.

C. Coordination: Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.4 SUBMITTALS

A. Testing Agency shall submit a certified written report of each inspection, test or similar service, to Engineer, in duplicate, unless Contractor is responsible for the service. If Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:

a. Date of issue.

b. Project title and number.

c. Name, address and telephone number of testing agency.

d. Dates and locations of samples and tests or inspections.

e. Names of individuals making the inspection or test.

f. Designation of the Work and test method.

g. Identification of product and Specification Section.

h. Complete inspection or test data.

i. Test results and interpretations of test results.

j. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.

k. Name and signature of laboratory inspector.

l. Recommendations on retesting.
1.5 QUALITY ASSURANCE

A. Qualification for Testing Agencies: Engage testing agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.

1. Each independent testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 - PRODUCTS (NOT APPLICABLE).

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is the Contractor’s responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 014500
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK

A. The Owner’s Testing Laboratory: An independent testing laboratory will sample and test materials as they are being installed for compliance with acceptance criteria as specified and report and interpret the results. The laboratory shall monitor and report on the installation of constructed work and shall perform tests on the completed construction as required to indicate Contractor’s compliance with the various material specifications governing this work. The owner shall be responsible for paying the testing laboratory for these services.

B. The Contractor shall not engage the same testing laboratory for construction services as the Owner has for quality assurance testing, unless agreed to by the Owner.

1.3 SPECIAL INSPECTIONS

A. The Owner’s Testing Laboratory or a separate agency shall serve as a Special Inspector to provide Special Inspection services for the items listed below. The scope of such services for each item shall be as defined in the International Building Code - 2012. These inspections are mandatory for conformance to the legal requirements of the building code and shall be in addition to the inspections and tests otherwise defined in this specification.

1. Reinforcing Steel Placement
2. Concrete Work
3. Bolts to be Installed in Concrete and Their Installation
4. Traffic Coating Materials and Application

B. Qualifications of Special Inspector: The special inspector shall be a qualified person who shall demonstrate competence, to the satisfaction of the Building Official, for inspection of the particular type of construction or operation being inspected. The Special Inspector shall meet the legal qualifications of the building code having jurisdiction.

C. Duties and Responsibilities of the Special Inspector:

1. The special inspector shall observe the work assigned to ascertain that, to the best of his/her knowledge, it is in conformance with the approved design drawings and specifications.
2. The special inspector shall furnish inspection reports to the Building Official, the Engineer, and the Owner. All discrepancies shall be brought to the immediate attention of the Engineer, Contractor, and Owner. A report that the corrected work has been inspected shall be sent to the Building Official, the Engineer, and the Owner.

3. The special inspector shall submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector’s knowledge, in conformance to the approved plans and specifications and the applicable workmanship provisions of the building code.

1.4 QUALIFICATIONS OF TESTING LABORATORY

A. The Testing Laboratory shall meet the basic requirements of ASTM E329 and shall submit to the Owner, Architect, and Engineer evidence of current accreditation from the American Association for Laboratory Accreditation, the AASHTO Accreditation Program or the “NIST” National Voluntary Laboratory Accreditation Program.

B. The Testing Laboratory shall be an Approved Agency by the Building Official of the city wherein the project is located to perform Special Inspections and other tests and inspections as outlined in the applicable building code.

C. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.

1.5 AUTHORITIES AND DUTIES OF THE LABORATORY

A. Attending Preconstruction Conferences: The Owner’s Testing Laboratory shall receive from the Owner and review the project plans and specifications with the Architect and Engineer immediately upon receipt and prior to the start of construction. The Laboratory shall attend preconstruction conferences with the Engineer, Project Manager, General Contractor, and Material Suppliers as required to coordinate materials inspection and testing requirements with the planned construction schedule and shall participate in such conferences throughout the course of the project.

B. Cost Proposal: The Testing Laboratory’s proposal to the Owner shall contain unit price stipulations for specified tests and inspections and on an hourly basis for personnel. A total estimated price shall also be submitted.

C. Cooperation with Design Team: The Laboratory shall cooperate with the Engineer and Contractor and provide qualified personnel promptly on notice.

D. The Laboratory shall perform the required inspections, sampling, and testing of materials as specified under each section and observe methods of construction for compliance with the requirements of the Contract Documents and the applicable building code.

E. Inspections Required by Government Agencies: The Testing Laboratory shall perform inspections and submit reports and certifications as required by government agencies having jurisdiction over the aspects of the project covered by this specification.

F. Notification of Deficiencies in the Work: The Laboratory shall notify the Engineer and Contractor within 24 hours of discovery by telephone or e-mail, and then in writing of observed irregularities and deficiencies of the work and other conditions not in compliance with the requirements of the Contract Documents.
G. Reports:

1. Information on Reports: The Laboratory shall submit copies of reports of inspections and tests promptly and directly to the parties named below. The reports shall contain at least the following information:

   a. Project Name
   b. Date report issued
   c. Testing Laboratory name and address
   d. Name and signature of inspector
   e. Date of inspection and sampling
   f. Date of test
   g. Identification of product and Specification section
   h. Location in the project
   i. Identification of inspection or test
   j. Record of weather conditions and temperature (if applicable)
   k. Results of test regarding compliance with Contract Documents

2. Copies: The Laboratory shall send signed copies of test and inspection reports to the following parties:

   a. Electronic copy to the Owner or his representative
   b. Electronic copy to the General Contractor
   c. Electronic copy to the Engineer of responsibility

3. Certification: Upon completion of the job, the Laboratory shall furnish to the Owner and Engineer of Record, a statement signed by a licensed professional engineer that, to the best of their knowledge, required tests and inspections were made in accordance with the requirements of the Contract Documents.

H. Accounting: The Testing Laboratory shall be responsible for separating and billing costs attributed to the Owner and costs attributed to the Contractor.

I. Monitoring Product and Material Certifications: The Testing Laboratory shall be responsible for monitoring the submittals of product and material certifications from manufacturers and suppliers as specified in the Specifications and shall report to the Owner and Engineer when those submittals are not made in a timely manner.

J. Limitations of Authority: The Testing Laboratory is not authorized to revoke, alter, relax, enlarge upon, or release any requirements of the Specifications or to approve or accept any portion of the work or to perform any duties of the General Contractor and his Subcontractors.

1.6 CONTRACTOR'S RESPONSIBILITY

A. Cooperation with Design Team: The Contractor shall cooperate with laboratory personnel, provide access to the work, and to manufacturer's operations.

B. Furnishing Samples and Certificates: The Contractor shall provide to the laboratory certificates and representative samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.

C. Furnishing Casual Labor, Equipment and Facilities: The Contractor shall furnish casual labor, equipment, and facilities as required for sampling and testing by the laboratory and otherwise facilitate the required inspections and tests.
D. Advance Notice: The Contractor shall be responsible for notifying the Testing Laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests. Failure to sufficiently notify may result in additional costs incurred by the Testing Laboratory that may be back-charged to the Contractor by the Owner.

E. Payment for Substitution Testing: The Contractor shall arrange for and pay for any additional samples and tests above those required by the Contract Documents as requested by the Contractor for his convenience in performing the work.

F. Payment for Retesting: The Contractor shall be liable to the Owner for the cost for any additional inspections, sampling, testing, and retesting done by the Owner’s Testing Laboratory as required when initial tests indicate work does not comply with the requirements of the Contract Documents.

G. Payment by Contractor: The Contractor shall furnish and pay for the following items if required:

1. Samples of concrete aggregates and delivery to the Contractor’s Testing Laboratory.
2. Concrete mix designs as prepared by his concrete supplier.
4. Concrete coring, tests of below strength concrete, and load tests, if ordered by the Owner or Engineer.
5. Certification of reinforcing steel mill order.
8. Tests, samples, and mock-ups of substitute material where the substitution is requested by the Contractor and the tests are necessary in the opinion of the Owner or Engineer to establish equality with specified items.
9. The making and testing of concrete cylinders for the purpose of evaluating strength at time of form stripping or the time spent evaluating the in situ strength of concrete using the Maturity Method.
10. Any other tests when such costs are required by the Contract Documents to be paid by the Contractor.

H. Notification of Source Change: The Contractor shall be responsible for notifying the Owner, Engineer, and Owner’s Testing Laboratory when the source of any material is changed after the original tests or inspections have been made.

I. Tests for Suspected Deficient Work: If in the opinion of the Owner or Engineer any of the work of the Contractor is not satisfactory, the Contractor shall furnish and pay for all tests that the Owner or Engineer deem advisable to determine its proper construction. The Owner shall pay all costs if the tests prove the questioned work to be satisfactory.
1.7 PAYMENT OF TESTING LABORATORY

A. The Owner will pay for the initial Laboratory services for testing of materials for compliance with the requirements of the Contract Documents. The Contractor will be liable to the Owner for the cost for testing and retesting of materials that do not comply with the requirements of the Contract Documents and shall furnish and pay for the testing and inspection of other items as specified in these Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCOPE OF WORK

A. The work to be performed by the Testing Laboratory shall be as specified in this Section of the Specification and as determined in meetings with the Owner and Engineer.

3.2 REINFORCING STEEL

A. Reinforcing Steel Field Inspection: The Owner’s Testing Laboratory or designated Special Inspector shall inspect 100% of reinforcement before each concrete pour to verify the information noted below. Inspection reports shall be prepared and distributed in accordance with the local building code and as specified in this specification.

1. Primary and secondary, longitudinal reinforcement has correct size and number in proper layers.

2. Longitudinal reinforcement has correct length and lap.

3. Reinforcement is properly supported and braced to formwork to prevent movement during concreting operation.

4. Reinforcement has proper cover.

5. Sufficient spacing between reinforcement for concrete placement.

6. Dowel reinforcement is of proper size, at proper spacing, and has proper lap length and embedment length.

7. Reinforcement around embedded items is erected according to details.
B. CONCRETE REPAIR MATERIALS

C. Field Inspection and Testing:

1. Sampling and testing of mortar shall be performed by ACI certified Concrete Field Technicians Grade I. Certification shall be no more than three years old.

2. Concrete Repair Material Compressive Strength
   
   a. Mold test cubes per ASTM C-109: Take minimum of 6 cubes (2"x2") for each 10 ft³ or fraction of each repair mortar placed in any one day.
   
   b. Additional cubes shall be taken as directed by Engineer.
   
   c. Cover and protect molds from contact with water for the first 24-hours after molding.
   
   d. Follow ACI Specifications for storage and handling of specimens.
   
   e. Test 3 cubes at 3 days.
   
   f. Test 3 cubes at 28 days.

3.3 CONCRETE MATERIALS AND POURED IN PLACE CONCRETE

A. Concrete Mix Designs: The Owner’s Testing Laboratory shall review the submitted mix designs for conformance to the specifications and for suitability for use in the project. The Testing Laboratory shall attend the Mix Design Conference and the Pre-Concrete Conference as noted in the Cast-in-Place Concrete Specification.

B. Job Site Inspection: The scope of the work to be performed by the inspector on the jobsite shall be as follows:

1. On-Site Concrete Material Testing and Inspection
   
   a. Verify that the Contractor is following appropriate concreting practices consistent with any extreme environmental conditions at the point of placement in the structure as defined below.
   
   b. Verify that the existing concrete substrate is saturated surface dry (SSD) prior to placement of new concrete.
   
   c. Inspect concrete upon arrival to verify that the proper concrete mix number, type of concrete, concrete strength, and that it is meeting job specifications, is being placed at the proper location. Report concrete not meeting the specified requirements and immediately notify the Contractor, Batch Plant Inspector, Engineer, and Owner.
   
   d. Inspect plastic concrete upon arrival at the jobsite to verify proper batching. Observe mix consistency and adding of water as required to achieve target slumps in mix designs. Record the amount of water added and note if it exceeds that allowed in the mix design. The responsibility for adding water to trucks at the job site shall rest only with the Contractor's designated representative. The Contractor is responsible that all concrete placed in the field is in conformance to the Contract Documents.
   
   e. Obtain concrete test cylinders as specified below.
   
   f. Perform tests to determine slump, concrete temperature, unit weight, and air entrainment as specified below. The slump tests shall be made on concrete taken from the same location from which the concrete for the test cylinders is obtained.
   
   g. Record information for concrete test reports as specified below.
h. Pick up and transport to Laboratory, cylinders cast the previous day.

2. During concrete placing, provide continuous monitoring to:
   
a. Verify that the concrete is not over 90 minutes old at the time of placement.
b. Verify that Hot-Weather or Cold-Weather techniques are being applied as required.
c. Verify that concrete deposited is uniform and that vertical drop does not exceed six feet and is not permitted to drop freely over reinforcement causing segregation.
d. Verify that there are no cold joints.
e. Verify that the concrete is properly vibrated.
f. Verify that the finishing of the concrete surface is done according to specifications.
g. Verify that the formwork has remained stable during the concreting operation.
h. Inspect bolts embedded in concrete prior to and during concrete placement for proper grade, size and length and verification they have been properly installed to the specified embedment.

3. Post-Installed Anchors in Concrete: Provide inspection of post-installed anchor installations at the frequency noted in the specifications and in accordance with the published, currently valid, Evaluation Service Report (ESR) for each anchor product.
   
a. Periodic Inspection: Verify initial installation of post-installed anchors in concrete for each individual installer with each individual anchor product in accordance with the requirements stated below for each type of anchor. Periodically inspect anchor installation after the initial verification.
b. All Post-Installed Anchors: Verify that the anchor is installed in accordance with manufacturer’s printed installation instructions as well as the following design requirements.
   (1) concrete type, concrete strength and concrete thickness are in accordance with design drawings
   (2) anchor manufacturer and product, including material, is in accordance with design drawings or approved substitution
   (3) anchor diameter, length and installed embedment depth
   (4) drill bit type and diameter
   (5) anchor edge distance and spacing
   (6) hole diameter and depth
   (7) hole cleaning procedure and cleanliness
   (8) anchor maximum tightening torque
c. Adhesive Anchors: In addition to the requirements for All Post-Installed Anchors, verify adhesive identification and expiration date.
d. The Owner’s Testing Laboratory shall evaluate the effectiveness of epoxy embedment for bolts, dowels, or reinforcing bars by conducting field proof tests. The load test method shall be submitted to the Engineer for review and approval.
e. Field proof test 10% of the epoxy embedded bolts, dowels or bars, with a minimum of two tests.
f. The Engineer may elect to increase or decrease the number of tests depending upon the outcome of the tests.
g. The proof load shall be 85% of the theoretical ultimate strength of the bolt, dowel or bar or as otherwise determined by the Engineer. Any slip of the embedded bolt, dowel or bar within the epoxy grout material, or slip
at the epoxy/concrete interface before the bolt, dowel or bar yields shall be considered to be a failure of the grouted item.

h. The cost of any repairs failing to meet the proof load and all additional tests deemed necessary by the Engineer shall be borne by the Contractor.

4. In-situ Concrete Strength Verification: The Owner’s Testing Laboratory shall verify that the concrete has reached the required minimum strength before form removal by evaluating the specified tests.

   a. If concrete strength for form stripping is to be determined using field-cured cylinders, one additional cylinder per set will be required for formed slab floors for the purpose of evaluating the concrete strength at the time of form stripping. This cylinder shall be stored on the floor where form removal is to occur under the same exposure conditions as the floor concrete. The cylinder shall be cured under field conditions in accordance with ASTM C31. Field cured test cylinders shall be molded at the same time and from the same samples as Laboratory cured test specimens. The cylinder shall be broken at the time of form removal as directed by the Contractor. The Contractor shall reimburse the Owner for the cost of making and testing these cylinders.

   b. If concrete strength for form stripping is to be determined using the Maturity Method, the Owner’s Testing Laboratory shall verify that the requirements of ASTM C 1074 are being followed and that the proper criteria for determining concrete strength by this method has been established and is being followed.

5. The job site inspector shall report any irregularities that occur in the concrete at the job site or test results to the Contractor, Owner, and Engineer.

C. Concrete Test Cylinders: The Owner’s Testing Laboratory shall mold and test concrete test cylinders as described below.

1. Cylinder Molding and Testing: Cylinders for strength tests shall be molded and Laboratory cured in accordance with ASTM C31 and tested in accordance with ASTM C39. Cylinders may be either 6” in diameter by 12” or 4” in diameter by 8”, however, the diameter of the cylinder shall be at least three times the nominal maximum size of the coarse aggregate in the mix tested. All of the cylinders for each class of concrete shall be of the same dimension for all sets of that class.

2. Field Samples: Field samples for strength tests shall be taken in accordance with ASTM C172.

3. Frequency of Testing: Each set of test cylinders shall consist of a minimum of four standard test cylinders. A set of test cylinders shall be made according to the following minimum frequency guidelines:

   a. One set for each class of concrete taken not less than once a day.
   b. All Other Concrete: A minimum of one set for each 150 cubic yards or fraction thereof.
   c. No more than one set of cylinders at a time shall be made from any single truck.
   d. If the total volume of concrete is such that the frequency of testing as specified above would provide less than five strength tests for a given
class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

e. The above frequencies assume that one batch plant will be used for each pour. If more than one batch plant is used, the frequencies cited above shall apply for each plant used.

4. The cylinders shall be numbered, dated, and the point of concrete placement in the building recorded.

5. For concrete specified on the drawings to reach the required strength at 28 days, break one cylinder of the set at seven days, two 6" by 12" cylinders or three 4" by 8" cylinders at 28 days, and one kept in reserve for testing at the Engineers direction.

6. Cylinder Storage Box: The Contractor shall be responsible for providing a protected concrete cylinder wooden storage box at a point on the job site mutually agreeable with the Testing Laboratory for the purpose of storing concrete cylinders until they are transported to the Laboratory. The box shall be constructed and equipped to maintain the environment specified for initial curing in ASTM C31.

7. Transporting Cylinders: The Owner’s Testing Laboratory shall be responsible for transporting the cylinders to the Laboratory in a protected environment such that no damage or ill effect will occur to the concrete cylinders including loss of moisture, freezing temperatures or jarring.

8. Information on Concrete Test Reports: The Owner’s Testing Laboratory shall make and distribute concrete test reports after each job cylinder is broken. Such reports shall contain the following information:

   a. Truck number and ticket number
   b. Concrete Batch Plant
   c. Mix design number
   d. Accurate location of pour in the structure
   e. Strength requirement
   f. Date cylinders made and broken
   g. Technician making cylinders
   h. Concrete temperature at placing
   i. Air temperature at point of placement in the structure
   j. Amount of water added to the truck at the batch plant and at the site and whether or not it exceeds the amount allowed by the mix design
   k. Slump
   l. Unit weight
   m. Air content
   n. Cylinder compressive strengths with type of failure if concrete does not meet Specification requirements. Seven day breaks are to be flagged if they are less than 60% of the required 28 day strength. 28 day breaks are to be flagged if either cylinder fails to meet Specification requirements.

9. Standards for Tests of Concrete:

   a. Slump Tests: Slump Tests (ASTM C143) shall be made at the beginning of concrete placement for each batch plant and for each set of test cylinders made. The slump test shall be made from concrete taken from the end of the concrete truck chute. The concrete shall be considered
acceptable if the slump is within plus or minus 1 inch of the slump noted on the mix design submittal form for that class of concrete.

b. Air Entrainment: Air entrainment tests (ASTM C231 or C173) shall be made at the same time slump tests are made as cited above.

c. Concrete Temperature: Concrete temperature at placement shall be measured (ASTM C1064) at the same time slump tests are made as cited above.

d. Unit Weight Test: ASTM C138

10. Evaluation and Acceptance of Concrete:

a. Strength Test: A strength test shall be defined as the average strength of two cylinder breaks from each set of cylinders tested at the time indicated above.

b. Quality Control Charts and Logs: The Owner’s Testing Laboratory shall keep the following quality control logs and charts for each class of concrete containing more than 2,000 cubic yards. The records shall be kept for each batch plant and submitted on a weekly basis with cylinder test reports:

   (1) Number of strength tests made to date.
   (2) Strength test results containing the average of all strength tests to date, the high test result, the low test result, the standard deviation, and the coefficient of variation.
   (3) Number of tests under specified strength.
   (4) A histogram plotting the number of strength test cylinders versus compressive strength.
   (5) Quality control chart plotting compressive strength test results for each test.
   (6) Quality control chart plotting moving average for strength where each point plotted is the average strength of three previous test results.
   (7) Quality control chart plotting moving average for range where each point plotted is the average of 10 previous ranges.

c. Acceptance Criteria: The strength level of an individual class of concrete shall be considered satisfactory if both of the following requirements are met:

   (1) The average of all sets of three consecutive strength tests equal or exceed the required f’c.
   (2) No individual strength test falls below the required f’c by more than the greater of 10% of f’c or 500 PSI.

d. If either of the above requirements is not met, the Testing Laboratory shall immediately notify the Engineer by telephone. Steps shall immediately be taken to increase the average of subsequent strength tests.

D. Investigation of Low Strength Concrete Test Results:

1. Cost of Investigations for Low Strength Concrete: The Contractor shall reimburse the Owner for the costs of investigations of low strength concrete, as defined above.
2. Scope of Investigations: See Specification Section 03300, Cast-In-Place Concrete, for the investigations that may be required by the Engineer. The Owner’s Testing Laboratory will conduct these investigations.

E. Causes for Rejection of Concrete: The Contractor shall reject concrete delivered to the site for any of the following reasons:

1. Wrong class of concrete (incorrect mix design number).

2. Environmental Conditions: Environmental condition limits shall be as follows unless appropriate provisions in concreting practices have been made for cold or hot weather:
   a. Cold Weather: Air temperature must be 40°F and rising or the average daily temperature cannot have been lower than 40°F for 3 consecutive days unless the temperature rose above 50°F for at least one-half of any of those 24 hour periods.
   b. Hot Weather: Environmental conditions must be such that cause an evaporation rate from the concrete surface of 0.2 lb./sq. ft./hr. or less as determined by Figure 2.1.5 in ACI 305R-91.

Concrete may be placed at other environmental condition ranges only with approval of the job inspector for the Owner’s Testing Laboratory or other duly appointed representative.

3. Concrete with temperatures exceeding 95°F shall not be placed in the structure.

4. Air contents outside the limits specified in the mix designs.

5. Slumps outside the limits specified.

6. Excessive Age: Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes unless approved by the Laboratory job inspector or other duly appointed representative.

F. Concrete Batch Trip Tickets: Concrete batch trip tickets shall be collected and retained by the Contractor. Compressive strength, slump, air, and temperature tests shall be identified by reference to a particular trip ticket. Tickets shall contain the information specified in ASTM C94. Each ticket shall also show the amount of water that may be added in the field for the entire batch that will not exceed the specified water cement ratio for the design mix. The Contractor and Owner’s Testing Laboratory shall immediately notify the Engineer and each other of tickets not meeting the criteria specified.

3.4 TRAFFIC COATING MATERIALS AND APPLICATION

A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

1. Samples of material delivered to Project site shall be taken, identified, sealed, and certified in presence of Owner and Contractor.

2. Testing agency shall perform tests for characteristics specified, using applicable referenced testing procedures or, if not referenced, using tests cited in
3. Testing agency shall verify thickness of coatings during traffic coating application.

4. If test results show traffic coating materials do not comply with requirements, remove noncomplying materials, prepare surfaces, and reapply traffic coatings.

5. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

6. Testing Agency will employ wet mil gauge to monitor thickness during application of the primer and base coat layers of the traffic coating at 1000 SF intervals.

7. Testing Agency will employ coverage rate calculations to monitor traffic coating mil thickness during application of each layer. The Contractor shall establish a uniformly gridded area of application and provide the square footage of each area to the Testing Agency. The Contractor shall measure the volume in gallons of traffic coating material applied within each uniformly gridded area and provide the number of gallons applied to the Testing Agency. Calculation of mil thickness shall be as follows:

   a. Manufacturer’s required dry mil thickness for each layer = % Solids by volume from manufacturers published test data for each layer x 1600 ft² x measured number of gallons applied within the gridded area / uniformly gridded area of application. When the manufacturer does not specify a dry mil thickness requirement then the % Solids by volume shall be taken as 100% and the required wet mil thickness shall be used.

   b. The calculated mil thickness shall be within 10% of the required mil thickness specified by the manufacturer’s data for each layer of the specified traffic coating system.

8. Determine overall traffic topping mil thickness:

   a. Contractor shall provide 6 in. by 6 in. membrane coupon on concrete surface for each 25,000 SF of traffic topping to be placed as directed by Engineer and Manufacturer.

   b. Contractor shall assist Testing Agency in removing membrane coupons from concrete surface at completion of manufacturer-specified cure period. Contractor shall repair coupon area per manufacturer's instructions.

   c. Testing Agency shall determine dry mil thickness of completed Traffic Topping System, including bond breaker using precision measurements from cross-sections of the membrane utilizing petrographic equipment. Report individual readings and overall traffic topping system average to Engineer.

9. Testing Agency will perform three (3) adhesion tests for every 25,000 SF of traffic topping installed. Acceptable tensile stress criterion is 200 psi for each test. Report individual readings to Engineer. Contractor shall repair test areas per manufacturer's instructions.
B. Manufacturer: Provide qualified representative on site for duration of work.

3.5 CORROSION INHIBITOR MATERIALS AND APPLICATION

A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

1. Verify material delivered to Project site in compliance with Contract Documents, is stored in accordance with manufacturer’s recommendations.

2. The job site inspector shall verify application of material is performed in accordance with Manufacturer’s recommendations, including but not limited to the surface preparation of the existing concrete substrate.

B. Manufacturer: Provide qualified representative on site for duration of work.

3.6 CONCRETE PENETRATING SEALER MATERIALS AND APPLICATION

A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

1. Verify material delivered to Project site in compliance with Contract Documents, is stored in accordance with manufacturer’s recommendations.

2. The job site inspector shall verify application of material is performed in accordance with Manufacturer’s recommendations, including but not limited to the surface preparation of the existing concrete substrate.

B. Manufacturer: Provide qualified representative on site for duration of work.

END OF SECTION 014529
SECTION 017329

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Divisions 02 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.

2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building’s appearance and other significant visual elements.

3. Products: List products to be used and firms or entities that will perform the Work.

4. Dates: Indicate when cutting and patching will be performed.

5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. **Engineer's Approval**: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

**1.5 QUALITY ASSURANCE**

A. **Structural Elements**: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. **Operational Elements**: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

C. **Miscellaneous Elements**: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

D. **Visual Requirements**: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. **Cutting and Patching Conference**: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

**1.6 WARRANTY**

A. **Existing Warranties**: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

A. **General**: Comply with requirements specified in other Sections of these Specifications.

B. **Existing Materials**: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

   a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION 017329
SECTION 017423

FINAL CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for final cleaning at Substantial Completion.

1. Special cleaning requirements for specific elements of Work are included in appropriate Sections of Divisions 02 through 16.

B. General Project closeout requirements are included in Section "Closeout Procedures."

C. Environmental Requirements: Conduct cleaning and waste disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.

1. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.

2. Burning or burying of debris, rubbish or other waste material on the premises will not be permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator of surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property, or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
1. Clean Project site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste materials, litter and foreign substances. Sweep paved areas broom clean. Remove petro-chemical spills, stains and other foreign deposits. Rake grounds that are neither planted nor paved, to a smooth even-textured surface.

2. Remove tools, construction equipment, machinery and surplus material from the site.

3. Remove snow and ice to provide safe access to the building.

4. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

5. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.


7. Vacuum clean carpet and similar soft surfaces, removing debris and excess nap. Shampoo if required.

8. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

9. Remove labels that are not permanent labels.

10. Touch-up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored, or that show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical name plates.

11. Wipe surfaces of mechanical and electrical equipment, elevator equipment and similar equipment. Remove excess lubrication, paint and mortar droppings and other foreign substances.

12. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

13. Replace air disposable filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills. Clean ducts, blowers, and coils if units were operated without filters during construction.

14. Clean food service equipment to a sanitary condition, ready and acceptable for its intended use.

15. Clean light fixtures, lamps, globes and reflectors to function with full efficiency. Replace burned out bulbs, and defective and noisy starters in fluorescent and mercury vapor fixtures.

16. Leave Project clean and ready for occupancy.

B. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during remainder of construction period.

C. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remain after completion of associated construction have become Owner's property, dispose of these materials as directed.

END OF SECTION 017423
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:

1. Inspection procedures.
2. Submittal of warranties.
3. Final cleaning.

B. Closeout requirements for specific construction activities are included in appropriate Sections in Divisions 02 through 16.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete following. List exceptions in request.

1. In Application for Payment that coincides with, or first follows, date Substantial Completion is claimed, show 100% completion for portion of Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and statement showing an accounting of changes to Contract Sum.

   a. If 100% completion cannot be shown, include list of incomplete items, value of incomplete construction, and reasons Work is not complete.

2. Advise Owner of pending insurance change-over requirements.
3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
4. Obtain and submit releases enabling Owner unrestricted use of Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
5. Submit record drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.
6. Deliver tools, spare parts, extra stock, and similar items.
7. Make final change-over of permanent locks and transmit keys to Owner. Advise Owner's personnel of change-over in security provisions.
8. Complete start-up testing of systems, and instruction of Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from site, along with construction tools, mock-ups, and similar elements.

B. Inspection Procedures: On receipt of request for inspection, Engineer/Architect will either proceed with inspection or advise Contractor of unfilled requirements. Engineer/Architect will prepare Certificate of Substantial Completion following inspection, or advise Contractor of construction that must be completed or corrected before certificate will be issued.

1. Engineer/Architect will repeat inspection when requested and assured that Work has been substantially completed.
2. Engineer/Architect will provide one repeat inspection under its contract with Owner. Subsequent inspections shall be at Contractor's expense.
3. Results of completed inspection will form basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in request.

1. Submit final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to Contract Sum.
3. Submit certified copy of Engineer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and list has been endorsed and dated by Engineer.
4. Submit final meter readings for utilities, measured record of stored fuel, and similar data as of date of Substantial Completion, or when Owner took possession of and responsibility for corresponding elements of Work.
5. Submit consent of surety to final payment.
7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

PART 2 - PRODUCTS (NOT APPLICABLE).

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operating and Maintenance Instructions: Arrange for each installer of equipment or materials that require regular maintenance to meet with Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives.
SECTION 017836
PRODUCT WARRANTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY
A. This Section includes administrative and procedural requirements for warranties required by Contract Documents, including manufacturers’ standard warranties on products and special warranties.

1. Refer to General Conditions for terms of Contractor's period for correction of Work.

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

1. Division 01 Section "Submittal Procedures" specifies procedures for submitting warranties.
2. Division 01 Section "Closeout Procedures" specifies contract closeout procedures.
3. Divisions 02 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.
4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in Contract Documents.

C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of warranty on Work that incorporates products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 WARRANTY REQUIREMENTS
A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as result of such failure or must be removed and replaced to provide access for correction of warranted construction.

B. Reinstatement of Warranty: When Work covered by warranty has failed and been corrected by replacement or rebuilding, reinstate warranty by written endorsement. Reinstated warranty shall be equal to original warranty with equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by warranty has failed replace or rebuild Work to an acceptable condition complying with requirements of Contract Documents. Contractor is responsible for cost of replacing or rebuilding defective Work regardless of whether Owner has benefited from use of Work through portion of its anticipated useful service life.
D. Owner's Recourse: Expressed warranties made to Owner are in addition to implied warranties, and shall not limit duties, obligations, rights and remedies otherwise available under law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: Owner reserves right to reject warranties and to limit selection to products with warranties not in conflict with requirements of Contract Documents.

E. Where Contract Documents require a special warranty, or similar commitment on Work or part of Work, Owner reserves the right to refuse to accept Work, until Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.4 SUBMITTALS

A. Submit written warranties to Engineer prior to date certified for Substantial Completion. If Engineer's Certificate of Substantial Completion designates commencement date for warranties other than date of Substantial Completion for Work, or designated portion of Work, submit written warranties upon request of Engineer.

B. When designated portion of Work is completed and occupied or used by Owner, by separate agreement with Contractor during construction period, submit properly executed warranties to Engineer within 15 days of completion of that designated portion of Work.

1. When Contract Documents require Contractor, or Contractor and subcontractor, supplier or manufacturer to execute a special warranty, prepare written document that contains appropriate terms and identification, ready for execution by required parties. Submit draft to Owner through Engineer/Architect for approval prior to final execution.

C. Prepare written document utilizing appropriate form, ready for execution by Contractor, or by Contractor and subcontractor, supplier or manufacturer. Submit draft to Owner through Engineer for approval prior to final execution.

1. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submittal of special warranties

D. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8.5 in. by 11in. paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark tab to identify product or installation. Provide typed description of product or installation, including name of product, and name, address, and telephone number of Installer.
2. Identify each binder on front and spine with typed or printed title "WARRANTIES," Project title or name, and name of Contractor.
3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

END OF SECTION 017836
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section describes the administrative and procedural requirements of the Contractor for preparation of Project Record Documents.

B. Store record documents and samples in the field office apart from Contract Documents used for construction. Do not permit Project Record Documents to be used for construction purposes. Maintain record documents in good order, and in a clean, dry, legible condition. Make documents and samples available at all times for inspection by the Engineer.

1.3 RECORD DRAWINGS

A. During the construction period, maintain a set of blue- or black-line white-prints of Contract Drawings and Shop drawings for Project Record Document purposes. Mark with red erasable colored pencil all deviations from the original drawings.

B. Upon Substantial Completion of the project, incorporate all changes into reproducible transparencies stamped "As-Built". Walter P. Moore and Associates will make originals available to Contractor's print shop. Contractor shall produce two sets of blue-lines and submit these with the reproducible transparencies to Walter P. Moore and Associates.

1.4 RECORD SPECIFICATIONS

A. During the construction period, maintain one copy of the project specifications, including addenda and modifications issued, for Project Record Document purposes. Mark any changes or modifications to the Specifications.

B. Upon completion of mark-up, submit record specifications to the Engineer for Owner's records.
PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 RECORDING

Post changes and modifications to the documents as they occur. Do not wait until the end of the project. The Engineer will periodically review record documents to assure compliance with this requirement.

END OF SECTION 017839
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including all sections incorporated in the Project Manual apply to the work of this Section.

1.2 SUMMARY

A. This Section requires the selective removal and subsequent reinstallation or off-site disposal of the following:

   1. Removal and disposal of the existing topping slab.
   2. Debris from demo shall not be stored within parking garage.

1.3 SUBMITTALS

A. General – Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections

   B. Schedule indicating proposed sequence of operations for selective demolition work, location of trash collection containers, and method of removal from the site to Owner's Representative for review prior to start of work. Include coordination of operations together with details for dust and noise control protection.

   C. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.

   D. Coordinate with Owner's continuing occupation of the existing building.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Regulatory Requirements: Comply with applicable requirements of federal, state, and local laws, regulations and codes having jurisdiction at project site or applicable requirements of these standards and specifications, whichever is more stringent.
1.5 JOB CONDITIONS

A. Occupancy: The parking garage will maintain operation throughout the entire project. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 1 week advance notice to Owner of demolition activities that will affect Owner's normal operations.

B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.

1. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's operations prior to start of selective demolition work.

C. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public to occupied portions of building.

1. Provide protective measures as required to provide free and safe passage of Owner's personnel and general public from injury due to selective demolition work.

2. Protect form damage existing finish work that is to remain in place and becomes exposed during demolition operations.

3. Provide temporary weather protection during interval between demolition and construction to ensure that no water leakage or damage occurs to structure or interior areas of exiting building. Temporary weather protection shall be capable of withstanding wind and rain forces normally encountered in this region. Contractor shall be responsible for correcting all water damage to interior resulting from inadequate temporary weather protection during construction at no additional cost to Owner.

4. Safety: Provide safety measures for workmen as required by OSHA and other authorities having jurisdiction.

5. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

6. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks and other adjacent occupied or used facilities.

   a. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

7. Environmentally Controlled Substances: It is the Contractor's responsibility to determine if controlled substances are contained in any of the materials.
to be removed and to dispose of any material containing controlled substances in accordance to the rules and regulation of the local municipality and government. Contractor shall contact Owner if environmentally controlled substances are uncovered.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials, not specifically described but required for proper completion of the work of this Section, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Report in writing to Engineer all prevailing conditions that will adversely affect satisfactory execution of work. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Starting work constitutes acceptance of the existing conditions and this Contractor shall then, at his expense, be responsible for correcting all unsatisfactory and defective work encountered.

3.2 PROTECTION

A. Protect Existing utilities indicated or made known which are not being demolished.

B. Protect bench marks and reference points from displacement or damage and, if displaced or damaged, replace at no cost to Owner.

C. Install and maintain required bracing, shoring and supports when removing structural elements and be responsible for safety and support of structure. If safety of structure appears to be endangered, cease operations and immediately notify Engineer; do not resume operations until safety is restored.

D. Protect trees and shrubs, where indicated to remain, so trees and shrubs will not be damaged in any way as part of this Work.

E. Protection of Persons and Property:

1. Barricade open depressions and holes occurring as part of this Work, and post warning lights on property adjacent to or with public access.

2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
3. Protect structures, utilities, sidewalks, pavements, and other facilities not being demolished from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by operations under this Section.

F. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

G. Maintain access to the site at all times.

3.3 UTILITIES

A. Coordinate with utility companies and agencies as required. Contact local utility companies 48 hours minimum prior to start of demolition work. Confirm verbal notices and written notices. Verify locations of all utilities and their locations on site.

B. Cooperate with Engineer, utility companies, adjacent property owners, and other building trades in maintaining, protecting, rerouting or extending of utilities passing through work areas which serve structures located on project site and on adjacent properties.

C. Verify that utilities that are to be removed, capped or abandoned are turned off, or are disconnected, or are rerouted to new locations before starting demolition.

D. Where utility cutting, capping, or plugging is required, perform such work in accordance with requirements of the utility company or governmental agency having jurisdiction.

3.4 TRAFFIC MANAGEMENT

A. Contractor shall provide blockades and signage with flashing lights at all areas affected by repair work. Contractor shall coordinate with Owner regarding signage. Owner may request Contractor to provide additional signage at no additional cost to Owner. Contractor shall provide signage for vehicle and pedestrian traffic as required.

3.5 DEMOLTION

A. Hydro demolition shall not be permitted for removal of existing topping slab.

B. General: Perform selective demolition work in a systematic manner in accordance with the phasing plans developed provided within the project drawings. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

C. If unanticipated structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.
D. Items removed shall be considered demolished material, unless noted otherwise on the drawings or in this or other sections of these specifications.

E. Rough grade site, within demolition areas, to meet adjacent contours and to provide positive drainage. Leave site in clean condition acceptable for performance of subsequent construction operations.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.

   1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

3.7 CLEANUP AND REPAIR

A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from the site.

   1. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 020700
SECTION 030101
SURFACE PREPARATION FOR PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the provisions of all labor, materials, supervision and incidentals required to locate and remove all delaminated and unsound concrete, including preparation of cavities created by removal to receive patching material and preparation of existing surface spalls to receive patching material.

B. Related Sections include the following:

1. Division 03 Section “Concrete Repair Materials.”

C. Contractor shall fully acquaint himself with the existing job site conditions and discuss the accessibility of the work areas with the Owner.

D. Provide barricades around the work area with appropriate signage to keep non-construction people from entering work area.

E. Contractor shall provide all traffic cones or barriers to direct traffic during the repair of the facility. This work shall be done in consultation with the Owner.

1.2 REFERENCES

A. Applicable Standards:

1. American Concrete Institute (ACI), latest version:
   ACI 301 Specifications for Structural Concrete
   ACI 546.1R Guide for Repair of Concrete Bridge Structures
   ACI 546R Concrete Repair Guide

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Epoxy Coating for existing exposed non-prestressed steel reinforcement:

1. BASF: MasterEmaco P 124 (formerly Emaco P24)
2. Sika Chemical Corporation: Armatec 110
3. Euclid Chemical: Duralprep A.C.

Substitutions may be considered provided complete technical information and job references are furnished to the Owner/Engineer and approved prior to commencement of work.

Changes in products required to suit temperature and environmental conditions at the time of material application shall be specified as separate line items by the Contractor showing credit or additions to the price for the various tasks.
In using the above products, follow strictly the manufacturer's specifications and directions for mixing and application. Also heed all label warnings by manufacturer. Make application in accordance with applicable safety laws.

PART 3 - EXECUTION

3.1 INSPECTION

A. Horizontal Surfaces

1. Contractor shall sound all designated floor areas for delaminations. This area shall include exposed top surfaces of the precast beams as well as all floor areas within the stairwells.

B. Vertical and Overhead Surfaces

1. Contractor shall sound all vertical and overhead surfaces in stairwell areas that show evidence of cracking and/or staining. 

C. Delaminated areas: Once located by Contractor, Contractor shall further sound and mark them to define limits.

D. Spalls: Contractor shall locate spalls by visual inspection, and mark boundaries.

E. Engineer may mark additional unsound concrete for removal.

F. Areas to be removed shall be rectangular to provide adequate appearance.

G. Contractor shall locate and determine the depth of all embedded reinforcement, electrical conduit, post-tensioned tendons, in repair area and mark these locations for reference during concrete removal. Do not cut any embeds unless approved by Engineer.

3.2 REPAIR PREPARATION

A. Contractor shall review all marked removal and preparation areas and request clarification by Engineer of shoring requirements in questionable areas. Shores shall be in place prior to concrete removal and cavity preparation in any area requiring shores.

B. All delaminated, spalled and unsound concrete shall be removed from within marked boundary to minimum depth of ¾” using 15 to 30 lb air hammers equipped with chisel point bits. When directed by Engineer, chipping hammers less than 15 lb shall be used to minimize damage to sound concrete. If delaminations exist beyond minimum removal depth, chipping shall continue until all unsound and delaminated concrete has been removed from cavity. Contractor shall remove ½” of sound concrete beyond exposed reinforcement.

C. Where embedded reinforcement, anchorages, or electrical conduit is exposed by concrete removal, proceed with caution to avoid damaging it during removal of unsound concrete. If bond between exposed embedded reinforcement/anchorages and adjacent concrete is impaired by Contractor’s removal operation, Contractor shall perform
additional removal around and beyond perimeter of reinforcement for minimum of ¾” along entire length affected at no cost to owner.

D. Necessary approvals shall be obtained by the Contractor from authorizing governmental or other agencies prior to abrasive-blasting. Abrasive-blasting operations shall comply with the requirements of OSHA and NIOSH (National Institute for Occupational Safety and Health) Standard PB-246-697.

E. If rust is present on embedded reinforcement where it enters sound concrete, additional removal of concrete along and beneath reinforcement will be required. Additional removal shall continue until non-rusted reinforcement is exposed, or may be terminated per Engineer’s instructions.

F. Removal of concrete for repair requires saw cutting ¾” into floor slab of the perimeter of the removal, unless a more stringent criteria applies. For vertical and overhead surfaces marked areas shall be saw-cut, ground, or chipped to depth of ½” to existing concrete, measured from original surface.

G. Edges of patch areas shall be dressed perpendicular to member face to eliminate feather edges. All edges shall be straight and patch areas square or rectangular-shaped.

H. Contractor shall exercise extra caution during saw cutting to avoid damaging existing reinforcement particularly post-tensioned tendons, sheathing, electrical conduit and any other embedded items near surface of concrete. Any damage to existing embedded items shall be repaired by Contractor with Engineer’s approved methods at no additional cost to Owner.

3.3 INSPECTION OF REPAIR PREPARATION

A. After removals are complete, but prior to final cleaning, cavity and exposed reinforcement shall be inspected by Contractor and subject to verification by Engineer for compliance with requirements of this Section.

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 of all defective and damaged reinforcement or conduits. Replacement of damaged or defective reinforcement/conduits shall be performed in accordance to the requirements of this Section.

3.4 CLEANING OF REINFORCEMENT

A. All exposed reinforcing steel shall be cleaned and free of rust and other contaminants. Cleaning shall be accomplished by abrasive methods. Cleaning shall be completed immediately before patch placement to insure that base metal is not exposed to elements and further rusting for extended periods of time. Use powered wire brushes in locations where reinforcing steel cannot be cleaned by abrasive-blasting or water-blasting.

B. All exposed reinforcing steel shall be coated with a corrosion inhibiting product specified in the Section “Products” in this specification prior to mortar application. Protect prepared surfaces from damage prior to and during patch placement.

3.5 REINFORCEMENT IN REPAIR AREAS

A. All embedded reinforcement exposed during surface preparation that has lost more than 10% of original cross-sectional area due to corrosion shall be considered defective.
Defective reinforcement shall be supplemented in accordance to Engineer’s instructions and shall be paid for by Owner.

B. Damaged reinforcement caused during removals made by Contractor shall be supplemented in accordance to Engineer’s instructions and shall be paid for by Contractor.

C. Supplement defective or damaged embedded reinforcement of equal diameter with a Class B splice in accordance to ACI–318 beyond damaged portion of reinforcement. Secure new reinforcement to existing reinforcement with approved anchors. Supplemental steel shall be A615 Grade 60 steel except where more stringent requirements apply in drawings and/or details.

D. Loose reinforcement exposed during surface preparation shall be securely anchored prior to patch placement. Loose reinforcement shall be adequately secured with wire ties to bonded reinforcement or with drilled-in anchors. Drilled-in anchors shall be TW-1400 anchors by ITW Ramset/Red Head, Tie-Wire Wedge-All anchors by Simpson Strong-Tie, or approved equal. Engineer will determine adequacy of wire ties and anchors. Securing loose reinforcement is incidental to surface preparation.

E. Minimum of 1 ½” concrete cover shall be provided over all new/existing reinforcement except where more stringent requirements apply in drawings and/or details.

3.6 PREPARATION OF CAVITY FOR PATCH PLACEMENT

A. Cavities will be examined prior to commencement of patching operations. Sounding surface shall be part of examination. Delaminations noted during sounding shall be removed as specified in this Section.

B. All debris shall be removed from site prior to commencement of patching.
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 provisions of all labor, materials, supervision and incidentals required to prepare deteriorated or damaged concrete surfaces and install patching materials to restore original surface condition and integrity.

B. Related Sections include the following:

1. Division 03 Section “Surface Preparation for Patching.”
2. Division 03 Section “Cast-in-Place Concrete.”

C. Contractor shall fully acquaint himself with the existing job site conditions and discuss the accessibility of the work areas with the Owner.

D. Contractor shall ensure that there is adequate ventilation in areas where repair work is being performed and that no work results in nauseating, annoying or toxic fumes and odors from entering occupied areas. Provide barricades around the work area with appropriate signage to keep non-construction people from entering work area.

E. Contractor shall provide all traffic cones or barriers to direct traffic during the repair of the facility. This work shall be done in consultation with the Owner.

1.3 SUBMITTALS

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

B. At the preconstruction meeting, contractor shall submit procedures to protect fresh patches from weather and traffic (if applicable).

1.4 QUALITY ASSURANCE

A. Work shall conform to requirements of the American Concrete Institute (ACI) as applicable except where more stringent requirements are shown on Drawings or specified in this Section.

B. Manufacturer’s Qualifications: Companies furnishing the repair materials shall have a proven track record of at least five years. Furthermore, they shall have in existence a program of training, certifying, and supporting a nationally organized program of approved contractors. Evidence of this shall be made available to the Engineer/Owner upon request.
C. Contractor's Qualifications: Contractor performing the work shall be an approved contractor by the manufacturer furnishing the repair materials, and shall have no less than five years experience in the various types of polymer related work required in this project. Upon request by the Engineer, a notarized certification from the manufacturer attesting to the training shall be submitted to the Engineer/Owner.

1.5 REFERENCES

A. Applicable Standards:

1. American Concrete Institute (ACI), latest version:

   ACI 301R Specifications for Structural Concrete
   ACI 305R Hot Weather Concreting
   ACI 306R Cold Weather Concreting
   ACI 308R Guide to Curing Concrete
   ACI 318R Building Code Requirements for Structural Concrete
   ACI 548.1R Guide for Use of Polymers in Concrete


   ASTM C109 Test Method for Compressive Strength of Hydraulic Cement Mortars

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR POLYMER MODIFIED CEMENTITIOUS MORTARS

A. Mortar used for bonding, patching, and resurfacing in exposed or exterior environmental conditions with large cyclic temperature changes shall have the following properties:

1. Mortar shall be non-sagging.

2. Acceptable materials shall have minimum 3-day compressive strength of 3,000 psi, and 5,000 psi at 28 days as certified by manufacturer.

3. Coefficient of thermal expansion shall be comparable with that of concrete (5.5 x 10^{-6} in/in/°F).

4. Sand used in preparing mortar shall be graded oven dry quartzite furnished in bags.

5. The mortar patch material shall match the existing texture and color of existing exposed/cured concrete without giving a blotchy appearance. A test patch shall be applied for approval prior to final acceptance of the mortar. Size of test patch shall be approximately equal to the size of the average mortar patch to be used on the project.

2.2 PRODUCTS AND MANUFACTURERS

A. Acceptable materials for this Work are:

   HORIZONTAL REPAIRS (POLYMER MODIFIED):
1. MasterEmaco N 300 CI (formerly EMACO R300 CI), MasterEmaco T 310 CI (formerly EMACO R310 CI) by BASF
2. SikaTop 122 Plus by Sika
3. Sika 222 with Latex R by Sika
4. Eucocrete Supreme by Euclid Chemical Company

HORIZONTAL REPAIRS (NON-POLYMER MODIFIED):
*(at locations where galvanic anodes are specified)
1. MasterEmaco S 477 CI (formerly EMACO S77 CI) by BASF
2. MasterEmaco T 1060 (formerly 10-60 Repair Mortar) or MasterEmaco T 1061 (formerly 10-61 Repair Mortar) by BASF
3. Sika 222 by Sika
4. Eucocrete by Euclid Chemical Company

OVERHEAD/VERTICAL REPAIRS: (POLYMER MODIFIED):
1. MasterEmaco N 425 (formerly Gel Patch) by BASF
2. MasterEmaco T 310 CI (formerly EMACO R 310 CI) by BASF
3. SikaTop 123 Plus by Sika
4. Sika 223 with Latex R by Sika

OVERHEAD/VERTICAL REPAIRS (NON-POLYMER MODIFIED):
*(at locations where galvanic anodes are specified)
1. MasterEmaco S 488 CI (formerly EMACO S88 CI) by BASF
2. MasterEmaco S 477 CI (formerly EMACO S77 CI) by BASF
3. Sika 223 by Sika

B. High early strength products (NON-POLYMER MODIFIED):
1. MasterEmaco T 415 (formerly EMACO T415) OR MasterEmaco T 430 (formerly EMACO T430) by BASF
2. MasterEmaco T 1060 (formerly 10-60 Rapid Mortar) or MasterEmaco T 1061 (formerly 10-61 Rapid Mortar) by BASF
3. SikaQuick 1000 or SikaQuick 2500 by Sika
4. Versaspeed by Euclid Chemical
Substitutions may be considered provided complete technical information and job references are furnished to the Owner/Engineer and approved prior to commencement of work.

Changes in products required to suit temperature and environmental conditions at the time of material application shall be specified as separate line items by the Contractor showing credit or additions to the price for the various tasks.

In using the above products, follow strictly the manufacturer's specifications and directions for mixing and application. Also read all label warnings by manufacturer. Make application in accordance with applicable safety laws.

PART 3 - EXECUTION

3.1 POLYMER MODIFIED AND NON-POLYMER MODIFIED CEMENTITIOUS MORTAR PATCH

A. Applicator’s Qualifications
   1. Mortar repair work shall only be performed by contractors who have successfully used this process on at least three similar structural repairs of equal scope which have performed successfully for a minimum period of five years.
   2. Only adequately trained and experienced personnel shall be used on the job.

B. Surface Preparation
   1. Concrete surface to which the mortar is to be applied shall be exposed parent concrete free of loose and unsound materials. Preparation of cavity to receive new mortar shall be in accordance to Section “Surface Preparation for Patching” and manufacturer's instructions.

C. Concrete Surface Inspection: Ensure that the surface and ambient temperature is at least 45°F and rising at the time of application.

D. Bonding Grout
   1. Apply bonding grout in strict accordance with manufacturer’s recommendations.
   2. If bonding grout dries, cavity shall not be patched until it has been re-cleaned and prepared as indicated in Section “Surface Preparation for Patching.” Grout shall not be applied to more cavities than can be patched within 15 min. by available manpower.
   3. Patching materials shall be placed immediately following grout application in strict accordance with manufacturer’s instructions.

E. Mortar Application
   1. Condition polymer mortar material to 65°F-80°F unless otherwise recommended by the manufacturer. Materials beyond this range of temperature shall not be used.
   2. Mix the two components in a clean container free of contaminants as recommended by the manufacturer.
3. Thoroughly blend components and aggregates with portable mixers to a uniform and homogenous mixture. Small batches of one quart or less may be mixed by spatulas, palette knives or similar devices.

4. Mixing should be accomplished within three minutes when using Jiffy mixer or five minutes when mixed by hand.

5. Apply mortar by means suitable for the consistency of the mortar mix.

6. Use appropriate forms as required for retaining mortar if mixed to a flowable consistency.

7. Consolidate the mortar thoroughly to remove entrapped air.

8. Supplemental wire mesh shall be required for delamination and spall repairs greater than 2" in depth. Fresh bonding grout is required between successive lifts of patching material.

9. Finish surface of mortar to match the texture and contours of existing concrete.

F. Curing

1. Immediately after finishing, keep patch material continually moist for at least 24 hrs. Continue curing for first 7 days after patch placement. During initial and final curing periods maintain patch material above 50 °F.

2. Prevent rapid drying at end of curing period.

3. Provide additional curing as required by manufacturer’s recommendations.

G. Cleanup

1. Protect surfaces surrounding the work areas against spillage.

2. Material spillage shall be cleaned before they set and become difficult to remove.

3. Cleanup all portions of the existing structure that are soiled or stained in the process of mortar repair work.

3.2 FIELD QUALITY CONTROL

A. Testing Agency:

1. Independent testing laboratory employed by Owner and acceptable to Engineer.

2. Sampling and testing of mortar shall be performed by ACI certified Concrete Field Technicians Grade I. Certification shall be no more than three years old.

3. Testing Agency is responsible for conducting, monitoring, and reporting results of all tests required under this Section. Testing Agency has authority to reject mortar not meeting Specifications.

4. Concrete Compressive Strength (Mold test cubes per ASTM C-109):
a. Take minimum of 9 cubes (2”x2”) for each 10 ft$^3$ or fraction of each repair 
    mortar placed in any one day (if less than 10 ft$^3$ is placed then 9 cubes 
    shall be taken and used for testing as specified below).
b. Additional cubes shall be taken as directed by Engineer.
c. Cover and protect molds from contact with water for the first 24-hrs. after 
    molding.
d. Follow ACI Specifications for storage and handling of specimens.

e. Test 3 cubes at 3 days.
f. Test 3 cubes at 7 days.
g. Test 3 cubes at 28 days.

5. Aggregate Extended Mortar Compressive Strength (Mold test cylinders per 
   ASTM C-31 and perform compressive strength tests in accordance with ASTM 
   C-39):

a. Take minimum of 6 cylinders (6” diameter x12”) or 6 cylinders 
   (4” diameter x8”) for each 27 ft$^3$ or fraction of each aggregate extended 
   repair mortar placed in any one day.
b. Additional cylinders shall be taken as directed by Engineer.
c. Cover and protect cylinders from contact with water for the first 24-hrs. 
   after molding.
d. Follow ACI Specifications for storage and handling of specimens.
e. High Early Strength Aggregate Extended Mortar (f’c at 7-days 
   acceptance).
   (1) Test 1 cylinder at 3 days either size.
   (2) Test 2 cylinder at 7 days for 6” diameter or 3 cylinders for 4” 
       diameter.
   (3) Test 3 cylinder at 28 days either size.
f. Aggregate Extended Mortar (f’c at 28-days acceptance).
   (1) Test 1 cylinder at 7 days either size.
   (2) Test 2 cylinder at 28 days for 6” diameter or 3 cylinders for 4” 
       diameter cylinders.
   (3) Test 3 cylinder at 56 days either size.

3.3 ACCEPTANCE OF REPAIRS

A. Acceptance of completed concrete repair will be in accordance to ACI 301.

B. Patched areas shall be sounded by Engineer and Contractor after curing for 72 hours. 
   Contractor shall repair all hollowness detected by removing and replacing patch or 
   affected area at no cost to Owner.

C. If shrinkage cracks appear in patch area after the initial curing period is concluded, the 
   patch in question shall be considered unacceptable, and it shall be removed and 
   replaced by Contractor at no cost to Owner.

END OF SECTION 030105
SECTION 030190
GALVANIC ANODE CORROSION PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the provisions of all labor, materials, supervision and incidentals required to install embedded galvanic anodes within concrete repairs.

B. Embedded galvanic anodes are designed to provide localized corrosion protection for areas around the repair patches. When placed as per designed spacing, along the perimeter of concrete patches or along interface between new and existing concrete, galvanic anodes help manage active corrosion and mitigate formation of new corrosion sites.

C. Related Sections include the following:

1. Division 3 Section “Surface Preparation for Patching.”
2. Division 3 Section “Concrete Repair Materials”.
3. Division 3 Section “Cast-in-place Concrete”.

D. Contractor shall fully acquaint himself with the existing job site conditions and discuss the accessibility of the work areas with the Owner.

Contractor shall provide all traffic cones or barriers to direct traffic during the repair of the facility. This work shall be done in consultation with the Owner.

1.3 REFERENCES

Applicable Standards:

American Concrete Institute (ACI):

ACI Concrete Repair Manual
ACI 222R-01(R10) Protection of Metals in Concrete against Corrosion.

International Concrete Repair Institute (ICRI):

ICRI 310.1R Guide for Surface Preparation for the Repair of Deteriorated Concrete resulting from Reinforcing Steel Corrosion.
American Society for Testing and Materials (ASTM):

- ASTM A 82: Specification for Plain Steel Wire for Concrete Reinforcement.
- ASTM B 6: Standard Specification for Zinc
- ASTM B 418: Standard Specification for Cast and Wrought Galvanic Zinc Anodes
- ASTM C 1202: Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration

1.4 INFORMATION SUBMITTALS

A. Make submittals in accordance with requirements of Division 1 and as specified in this Section.

B. Product Data: Product data sheets, Material Safety Data Sheets/Safety Data Sheets (MSDS/SDS), and installation instructions for each product proposed for use on the project.

C. Material Test Reports:
   1. Submit material testing report for the resistivity of concrete repair material as measured in accordance with the Florida Test Method for the Electrical Resistivity of Concrete (Test Method FM 5-578).
   2. Alternatively, submit concrete repair material results of rapid chloride permeability chloride resistance characteristic of concrete repair materials in accordance with ASTM C1202.
   3. Submit material testing shall be performed by an independent laboratory or as published by the material manufacture.

D. Submit material samples of anode(s) and the related materials minimum of 7 days in advance of installation.

E. Submit manufacturer technical representative’s log for each site visit during installation.

1.5 ACTION SUBMITTALS

A. Submit manufacturer technical representative’s log for each site visit during installation.

1.6 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.

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.

1.7 QUALITY ASSURANCE
A. Source Limitations:

1. Use anode and concrete repair materials for work governed by this Section from a single manufacturer.

B. Qualifications

1. Manufacturer's Qualifications: Companies furnishing the galvanic anodes shall have a proven track record of at least five years. Furthermore, they shall have in existence a program of training and supporting Contractors. Evidence of this shall be made available to the Engineer/Owner upon request.

2. Contractor's Qualifications: Contractor installing the galvanic anodes shall be an approved Contractor by the manufacturer furnishing the anodes, and shall have no less than five years experience in the various concrete repairs projects. Upon request by the Engineer, a notarized certification from the manufacturer attesting to the training shall be submitted to the Engineer/Owner.

3. Installer’s Qualifications:

a. Galvanic anode installation shall only be performed by contractors who have prior experience on at least three similar projects of equal scope.

b. Only adequately trained and experienced personnel shall be used on the job.

1.8 PRE-INSTALLATION CONFERENCE

A. Before installing galvanic anodes, meet with representatives of authorities having jurisdiction, manufacturer’s technical representative, Owner, Engineer, consultants, independent testing agency, and other concerned entities. Review requirements for anodes. Notify participants at least seven days before conference.

1.9 WARRANTY

A. Provide a single source performance guarantee that the embedded galvanic anodes will remain electrochemically active and provide corrosion protection for a period of five (5) years starting from the date of installation.

PART 2 - PRODUCTS

2.1 GALVANIC ANODES

A. General Requirements For Galvanic Anodes

1. Embedded galvanic anodes shall be pre-manufactured, and contain sufficient quantity of metallic zinc to mitigate corrosion for a period of fifteen years. Amount of zinc shall be at least 200% of amount needed to satisfy anticipated service life based on electrochemical theory (Faraday’s Law) and based on currents that are expected to flow in anodes.

2. Anodes shall be supplied with integral tie wires for connection to reinforcing steel. Zinc shall comply with ASTM B418 Type II and ASTM B6.
3. Embedded galvanic anodes shall have demonstrated current output equal to or greater than 0.4 mA of current after 90 days of operation when laboratory tested at room temperature and 55% (+/- 5%) relative humidity (RH) in a concrete block containing 0.25 (+/- 0.05) square feet of reinforcing steel surface area. Test result shall be certified by an independent testing laboratory.

4. Embedded galvanic anodes shall have verifiable record showing minimum three years satisfactory performance in similar field environment. Records shall demonstrate satisfactory flow of protective current throughout three-year period; including at least 0.2 mA after 1 year, and at least 0.1 mA after 3 years.

B. Products

1. Acceptable materials:
   a. Vector Corrosion Technologies; Galvashield XP2 or Galvanode VP 100
   b. Sika Corporation; FerroGuard 670
   c. Euclid Chemical Company; Sentinel Silver
   d. BASF Construction Chemicals; MasterProtect 8105 CP

Substitutions may be considered provided complete technical information and job references are furnished to the Owner/Engineer and approved prior to commencement of work.

In using the above products, follow strictly the manufacturer's specifications and directions. Also read all label warnings by manufacturer. Make application in accordance with applicable safety laws.

2.2 CONCRETE REPAIR MATERIAL

A. General Requirements For Concrete Repair Material:

B. Repair material shall have a chloride penetration resistance HIGHER THAN 1350 Coulombs as measured after 28-day wet-cure. The Contractor shall provide submittals as per Section 1 “Submittal Procedures” confirming the chloride penetration resistance of the repair material by an independent testing laboratory prior to beginning the work. Chloride penetration resistance of repair material shall be verified in accordance with ASTM C1202.

C. Insulating materials such as epoxy bonding agents shall NOT be used in the concrete repair patch protected by galvanic anodes unless otherwise called for in the design. If epoxy bonding agents are called for in the repair design, verify and coordinate usage and locations with Engineer.

D. The performance of the installed galvanic anodes shall be monitored at three (3) random locations selected by Engineer to assure the effectiveness of corrosion protection. The performance criteria shall include monitoring the galvanic current and the electrical potentials between the zinc anodes and the reinforcing steel for a period of one (1) month after installation at the selected locations.

PART 3 - EXECUTION

3.1 GALVANIC ANODE INSTALLATION
A. Concrete Removal

1. Remove loose or delaminated concrete.

2. Concrete removal shall be extended until clean reinforcing steel is encountered.

3. Concrete removal and preparation of the concrete surface for patching shall be conducted according to Section "Surface Preparation for Patching".

B. Cleaning and Repair of Steel Reinforcement

1. Clean exposed reinforcing steel of rust, mortar, etc. per Section "Surface Preparation for Patching" to provide an effective electrical connection.

2. If significant reduction in the cross section of the reinforcing steel as defined in Section "Surface Preparation for Patching" has occurred, replace or install supplemental reinforcement as directed by the engineer. Supplemental reinforcing steel must be tightly tied to other bars, and shall be tested to ensure electrical continuity according to Part "Field Quality Control" Subpart "Minimum Quality Control Requirements" below.

3. Secure loose reinforcing steel by tying tightly to other bars with steel tie wire. Newly secured reinforcing steel shall also be tested to ensure electrical continuity according to Part "Field Quality Control" Subpart "Minimum Quality Control Requirements" below.

C. Installation Location

1. Calculate the spacing of anodes using the spreadsheet and shall insert the spacing table in the repair detail. Designed spacing shall not exceed the maximum spacing recommended by the manufacturer. However, in no case spacing between anodes shall exceed 30 inches.

2. Galvanic anodes shall be installed along the perimeter of repair patch or at the interface with spacing of anodes as per the project drawings.

3. Anode may be tied to a single bar or may be placed at the intersection between two bars and secured to each clean bar.

4. Provide sufficient clearance between anodes and substrate to allow repair material to encase anode.

5. Galvanic anodes shall be installed at the location providing maximum concrete cover. In no case shall the concrete cover over anode surface be less than 1 in. If concrete cover is expected to be less than 1 in., place anode beneath or besides the rebar.

6. Secure galvanic anodes as close as possible to patch edge using anode tie wires. Tie wires shall be wrapped at least one full turn around cleaned and non-epoxy coated reinforcing steel and twisted tight to allow little or no free movement during the placement of repair material.

3.2 FIELD QUALITY CONTROL
A. Responsibilities

1. Manufacturer’s Responsibility: Manufacturer’s field representation shall be responsible for periodically performing quality control reviews when required by Part 1 “Quality Assurance” in the Specification Section.

2. Contractor’s Responsibility: Contractor is responsible for performing continuous field quality control during the progress of work.

B. Minimum Quality Control Requirements

1. Confirm electrical connection between anode tie wire and reinforcing steel by measuring DC resistance (ohm) with a multi-meter. Connection is acceptable if DC resistance is less than 1 ohm.

2. Confirm electrical continuity of exposed reinforcing steel within repair area using a multi-meter on the mV scale. Electrical continuity is acceptable if mV difference between reinforcing bars is equal to or less than 1 mV. If necessary, electrical continuity shall be established by wrapping tightly with steel tie wire.

C. Acceptance of Work

1. Anode shall provide an average of at least 0.5 mA of protective current after one month.

2. Acceptance of completed concrete repair will be in accordance to ACI 301.

3. Patched areas shall be sounded by Engineer and Contractor after curing for 72 hours. Contractor shall repair all hollowness detected by removing and replacing patch or affected area at no cost to Owner.

4. If shrinkage cracks appear in patch area after the initial curing period is concluded, the patch in question shall be considered unacceptable, and it shall be removed and replaced by Contractor at no cost to Owner.

3.3 FIELD QUALITY ASSURANCE

A. Responsibilities

1. Owner’s Responsibility
   a. Owner shall retain the Testing Agency under separate contract in accordance with the referenced building code for the project.
   b. Cost associated with retesting shall be paid for by the Owner.
   c. Testing Agency shall be an agency acceptable to the Owner and Engineer.

2. Contractor’s Responsibility
a. Notify Owner and Engineer of work schedule at least 7 days in advance.

b. When the Testing Agency reports testing or inspection results that are not in conformance with the project requirements or manufacturer’s requirements the Engineer and Owner reserve the right to amend the rate of testing, amend the rate of inspections, request additional testing, and request additional inspections.

1) Contractor shall reimburse the Owner for the cost of all re-testing, re-inspection, additional testing, and additional inspections.

2) The cost of repair, rework, and/or replacement shall be borne by the Contractor.

3. Testing Agency’s Responsibility

a. Testing Agency is responsible for conducting, monitoring, and reporting results of all tests required under this Section.

b. Testing Agency has authority to reject materials and work not meeting Specifications.

B. Testing

1. The performance of the installed galvanic anodes shall be monitored at three random locations selected by Engineer to observe the effectiveness of corrosion protection. The performance criteria shall include monitoring the galvanic current between the zinc anodes and the reinforcing steel for a period of one month after installation at the selected locations.

END OF SECTION 030190
SECTION 031000
CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 SUMMARY

A. Section includes formwork, shoring, reshoring, backshoring, falsework, bracing, and other temporary supports required to form and support all cast-in-place concrete shown on the drawings.

B. Related Requirements:

1. Specification 014000 “Quality Requirements” for requirements of material testing and inspection.
2. Specification 014529 “Structural Testing and Inspections” for inspection requirements associated with forming and accessories.

1.3 REFERENCES

A. Definitions:

1. Backshores: Shores placed snugly under a stripped concrete structural member after the original formwork and shores have been removed from a small area without allowing the structural member to deflect or support its own weight or superimposed construction loads. It is assumed that backshores carry the same load as that carried by the original shores they replace.
2. Formwork: The total system of support for freshly placed concrete, including the mold or sheathing that contacts the concrete and all supporting members, hardware, and necessary bracing.
3. Professional Engineer: A professional engineer who is licensed to practice engineering in the state where the project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with concrete formwork that are similar to that indicated for this Project in material.
4. Reshores: Shores placed snugly under a stripped concrete structural member after the original forms and shores have been removed from the member, thus requiring the member to carry its own weight and superimposed construction loads at the time of installation. Reshores are assumed to carry no load at the time of installation. After the installation of
reshores, superimposed construction loads are assumed to be distributed among all members connected by reshores.

5. Shores: Vertical or inclined support members designed to carry the weight of formwork, concrete, and construction loads above.

B. Reference Standards:

1. Comply with the provision of the following codes, specifications, and standards except where more stringent requirements are shown or specified:
   a. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
   b. ACI 301, "Specifications for Structural Concrete for Buildings."
   c. ACI 318, "Building Code Requirements for Structural Concrete."
   d. CRSI, "Manual of Standard Practice."

1.4 RESPONSIBILITY

A. The design, construction, and safety of all formwork shall be the responsibility of the Contractor. All forms, shores, reshores, backshores, falsework, bracing, and other temporary supports shall be engineered to support all loads imposed including the wet weight of concrete, construction equipment, live loads, lateral loads due to wind and wet concrete imbalance. The Contractor shall also be responsible for determining when temporary supports, shores, reshores, backshores, and other bracing may be safely removed.

1.5 SUBMITTALS

A. Product Data: Submit technical data and brochures for carton forms.

B. Shop Drawings:

1. Formwork Drawings: Formwork drawings, prepared under the supervision and sealed by the formwork design engineer, shall be submitted for Owner’s record and shall be reviewed by the Engineer for conformance to structural layout only. Such shop drawings shall indicate all dimensions and types of materials, sizes, lengths, connection details, design allowance for construction loads, anchors, form ties, shores, braces, construction joints, reveals, camber, openings, formwork coatings, and all other pertinent information.

2. Pan Form Shop Drawings: The Contractor shall submit pan shop drawings for Engineer's review and approval. Approval will be for conformance to structural layout only.

3. Shoring Plan: Submit drawings to indicate the number of levels of shoring, proposed time and sequence of formwork and shore removal, minimum concrete strength for stripping of forms and shore removal, assumed construction loads, amount and layout of shores (specify whether backshores or reshores), and length of time shores are to be left in place. This plan shall be strictly followed by the Contractor. Shoring plans are to be submitted for Owner's record only and will not be reviewed or returned.

C. Temporary Structure Design Submittals: Submit the following items for the Owner’s records:

1. Design Calculations: Submit, for record purposes, calculations of all concrete formwork sealed by the formwork design engineer.
1.6 QUALITY ASSURANCE

A. Qualifications:

1. Licensed Professionals: The formwork design engineer retained by the Contractor shall be a professional engineer registered in the state where the project is located and shall be experienced in the design of concrete formwork.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Non-specific formed concrete: Unless otherwise specified, the default finish for formed surfaces shall be rough-form finish constructed with plywood, lumber, metal, or other acceptable material. Lumber shall be dressed on at least two edges and one side for tight fit. The minimum grade shall be B-C, exterior grade.

B. Textured-form finished concrete: For exposed surfaces as noted on the drawings provide units of form face design, size, arrangement and configuration that matches Architect's control sample. Provide solid backing and form supports to ensure stability of textured form liners. See Architect's drawings, specifications and control sample for special form textured finish concrete.

2.2 PRECAST CONCRETE RETAINERS

A. Retainers shall be used with voids or carton forms where shown on the drawings.

B. Retainers shall have a minimum compressive strength of 2,500 PSI and be reinforced with 6x6xW1.4xW1.4 welded wire reinforcement and minimum thickness of 1 5/8”.

2.3 FORMWORK COATINGS

A. Formwork coatings shall be of a commercial formulation that will not bond with, stain, nor adversely affect concrete surfaces or impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede curing with water or curing compounds. Provide a product that has a maximum VOC (Volatile Organic Compounds) of 50 g/l but not greater than that permitted by the local government agency having jurisdiction in the area where the project is located.

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

1. Dayton Superior; Bio-Release EF.
2. Unitex; Farm Fresh.
3. Universal Form Clamp; Bio-Form.
4. US Spec; Aqua Blue.

2.4 NAILS AND FASTENERS

A. Use only galvanized nails and fasteners for securing formwork in structures exposed to weather or unconditioned spaces such as garages, canopies, and porte-cocheres.
2.5 FORM TIES

A. Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to minimize spalling of concrete on removal.

1. Exposed Surfaces: For surfaces designated with Surface Finish Class SF-2.x or SF-3.x, furnish units that will leave no portion of the tie closer than 3/4 inch to the plane of the concrete surface and that will leave holes not larger than one inch in diameter in concrete surface when the ends or end-fasteners have been removed.

2. Dampproofed Surfaces: Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

3. Exposed to Weather or Unconditioned Space: Provide removable, glass-fiber-reinforced plastic, stainless steel, or galvanized form ties that will leave no corroding metal closer than 1 1/2 inches in surfaces that will be exposed to weather or in an unconditioned space in the final structure. The ties shall leave holes no larger than one inch in diameter in concrete surfaces when the ends or end-fasteners are removed.

2.6 CHAMFER STRIPS

A. Provide wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

PART 3 - EXECUTION

3.1 FABRICATION AND CONSTRUCTION

A. Design, erect, support, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic construction loads that might be applied until the concrete structure can support such loads.

1. The formwork design engineer shall design the concrete formwork, formwork removal, shoring, reshoring, and backshoring.

B. 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, inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of concrete mortar.

C. Carton Forms:

1. Carton forms shall be kept dry and protected until concrete is poured. Wet, compressed, or deteriorated carton forms shall not be used. Do not wrap or cover carton forms with polyethylene sheets or permanent waterproof cover as that will prevent proper deterioration of the forms.

2. The Contractor shall use expandable foam to fill all gaps and holes between carton forms and at intersections with foundations.

3. For slab conditions, cover carton forms with a 1/4 inch masonite protection cover board to prevent puncture and other damage during construction.
D. 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 steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

F. 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 patch forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

G. Chamfer exposed corners and edges as indicated, using specified chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

H. 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.

3.2 CLEANING AND TIGHTENING

A. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and all other debris just prior to concrete placement. Retighten forms and bracing prior to concrete placement as required to prevent concrete mortar leaks and maintain proper alignment.

3.3 CLEANING AND RE-USE OF FORMS

A. Forms reused in the work shall be repaired and cleaned. Split, frayed, delaminated, or otherwise damaged facing material will not be acceptable for exposed surfaces. Forms intended for successive concrete placement shall have surfaces cleaned, fins and laitance removed, and joints tightened to avoid surface offsets. New form coating compound shall be applied to reused forms. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.4 TOLERANCES

A. Unless specified otherwise, all tolerances for concrete formwork shall conform to ACI Standard 117, "Standard Tolerances for Concrete Construction and Materials". Before concrete placement the Contractor shall check lines and levels of erected formwork and make any corrections and adjustments as required to ensure proper size and location of concrete members and stability of forming systems. During concrete placement the Contractor shall check formwork and supports to ensure that forms have not displaced and that completed work will be within specified tolerances.
B. Construct forms so as to limit the offset between adjacent pieces of formwork facing material in accordance with the surface tolerance class as defined in ACI 117 corresponding to the Surface Finish Class noted on the drawings. The offset limits shall apply to both abrupt and gradual variations in the surface.

C. The Owner shall hire an independent qualified surveyor to verify the proper form, line, position, and elevation of the finished concrete work. The results of each survey shall be sent to the Owner, Architect/Engineer, and Contractor and shall identify any deviation from specified tolerances. All work not in conformance with specified tolerances shall be removed at the Contractor’s sole expense if so specified by the Owner.

3.5 SHORES AND SUPPORTS

A. Comply with requirements of ACI 301 for shoring, reshoring and backshoring in concrete construction and as herein specified where more stringent.

B. Design: Shores and reshores or backshores must be designed to carry all loads transmitted to them. A rational analysis should be used to determine the number of floors to be shored, reshored, or backshored, subject to the minimums stated in the following paragraph, and to determine the loads transmitted to the floors, shores and reshores or backshores as a result of the construction sequence. The analysis should consider, but should not necessarily be limited to, the following:

1. Structural design load of the slab or member including live load, partition loads, and other loads for which the engineer designed the slab. The live load reduction method for the design of certain members is shown on the structural drawings. The reduced live load and an allowance for construction loads shall be taken into consideration when performing the analysis.
2. Dead load weight of the concrete and formwork.
3. Construction live loads, such as placing crews and equipment or stored materials.
5. Cycle time between placement of successive floors.
6. Strength of concrete at time it is required to support shoring loads from above.
7. The distribution of loads between floors, shores, and reshores or backshores at the time of placing concrete, stripping formwork, and removal of reshoring or backshoring.
8. Span of slab or structural member between permanent supports.
9. Type of formwork systems, i.e., span of horizontal formwork components, individual shore loads, etc.
10. Minimum age of concrete where appropriate.
11. Alignment of shores: Where possible, shores for any floor shall be placed directly above previously placed shores so that load will be transferred directly to such shores. Where shores are not vertically aligned, calculations shall include verification that the structure can support the reaction.

3.6 REMOVAL OF FORMS AND SUPPORTS

A. Determination by Contractor's Registered Engineer: The Contractor's registered professional engineer shall determine and submit for Owner's record the time and sequence of formwork and shore removal subject to the criteria as specified below. The submittal shall clearly distinguish between reshoring and backshoring procedures.

B. Determining in situ Strength of Concrete: The General Contractor shall be responsible for making and curing concrete cylinders, cured under field conditions, for the purpose of determining
concrete strength at time of form and shore removal. Such cylinders shall be made by the Contractor and tested by his testing laboratory. Alternatively, the in situ strength of concrete may be determined by the Maturity Method following the requirements of ASTM C 1074. An acceptable system for this method is the “intelliRock” system manufactured and supplied by Engius Constructive Intelligence of Stillwater, OK.

C. Records of Weather Conditions: The Contractor shall be responsible for keeping records of weather conditions to be used in the decision on when to remove forms.

D. Formwork Not Supporting Concrete: Formwork not supporting concrete, such as sides of beams, walls, columns and similar parts of the structure, may be removed after cumulatively (not necessarily consecutively) curing at not less than 50°F for 12 hours after placing concrete, provided the concrete is sufficiently hard so as not to be damaged by form removal operations and provided curing and protection operations are maintained. If ambient air temperatures remain below 50°F, if retarding agents are used, or if Type II and Type V Portland cement is used, then this specified minimum period shall be increased as required to safely remove the forms without damage to the concrete. Where such forms also support formwork for slab or beam soffits, the removal times of the latter shall govern.

E. Formwork Supporting Weight of Concrete: Formwork supporting weight of concrete such as beam soffits, joists, slabs and other structural elements shall not be removed until concrete has attained at least the following percentages of the design compressive strength:

1. Joists, Beam Bottoms: 70%, but not less than 2,800 psi.
2. Slabs: 70%, but not less than 2,800 psi.

F. Placing Reshores and Backshores:

1. All shoring operations shall be carried out in accordance with a planned sequence as determined by the Contractor's shoring engineer.
2. Shoring operations shall be performed so that at no time will areas of new construction be required to support combined dead and construction loads in excess of the available strength as determined by the design loads (as specified in the General Notes) and the developed concrete strength (as determined by field cured cylinders or maturity method) at the time of stripping and reshoring or backshoring.
3. Shores (backshores or reshores) shall not be removed until the structural member supported has sufficient strength to support all applied loads.
4. For backshoring operations, the forms shall be removed in such a manner that individual structural members are not allowed to deflect and carry load.
5. Reshoring operations require that the structural members be strong enough to safely support their own weight before stripping of formwork.
6. For reshoring operations, no structural member shall be overstressed under its own dead weight plus the weight of the floors above and construction loads assigned to the structural member by a rational analysis that accounts for the relative stiffness of each floor with due consideration of concrete age and strength. While reshoring is underway, no construction loads shall be permitted on the new construction unless it can safely support the construction loads.
7. Where possible, shores shall be located in the same position on each floor so that they will be continuous in their support from floor to floor.

3.7 FIELD QUALITY CONTROL

A. Field Inspection: Refer to Specification 014529 “Structural Testing and Inspections” for inspection requirements associated with forming and accessories.
B. Field Inspection:

1. Shallow Foundation Elements:
   a. Verify element width, length, depth, and elevation.
   b. Verify that forms are plumb and straight, braced against movement, and lubricated for removal.

2. Slabs-on-Grade:
   a. Verify formwork at turndowns and slab edges is plumb and straight, braced against movement and lubricated for removal.

3. Columns and Walls:
   a. Verify that forms are plumb and straight, braced against movement, lubricated for removal, and conform to approved shop drawings.
   b. Verify proper dimensions and orientation.
   c. Verify top of column elevation is set in form and that it is 1/2 inch below the future slab soffit.

4. Suspended Floors (General):
   a. Verify that formwork conforms to signed and sealed shop drawings.
   b. Verify that shoring layout conforms to signed and sealed shop drawings.
   c. Verify that reshores at all levels conform to signed and sealed shop drawings.
   d. Verify that forms are plumb and straight, braced against movement, and lubricated for removal.
   e. Verify that the forms used for exposed finish surfaces are of the type specified and provide a joint system as shown on the Architect’s drawings.
   f. Verify the proper dimensions of girders, beams, and joists.
   g. Verify that the slab thickness and top of slab elevation is correct.
   h. Verify the top of columns are 1/2 inch below the deck soffit.

5. Pan Form Slabs:
   a. Verify that pans used are of the type specified and are free of dents, surface irregularities, sags, rust, or stains.
   b. Verify that the discontinuities that will be created in the slab soffit at the splice points of the pans do not exceed the value specified.

6. Flat Slabs:
   a. Verify that the top of columns are 1/2 inch below the deck soffit.

7. Tilt-Up Concrete:
   a. Verify that the formwork complies with the shop drawings.

8. In-Situ Concrete Strength Verification Prior to Form Stripping: The Testing Laboratory shall verify that the concrete has reached the required minimum strength before form removal by evaluating the specified tests. Refer to Specification 033000 “Cast-in-Place Concrete” for additional information regarding the tests.
SECTION 032000
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 SUMMARY

A. Section includes labor, materials, hardware, equipment, transportation and services required to fabricate and place all reinforcement for cast-in-place concrete including bars, welded wire reinforcement, ties and supports shown on the drawings and as specified.

B. Related Requirements:

1. Specification 014529 “Structural Testing and Inspections for testing and inspection requirements associated with concrete reinforcing.
2. Specification 031000 “Concrete Forming and Accessories” for forming associated with cast-in-place concrete.

1.3 PRICE AND PAYMENT PROCEDURES

A. Alternates:

1. Products Requiring International Code Council (ICC) Evaluation Service Reports:

   a. For those products listed in Part 2 as requiring Evaluation Service Reports (ESRs), alternate products that do not have ESRs will be considered by the Engineer only if valid research reports or test data from an independent and approved agency is provided and use of the product receives prior approval from the Building Official.

1.4 REFERENCES

A. Reference Standards:

1. Comply with all provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified:

   b. ACI 301, "Specifications for Structural Concrete for Buildings."
d. CRSI, "Manual of Standard Practice."

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Quality Control: The Contractor is responsible for quality control, including workmanship and materials furnished by subcontractors and suppliers.
2. Document Conflict and Precedence: In case of conflict among documents, including architectural and structural drawings and specifications, notify the Architect/Engineer prior to submitting proposal. In case of conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Architect/Engineer.

B. Preinstallation Meetings: The Reinforcing-Placing subcontractor shall attend the Pre-Concrete Conference conducted by the Concrete Contractor as described in Specification 033000 "Cast-in-Place Concrete."

1.6 SUBMITTALS

A. Product Data: Submit manufacturer’s product data with application and installation instructions for proprietary materials and items including mechanical splices, hooked anchorage systems, large-headed stud punching shear reinforcement, dowel bar replacement systems, and dowel bar sleeves.

B. Certificates:

1. Submit, for record, mill certificates and/or test results signed by Producer, for all reinforcement.

C. Test and Evaluation Reports:


1.7 QUALITY ASSURANCE

A. Testing Laboratory Requirements: The Owner’s Testing Laboratory shall:

1. Review the Welding Procedure Specification (WPS) submitted by the Contractor for any reinforcing steel other than ASTM A 706 that is proposed to be welded for consistency with acceptable welding practices and AWS.
2. Review the welder qualifications by certification or verify by retesting and shall obtain the welder certificates.

B. Welder Qualifications: Qualify procedures and personnel according to ANSI/AWS D1.4.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Reinforcement:

1. Reinforcing materials shall be delivered from the mill in bundles that are identified as to heat number and manufacturer and accompanied with mill and analysis test reports and an affidavit from the supplier stating that the material conforms to the requirements of the governing ASTM specification listed herein.
2. Reinforcing Bars: Reinforcing bars shall conform to ASTM A 615, Grade 60 as noted on the drawings.
3. Deformed Bar Anchors: AWS Type C studs manufactured in conformance with ASTM A 1064 with a minimum tensile strength of 80,000 PSI. ASTM A 615 reinforcing bars may not be substituted for deformed bar anchors. Reinforcement shall be approved by the ICC-Evaluation Service, Inc and shall have the Evaluation Service Report submitted for Engineer review. The following are acceptable products, provided that their Evaluation Service Reports are still valid at the time of intended use on the project:
   b. Tru-Weld Division, TFP Corporation; Deformed Bar Anchors (ESR-2823).
4. Epoxy-Coated Reinforcing Steel: Provide epoxy coated reinforcing bars at the locations indicated on the drawings. Epoxy coated reinforcing bars shall conform to ASTM A 775. Bars that are to be epoxy coated shall conform to the type of steel required for the given situation as noted on the drawings.
5. Plain Steel Welded Wire Reinforcement: ASTM A 185 with a yield strength of 65,000 PSI. Provide in flat sheets only.
6. Deformed-Steel Welded Wire Reinforcement: ASTM A 1064 with a yield strength of 70,000 PSI. Provide in flat sheets only.

2.2 SPLICES

A. End Bearing Compression Splices: Members with end bearing compression splices shall have vertical bars saw cut or otherwise finished for true bearing. Bar ends shall terminate in flat surfaces within 1 1/2 degrees of a right angle to the axis of the bars and shall be fitted within three degrees of full bearing after assembly. Splice bars shall be held in concentric contact by a suitable device. The following are acceptable end bearing compression devices:

1. Erico Products, Inc.; Speed Sleeve.
2. Other Engineer-approved product.

B. Mechanical Tension Splices:

1. Mechanical splices shall conform to Type 1 splices.
   a. Type 1 splice shall develop, in tension and compression, 1.25 times the specified yield strength of the splice bar.
2. Splices shall be approved by the ICC-Evaluation Service, Inc and shall have the Evaluation Service Report submitted for Engineer review.
3. The bar ends that are to attach to the splice shall be prepared and installed in accordance with the manufacturer’s requirements.

4. The following are acceptable mechanical tension splices (splices qualified for use with grade 75 bars are parenthetically noted), provided that their Evaluation Service Reports are still valid at the time of intended use on the project:

   a. BarSplice Products, Inc.; BPI-Grip XL System (ESR-2299). (Type 1 or Type 2)
   b. BarSplice Products, Inc.; Taper Threaded Grip-Twist System (ESR-2299). (Type 1 or Type 2)
   c. BarSplice Products, Inc.; Position Taper Threaded Grip-Twist System (ESR-2299). (Type 1 or Type 2)
   d. Headed Reinforcement Corporation; HRC 500/510 Xtender Mechanical Coupler System (ESR-2764). (Type 1 or Type 2)
   e. Dayton Superior Corporation; DBDI Reinforcing Bar Mechanical Splice System (ESR-2649). (Type 1 or Type 2).
   f. Dayton Superior Corporation; Bar-Lock Coupler Systems for Splicing Reinforcement Bars, S-Series (ESR-2495). (Type 1 and Type 2)
   g. Dayton Superior Corporation; Bar-Lock Coupler Systems for Splicing Reinforcement Bars, L-Series (ESR-2495). (Type 1 or Type 2)
   h. Dayton Superior Corporation; Taperlok Reinforcing Bar Mechanical Splice Couplers (ESR-2481). (Type 1 or Type 2)
   i. Dextra Manufacturing Co., Ltd.; Bartec Mechanical Splice System for Steel Reinforcing Bars in Concrete (ESR-1705). (Type 1 or Type 2)
   j. BarSplice Products, Inc.; ZAP Screwlok (qualified for use with grade 75 bars) (ER-5461). (Type 1 and Type 2)
   k. Erico Products, Inc.; Lenton Coupler (ER-3967). (Type 1 or Type 2) (for grade 75 bars #9 and larger, use only Standard Coupler).
   l. Splice Sleeve North America; NMB Splice-Sleeve (ER-5645). (Type 1 or Type 2).

C. Dowel Bar Replacement: All grade 60 reinforcing steel dowel bars shown on the drawings crossing concrete construction joint surfaces with inserts cast flush against the form and having reinforcing bars connected to the insert in a subsequent concrete pour shall conform to the following:

   1. Splice connection to the insert shall develop the 1.25 times the specified yield strength and the full tensile strength of the spliced bar.
   2. Splices shall be approved by the ICC Evaluation Service, Inc. as expressed in an ICC Evaluation Service Report which shall be submitted for review.
   3. The following are acceptable products (for use only with grade 60 bars), provided that their Evaluation Service Reports are still valid at the time of intended use on the project:

      b. Erico Products, Inc.; Lenton Form Saver (ER-3967).

D. Hooked Anchorage Replacement: Reinforcing bar terminations shall be manufactured out of ASTM A 576, ASTM A 615, or A 706 material and shall develop the full tensile strength of the bar when installed at the manufacturer’s recommended depth.

   1. The anchorage shall be approved by the ICC Evaluation Service Inc. as expressed in an ICC Evaluation Service Report which shall be submitted for review.
   2. The following are acceptable products (for use only with grade 60 bars), provided that their Evaluation Service Reports are still valid at the time of intended use on the project:
2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: Smooth bars used to dowel across slab-on-grade construction joints shall conform to ASTM A 615, Grade 40 or ASTM A 36, plain-steel bars. Cut bars true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: Smooth epoxy-coated bars used to dowel across slab-on-grade construction joints shall conform to ASTM A 775 with ASTM A 615, Grade 40 or ASTM A 36 plain-steel bars. Cut bars true to length with ends square and free of burrs.

C. Dowel Bar Sleeves: Plastic or gage metal (26 gauge minimum) sleeves with an inside diameter of 1/16 inch greater than the dowel bar that it encases, that have the strength, durability, and design to provide free movement of the dowel relative to the concrete slab and that are specifically manufactured for this purpose.

D. Alternate Slab-on-Grade Joint Load Transfer Systems: A system that consists of flat, ASTM A 36 plate that is saw cut into a square or rectangular shape and is embedded into or encased by a plastic sleeve that allows movement in both lateral directions but not in the vertical direction. Acceptable systems are manufactured by PNA Construction Technologies with products known by the names “Diamond Dowel System” and “PD3 Basket” and Greenstreak Group Inc. with products known as “Speed Plate” and “Double-Tapered Basket”.

E. Tie Wire: Tie wire shall be annealed steel tie wire, minimum 16 gauge.
   a. Tie wire in architecturally exposed concrete shall be plastic coated or stainless steel.
   b. Tie wire for epoxy-coated reinforcement shall be epoxy-coated.
   c. Tie wire for galvanized reinforcement shall be galvanized.

F. Holding Wire: Holding wire shall conform to ASTM A 82 or ASTM A 1064.

G. Coating Repair Materials: Repair damaged areas of epoxy-coated or galvanized reinforcement using the following products.
   1. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating compatible with epoxy coating on reinforcement and complying with ASTM A 775.
   2. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc shall be used to repair damaged areas of galvanized reinforcement.

H. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Use wire bar type supports complying with CRSI recommendations.
   1. Slabs-on-Grade: Use precast concrete bar supports (dobies) or supports with sand plates or horizontal runners designed for use on ground.
   2. Spread Footing Bottom Reinforcement: Use precast concrete bar supports (dobies) or chairs designed for soil-supported slabs.
3. Mat Foundation: Use precast concrete bar supports (dobies), chairs designed for soil-supported slabs, or cast-in-place concrete curbs.

4. Exposed to View Concrete: Provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

5. Support of Epoxy-Coated Reinforcement: Provide epoxy-coated or other dielectric-polymer-coated wire bar supports to support epoxy-coated reinforcement.


PART 3 - EXECUTION

3.1 FABRICATION AND DELIVERY

A. Bending and Forming: Fabricate bars of indicated sizes and accurately form to shapes and lengths indicated and required, by methods not injurious to materials. Do not heat reinforcement for bending. Bars shall be free from injurious defects, have a workman-like finish with no excessive rust and/or pitting, and have no unusual kinks or bends.

B. Marking and Shipping: Bundle reinforcement and tag in accordance with Section 7.4.5 of the CRSI "Manual of Standard Practice." Transport and store at site so as not to damage material. Keep sufficient supply of tested, approved, and proper reinforcement at the site to avoid delays. Maintain reinforcing bars free of mud, dirt, grease, or other coating.

C. Repair of Epoxy-Coated Reinforcing: Repair cut and damaged epoxy coatings on fabricated reinforcing before delivery with epoxy repair coating according to ASTM D 3963

3.2 PLACING REINFORCEMENT

A. Comply with CRSI recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as herein specified.

B. Before placing reinforcement and again before concrete is placed, clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by chairs, runners, bolsters, spacers, and hangers as required. Exercise particular care to maintain proper distance and clearance between parallel bars and between bars and forms. Provide spreaders and spacers to hold steel in position. Support steel at proper height upon approved chairs.

D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set tie wires so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in as long lengths as practicable. Provide lap splice for wires of adjoining pieces per ACI 318 Chapter 12.18.1 or 12.19.1 and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

F. Coordinate with other trades and expedite materials and labor to avoid omissions and delay.
G. Install waterproof membrane or vapor retarder as specified prior to placing steel for concrete slabs-on-grade.

H. Extend reinforcement continuous through construction joints unless otherwise shown on the drawings.

I. Epoxy-Coated Reinforcement: Use epoxy-coated steel tie wires to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963.

J. Do not bend reinforcement that is embedded partially in concrete except in locations noted on the drawings or approved by the Engineer.

3.3 SPLICING REINFORCING STEEL

A. Provide splices as indicated on the drawings. Splice reinforcing bars only at locations shown on the structural drawings and approved shop drawings. Unauthorized or unscheduled splices not approved by the Engineer in writing will not be accepted.

B. All lap splices in reinforcing steel shall be contact lap splices unless detailed otherwise on the drawings.

C. Maintain proper cover and spacing between reinforcing bars at splices.

D. Lap unscheduled reinforcing bars not otherwise specified with a Class B lap splice. Lap welded wire reinforcement per ACI 318 Chapter 12.18.1 or 12.19.1.

3.4 PLACEMENT OF WELDED WIRE REINFORCEMENT

A. Wherever welded wire reinforcement is specified as reinforcement in topping slabs, it shall be continuous and properly lapped per ACI 318 Chapter 12.18.1 or 12.19.1 across the entire concrete surface and not interrupted by beam or girders.

3.5 REINFORCEMENT IN TOPPING SLABS

A. Provide welded smooth wire reinforcement minimum 4 x 4 W4.0 x W4.0 in all topping slabs unless specified otherwise on the drawings.

B. Provide non-metallic chairs as required to provide adequate cover as indicated on the drawings.

3.6 REINFORCEMENT IN SIDEWALKS

A. Provide welded smooth wire reinforcement minimum 6 x 6 W1.4 x W1.4 in all sidewalks unless detailed otherwise on the Architectural, Civil, or Structural Drawings.

3.7 FIELD QUALITY CONTROL

A. Refer to Section 014520 “Structural Testing”.

KUMC CAMBRIDGE GARAGE TOPPING REPAIRS
KANSAS CITY, KS
WALTER P MOORE PROJECT NO. D08.17003.00

CONCRETE REINFORCING
032000 - 7
SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary
   Conditions and Division 01 Specification sections, apply to work of this section.

1.2 SUMMARY

A. Section includes all labor, materials, services, equipment, and hardware required in conjunction
   with or related to the forming, delivery, and pouring of all cast-in-place concrete work.

B. Related Requirements:
   1. Specification 014529 “Structural Testing and Inspections” inspection requirements
      associated with cast-in-place concrete.
   2. Specification 031000 “Concrete Forming and Accessories” for forming associated with
      cast-in-place concrete.

1.3 REFERENCES

A. Reference Standards:
   1. Codes and Standards: Comply with provisions of following codes, specifications and
      standards, except where more stringent requirements are shown or specified:
      b. ACI 301, “Specifications for Structural Concrete.”
      c. ACI 305.1, “Specification for Hot Weather Concreting.”
      d. ACI 318, “Building Code Requirements for Structural Concrete.”
      e. ACI 355.4, “Qualification of Post-Installed Adhesive Anchors in Concrete.”

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Quality Control: The Contractor is responsible for quality control, including workmanship
      and materials furnished by subcontractors and suppliers.
   2. Document Conflict and Precedence: In case of conflict among documents, including
      structural drawings and specifications, notify the Engineer prior to submitting proposal.
case of conflict between and/or among the structural drawings and specifications, the
strictest interpretation shall govern, unless specified otherwise in writing by the Engineer.

3. Materials and installed work may require testing and retesting, as directed by the governing
building code or the Engineer, at any time during progress of work.

   a. The Contractor shall provide adequate notification to the Owner’s Testing Agency of
      construction operations including the project schedule to allow the Testing Agency
to schedule inspections. Failure to notify sufficiently may result in additional costs
 incurred by the Testing Laboratory that may be back-charged to the Contractor by
the Owner.
   b. The Contractor shall cooperate with laboratory personnel, provide access to the
      work, and provide access to manufacturer’s operations.
   c. The Contractor shall make adequate arrangement with the Owner’s Testing Agency
      for inspection of material stockpiles and facilities.
   d. The Contractor shall provide to the laboratory certificates and representative
      samples of materials proposed for use in the work in quantities sufficient for accurate
      testing as specified.
   e. The Contractor shall furnish casual labor, equipment, and facilities as required for
      sampling and testing by the laboratory and otherwise facilitate the required
      inspections and tests.
   f. Inspection or testing by the Owner does not relieve the Contractor of his
      responsibility to perform the Work in accordance with the Contract Documents.
      Tests not specifically indicated to be done at the Owner’s expense, including
      retesting of rejected materials and installed work, shall be done at the Contractor’s
      expense. See Structural Testing and Inspections section of the Specifications.

4. Responsibility for Selection and Use of Concrete Admixtures and Chemical Treatments:
The Contractor shall be responsible for selecting admixtures and surface treatments that
are compatible with the intended use of the concrete including all final surface treatments
called for within this or other specifications or on the structural or architectural drawings.
The Contractor is responsible for following the manufacturer’s instructions for the use of
their product including abiding by any limitations placed by the manufacturer on the use of
any of its products.

B. Preinstallation Meetings:

1. Pre-Concrete Conference:

   a. At least seven days prior to beginning concrete work, the Contractor shall conduct
      a meeting to review the proposed design mixtures and to discuss required methods
      and procedures to produce concrete construction of the required quality. Also,
      review requirements for submittals, status of coordinating work and availability of
      materials. Establish work progress schedule and procedures for materials
      inspection, testing, and certifications. The contractor shall send a pre-concrete
      conference agenda to all attendees seven days prior to the scheduled date of the
      conference.
   b. The **Contractor shall require responsible representatives of every party** who is
      concerned with the concrete work to attend the conference, including but not limited
      to the following:

      1) Contractor’s Superintendent.
      2) Laboratory responsible for the concrete design mix.
      3) Laboratory responsible for field quality control.
      4) Concrete Subcontractor.
      5) Ready-Mix Concrete Producer.
6) Admixture Supplier.
7) Concrete Pumping Contractor.
8) Owner’s and Architect’s/Engineer’s Representative.

c. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed by him to all parties concerned within five days of the meeting. One copy of the minutes shall be transmitted to the following for information purposes:

1) Owner’s Representative.
2) Architect.
3) Engineer-of-Record.

d. The Engineer shall be present at the conference. The Contractor shall notify the Engineer at least seven days prior to the scheduled date of the conference.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer’s product data with application and installation instructions for proprietary materials and items, including admixtures, patching compounds, epoxies, grouts, waterstops, joint systems, curing compounds, dry-shake finish materials, hardeners, sealers, joint fillers, and others as requested by Engineer.

B. Shop Drawings:
   1. Construction Joints: Submit drawings of proposed construction joint locations in concrete for topping slab. Submit any additional or changed reinforcing that is required at construction joints that differs from that shown on the drawings.
   2. Openings, Sleeves, and Cores: Submit drawings of all openings to be formed, sleeved, cored, or sawcut in cast-in-place elements. Drawings shall indicate size and location of openings, sleeves, or cores.

C. Samples: Submit samples of materials specified if requested by Engineer, including names, sources, and descriptions.

D. Certificates:
   1. Material and Mill Certificates:
      a. Provide material and mill certificates as specified herein and in the Testing Laboratory section of the Specifications. The Manufacturer and Contractor shall sign the material and mill certificates certifying that each material item complies with specified requirements.
      b. Provide certification from admixture manufacturers that chloride ion content complies with specified requirements.

E. Design Mixtures: Submit for each concrete mixture as specified herein. Mix design submittal shall be provided with adequate testing documentation.

F. Qualification Statements: Submit certifications for adhesive anchor installers.

G. Minutes of Preinstallation Meetings: Contractor shall submit for review.
1.6 QUALITY ASSURANCE

A. Testing Laboratory Requirements: The Owner’s Testing Laboratory shall:

1. Concrete Design Mixtures: Review the submitted design mixtures for conformance to the specifications and for suitability for use in the project.
2. Preinstallation Meetings: Attend the preinstallation meetings referenced above.

B. Qualifications:

1. Concrete Supplier: The concrete supplier shall have a minimum of five years of experience in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment. The supplier must be certified according to the National Ready Mixed Concrete Association’s Certification of Ready Mixed Concrete Production Facilities.
2. Concrete Contractor: The concrete contractor shall have a minimum of five years of experience with installation of concrete similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful service performance.
3. Adhesive Anchor Installers: The individuals performing the installation of adhesive anchors that are horizontally or upwardly inclined shall be certified in accordance with the ACI/CRSI Adhesive Anchor Installer Certification program.

C. Mockups: Provide mock-ups as required.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Refer to the drawings for classes and strengths of concrete required.

B. Hydraulic Cement:

1. Use ASTM C 150, ASTM C 1157, or ASTM C 595 (excluding Type IS) unless otherwise specified. Do not use Type III cement in slabs-on-grade unless approved in advance by the Engineer.
2. Concrete Exposed to Sulfates in Soil or Water:
   a. Exposure Class S1: For concrete designated on the drawings as Exposure Class S1, use ASTM C 150, Type II or ASTM C 1157, Type MS.
   b. Exposure Class S2: For concrete designated on the drawings as Exposure Class S2, use ASTM C 150, Type V or ASTM C 1157, Type HS.
   c. Alternate Cement Types for Exposure Classes S1 and S2: ASTM C 150, Type I or III cement may be used for concrete designated as Exposure Class S1 or S2 if the tricalcium aluminate (C₃A) content is less than eight percent for Exposure Class S1 or five percent for Exposure Class S2. ASTM C 150, Type I or III cement may be used for exposure to seawater if the tricalcium aluminate content does not exceed 10 percent and the water/cementitious material ratio of the concrete mix does not exceed 0.40.
d. Exposure Class S3: For concrete designated on the drawings as Exposure Class S3, use ASTM C 150, Type V plus pozzolan or slag or ASTM C 1157, Type HS plus pozzolan or slag or ASTM C 595, Type IP (HS) or Type IS (HS). The amount of pozzolan or slag added or in a blended mix shall be such that has been determined by service record to improve sulfate resistance when used with Type V cement or the amount that when tested according to ASTM C 1012 meets the criteria of Table 4.5.1 in ACI 318-08.

3. Use one brand of cement, for each class of concrete, throughout the project, unless approved otherwise by the Architect/Engineer and the Owner’s Testing Laboratory. Submit mill certificates certifying conformance to this specification for each brand and type of cement.

4. Testing of cement in lieu of mill certificate submittal will be required if:

a. The cement has been in storage at the mixing site for over 30 days.

b. It is suspected by the Owner, Architect, Engineer, or Owner’s Testing Laboratory that the cement has been damaged in storage or in transit or is in any way defective.

C. Low-alkali cement: Cement that has the additional requirement that equivalent alkalis (Na₂O + 0.658K₂O) do not exceed 0.60% according to ASTM C 150-00, Table 2.

D. Expansive Cement: ASTM C 845, Type G or K

E. Fly Ash: ASTM C 618, Class C or F.

F. Silica Fume: ASTM C 1240, Amorphous Silica.

G. Slag Cement: ASTM C 989, Grade 100 or 120 or ASTM C 595, Type IS or Type S.

H. Normalweight Aggregates: ASTM C 33, and as herein specified. Submit material certificates from aggregate supplier or test results from an independent testing agency certifying conformance to this specification for each source of aggregate.

2.2 ADMIXTURES


1. Subject to compliance with requirements, provide one of the following products and manufacturers:

   a. W.R. Grace & Co.; Darex or Daravair series.
   b. BASF Corporation; MasterAir VR 10, MasterAir AE 90, MasterAir AE 200.
   c. Sika Corporation; Sika AER.
   d. The Euclid Chemical Company; Air Mix, AEA-92, Eucon Air 30 or Eucon Air 40.

2. Submit manufacturer’s certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

B. Water-Reducing Admixture: ASTM C 494, Type A. See maximum permissible chloride ion content in concrete specified below.

1. Subject to compliance with requirements, provide one of the following products and manufacturers:
a. BASF Corporation; MasterPozzolith Series.
b. Sika Corporation; Plastocrete 161.
c. The Euclid Chemical Company; Eucon WR-75, Eucon WR-91, Eucon NW or Eucon LW.

2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

C. Mid-Range Water-Reducing Admixture: ASTM C 494, Type A and Type F. See maximum permissible chloride ion content in concrete specified below.

1. Subject to compliance with requirements, provide one of the following products and manufacturers:
   a. BASF Corporation; MasterPolyheed Series.
   b. The Euclid Chemical Company; Eucon MR, Eucon X-15 or Eucon X-20.
   c. Sika Corporation; Sikament HP.
   d. W.R. Grace & Co.; Daracem or Mira series.

2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

D. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G. See maximum permissible chloride ion content in concrete specified below.

1. Subject to compliance with requirements, provide one of the following products and manufacturers:
   a. W.R. Grace & Co.; ADVA or Daracem Series.
   b. BASF Corporation; MasterRheobuild 1000; MasterGlenium Series, PS 1466.
   c. Sika Corporation; Sikament.
   d. The Euclid Chemical Company; Eucon 37/1037, Plastol series, Eucon SP or Eucon RD2.

2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

E. Water-Reducing, Accelerator Admixture (Non-Corrosive, Non-Chloride): ASTM C 494, Type C or E. See maximum permissible chloride ion content in concrete specified below.

1. Subject to compliance with requirements, provide one of the following products and manufacturers:
   a. W.R. Grace & Co.; Polarset, Lubricon NCA, Daraset 400, or DCI.
   b. BASF Corporation; MasterSet FP 20, MasterSet AC 534.
   c. The Euclid Chemical Company; Accelguard 80/90, Accelguard NCA, or Accelguard AcN.
   d. Sika Corporation; Plastocrete 161FL.

2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.
F. Water-Reducing, Retarding Admixture: ASTM C 494, Type D. See maximum permissible chloride ion content in concrete specified below.

1. Subject to compliance with requirements, provide one of the following products and manufacturers:
   a. W.R. Grace & Co.; Daratard series, or Zyla R.
   b. BASF Corporation; MasterPozzolith R series, or MasterSet DELVO series.
   c. Sika Corporation; Plastiment.
   d. The Euclid Chemical Company; Eucon Retarder series.

2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

G. Viscosity Modifying Admixture: Used to enhance plastic concrete properties such as workability, pumpability, and stability for “Self-Consolidating Concrete”.

1. BASF Corporation; MasterMatrix VMA series.
2. The Euclid Chemical Company; Eucon SL or Visctrol.
3. Sika Corporation; VisoCrete series.

H. Shrinkage Reducing Admixture.

1. Subject to compliance with requirements, provide one of the following products and manufacturers:
   a. For Air-Entrained Concrete:
      1) W.R. Grace & Co.; Eclipse 4500.
      2) The Euclid Chemical Company; Eucon SRA.
      3) BASF Corporation; MasterLife CRA 007.
   b. For Non Air-Entrained Concrete
      2) BASF Corporation; MasterLife SRA 20

I. Corrosion Inhibitor: 30% calcium nitrite:

1. Products: Subject to compliance with requirements, provide the following at dosage rates per Engineer from manufacturer’s recommendation based on design life, application, clear cover and other products in concrete mix:
   a. The Euclid Chemical Company; Eucon CIA or Eucon BcN.
   b. W.R. Grace & Co.; DCI or DCI-S.
   c. BASF Corporation; MasterLife CI 30.
   d. Sika Corporation; Sika CNI.

J. Corrosion Inhibitor: Amine-Ester type:

1. Products: Subject to compliance with requirements, provide the following at dosage rates per manufacturer’s recommendation:
K. Crystalline-Forming Waterproofing Admixture: A powder admixture capable of producing concrete that is water tight under hydrostatic pressure up to seven atmospheres when tested in accordance with Corps of Engineers test CRD-C48 and capable of sealing cracks up to 0.4 mm.

1. Products: Subject to compliance with requirements, provide the following at dosage rates per manufacturer’s recommendation:

   a. ICS/Penetron International/Ltd; Penetron Admix.
   c. Xypex Chemical Corporation; Xypex Admix C1000 or C500.
   d. Sika Corporation; Sika WT-215P
   e. BASF Corporation; MasterLife 300D
   f. The Euclid Chemical Company; Eucon Vandex AM-10

L. Calcium Chloride: Calcium chloride is not permitted. For shrinkage compensating concrete, admixtures must be free of calcium chloride.

M. Certification: Written conformance to all the above-mentioned requirements and the chloride ion content of the admixture as tested by an accredited laboratory will be required from the admixture manufacturer at the time of design mixture review by the Engineer.

2.3 CURING MATERIALS

A. Water and Chloride Ion Repelling Penetrating Sealer: Clear, solvent free, Silane penetrating sealer which reacts chemically with the concrete surface to function as a Chloride Ion screen with a minimum 83% factor when tested in accordance with NCHRP #244, Series II and applied in accordance with the manufacturer’s recommendation.

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

   a. 100% solids:
      1) Evonik Industries; Protectosil BHN.

2.4 RELATED MATERIALS

A. Post-Installed Anchors:

1. Qualified Products:

   a. Mechanical Anchors: Only anchors having passed Acceptance Criteria 193 for use in cracked concrete and resisting wind and seismic loads shall be approved for use. Reports from the following organizations are acceptable:

      2) IAPMO Uniform Evaluation Services.

   b. Adhesive Anchoring Systems: Only adhesive anchor systems that comply with the latest revision of ICC-ES Acceptance Criteria 308 for use in cracked concrete and
resisting wind and seismic loads shall be approved for use. Reports from the following organizations are acceptable:

2) IAPMO Uniform Evaluation Services.

2. Alternate Anchor Approval: Install only anchors identified on the drawings by manufacturer and product. Substitutions using products approved by this Specification may be permitted provided complete design calculations are signed and sealed by a registered professional engineer licensed in the state where the project is located and furnished to the Engineer for review and approval prior to commencement of work. The Contractor shall request design criteria for all conditions where a product substitution is considered. Failure to obtain approval for an anchor substitution may result in the request by the Engineer to remove installed anchors and replace with the product specified on the drawings at the Contractor's expense.

3. Installation: All installation of post-installed anchors shall be in accordance with the Manufacturer’s Printed Installation Instructions (MPII).

4. Interior Use: All anchors for use in interior conditioned environments free of potential moisture shall be manufactured from carbon steel zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3.

5. Exterior or Exposed Use: All anchors for use in exposed or potentially wet environments or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors shall conform to ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel.

6. Nuts and Washers: Nuts and washers shall be furnished from the manufacturer and used with the anchors.

7. Anchor Types:

a. Expansion and Undercut Anchors in Concrete:

1) Type: All expansion and undercut anchors in concrete shall be wedge type expansion, sleeve type expansion, or undercut type anchors.

2) Acceptable Products and Manufacturers – Normalweight and Sand-Lightweight Concrete Not on Corrugated Steel Deck:

   a) Hilti, Inc.; Kwik Bolt TZ (ESR-1917).
   b) Hilti, Inc.; HDA Undercut Anchor (ESR-1546).
   c) Hilti, Inc.; HSL-3 Heavy Duty Sleeve Anchor (ESR-1545).
   d) Simpson Strong-Tie Co., Inc.; Strong-Bolt Wedge Anchor (ESR-1771).
   e) Simpson Strong-Tie Co., Inc.; Strong-Bolt 2 Wedge Anchor (ESR-3037).
   f) ITW Red Head; Red Head Trubolt+ Wedge Anchor (ESR-2427).
   g) USP Structural Connectors; DUC Undercut Anchor (ESR-1970).
   h) Dewalt/Powers; Power Stud+ SD1 Expansion Anchor (ESR-2818).
   i) Dewalt/Powers; Power Stud+ SD2 Anchor (ESR-2502).
   j) Dewalt/Powers; Atomic+ Undercut Anchor (ESR-3067).

B. Non-Shrink Grout:

1. Type: Grout for base plates, bearing plates and grouting under precast or tilt-up wall panels shall be a non-metallic, shrinkage resistant, premixed, non-corrosive, non-staining product containing Portland cement, silica sands, shrinkage compensating agents and fluidity improving compounds.

2. Specifications: Non-shrink grout shall conform to ASTM C 1107.
3. Compressive Strength: Provide the minimum strength as shown below as determined by grout cube tests at 28 days:
   a. 6,000 PSI for supporting concrete 3,000 PSI and less.
   b. 8,000 PSI for supporting concrete greater than 3,000 PSI and less than or equal to 4,000 PSI.
   c. Unless noted otherwise on the drawings, grout strength on supporting concrete greater than 4,000 PSI shall be 8,000 PSI.

4. Products: Acceptable non-shrink grouts are listed below:
   a. L&M Construction Chemicals, Inc.; Crystex.
   b. BASF Corporation; Masterflow 713.
   c. BASF Corporation; MasterFlow 100.
   d. The Euclid Chemical Company; NS Grout.
   e. Dayton Superior Corporation, Inc; 1107 Advantage Grout
   f. Hilti, Inc.; Precision Grout.
   g. W.R. Meadows, Inc; CG-86 Grout.
   i. SpecChem, LLC; SC Multipurpose Grout.

5. High Flow, Non-Metallic Grout: Use high-flow grout where high fluidity and/or increased placing time are required and for base plates that are larger than 10 square feet. The factory pre-mixed grout shall conform to ASTM C 1107, "Standard Specification for Packages Dry, Hydraulic-Cement Grout (Non-Shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve minimum 95% bearing under an 18" x 36" base plate. Provide one of the following:
   a. The Euclid Chemical Company; Hi-Flow Grout.
   b. BASF Corporation; Masterflow 928.
   c. BASF Corporation; MasterFlow 928.
   d. W.R. Meadows, Inc; 588-10K Grout.
   e. US Mix Co.; US Spec MP Grout.
   f. SpecChem, LLC; SC Precision Grout.
   g. Dayton Superior Corporation, Inc; Sure Grip High Performance Grout

6. Epoxy Grout: High performance, highly flowable, epoxy grout consisting of pre-packaged components on each resin, one each hardener, and pre-packaged aggregate. Epoxy grout shall be capable of achieving minimum 28 day compressive strength of 19,000 PSI in accordance with ASTM C 579, maximum linear shrinkage of 0.025% at 14 days per ASTM C 531, and maximum creep of 2.7 10-4 inches per inch at 28 days when measured at 400 PSI and 73 degrees F per ASTM C 1181. Provide one of the following, only at locations required by the structural drawings:
   a. The Euclid Chemical Company; E³-X.
   b. Dayton-Superior Corporation; Pro-Poxy Chock

C. Bondbreaker for Construction Joints in Slabs-on-Grade: A dissipating bondbreaking compound containing no silicones, resins, or waxes, and that conforms to ASTM C 309. Subject to compliance with requirements, acceptable manufacturers include the following:
   1. Dayton-Superior Corporation, Inc.; Sure-Lift J6WB.
   2. SpecChem, LLC; SpecTilt 100.
D. Joint-Filler Strips for Isolation Joints in Slabs-on-Grade: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.5 PROPORTIONING AND DESIGN OF CONCRETE MIXTURES

A. The Contractor shall submit design concrete mixtures for each class of concrete indicated on the structural drawings and in the Specifications for approval by the Engineer and Owner's Testing Laboratory at least 15 working days prior to the start of construction. If required, the Contractor shall engage the services of an independent Testing Laboratory to assist in preparing the design mixtures. The Contractor shall not begin work with a particular mixture until that design mixture has been approved.

B. The Contractor, acting in conjunction with his Concrete Supplier and his Testing Laboratory, shall submit in writing, with his design mixtures, the method used to select mixture proportions. Either of the following methods, as outlined in ACI 301, may be used:

1. Field Experience Method.
2. Laboratory Trial Mixture Method.

C. Required types of concrete and compressive strengths shall be as indicated on the Structural Drawings.

D. All design mixtures shall state the following information:

1. Design mixture number or code designation by which the Contractor shall order the concrete from the Supplier.
2. Identify design mixture usage (i.e., columns, shear walls, footings, slab-on-grade, etc.).
3. Wet and dry unit weights.
4. Compressive strength and associated age (28-day, 56-day, etc.).
5. Aggregate type, source, size, gradation, fineness modulus.
6. Cement type and brand.
7. Fly ash or other pozzolan type and brand (if any).
8. Admixtures including air entrainment, water reducers, high-range water reducers, accelerators, and retarders.
9. Design slump or slump/flow.
10. Proportions of each material used.
11. Water/cementitious ratio and maximum allowable water content.
12. Method by which the concrete is intended to be placed (bucket, chute, or pump).
13. Required average strength qualification calculations per ACI 301 4.2.3.3a and 4.2.3.3b. Submit separate qualification calculations for each production facility that will supply concrete to the project.
14. Documentation of Average Strength (Trial Mixture Data or Field Test Data) per ACI 301: When field test data is used to qualify average strength, submit separate documentation for each production facility that will supply concrete to the project.
15. Field test data submitted for qualification of average strength under ACI 301 shall include copies of the Concrete Testing Agency's reports from which the data was compiled.

E. Supplementary Cementitious Materials: Fly ash and/or ground granulated blast-furnace slag replacement of Portland cement shall be within percentage replacement levels listed on the drawings unless noted otherwise. Every effort should be made to reduce the amount of cement to the minimum practical amount, and still achieve performance requirements contained in the Contract Documents.
1. Cement replacement shall not exceed a percentage level that has been shown by experience on other projects to exhibit satisfactory performance using materials from identical sources as proposed for this project. As an alternate, trial concrete batches can be performed to identify design mixtures that maximize cement replacement while meeting strength requirements per ACI 318 Section 5.3 and finishability criteria.

2. The use of fly ash or slag in architecturally exposed structural concrete shall be coordinated with the Architect, Engineer, and Contractor.

3. Overall replacement percentages with combined fly ash and slag shall not exceed the maximum identified with slag or be less than the minimum identified with fly ash for each type of element. In addition, the replacement percentage of fly ash within the combined mixture shall not exceed the maximum identified with fly ash alone.

4. Replacement percentages exceeding the maximum may be permitted at the discretion of the Architect, Engineer of Record, and Contractor.

5. For concrete identified on the drawings as being subject to Exposure Class F3, the maximum amount of supplementary cementitious materials shall not exceed the limits noted in Table 4.2.2.7.b.2 “Maximum cementitious materials requirements for concrete exposed to deicing chemicals” of ACI 301.

6. Except for Mass Concrete, the Contractor may submit for approval a revised design mixture with lower supplementary cementitious material percentages than herein specified should finishability or other issues arise due to changing weather conditions.

F. Aggregate: Comply with the following special requirements:

1. For exposed concrete, provide aggregates from a single source.

2. For exposed surfaces subject to Exposure Class C1 or C2, do not use aggregates containing spalling-causing deleterious substances.

3. For slabs and other designated concrete, combined aggregate gradation shall be 8% - 18% for large top size aggregates (1 1/2 inches) or 8% - 22% for smaller top size aggregates (1 inch or 3/4 inch) retained on each sieve below the top size and above the No. 100. Deviations from this gradation may be allowed upon the approval of the Engineer subject to the following limitations:
   
   a. The percent retained on two adjacent sieves shall be not less than 5%.
   
   b. The percent retained on three adjacent sieves shall be not less than 8%.
   
   c. If the percent retained on two adjacent sieves is less than 8%, the total percent retained on either of those sieves and the adjacent outside sieve shall be not less than 13%.

G. Admixtures:

1. Admixtures to be used in concrete shall be subject to the approval of the Engineer and Owner's Testing Laboratory and shall be used for the purpose intended by the manufacturer to produce concrete to meet the specified requirements.

2. Quantities of admixtures to be used shall be in strict accordance with the manufacturer’s instructions.

3. Air Content Requirements: For concrete subject to Exposure Class F1, F2 or F3 as noted on the drawings, use air-entrainment admixtures to provide concrete such that the air content at the point of placement shall conform to the requirements of ACI 301 Table 4.2.2.7.b “For Exposure Category F: Freezing and thawing exposures” within plus or minus 1.5%. Required air content levels may be reduced by 1.0 percent for concrete strengths above 5,000 PSI.

   a. Interior steel troweled surfaces shall not have more than 3% total air content.

   b. Surfaces scheduled to receive hardeners shall not have more than 3% total air content.
c. Air-entraining admixtures are not permitted in industrial slabs.

H. Adjustments of Concrete Mixtures: Design mixture adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Such adjustments shall be provided at no additional cost to the Owner. Any adjustments in approved design mixtures including changes in admixtures shall be submitted in writing to the Engineer and Owner’s Testing Laboratory for approval prior to field use.

I. Shrinkage: Concrete so identified on the drawings shall be proportioned for a maximum allowable unit shrinkage as noted on the drawings, measured at 28 days after curing in lime water as determined by ASTM C 157 (using air storage). Submit results of test for each class of applicable concrete after every 500 cubic yards placed.

J. Chloride Ion Content:

1. Unless noted otherwise, the maximum water soluble chloride ion concentration in hardened concrete measured at ages from 28 to 42 days contributed from all ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed the limits specified in ACI 301 Table 4.2.2.7.a.1 “Requirements for establishing suitability of cementitious materials combinations exposed to water-soluble sulfate” depending on to which Corrosion Exposure Class (C0, C1 or C2) the concrete is subject as noted on the drawings. Water-soluble chloride ion tests shall conform to ASTM C 1218. One test shall be run for each class of concrete before the design mixture submittal and each time a change is made to the design mixture (such as change in aggregate type or source).

2. The chloride ion content in all concrete used for prestressed or post-tensioned concrete shall not exceed 0.06 percent by weight of cement.

3. The Concrete Supplier shall certify that the chloride ion content in all concrete design mixtures used on the project does not exceed the limits stated above.

2.6 CONCRETE MIXING

A. Ready-Mix Concrete: Comply with requirements of ANSI/ASTM C 94 and the Structural Testing and Inspections section of the specifications.

PART 3 - EXECUTION

3.1 SLUMP LIMIT

A. The slump, as measured in the field where concrete cylinders are taken, shall be within plus or minus 1-1/2 inches of the design slump noted in the approved Design Mixture submittal. Self-Consolidating Concrete shall have a slump/flow of plus or minus two inches of the design slump/flow noted on the approved Design Mixture submittal. Water may be added to the concrete in the field only to the extent that the prescribed water/cementitious ratio noted in the approved Design Mixture submittal is not exceeded. The responsibility for adding water to trucks at the job site shall rest only with the Contractor’s designated representative. The Contractor is responsible that all concrete placed in the field is in conformance with the Contract Documents.
3.2 JOINTS IN CONCRETE

A. Construction Joints: Locate and install construction joints as indicated on the drawings or if not shown on drawings, located so as not to impair strength and appearance of the structure, as acceptable to Architect/Engineer.

1. Keyways: Provide keyways with a depth of one tenth of the member thickness (1 1/2" minimum or as shown on the drawings) in construction joints only where shown on the drawings.

2. Joint Construction: Place construction joints in the center one third of suspended spans and grade beams and as shown on the drawings for slabs-on-grade and walls unless shown otherwise. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise shown on the drawings. Dowels that cross construction joints shall be supported during concreting operations so as to remain parallel with the slab or wall surface and at right angles to the joint. Submit all construction joint locations as a shop drawing submittal.

B. Contraction Joints in Unbonded Topping Slabs: Install contraction joints at locations and spacings as indicated on the drawings or if not shown on drawings, located so as not to impair strength and appearance of the structure, as acceptable to Engineer. Maximum joint spacing shall be per the drawings and be perpendicular to the slab surface. Use one of the two following methods (sawed or formed) to create the joints. Do not use the formed joint in areas subject to vehicular traffic or in industrial slabs.

1. Sawed Joints:
   a. Primary Method: Early-Entry, dry-cut method, using Soff-Cut saws. Finisher must have documented successful experience in the use of this method prior to this project. Install cuts within one to four hours, depending on air temperature, after final finish as soon as the concrete surface is firm enough to not be torn or damaged by the blade at each saw cut location. Use 1/8 inch thick blade, cutting to a depth of one quarter of the slab thickness but not less than one inch. Cut to a depth of one third of the slab thickness for slabs reinforced with steel fibers or synthetic fibers.
   b. Optional Method (where Soff-Cut System method equipment is not available, subject to limitations): This method may not be used when there is no dowel passing through the contraction joint. Use a conventional saw to cut joints within four to 12 hours after finishing as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Complete cutting before shrinkage stresses become sufficient to produce cracking. Use 1/8 inch thick blade, cutting to a depth of one quarter of the slab thickness but not less than one inch. Cut to a depth of one third of the slab thickness for slabs reinforced with steel fibers.

2. Formed Joints: Form contraction joints by inserting premolded plastic hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. The depth is to be one quarter of the slab thickness, but not less than one inch. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

   a. Remove dirt and debris from the joint by vacuuming immediately prior to filling joint. Clean the joint of curing compounds and sealers.
   b. Filler material shall be applied to the joints when the building is under permanent temperature control, but no less than 90 days after slab construction.
c. Follow the manufacturer’s recommended procedure for installing filler material. The joint filler must be flush with the adjacent concrete. A concave profile on the top of the joint filler is unacceptable and will be grounds for removal and replacement.

4. The Contractor shall protect the joints from damage caused by wheeled traffic or other sources during construction until a joint-filler material (if specified) has been installed.

3.3 CONCRETE PLACEMENT

A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. Concrete Batch Trip Tickets: The Contractor shall collect and retain concrete batch trip tickets. Compressive strength, slump, air content, and temperature tests shall be identified by reference to a particular trip ticket. Tickets shall contain the information specified in ASTM C 94. Each ticket shall also show the amount of water that may be added in the field for the entire batch that will not exceed the specified water cement ratio for the design mixture. The Contractor and Testing Laboratory shall immediately notify the Engineer and each other of tickets not meeting the criteria specified.

C. Causes for Rejection of Concrete: The Contractor shall reject concrete delivered to the site for any of the following reasons:

1. Wrong class of concrete (incorrect design mixture number).
2. Environmental condition limits shall be as follows unless appropriate provisions in concrete practices have been made for cold or hot weather:
   a. Cold Weather: Air temperature must be 40°F and rising or the average daily temperature cannot have been lower than 40°F for three consecutive days unless the temperature rose about 50°F for at least one-half of any of those 24 hour periods.
   b. Hot Weather: Environmental conditions must be such that cause an evaporation rate from the concrete surface of 0.2 pounds per square foot per hour or less as determined by the figure “NRMCA Nomograph for Estimating Evaporation Rate on the Basis of Menzel Formula” in Appendix A of ACI 305.1.
   c. Concrete may be placed at other environmental condition ranges only with the approval of the job inspector for the Testing Laboratory or other duly appointed representative.
3. Concrete with temperatures exceeding 95°F.
4. Air contents outside the limits specified in the design mixtures.
5. Slumps outside the limits specified.
6. Water added to the mix that exceeds the maximum allowed water-to-cementitious material ratio.
7. Excessive Age: Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes and it shall be discharged before the drum has revolved 300 revolutions, unless approved by the Testing Laboratory job inspector or other duly appointed representative.

D. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.
E. Comply with ACI 301 and as herein specified:

1. Concrete Temperature: The maximum acceptable concrete temperature at the truck discharge point shall be 95°F.
2. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation. Spread concrete using short-handled, square-ended shovels, or come-alongs.
3. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
4. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use internal vibrators of the largest size and power that can properly be used in the work.
5. Do not vibrate Self-Consolidating Concrete.
6. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to penetrate rapidly placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
7. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed. Place concrete for beams, girders, brackets, column capitals, haunches, and drop panels at the same time as concrete for slabs. Do not place concrete over columns and walls until concrete in columns and walls is no longer plastic and has been in place at least one hour.
8. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners of forms, eliminating air and stone pockets that may cause honeycombing, pitting, or planes of weakness.
9. Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedges, bull floats, or darbies to smooth surface free of humps or hollows before excess moisture or bleedwater appears on the surface. Do not disturb slab surfaces prior to beginning finishing operations.
10. Maintain reinforcing in proper position during concrete placement operations.
11. Protect adjacent finish materials against damage and spatter during concrete placement.
12. Placing Concrete by Pump: If concrete is placed by using a pump, the grout used for pump priming must not become a part of the completed structure unless an engineered grout design mix and grout location are approved in advance by the Engineer.

3.4 FINISH OF FORMED SURFACES

A. General: Formed surfaces shall have the finishes as described below and as shown on the drawings after formwork is removed and repairs made.

B. Matching Mockup Finish: In all areas where a special finish is required or a mock-up is required below, Contractor shall prepare a 100 square foot mock-up to match the required finish. The mock-up should match the finish on a sample panel furnished to the Contractor. If a sample is not furnished, provide finish to match SF2.0 or any other finish specified for the project. Protect mock-up from damage for the duration of project. Approval of mock-up by Architect is required before proceeding with application of finish in project.
C. Classifications and Finish Requirements:

1. Surface Finish 1.0 (SF-1.0):
   a. No formwork facing material is specified.
   b. Patch voids larger than 1-1/2 inch wide or 1/2 inch deep.
   c. Remove projections larger than 1.0 inch.
   d. Provide surface tolerance Class D as specified in ACI 117.
   e. Tie holes need not be patched.

2. Surface Finish 1.1 (SF-1.1):
   a. No formwork facing material is specified.
   b. Patch voids larger than 1 inch wide or 1/2 inch deep.
   c. Remove projections larger than 1/2 inch.
   d. Provide surface tolerance Class C as specified in ACI 117.
   e. Tie holes need not be patched.

3. Surface Finish 2.0 (SF-2.0):
   a. Provide specified formwork-facing material.
   b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
   c. Patch tie holes.
   d. Remove projections larger than 1/4 inch.
   e. Provide surface tolerance Class B as specified in ACI 117.
   f. Provide mock-up of concrete surface appearance.

4. Surface Finish 2.1 (SF-2.1):
   a. Provide specified formwork-facing material.
   b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
   c. Patch tie holes.
   d. Remove projections larger than 1/4 inch.
   e. Provide surface tolerance Class B as specified in ACI 117.
   f. Provide specified rubbed finish after formwork removal.
   g. Provide mock-up of concrete surface appearance.

5. Surface Finish 2.2 (SF-2.2):
   a. Provide specified formwork-facing material.
   b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
   c. Patch tie holes.
   d. Remove projections larger than 1/4 inch.
   e. Provide surface tolerance Class B as specified in ACI 117.

6. Surface Finish 2.3 (SF-2.3):
   a. No formwork-facing material is specified.
   b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
   c. Patch tie holes.
   d. Remove projections larger than 1/4 inch.
   e. Provide surface tolerance Class B as specified in ACI 117.

7. Surface Finish 3.0 (SF-3.0):
a. Provide specified formwork facing material.
b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
c. Remove projections larger than 1/8 inch.
d. Patch tie holes.
e. Provide surface tolerance Class A as specified in ACI 117.
f. Provide mock-up of concrete surface appearance.

8. Surface Finish 3.1 (SF-3.1):

a. Provide specified formwork-facing material.
b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
c. Patch tie holes.
d. Remove projections larger than 1/8 inch.
e. Provide surface tolerance Class A as specified in ACI 117.
f. Provide specified rubbed finish after formwork removal.
g. Provide mock-up of concrete surface appearance.

9. Surface Finish 3.2 (SF-3.2):

a. Provide specified formwork-facing material.
b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
c. Patch tie holes.
d. Remove projections larger than 1/8 inch.
e. Provide surface tolerance Class A as specified in ACI 117.

10. Surface Finish 3.3 (SF-3.3):

a. No formwork-facing material is specified.
b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
c. Patch tie holes.
d. Remove projections larger than 1/8 inch.
e. Provide surface tolerance Class A as specified in ACI 117.

D. Standard Finish: Provide SF-1.0 on all concrete surfaces not exposed to view in the final condition unless otherwise specified.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring 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.

3.5 MONOLITHIC SLAB FINISHES

A. Place, consolidate, strike off, and level concrete, eliminating high spots and low spots, before proceeding with any other finish operation. Do not add water to the surface of the concrete during finishing operation.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using a hand float, a bladed power float equipped with float shoes, or a powered disk float, when the bleed water sheen has disappeared and the concrete
surface has stiffened sufficiently to permit the operation. Check and level surface plane to a
tolerance as specified below. Cut down high spots and fill low spots. Uniformly slope surfaces
to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab
surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film
finish coating system. After floating, begin first trowel finish operation by hand or power-driven
trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over
surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks,
uniform in texture and appearance, and with a level surface to a tolerance as specified below.
Grind smooth surface defects that would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar,
apply initial trowel finish as specified above, then immediately follow with slightly scarifying
surface by fine brooming.

E. Slip-Resistive Broom Finish: Apply slip-resistant broom finish to garage floors and ramps less
than 6% slope, exterior concrete platforms, steps, and ramps and elsewhere as indicated.
Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle
broom perpendicular to main traffic route. Coordinate required final finish with Architect before
application. For concrete containing fibers, broom once only in one direction.

F. Penetrating Sealer Finish: Apply a chloride-and-water-repelling-penetrating-sealer finish to
surfaces as described below and where indicated on the drawings. Apply liquid penetrating sealer
after complete curing and drying of the concrete surface. Apply proprietary sealers in strict
accordance with manufacturer’s printed instructions. The Contractor shall verify the compatibility
of the sealer product with the paint used to stripe parking decks and coordinate the sequencing
of the sealing and striping operations. Apply to the following surfaces:

1. Sloping and horizontal surfaces of parking garages.
2. Top surfaces of exposed exterior balconies.

3.6 CONCRETE FINISH MEASUREMENT AND TOLERANCES

A. Testing Procedure: ASTM E 1155.

B. Tolerance on Floor Elevations: Construction tolerance on absolute floor elevation from the
specified elevation as shown on the drawings shall be as specified below, taken from ACI 117:

1. Slab-on-Grade Construction: ±3/4”.
2. Top Surfaces of Formed Slabs Measured Prior to Removal of Supporting Shores: ±3/4”.
3. Top Surfaces of All Other Slabs: ±3/4”.

C. Random Traffic Floor Finish Tolerances:

1. Specified overall values for flatness (SOF_F) and levelness (SOF_L) shall conform to the
values listed below for the floor surface classification noted for each slab category noted.

   a. Conventional:

      1) SOF_F: 20.
      2) SOF_L: 15.
b. Moderately Flat:
   1) \( \text{SOF}_F \): 25.
   2) \( \text{SOF}_L \): 20.

c. Flat:
   1) \( \text{SOF}_F \): 35.
   2) \( \text{SOF}_L \): 25.

d. Very Flat:
   1) \( \text{SOF}_F \): 45.
   2) \( \text{SOF}_L \): 35.

e. Super Flat:
   1) \( \text{SOF}_F \): 60.
   2) \( \text{SOF}_L \): 40.

2. Minimum local values for flatness (MLF\(_F\)) and levelness (MLF\(_L\)) shall equal 3/5 of the SOF\(_F\) and SOF\(_L\) values, respectively, unless noted otherwise. The MLF\(_F\) and MLF\(_L\) values shall apply to the minimum areas bounded by the column lines and half-column lines, or the minimum areas bounded by the construction and contraction joints, whichever are the smaller areas.

3. The SOF\(_L\) and MFL\(_L\) tolerance values shall apply only to level slabs-on-ground or to level, uncambered suspended slabs that are shored such that it cannot deflect from the time the floor is placed to the time it is measured.

4. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10 feet at any point.

D. Construction Requirements to Achieve Specified Floor Finish Tolerances:

1. Forms shall be properly leveled, in good condition, and securely anchored including special attention to ends and transitions.
2. Bearing surfaces for straightedges such as form edges or previously poured slabs shall be kept clean of laitance, sand, gravel, or other foreign elements.
3. Screeds shall be maintained in good condition with true round rolling wheels and level cutting edges. The use of optical sighting equipment such as lasers is recommended for checking levelness and straightness. The Contractor shall promptly adjust or replace equipment when test results indicate substandard work.
4. Highway straightedges are recommended for use in lieu of bullfloats for all slab placement and finishing operations. If mineral, non-oxidizing metallic, or metallic floor hardeners are used, the slab shall be wood bullfloated immediately after the straightedge.

E. Contractor Responsibility for Concrete Floor Finish Requirements: Floor finish requirements shown below (flatness and levelness tolerances) are minimum requirements that apply unless stricter requirements are contained in instructions for installation of applied floor products in which case the Contractor is responsible for attaining the values prescribed by the manufacturer of such products.

1. Finish Tolerance of Random Traffic Floor Surfaces:
a. Slabs in Nonpublic Areas, Mechanical Rooms, Surfaces to Received Raised Computer Flooring, Surfaces to Have Thick-Set Tile or a Topping, and Parking Structures: Conventional.
b. Carpeted Areas: Moderately Flat.
c. Exposed slabs in public spaces, slabs to receive thin-set flooring: Flat.
d. Movie or Television studios: Super Flat.
e. Eighty percent (80%) of the final floor surface shall fall within an envelope of 0.75" centered about the mean elevation of all the readings. The mean elevation of all readings shall not deviate from the specified design grade by more than ± 0.375".

2. Extra Concrete: The Contractor shall include in his bid any additional concrete required to achieve the specified slab surface finish tolerance and to compensate for steel deck deflection, beam camber and beam deflection.

F. Remedial Measures for Slab Finish Construction Not Meeting Specified Tolerances:

1. Application of Remedial Measures. Remedial measures specified herein are required whenever either or both of the following occur:

   a. The composite overall values of $F_\text{F}$ or $F_\text{L}$ of the entire floor installation measure less than specified values.
   b. Any individual test section measures less than the specified absolute minimum $F_\text{F}$ or $F_\text{L}$ value.

2. Modification of Existing Surface:

   a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work can be repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately undertake the approved repair method.
   b. The Contractor shall submit for review and approval a detailed work plan of the proposed repair showing areas to be repaired, method of repair, and time to affect the repair.
   c. Repair method(s), at the sole discretion of the Architect/Engineer or Owner's Representative, may include grinding (floor stoning), planing, retopping with self-leveling underlayment compound or repair topping, or any combination of the above.
   d. The Architect/Engineer or Owner's Representative maintains the right to require a test repair section using the approved method of repair for review and approval to demonstrate a satisfactory end product. If, in the opinion of the Architect/Engineer or Owner's Representative, the repair is not satisfactory an alternate method of repair shall be submitted or the defective area shall be replaced.
   e. The judgment of the Architect/Engineer or Owner's Representative on the appropriateness of a repair method and its ability to achieve the desired end product shall be final.
   f. All repair work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3. Removal and Replacement:

   a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work cannot be satisfactorily repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately commence to remove and replace the defective work.
b. Replacement section boundaries shall be made to coincide with the test section boundaries as previously defined.

c. Sections requiring replacement shall be removed by sawcutting along the section boundary lines to provide a neat clean joint between new replacement floor and existing floor.

d. The new section shall be reinforced the same as the removed section and doweled into the existing floor as required by the Engineer. No existing removed reinforcing steel may be used. All reinforcing steel shall be new steel.

e. Replacement sections may be retested for compliance at the discretion of the Architect/Engineer or Owner's Representative.

f. The judgment of the Architect/Engineer or Owner's Representative on the need for replacement shall be final.

g. All replacement work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3.7 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Maintain concrete with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of concrete. Limit moisture loss to a maximum of 0.05 pounds per square foot per hour for concrete containing silica fume and 0.2 pounds per square foot per hour for all other concrete before and during finishing operations. If using an evaporation retarder, apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

2. Curing shall commence as soon as free water has disappeared from the concrete surface after placing and finishing. The curing period shall be seven days for all concrete except high early strength concrete that shall be cured for three days minimum.

3. Ramps and Horizontal Surfaces of Parking Areas, Exposed Exterior Balconies: Cure using only Methods 1 or 2 as specified below.

B. Curing Methods:

1. Method 1 – Moisture Curing: Provide moisture curing by one of the following methods:

a. Keep concrete surface continuously wet by covering with water.

b. Continuous water-fog spray.

c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water, and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Method 2 – Moisture-Retaining Cover Curing: Provide moisture-retaining cover curing as follows:

a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Water may be added to concrete surface to prevent drying before the cover is installed, but the surface shall not be flooded with water if a non-absorptive cover is used.
3.8 HOT WEATHER CONCRETING

A. Definition:

1. Conditions warranting hot weather concreting practices are defined as any combination of high air temperature, low relative humidity, and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise result in abnormal properties. If conditions cause an evaporation rate of 0.2 pounds per square foot per hour or greater as calculated by the figure “NRMCA Nomograph for Estimating Evaporation Rate on the Basis of Menzel Formula” in Appendix A of ACI 305.1, then precautions shall be taken to prevent plastic shrinkage cracks from occurring.

B. Specification: Follow hot weather concreting practices specified below when required to limit the concrete temperature at the truck discharge point to the stated maximum acceptable temperature.

C. Records: Under hot weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature at truck discharge and general weather conditions.

D. Hot Weather Concreting Requirements: The following items, all or in part as required, shall be followed to limit the concrete temperature to the stated maximum acceptable temperature and to minimize the possibility of plastic shrinkage cracks from developing.

1. Design the concrete mixtures specifically for hot weather conditions replacing some cement with fly ash or other pozzolan and using a water reducing retarding admixture (ASTM C 494 Type D).
2. Use the largest size and amount of coarse aggregate compatible with the job.
3. Use sunshades and/or windbreaks.
4. Delay construction of indoor slabs-on-grade until the walls and roof are constructed.
5. Cool and shade aggregate stockpiles.
6. Use ice as part of the mixing water or cool the water with liquid nitrogen. Do not place concrete that contains unmelted ice.
7. Limit the number of revolutions at mixing speed to 125 maximum.
8. Reduce time between mixing and placing as much as possible.
9. Do not add water to ready-mixed concrete at the job site unless it is part of the amount required initially for the specified water-cement ratio and the specified slump.
10. Schedule concrete placement for early morning, late afternoon, or night.
11. Have all forms, equipment, and workers ready to receive and handle concrete.
12. Maintain one standby vibrator for every three vibrators used.
13. Keep all equipment and material cool by spraying with water including exteriors of forms, reinforcing steel, subgrade, chutes, conveyors, pump lines, tremies, and buggies.
14. Protect slab concrete at all stages against undue evaporation by applying a fog spray or mist above the surface or applying a monomolecular film. Where high temperatures and/or placing conditions dictate, use water-reducing retarding admixture (Type D) in lieu of the water-reducing admixture (Type A) as directed by the Owner's Testing Laboratory.
15. Provide continuous curing, preferably with water, during the first 24 hours using wet burlap, cotton mats, continuous spray mist, or by applying a curing compound meeting ASTM C 1315. Continue curing for three days minimum.
16. Cover reinforcing steel with water soaked burlap so that steel temperature will not exceed ambient air temperature immediately before placement of concrete.
17. As soon as possible, loosen forms and run water down the inside. When forms are removed, provide a wet cover to newly exposed surfaces.
3.9 COLD WEATHER CONCRETING

A. Definition:

1. Concrete shall not be placed when the outside air temperature is 40°F or less unless cold weather concreting practices are followed as specified below.
2. Cold weather concreting practices should also be followed whenever the average daily air temperature is expected to be less than 40°F for more than three successive days. The average daily air temperature is the average of the highest and lowest temperature occurring during the period from midnight to midnight. The requirement for adhering to these cold-weather concreting practices may be terminated when the air temperature is above 50º F for more than half of any 24 hour duration.
3. Cold-weather concreting practices invoked shall keep the temperature of the concrete immediately after placing within the following temperature ranges:
   a. 55º to 75º F for sections less than 12 inches in the least dimension.
   b. 50º to 70º F for sections 12 to 36 inches in the least dimension.
   c. 45º to 65º F for sections 36 to 72 inches in the least dimension.
   d. 40º to 60º F for sections greater than 72 inches in the least dimension.
4. Concrete Protection: Protect the concrete immediately after placing and during the defined protection period such that the concrete does not freeze nor fall below the temperature levels stated in the above paragraph. For concrete not loaded during construction, the protection period shall be for a minimum of three days if cold-weather conditions persist. The time may be reduced to a minimum of two days if Type III cement or an accelerating admixture is used or if an additional 100 pounds of cement per cubic yard is added to the concrete mix. Concrete fully loaded during construction shall be protected during cold weather conditions for whatever time is required to obtain the required strength as determined by nondestructive strength tests (Windoso probe, Swiss Hammer Test) on the in-place concrete. Protect concrete surfaces from freezing for the first 24 hours even if cold-weather conditions do not officially exist due to high volatility in ambient temperatures.
5. Protection Deficiency: If the temperature requirements during any portion of the protection period are not met but the concrete surface did not freeze, the protection period shall be extended until twice the deficiency expressed in degree-hours is made up. Deficiency degree-hours are defined as the average deficiency in temperature below the required value times the number of hours the deficiency persisted. Make-up degree hours are the average increase in temperature above the minimum value times the hours required to make up twice the deficiency degree-hours. Contact the Architect/Engineer if the concrete surface was allowed to freeze during the protection period.
6. Protection Removal: As the protection is being removed the decrease in temperature measured at the surface of the concrete in a 24 hour period shall not exceed the following:
   a. 50º F for sections less than 12 inches in the least dimension.
   b. 40º F for sections 12 to 36 inches in the least dimension.
   c. 30º F for sections 36 to 72 inches in the least dimension.
   d. 20º F for sections greater than 72 inches in the least dimension.
7. The maximum concrete temperature heated by artificial means at point of placement shall not exceed 90°F.

B. Records: Under cold weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature as placed and general weather conditions. The temperature record shall be taken no less than two times per 24 hour duration.
C. Cold Weather Concreting Requirements: The following items, all or in part as required, should be followed to assure acceptable concrete in cold weather conditions:

1. Design the concrete mixture to obtain high early strength by using higher cement content, a high early strength cement (Type III), or a specified non-chloride accelerator (ASTM C 494 Type C or E).
2. Protect the concrete during curing period using insulating blankets, insulated forms, enclosures, and/or heaters.
3. Concrete cured in heated enclosures shall have heaters vented to prevent exposure of concrete and workmen to noxious gases.
4. Frozen subgrade shall be thawed prior to concrete placement and snow and ice shall be removed from forms.
5. Temperature of embedments in concrete must be heated to above 32°F prior to placing concrete.
6. Heat the mixing water and then blend hot and cold water to obtain concrete no more than 10°F above the required temperature.
7. Heat the aggregates by circulating steam in pipes placed in the storage bins for air temperatures consistently below 32°F. When either water or aggregate is heated to over 140°F, combine them in the mixer first to obtain a maximum temperature of the mixture not to exceed 140°F in order to prevent flash set of the concrete.
8. Uniformly thaw aggregates far in advance of batching to prevent moisture variations in the stockpile.
9. Cover warmed stockpiles with tarps to retain heat.
10. Place air entraining admixture in the batch after the water temperature has been reduced by mixing with cooler solid materials.
11. Use wind screens to protect concrete from rapid cooling.
12. Place vertical pump lines inside the building, if possible, for concrete being pumped.
13. Maintain artificial heat as low as possible to reduce temperature stresses during cooling.
14. Avoid water curing of concrete except for parking garage structures. Apply the required curing compound to unformed surfaces as soon as possible to prevent drying of concrete from heated enclosures.
15. Delay form stripping as long as possible to help prevent drying from heated enclosures and to reduce damage to formed surfaces caused by premature stripping.
16. Provide triple thickness of insulating materials at corners and edges vulnerable to freezing.
17. Wrap protruding reinforcing bars with insulation to avoid heat drain from the warm concrete.
18. Gradually reduce the heat at the end of the heating period to reduce likelihood of thermal shock.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor rods for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
D. Grout base plates and foundations as indicated, using specified non-shrink, non-metallic grout. Use high-flow grout where high fluidity and/or increased placing time are required. This grout shall be used for all base plates larger than 10 square feet.

E. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp and finish concrete surfaces as scheduled.

F. Adhesive Anchors: All drilled holes for adhesive anchors shall be within six degrees of perpendicular to the surface of the concrete member.

3.11 INVESTIGATION OF LOW CONCRETE STRENGTH TEST RESULTS

A. Contractor Responsibility for Low Strength Concrete:
   1. If the average of any three consecutive strength tests falls below the required f’c for a class of concrete but no individual strength test is more than 500 PSI below the required f’c, the Contractor shall immediately notify the Engineer by telephone or email and take immediate steps to increase the average of subsequent strength tests.
   2. If any individual strength test falls more than 500 PSI below the required f’c, the Contractor shall immediately notify the Engineer by telephone or e-mail and take immediate steps to assure that the load-carrying capacity of the structure is not jeopardized.

B. Additional Field Tests to Confirm Low Concrete Strengths:
   1. The cost of all investigations of low-strength concrete, as defined by any individual strength test being more than 500 PSI below the required f’c, shall be borne by the Contractor.
   2. Code-Prescribed Acceptance: The only accepted field-test methods of determining actual in-situ concrete strength is by the way of core tests as prescribed by ACI 318.
   3. Non-Destructive Tests: If any individual strength test falls more than 500 PSI below the required f’c, the Engineer may request that non-destructive field tests be performed on the concrete in question using Swiss Hammer, Windsor Probe, or other appropriate methods as approved by the Engineer. Report the comparative test results of the suspect concrete under consideration with identical tests done on concrete of known strength and of the same class. The Engineer considers these test results as only approximate indicators of strength and may not necessarily, by themselves, resolve the low concrete strength issue. These test results will be considered as additional information by which to make an informed judgment. The Engineer reserves the right to accept the concrete based on the results of these approximate tests or order that core tests be taken as prescribed below. At the Contractor’s option, the approximate non-destructive field-tests may be waived and core tests immediately initiated.
   4. Core Tests: If, in the opinion of the Engineer, the likelihood of low-strength concrete is confirmed and it has been determined that the load-carrying capacity of the structure is significantly reduced as a result, the Engineer may request that core tests be taken from the area in question as directed by the Engineer. There shall be a minimum of three cores taken for each strength test more than 500 PSI below the required f’c in accordance with ASTM C 42. If concrete in the structure will be dry under service conditions, cores shall be air dried (temperature 60° to 80°F, relative humidity less than 60 percent) for seven days before test and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, cores shall be immersed in water for at least 40 hours and tested wet. The Contractor shall fill all holes made by drilling cores with an approved drypack concrete.
5. Acceptance Criteria for Core Test: Concrete in an area represented by core tests shall be considered adequate if the average of three cores is equal to at least 85% of the required \( f'c \) and no single core is less than 75% of the required \( f'c \). If approved by the Engineer, locations of erratic core strengths may be retested to check testing accuracy.

6. Load Test: If the concrete strength is not considered adequate based on core tests and the structural adequacy remains in doubt, the Engineer may order a load test as specified in ACI 318 be conducted for the questionable portion of the structure.

7. Strengthening or Demolition of the Structure: If the structural adequacy of the affected portion of the structure remains in doubt following the load test, the Engineer may order the structure to be strengthened by an appropriate means or demolished and rebuilt at the Contractor's expense.

### 3.12 CONCRETE SURFACE REPAIRS

**A. Defective Areas:**

1. Formed Surfaces: Concrete surfaces requiring repairs shall include all cracks in excess of 1/32" in width and any other defects that affect the durability or structural integrity of the concrete. Voids, including honeycombing and rock pockets, and tie holes shall be repaired as required by the specified Surface Finish.

2. Unformed Surfaces: Concrete surfaces requiring repair shall include all surface defects such as crazing, cracks in excess of 1/32" in width or cracks that penetrate to reinforcement or through the member, popouts, spalling, and honeycombs.

**B. Classification:**

1. Structural Concrete Repair: Major defective areas in concrete members that are load carrying (such as shear walls, beams, joists and slabs), are highly stressed, and are vital to the structural integrity of the structure shall require structural repairs. Structural concrete repairs shall be made using a two-part epoxy bonder, epoxy mortar, or specified polymer repair mortar. The Engineer shall determine the locations of required structural concrete repairs.

2. Cosmetic Concrete Repair: Defective areas in concrete members that are non-load carrying and minor defective areas in load carrying concrete members shall require cosmetic concrete repair when exposed to view and not covered up by architectural finishes. Cosmetic concrete repairs may be made using a polymer repair mortar and compatible bonding agent. The Architect/Engineer shall determine the locations of required cosmetic concrete repairs. Stains and other discolorations that cannot be removed by cleaning and are exposed to view will require cosmetic repair. Cosmetic concrete repair in exposed-to-view surfaces will require Architect's approval prior to patching operation.

3. Slab Repairs: High and low areas in concrete slabs shall be repaired by removing and replacing defective slab areas unless an alternate method, such as grinding and/or filling with self-leveling underlayment compound or repair mortar is approved by the Architect/Engineer. Repair of slab spalls and other surface defects shall be made using epoxy products as specified above and as determined by the Engineer. The high strength flowing repair mortar may be used for areas greater than one inch in depth.

### 3.13 FIELD QUALITY CONTROL

**A. Field Testing and Inspection:** Refer to Specification 014529 "Structural Testing and Inspections" for testing and inspection requirements associated with cast-in-place concrete.
B. Field Testing: The following tests shall be completed by the Testing Laboratory:

1. During Concrete Placement:
   a. Record the amount of water added and note if it exceeds the amount allowed to be added shown in the approved design mixture.
   b. Mold concrete test cylinders as specified below in “Concrete Test Cylinders” Paragraph below.
   c. Perform tests to determine slump, concrete temperature, unit weight, and air entrainment as specified below.
   d. Record information for concrete test reports as specified below.
   e. Pick up and transport to Laboratory cylinders cast the previous day.

2. After Concrete Placement:
   a. In-situ Concrete Strength Verification for Form Stripping: The Testing Laboratory shall perform the tests necessary to determine the concrete strength prior to form stripping:
      1) If concrete strength for form stripping is to be determined using field-cured cylinders, the cylinder shall be broken at the time of form removal as directed by the Contractor.
      2) If concrete strength for form stripping is to be determined using the Maturity Method, the Testing Laboratory shall verify that the requirements of ASTM C 1074 are being followed and that the proper criteria for determining concrete strength by this method has been established and is being followed.
   b. Investigation of Low Strength Concrete Test Results:
      1) Cost of Investigations for Low Strength Concrete: The Contractor shall reimburse the Owner for the costs of investigations of low strength concrete.
      2) Scope of Investigations: See above for the investigations that may be required by the Engineer. The Testing Laboratory will conduct these investigations if required.
   c. Post-Installed Anchors in Concrete:
      1) Verify maximum anchor tightening torque for all applicable post-installed anchors.
      2) Verify that all drilled holes for adhesive anchors are within six degrees of perpendicular to the surface of the concrete member.
      3) Provide pull tests on individual anchors as specified in the ICC Evaluation Services Report, on the drawings, or as directed by the Engineer-of-Record.
   d. Floor Flatness and Levelness Measuring: Perform tests as defined below.
   e. Testing of Non-Shrink Grout for Base Plates, Bearing Plates, and Precast Wall Panels:
      1) Compressive Strength Tests: Compressive strength of grout shall be determined by testing grout cubes according to the requirements of ASTM C 109 – Modified. Test one set of three cubes at one day, and one set of three cubes at 28 days.
      2) Frequency of Testing: One set of cubes (six cubes) shall be made for every ten base plates and bearing plates or fraction thereof but not less than one
set for each day's operation. One set of cubes shall be made for each day's operation of grouting wall panels.

3. Standards for Concrete Tests:

a. Concrete Test Cylinders: Mold and test concrete cylinders as described below:

1) Cylinder Molding and Testing: Cylinders for strength tests shall be molded and Laboratory cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Cylinders may be either 6" in diameter by 12" or 4" in diameter by 8", however, the diameter of the cylinder shall be at least three times the nominal maximum size of the coarse aggregate in the mix tested. All of the cylinders for each class of concrete shall be of the same dimension for all sets of that class.

2) Field Samples: Field samples for strength tests shall be taken in accordance with ASTM C 172 at the point of placement.

3) Quantity of Cylinders: Each set of test cylinders shall consist of a minimum of four standard test cylinders. If concrete strength for form stripping is to be determined using field-cured cylinders, one additional cylinder per set will be required for formed slab and pan-formed beam floors for the purpose of evaluating the concrete strength at the time of form stripping. This cylinder shall be stored on the floor where form removal is to occur under the same exposure conditions as the floor concrete. The cylinder shall be cured under field conditions in accordance with ASTM C 31. Field-cured test cylinders shall be molded at the same time and from the same samples as laboratory-cured test specimens. The Contractor shall reimburse the Owner for the cost of making and testing these cylinders.

4) Frequency of Testing: A set of test cylinders shall be made according to the following minimum frequency guidelines:

a) One set for each class of concrete taken not less than once a day.

b) Floors: One set for each 150 cubic yards or fraction thereof but not less than one set for each 5,000 square foot of floor area.

5) The cylinders shall be numbered, dated, and the point of concrete placement in the building recorded.

6) For concrete specified on the drawings to reach the required strength at 28 days, break one cylinder of the set at seven days, two 6" by 12" cylinders or three 4" by 8" cylinders at 28 days, and keep one in reserve for testing at the Engineer’s direction.

7) Cylinder Storage Box: The Contractor shall be responsible for providing a protected concrete cylinder wooden storage box at a point on the job site mutually agreeable with the Testing Laboratory for the purpose of storing concrete cylinders until they are transported to the Laboratory. The box shall be constructed and equipped to maintain the environment specified for initial curing in ASTM C 31.

8) Transporting Cylinders: The Testing Laboratory shall be responsible for transporting the cylinders to the Laboratory in a protected environment such that no damage or ill effect will occur to the concrete cylinders including loss of moisture, freezing temperatures or jarring.

9) Information on Concrete Test Reports: The Testing Laboratory shall make and distribute concrete test reports after each job cylinder is broken. Such reports shall contain the following information:

a) Truck number and ticket number.
b) Concrete Batch Plant.
c) Design mixture number.
d) Accurate location of pour in the structure.
e) Strength requirement.
f) Date cylinders made and broken.
g) Technician making cylinders.
h) Concrete temperature at placing.
i) Air temperature at point of placement in the structure.
j) Amount of water added to the truck at the batch plant and at the site and whether or not it exceeds the amount allowed by the design mixture.
k) Slump.
l) Unit weight.
m) Air content.
n) Cylinder compressive strengths with type of failure if concrete does not meet Specification requirements. Seven day breaks are to be flagged if they are less than 60% of the required 28 day strength. 28 day breaks are to be brought to the attention of the Architect and Engineer in writing if either cylinder fails to meet specification requirements.

b. Slump Tests: Slump Tests (ASTM C 143) shall be completed at the beginning of concrete placement for each batch plant and for each set of test cylinders made. The slump test shall be made from concrete taken from the end of the concrete truck chute. The concrete shall be considered acceptable if the slump is within the slump tolerance noted in the approved design mixture submittal for that class of concrete.

c. Air Entrainment: Air entrainment tests (ASTM C 231 or C 173, C 173 only for lightweight concrete) shall be made at the same time slump tests are made as cited above. Samples for air entrainment tests shall be taken at the point of placement.

d. Concrete Temperature: Concrete temperature at placement shall be measured (ASTM C 1064) at the same time slump tests are made as cited above.

e. Testing of Concrete Floor Slabs for Acceptability to Receive an Adhesive-Applied, Low-Permeable Floor Covering:

1) The following tests shall be performed by the Testing Laboratory as a part of quality assurance testing to insure that the proper moisture condition and alkalinity of the substrate has been achieved prior to installing adhesive-applied, low-permeability floor coverings such as vinyl composition tile (VCT), linoleum, sheet vinyl, vinyl-backed carpet, rubber, athletic flooring, synthetic turf, wood, acrylic terrazzo, thin-set tile, epoxy overlays and adhesives, waterproofing, et.al.

2) Moisture Vapor Emission Rate: Perform testing according to ASTM F 1869 to determine if the moisture emission rate from the floor is below the flooring manufacturer’s maximum recommended value but not greater than five pounds per 1,000 square feet per 24 hours.

3) Relative Humidity Determination Test: As an alternate to the Moisture Vapor Emission Rate Test, and if agreed to by the Contractor, Architect and Owner, perform testing according to ASTM F 2170 to determine if the relative humidity of the concrete slab is below the flooring manufacturer’s maximum recommended value but not greater than 75%.

4. Evaluation and Acceptance of Concrete:

a. Strength Test: A strength test shall be defined as the average strength of two six inch cylinder breaks or three four inch cylinder breaks from each set of cylinders tested at the time indicated above.
b. Quality Control Charts and Logs: The Testing Laboratory shall keep the following quality control logs and charts for each class of concrete containing more than 2,000 cubic yards. The records shall be kept for each batch plant and submitted on a weekly basis with cylinder test reports:

1) Number of strength tests made to date.
2) Strength test results containing the average of all strength tests to date, the high test result, the low test result, the standard deviation, and the coefficient of variation.
3) Number of tests under specified strength.
4) A histogram plotting the number of strength test cylinders versus compressive strength.
5) Quality control chart plotting compressive strength test results for each test.
6) Quality control chart plotting moving average for strength where each point plotted is the average strength of three previous test results.
7) Quality control chart plotting moving average for range where each point plotted is the average of 10 previous ranges.

c. Acceptance Criteria: The strength level of an individual class of concrete shall be considered satisfactory if both of the following requirements are met:

1) The average of all sets of three consecutive strength tests equal or exceed the required f’c.
2) No individual strength test falls below the required f’c by more than the greater of 10% of f’c or 500 PSI.

d. If either of the above Acceptance Criteria requirements is not met, the Testing Laboratory shall immediately notify the Engineer by telephone. Steps shall immediately be taken to increase the average of subsequent strength tests.

5. Testing Reports: Compressive strength, slump, air, and temperature tests shall be identified by reference to a particular trip ticket.

C. Field Inspection: The scope of the work to be performed by the inspector on the jobsite shall be as follows:

1. Before Concrete Placement:
   a. Inspect concrete formwork per Specification 031000 “Concrete Forming and Accessories.”
   b. Inspect concrete reinforcing per Specification 032000 “Concrete Reinforcing.”
   c. Inspect bolts and rods to be embedded in concrete for proper grade, size, length, and embedment.
   d. Verify that there is no standing water in pour area and that all debris has been removed from the area and from the formwork.
   e. Verify that openings and sleeves in slabs or walls are correct size and location. Verify that the openings are shown on the structural drawings and notify the Engineer immediately of any openings in the field that are not shown on the drawings.

2. During Concrete Placement: Provide continuous monitoring to:
   a. Upon arrival of concrete, inspect the concrete to verify that the proper concrete mix number, type of concrete, concrete strength is being placed at the proper location.
Verify that the mix meets the project specifications and is not over 90 minutes old at the time of placement. Report concrete not meeting the specified requirements and immediately notify the Contractor, Batch Plant Inspector, Architect, Engineer, and Owner.

b. Inspect plastic concrete upon arrival at the jobsite to verify proper batching. Observe mix consistency and adding of water as required to achieve target slumps in design mixtures.

c. Verify that the Contractor is following appropriate Hot Weather or Cold Weather concreting practices consistent with any extreme environmental conditions at the point of placement in the structure.

d. Verify that concrete deposited is uniform and that vertical drop does not exceed six feet and is not permitted to drop freely over reinforcement causing segregation.

e. Verify that the formwork has remained stable during the concreting operation.

f. Verify that there are no cold joints.

g. Verify that the concrete is properly vibrated.

h. Inspect bolts embedded in concrete during concrete placement for verification that they have been properly installed to the specified embedment.

i. Verify that the finishing of the concrete surface is done according to specifications.

The Testing Laboratory shall report any irregularities that occur in the concrete at the job site or test results to the Contractor, Architect, Owner, and Engineer.

3. After Concrete Placement:

a. Verify that the curing process is according to Specifications and that any curing compound used is applied in accordance with the manufacturer's recommendations.

b. Post-Installed Anchors in Concrete: Provide inspection of post-installed anchor installations at the frequency noted in the specifications and in accordance with the published, currently valid, Evaluation Service Report (ESR) for each anchor product. Post-installed anchors include anchors and reinforcing steel. Inspection of post-installed anchors shall include but not be limited to the following:

1) Periodic Inspection: Verify initial installation of post-installed anchors in concrete for each individual installer with each individual anchor product in accordance with the requirements stated below for each type of anchor. Periodically inspect anchor installation after the initial verification.

2) Continuous Inspection: Verify each installation of post-installed anchors in concrete in accordance with the requirements stated below for each type of anchor.

3) All Post-Installed Anchors: Verify that the anchor is installed in accordance with manufacturer's printed installation instructions as well as the following design requirements.

a) Concrete type, concrete strength and concrete thickness are in accordance with design drawings.

b) Anchor manufacturer and product, including material, is in accordance with design drawings or approved substitution.

c) Anchor diameter, length and installed embedment depth.

d) Drill bit type and diameter.

e) Anchor edge distance and spacing.

f) Hole diameter and depth.

g) Hole cleaning procedure and cleanliness.

4) Adhesive Anchors: In addition to the requirements for All Post-Installed Anchors, verify adhesive identification and expiration date.
a) The installation of all adhesive anchors shall be continuously inspected when anchors are subject to sustained tension loads, such as anchors for shelf angles, or when anchors are installed in an upwardly inclined condition.
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 the work of this section.

B. Related Sections include the following:
   1. Division 03 Section “Surface Preparation for Patching.”
   2. Division 03 Section “Concrete Repair Materials.”

1.2 SCOPE OF WORK

A. The following epoxy related work is shown on the drawings and in this project manual:
   1. Crack locations and approximate lengths of cracks for epoxy injection work.
   2. Epoxy mortar patch locations and approximate sizes.
   3. Epoxy bonded steel plate locations.
   4. Locations requiring epoxy bonder between fresh and hardened concrete.
   5. Locations requiring bolts, dowels or reinforcing steel set in epoxy.
   6. Locations requiring skid-resistant surface on concrete by the use of multi-component epoxy or non-epoxy systems.
   7. Locations requiring epoxy penetrant sealer.
   9. Locations requiring polymer modified cementitious mortar overlay system.
  10. Locations requiring epoxy resin overlay system.

These drawings are for the Contractor's guidance only, and are to be considered as a minimum for pricing. Contractor shall not do any additional work beyond what is shown in the drawings without prior written approval of the Engineer.

B. Contractor shall fully acquaint himself with the existing job site conditions and discuss the accessibility of the work areas with the Owner.

C. Contractor shall ensure that there is adequate ventilation in areas where epoxy repair work is being performed and that no work results in nauseating, annoying or toxic fumes and odors from entering occupied areas. Provide barricades around the work area with appropriate signage to keep non-construction people from entering work area.
D. Contractor shall provide all traffic cones or barriers to direct traffic during the repair of the parking garage. This work shall be done in consultation with the Owner.

E. During the course of construction, Engineer may require certain items to be repaired by methods involving epoxies. Repairs may include epoxy injection of cracks, epoxy or polymer mortar patching, epoxy grouted dowels or reinforcing steel, and bonding fresh concrete to hardened concrete. Such work shall be done by the Contractor in strict conformance to these specifications.

1.3 QUALITY ASSURANCE

A. Applicable Standards

1. American Society for Testing and Materials (ASTM)

C881 Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete

2. American Concrete Institute (ACI)

ACI 503 Use of Epoxy Compounds with Concrete

ACI 503.1 Standard Specification for Bonding, Hardened Concrete, Steel, Wood, Brick, and Other Materials to Hardened Concrete with a Multi-Component Epoxy Adhesive

ACI 503.2 Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive

ACI 503.3 Standard Specification for Producing a Skid-Resistant Surface on Concrete by the Use of Multi-Component Epoxy System

ACI 503.4 Standard Specification for Repairing Concrete with Epoxy Mortars

ACI 548.1R Guide For Use of Polymers in Concrete

B. Manufacturer's Qualifications: Companies furnishing the epoxy materials shall have a proven track record of at least five years. Furthermore, they shall have in existence a program of training, certifying and supporting a nationally organized program of approved contractors. Evidence of this shall be made available to the Engineer/Architect upon request.

C. Contractor's Qualifications: Contractor performing the work shall be an approved contractor by the manufacturer furnishing the epoxy materials, and shall have no less than five years experience in the various types of epoxy related work required in this project. A notarized certification from the manufacturer attesting to the training shall be submitted to the Engineer/Architect along with the proposal to do the work.

D. Injection Equipment Requirements: Injection equipment used by the Contractor shall be from a manufacturer who has been producing such equipment for a minimum of five years. Such equipment shall have a record of satisfactorily proportioning, mixing, and dispensing of the injection resin being used.
PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EPOXY MATERIALS

A. All epoxy material shall be new and manufactured within the shelf life limitations set forth by the manufacturer.

B. Epoxy shall be a two-part epoxy adhesive material, and shall be of epichlorohydrin/amine type. Polysulphide epoxies are not acceptable.

C. Epoxy used shall be insensitive to the presence of water and moisture, and shall be capable of application and of strength development even when applied to damp surfaces having a temperature of 40° or above.

D. Epoxy used shall develop a minimum strength of 2000 psi in tension and 4000 psi in compression at the end of seven days.

E. Epoxies used shall not deteriorate under approximately 200 freeze thaw cycles.

F. Epoxies used shall be 100% solids without solvents.

G. With the exception of epoxy penetrant sealers, epoxies used shall be 100% solids without solvents.

H. Bonding and strength characteristics of epoxies shall be stable when exposed to ultraviolet rays.

I. The viscosity of the epoxy used for injection work shall be low enough (about 300 cps at 77°F) to completely fill hairline cracks as small as 10 mils.

2.2 ADDITIONAL REQUIREMENTS FOR EPOXY MORTARS

A. Epoxy mortar used for bonding, patching, and resurfacing, shall have the following additional properties:

   1. Epoxy mortar shall be non-sagging.

   2. Sand used in preparing mortar shall be graded oven dry quartzite and furnished in bags.

   3. The epoxy mortar patch material shall match the existing texture and color of exposed concrete without giving a blotchy appearance. A test patch shall be applied for approval prior to final acceptance of the mortar. Size of test patch shall be approximately equal to the size of the average mortar patch to be used on the project.

2.3 GENERAL REQUIREMENTS FOR HIGH MOLECULAR WEIGHT METHACRYLATE SELF-PENETRATING CONCRETE CRACK FILLER AND SEALER

A. Crack filler used shall be a synthesized methacrylate monomer having high molecular weight, low viscosity and low volatility with the following properties.

   1. Viscosity shall be between 15 and 30 cps Brookfield LVT W/UL adapter 50 RPM at 77°F.
2. Density shall be a minimum of 8.5 pounds per gallon at 77°F.
3. Material shall not gel under 16 hours exposure to 205°F temperature.
4. Odor should be barely perceptible.
5. Material shall cure in less than 8 hours at 75° temperature when applied to a surface.
6. Resin used shall be free of wax additives.

2.4 PRODUCTS AND MANUFACTURERS

A. Epoxy Injection Work
1. BASF: MasterInject 1380 (formerly SCB Concresive 1380) or MasterInject 1500 (formerly Concresive Standard LVI)
2. Sika Corporation: Sikadur 35 Hi-Mod LV or Sikadur 52 Injection Resin
3. Euclid Chemical: Eucopoxy Injection Resin or Dural 452 LV

B. Epoxy Mortar Patch
1. BASF: MasterInject 1500 (formerly Concresive Standard LVI)
2. Sika Corporation: Sikadur 31 Hi-Mod Gel or Sikadur 35 Hi-Mod
3. Euclid Chemical: Dural 452 LV

C. Epoxy for Bonding Steel Plates
1. BASF: MasterEmaco ADH 1490 (formerly Concresive 1490) or MasterEmaco ADH 327 (formerly Concresive Paste LPL)
2. Sika Corporation: Sikadur 31 Hi-Mod Gel
3. Euclid Chemical: Euco #452 Epoxy System

D. Epoxy for Bonding Fresh Concrete to Hardened Concrete
1. BASF: MasterEmaco ADH 326 (formerly Concresive Liquid (LPL)), MasterEmaco ADH 327 (formerly Concresive Paste (LPL))
2. Sika Corporation: Sikadur 32 Hi-Mod
3. Euclid Chemical: Dural LPL

E. Epoxy for Grouting Bolts, Dowels or Reinforcing Steel
1. BASF: MasterEmaco ADH 326 (formerly Concresive Liquid (LPL)), MasterEmaco ADH 327 (formerly Concresive Paste (LPL))
2. Sika Corporation: Sikadur 31 Hi-Mod Gel, (horizontal and overhead use); Sikadur 32 Hi-Mod or Sikadur 35 Hi-Mod (vertical downhand use).
3. Euclid Chemical: Euco #452 Epoxy System or Dural LPL

F. Epoxy for Skid-Resistant Surface
1. BASF: Masterseal 350 (formerly Traffic Guard EP-35)
2. Sika Corporation: Sikadur 22 Lo-Mod
3. Neogard: 70714/70715-01

G. Epoxy Penetrant Sealer
1. BASF: MasterEmaco P 160 (formerly Nitoprime 60)
2. Sika Corporation: Sikafloor 619
3. Euclid Chemical: Euco #512 VOX

H. Polymer Modified Cementitious Mortar Overlay System

I. Epoxy Resin Floor Overlay System
1. Sika Corporation: Sikafloor Merflex 90

J. High Molecular Weight Methacrylate Self-Penetrating Concrete Crack Filler
1. BASF: MasterSeal 630 (formerly Degadeck CSP)
2. Sika Corporation: Sika Pronto 19, Crack Healer/Penetrating Sealer
3. Euclid Chemical: Dural 335

Substitutions may be considered provided complete technical information and job references are furnished to the Engineer and approved prior to commencement of work.

Changes in products required to suit temperature and environmental conditions at the time of material application shall be specified as separate line items by the Contractor showing credit or additions to the price for the various tasks.

In using the above products, follow strictly the manufacturer's specifications and directions for mixing and application. Also heed all label warnings by manufacturer. Make application in accordance with applicable safety laws.

2.5 ABRASIVE MATERIAL FOR ABRASIVE BLASTING

A. Coal slag shall be used as the blast abrasive in abrasive blasting operations.

2.6 CORROSION INHIBITING PAINT

A. Z.R.C. Cold Galvanizing Compound manufactured by ZRC Chemical Products Company, Quincy, Massachusetts.
Substitutions may be considered provided complete technical information and job references are furnished to and approved by the Engineer prior to commencement of work.

2.7 SAND

A. Sand used for spreading over a surface application of the self-penetrating concrete crack filler and sealer using high molecular weight methacrylate shall be clean, washed, and dried silica sand free from all dust, dirt and organic materials.

1. Free moisture content of the sand shall be limited to a maximum of 0.25% by weight at time of application.

2. Sand used shall be oven-dried 20-40 graded quartz sand.

3. Sand used shall be uniformly graded with 100% passing the No. 10 sieve and retained on the No. 20 sieve.

4. Contractor shall submit samples of the sand to the Owner’s Testing Laboratory for acceptance testing prior to commencing work. Do not change the source of material once the material source has been found to be acceptable.

2.8 JOINT FILLER MATERIAL

A. Filler material shall have a minimum Shore A hardness of 80, or Shore D hardness of 50, and shall conform to ASTM D2240-00.


2. Sika Chemical Corporation: Sikadur 51 NS/SL.

B. Filler material shall have a minimum Shore A hardness of 35 and shall conform to ASTM D2240-00.

1. Mameco International: Vulkem 245.

Substitutions may be considered provided complete technical information and job references are furnished and approved by the Engineer prior to commencement of work.

PART 3 - EXECUTION

3.1 EPOXY INJECTION

A. Applicator’s Qualifications

1. Epoxy injection work shall only be performed by contractors who have successfully used this process on at least five similar structural repairs of 1000 linear feet or longer, and which have performed successfully for a minimum period of five years.

2. Only adequately trained epoxy injection applicators shall be used on the job. Furnish certificate of training prior to commencing work.

B. Preparation
1. Before proceeding, the space in the vicinity of the crack location receiving epoxy shall be swept and be in a generally clean condition to permit proper bonding of surface seal.

2. Cracks may be dry or damp, but free of standing water and frost.

3. Entry points shall be established judiciously at a distance along the seal so that epoxy penetrates the crack completely. Spacing of entry points, however, shall be no greater than the thickness of the concrete at that location. Tighter joints will require closer spacing of entry ports.

4. Adequate surface seal shall be applied to the face of the crack between the entry points. Use masking tape at the pre-established entry points to prevent the surface sealer from sealing the entry points. Alternatively, drill and port method may be used to establish entry points. Use only rotary-percussion type drills for drilling holes. Drills shall be fitted with bits having single tooth that produce large cuttings, and hollow stem drill rods that permit simultaneous blowing of compressed air providing immediate expulsion of the cuttings from the hole. Ensure that the drilling operation does not contaminate the cracks.

5. For through cracks, surface seal shall be applied to both faces. Provide entry ports on both faces staggered with each other when the cracked concrete element is greater than 8" thick. Injection of cracks from both faces shall also be necessary when the cracks are contaminated in concrete elements equal to or less than 8" thick.

6. Pre-sealing between ports may be done using a material meeting the requirements of these specifications.

7. Allow adequate time for the surface seal material to cure before proceeding with the injection.

C. Equipment for Injection

1. Pumps used for injection shall be a positive displacement type with interlock to provide positive ratio control in proper proportions. The pumps used shall be electrically or air powered, portable and shall provide an in-line mixing and metering system for the two-component epoxy. The pressure hoses and injection nozzle shall be of such a design as to allow proper mixing of the two components of the epoxy. Dwell time in mixing head shall not exceed ten seconds.

2. The injection equipment shall have automatic pressure control, and shall be capable of injection pressures up to 300 psi to ensure complete penetration of cracks. Equipment used shall also have the capability of presetting the pressures, and shall be equipped with manual pressure control override.

3. The presence of a stand-by injection unit shall be required.

D. Crack Cleaning

1. All cracks shall be cleaned and flushed with water, and checked for port-to-port transmission.
2. All cracks shall be cleaned and flushed with water, checked for port-to-port transmission. Cracks which are contaminated with algae shall be flushed with chlorinated water mixed with copper sulphate.

3. Blow the water out of the cracks using compressed air, and allow adequate time for drying before injecting with epoxy.

4. If in the process of water flushing the cracks, the Contractor notices rust particles being flushed out with the water, or if the water has rust stains, the Engineer shall be notified prior to doing any epoxy injection work. The Engineer will then evaluate the extent of corrosion in the embedded reinforcement, and make necessary adjustments in the repair procedure. The Engineer/Owner reserves the right to either issue a change order for any additional work involved or to delete those portions of the work which show evidence of corrosion of the reinforcing steel. When work is deleted, the Contractor shall give a credit to the Owner on the basis of unit prices quoted for the project.

5. When temperature is near the freezing point of water, ensure that the crack is free of ice before doing the injection work.

E. Epoxy Injection

1. Condition epoxy materials at temperature between 65°F-80°F unless otherwise recommended by the manufacturer. Epoxies beyond this range of temperature shall not be used. Do not store epoxy (even for a short period) in direct sunlight.

2. Epoxy adhesive shall be injected into the crack at the first lower entry port with sufficient pressure to advance the epoxy to the next adjacent port. The original port shall be sealed and entry shifted to the port in which the epoxy appears. This manner of port-to-port injection shall be continued until each joint has been injected for the entire length.

3. If port-to-port travel of epoxy is not achieved, the crack shall be identified, and the Engineer notified.

4. Samples of mixed material shall be injected into a paper cup every 60 minutes to test ratio mix. These samples shall be dated and numbered and left at the sampling location until reviewed by the testing laboratory.

5. Solvents shall not be used to thin epoxy introduced into the cracks.

F. Test Cores

1. A minimum of one test core shall be taken for every 100 feet of epoxy injection work. The total number of test cores taken shall not be less than three.

2. Cores shall be 2" to 4" in diameter, taken from locations marked by the Engineer. Before taking the cores from those locations, the Contractor shall use a magnetic reinforcing bar locator or employ other procedures to ensure that the core will not cut through any reinforcing steel. Should it be determined by the Contractor that the core location marked by the Engineer will cut through the reinforcing steel or prestressing tendons, the Contractor shall notify the Engineer for selecting alternate locations.
3. The cores shall be visually inspected for penetration of epoxy in the cracks. If the penetration is less than 95%, the repair work shall be considered unsatisfactory and unacceptable.

4. In addition to the visual inspection, one third of the cores or a minimum of three cores shall be tested under compression by an independent testing laboratory employed by the Owner. The epoxy injection work shall be considered acceptable if the concrete fails prior to adhesive failure.

5. If cores indicate either lack of penetration or deficiency in bond strength under compression test, the Contractor shall re-inject or perform other remedial work acceptable to the Engineer. Engineer then reserves the right to specify and request additional core samples for inspection and compression test by the testing laboratory, the cost of which shall be borne entirely by the Contractor.

6. All test cores shall be filled completely with polymer mortar to match color, finish, and texture of existing concrete. Mortar used shall comply with the requirements of these specifications.

G. Finishing

1. Allow epoxy adhesive in the cracks to cure before removing the surface seal. Ensure that there is no drainage of epoxy from the cracks due to premature removal of surface seal.

2. The surface of the crack herein treated shall be finished flush with the adjacent concrete surfaces and shall show no indentations or evidence of port fittings.

3. All work shall be performed and conducted in a neat, orderly manner. Clean-up whatever portions of the existing structure that get soiled or stained in the process of epoxy injection work.

3.2 EPOXY MORTAR

A. Applicator's Qualifications

1. Epoxy mortar repair work shall only be performed by contractors who have successfully used this process on at least three similar structural repairs of equal scope which have performed successfully for a minimum period of five years.

2. Only adequately trained and experienced personnel shall be used on the job.

B. Surface Preparation

1. Concrete surface to which the epoxy mortar is to be applied shall be exposed parent concrete free of loose and unsound materials. Surface preparation shall be done by abrasive blasting, waterblasting or as otherwise required by the manufacturer.

2. Necessary approvals shall be obtained by the Contractor from authorizing governmental or other agencies prior to abrasive blasting. Abrasive blasting operations shall comply with the requirements of OSHA and NIOSH (National Institute for Occupational Safety and Health) Standard PB-246-697.
3. Surfaces shall be free of any deleterious materials such as laitance, dust, dirt, and oil.

4. Any exposed reinforcing steel shall also be cleaned and be free of rust and other contaminants. Cleaning shall be accomplished by mechanical means. Use powered wire brushes in locations where reinforcing steel cannot be cleaned by abrasive-blasting or water-blasting. All exposed reinforcing steel shall be coated with a corrosion inhibiting product specified elsewhere in this specification prior to mortar application.

5. Prime the cleaned surface with primer as required by the manufacturer.

C. Concrete Surface Inspection

1. Ensure that the surface temperature is at least 40°F to permit wetting of concrete surface by epoxy coating.

2. The Contractor shall evaluate the moisture content of concrete surface receiving epoxy mortar. This shall be done by determining if moisture will collect at bond lines between concrete and epoxy mortar before epoxy has cured. Evaluate this by taping a piece of polyethylene sheet to the concrete. If moisture collects on underside of the polyethylene sheet before epoxy would cure, then allow concrete to dry sufficiently to prevent the possibility of moisture between old concrete and new epoxy.

D. Mortar Application

1. Condition epoxy compound components to a temperature between 65°-80°F unless otherwise recommended by the manufacturer. Epoxies beyond this range of temperature shall not be used.

2. Stir each of the two parts of epoxy separately before mixing. Then mix in a clean container free of contaminants.

3. Thoroughly blend epoxy components and sand with Jiffy mixers (made by The Jiffy Mixer Co., Irvine, California) to a uniform and homogenous mixture. Small batches of one quart or less may be mixed by spatulas, palette knives or similar devices.

4. Mixing should be accomplished well within the pot life of epoxy (three minutes when using Jiffy mixer or five minutes when mixed by hand) after allowing for time required for application.

5. Apply mortar by trowel or other means suitable for the consistency of the epoxy-sand mortar mix.

6. Build up the repair area in layers with mortar thicknesses within those specified by the manufacturer (1/4" maximum per layer).

7. Consolidate the mortar thoroughly to remove entrapped air.

8. Finish surface of mortar to match the texture and contours of existing concrete.

9. Allow mortar to cure in accordance to manufacturers recommendations.
E. Cleanup

1. Protect surfaces surrounding the work areas against spillage.

2. Epoxy and epoxy mortar spillages shall be cleaned before they set and become difficult to remove.

3. Cleanup all portions of the existing structure that are soiled or stained in the process of epoxy mortar repair work.

3.3 EPOXY BONDING OF STEEL PLATES

A. Applicator’s Qualifications

1. Epoxy bonding of steel plates shall only be performed by contractors who have had successful experience in bonding plates to concrete for three projects of similar scope, or those who have had continuous five years of epoxy application experience.

2. Only adequately trained epoxy applicators shall be used on the job. Furnish certificates of training on request.

B. Surface Preparation

1. Remove loose concrete, debris, laitance, oil, grease and other contaminants from surface receiving epoxy. All surfaces must be free of protrusions and shall be clean, sound, and free of surface water.

2. Clean concrete surface by abrasive blasting prior to applying epoxy bonder. Abrasive blasting shall take place no more than one day prior to bonding of plates.

3. The Contractor shall obtain all necessary permits from all governmental, environmental and other agencies having jurisdiction over the area where the Abrasive blasting work is to be performed. Abrasive blasting operations shall comply with the requirements of OSHA and NIOSH (National Institute for Occupational Safety and Health) Standard PB-246-697.

4. Both exterior and interior faces of the steel plate shall be abrasive blasted no more than eight hours before the application of the bonder. If evidence of oxidation exists on the plate prior to the application of the bonder, the plate shall be recleaned. Blast-clean carbon steel surfaces, using Steel Structures Painting Council, Surface Preparation No. 6, to give a surface condition corresponding to ASa2, BSa2, CSa2 of SSPC Vis 1, depending on the initial surface condition of the steel surface. Prior to blast-cleaning, clean surfaces to conform to SSPC SP1, SP2, and SP3, as required.

5. Remove all abrasive from work area by vacuuming or other appropriate means. Remove blast cleaning residue with compressed air from an oil-and-water-free compressed air source from both concrete and steel surfaces prior to epoxy application.

6. Supply all necessary barriers to contain abrasive within the work area. The Contractor is responsible for all damage done to automobiles parked in the
garage and surrounding areas as a result of abrasive blasting, as well as to the adjacent grounds and structures.

C. Protection of Concrete Member During Curing Period.

1. The Contractor shall keep all traffic off the plated member during the curing period.

2. The Contractor shall shore each member each side of each plate to the floor below during the curing period. Extent of shoring need not exceed each end and the one quarter points of the span. Shoring extent and method shall be submitted to the Engineer for review and approval. Unnecessary traffic and vibration shall be kept off the member during the curing period.

D. Epoxy Application

1. Mix epoxy materials in a clean container free of contaminants.

2. Condition epoxy compound materials at a temperature between 65°-80°F unless otherwise recommended by the manufacturer. Epoxies beyond this range of temperature shall not be used.

3. Thoroughly blend epoxy components with mechanical mixers to a uniform and homogenous mixture. Small batches may be mixed by spatulas, pallette knives or similar devices.

4. Mixing shall be accomplished well within the pot life of the epoxy after allowing for time required for application.

5. Apply sufficient amounts of bonder to both concrete and steel surfaces (approximately 1/16") so that when the plate is clamped to the concrete, a small amount of excess bonder is forced out of the joint area evenly. If no bonder is squeezed out of the joint area, immediately remove the plate and apply more bonder and repress against the concrete surface. Wipe off excess epoxy immediately before it begins to harden.

6. Keep the plates clamped and the concrete member protected from vibration until the epoxy bonder has cured and set. No traffic or loading shall be permitted until the curing is complete.

7. Devices or procedures used for clamping shall provide a uniform pressure across the entire plate. Submit the proposed procedure for clamping the plates to the Engineer for approval prior to commencement of work.

E. Corrosion Protection of Steel Plates

1. All exterior surfaces of steel plates epoxy bonded to the concrete shall be protected from corrosion.

2. Apply the corrosion inhibiting paint by brush, roller or aerosol spray on all exposed metal surfaces including the edges. Minimum dry film thickness of the paint shall be 1.5-2.0 mils.

F. Cleanup
1. Protect surfaces surrounding the work areas against spillage.
2. Epoxy spillages shall be cleaned before they set and become difficult to remove.
3. Cleanup whatever portions of the existing structure that are soiled or stained in the process of epoxy bonding of plates.
4. Cleanup and remove paint from whatever portion of the structure that is stained by paint beyond the steel plates.

G. Testing
1. The Engineer or Testing Laboratory shall evaluate the bonding of steel plate to concrete by tapping the steel plate with a blunt metal instrument.
2. Detection of a hollow sound in any area shall be reason to suspect inadequate bonding. Contractor shall fill in these areas with epoxy by injection procedures approved by the Engineer or shall remove and rebond the plates as directed by the Engineer.

3.4 EPOXY BONDING OF FRESH (PLASTIC) CONCRETE TO HARDENED CONCRETE

A. Applicator's Qualifications
1. Epoxy bonding of fresh concrete to hardened concrete shall only be performed by contractors who have had successful experience in bonding concrete on a minimum of three projects of similar scope.
2. Only adequately trained epoxy applicators shall be used on the job. Furnish certificates of training on request.

B. Surface Preparation
1. Remove loose concrete, debris, laitance, oil, grease and other contaminants from surface receiving epoxy. All surfaces shall be clean, sound and free of surface water.
2. Clean concrete surface by abrasive blasting prior to applying epoxy bonder. Abrasive blasting shall take place no more than one day prior to bonding fresh concrete.
3. The Contractor shall obtain all necessary permits from all governmental, environmental, and other agencies having jurisdiction over the area where the abrasive blasting work is to be performed. Abrasive blasting operations shall comply with the requirements of OSHA and NIOSH (National Institute for Occupational Safety and Health) Standard PB-246-697.
4. Remove all abrasive from work area by vacuuming or other appropriate means. Remove blast cleaning residue with compressed air from an oil-and-water-free compressed air source prior to epoxy application.
5. Provide all necessary barriers to contain abrasive within the work area. The Contractor is responsible for all damage to property or injury to people as a result of sandblasting.
C. Epoxy Application

1. Condition epoxy compound materials at a temperature between 65°-80°F unless otherwise recommended by the manufacturer. Epoxies beyond this range of temperature shall not be used.

2. Mix epoxy materials in a clean container free of contaminants.

3. Thoroughly blend epoxy components with mechanical mixers to a uniform and homogenous mixture.

4. Mixing shall be accomplished well within the pot life of the epoxy after allowing for time required for application.

5. Apply epoxy adhesive to concrete surface by brush, roller, broom, squeegee, or spray equipment. The minimum average application thickness shall be between 15-18 mils for normal weight concrete. For lightweight concrete, use a second coat of epoxy bonder having a minimum average thickness of 15 mils. Application of epoxy shall be in strict accordance with manufacturer's instructions.

6. Do not apply epoxy bonder in rain or in the presence of standing water.

7. Do not let the epoxy adhesive reach the gel stage before pouring concrete. This can be determined by checking whether the adhesive is still tacky. If the adhesive loses its tack before plastic concrete is placed, remove the epoxy by abrasive blasting or other suitable means prior to reapplying the epoxy adhesive.

8. Production, placing, consolidation and curing of new concrete shall conform to ACI 301-99 and the project specifications.

D. Cleanup

1. Protect surfaces surrounding the work areas against spillage.

2. Epoxy spillages shall be cleaned before they set and become difficult to remove.

3. Cleanup whatever portions of the existing structure that are soiled or stained in the process of applying epoxy adhesive.

E. Testing

1. The Engineer or Testing Laboratory shall evaluate bonding of fresh concrete to existing concrete after the fresh concrete has sufficiently cured.

2. The evaluation shall be performed by sounding, using one of the following, or similar, methods:

   a. Tapping fresh concrete with a blunt metal instrument.
   b. Dragging a heavy steel chain across the surface (for horizontal surfaces only).

3. Detection of a hollow sound in any area shall be reason to suspect inadequate bonding, and Contractor shall then core each such area, as required by the Engineer, to determine bonding adequacy.
4. Coring shall be through the new concrete and into the existing concrete. Core diameter shall be 4” unless specified otherwise by the Engineer. Length of cores shall be twice the core diameter, or twice the thickness of new concrete, or as specified by the Engineer.

5. Cores will be visually inspected, and further testing may be required as determined by the Engineer.

6. The cost of any repairs or replacement, and any additional cores or other testing deemed necessary by the Engineer, shall be borne by the Contractor.

3.5 EPOXY GROUTED BOLTS, DOWELS OR REINFORCING STEEL

A. Applicator’s Qualifications

1. Epoxy grouting of bolts, dowels or reinforcing steel shall only be performed by contractors who have had successful experience on a minimum of three projects of similar scope.

2. Only adequately trained epoxy applicators shall be used on the job. Furnish current certificate of training on request.

B. Surface Preparation

1. All bolts, dowels and reinforcing bars shall be abrasive blasted no more than eight hours before the grouting. If evidence of oxidation exists on the surface, the bolts, reinforcing bars and dowels shall be reconealed. Blast-clean surfaces using Steel Structures Painting Council, Surface Preparation No. 6, to give a surface condition corresponding to ASa2, BSa2, CSa2 of SSPC Vis 1, depending on the initial surface condition of the steel surface. Prior to blast-cleaning, clean surfaces to conform to SSPC SP1, SP2, and SP3, as required.

2. All holes shall be clean of dust, debris, and contaminants. Use compressed air from an oil-and-water-free compressed air source prior to epoxy application.

C. Drilling Holes for Embedment

1. Use only rotary-percussion type drills for drilling holes.

2. Drills shall be fitted with bits having single tooth that produce large cuttings, and hollow stem drill rods that permit simultaneous blowing of compressed air providing immediate expulsion of the cuttings from the hole.

3. Do not cut through any reinforcing steel unless indicated otherwise on the drawings. Use small diameter exploratory holes to detect presence of reinforcing steel prior to drilling holes for grouting.

4. Core drilling equipment, and electric impact hammers or other tools which do not provide for immediate expulsion of the drill cuttings shall not be used.

5. Unless noted otherwise on the drawings, depth of holes used for embedding the bolts, bars or dowels shall be at least ten times their diameter, but not less than 6”.

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6. Unless noted otherwise on the drawings, depth of hole used for embedding the bolts, bars or dowels shall be at least fifteen times their diameter.

7. Unless noted otherwise on the drawings, the center to center distance between the embedded bolts, bars or dowels shall be at least twelve times their diameter.

8. Unless noted otherwise on the drawings, the edge distance shall be at least six times the diameter of the bolt, bar or dowel.

9. Hole diameter shall normally be 1/4" larger than the outside diameter of the embedded item. In no case shall the hole diameter be 3/8" larger than the diameter of the embedded item.

D. Epoxy Application

1. Condition epoxy compound materials at a temperature between 65°-80°F unless otherwise recommended by the manufacturer. Epoxies beyond this range of temperature shall not be used.

2. Mix epoxy materials in a clean container free of contaminants.

3. Thoroughly blend epoxy components with mechanical mixers to a uniform and homogenous mixture. Mix small batches (up to 1 quart) by use of spatulas, pallette knives, or similar devices. Take care to use proper proportions of the epoxy components when using small batches.

4. Mixing shall be accomplished well within the pot life of the epoxy after allowing for time required for application.

5. Partially fill the hole with epoxy. Then insert the bolt, dowel or reinforcing bar into the hole such that the resin material oozes out around the embedded item, ensuring complete contact. Twist the bolt, dowel or bar slightly as it is inserted in the hole to ensure complete contact.

6. As an alternative to inserting the embedded item after the epoxy is poured in the hole, the bolt, dowel, or bar may be positioned in the hole and filled up with epoxy by hand caulking guns or injected with an in-head mixing equipment. In either case, the nozzle shall be provided with a hose or tube of sufficient length to reach the bottom of the hole being filled.

7. Where the holes are horizontal or overhead, the opening shall be covered by a masking or a duct tape. Make a split in the tape and insert the epoxy injection tube through the split. Fill hole completely with epoxy and then insert the embedded item through the split tape. Amount of epoxy should be such that a small amount of material oozes through the split. Twist the bolt, dowel or bar slightly as it is inserted in the hole to ensure complete contact.

8. Do not apply epoxy in the rain or in the presence of standing water.

E. Cleanup

1. Protect surfaces surrounding the work area against spillage.

2. Epoxy oozed out from the holes and spillages shall be cleaned before they become difficult to remove.
3. Cleanup whatever portions of the existing structure are soiled or stained in the process of grouting the bolts, dowels or reinforcing bars.

F. Testing

1. The Owner's Testing Laboratory shall evaluate the effectiveness of grouting the bolts, dowels, or reinforcing bars by conducting field proof tests. The load test method shall be submitted to the Engineer for review and approval.

2. Field proof test 10% of the grouted bolts, dowels or bars, with a minimum of two tests.

**OR**

3. Field proof test 25% of the grouted bolts, dowels or bars.

**OR**

4. Field proof test 50% of the grouted bolts, dowels or bars.

5. The Engineer may elect to increase or decrease the number of tests depending upon the outcome of the tests.

6. The proof load shall be 85% of the theoretical ultimate strength of the bolt, dowel or bar or as otherwise determined by the Engineer. Any slip of the embedded bolt, dowel or bar within the epoxy grout material, or slip at the epoxy/concrete interface before the bolt, dowel or bar yields shall be considered to be a failure of the grouted item.

7. The cost of any repairs failing to meet the proof load and all additional tests deemed necessary by the Engineer shall be borne by the Contractor.

3.6 EPOXY FOR PRODUCING SKID RESISTANT SURFACE ON CONCRETE

A. Applicator's Qualifications

1. Work requiring epoxy application for producing skid resistant surfaces on concrete shall only be performed by contractors who have had successful experience in applying epoxy on at least three projects of similar scope.

2. Only adequately trained epoxy applicators shall be used on the job. Furnish certificates of training on request.

B. Surface Preparation

1. Remove loose concrete, debris, laitance, oil, grease and other contaminants from surface receiving epoxy. All surfaces shall be clean, sound, and free of surface water.

2. Clean concrete by mechanical abrasion such as abrasive blasting, scarifying, or waterblasting and as required by the manufacturer.

3. The Contractor shall obtain all necessary permits from all governmental, environmental and other agencies having jurisdiction over the area where the mechanical abrasion work is to be performed. Abrasive blasting operations shall
comply with the requirements of OSHA and NIOSH (National Institute for Occupational Safety and Health) Standard PB-246-697.

4. Where abrasive blasting is used, all abrasive shall be removed from the work area by vacuuming or other appropriate means. Remove blast cleaning residue with compressed air from an oil-and-water-free compressed air source prior to epoxy application.

5. Provide all necessary barriers to contain the abrasive material within the work area. The Contractor is responsible for all damage to property or injury to people as a result of mechanical abrasion process.

C. Epoxy Application

1. Condition epoxy compound material to be at a temperature between 65°-80°F unless otherwise recommended by the manufacturer. Epoxies beyond this range of temperature shall not be used.

2. Stir each of the two parts of epoxy separately before mixing. Then mix the two parts in a clean container free of contaminants.

3. Thoroughly blend epoxy components with mechanical mixers to a uniform and homogenous mixture.

4. Mixing shall be accomplished well within the pot life of the epoxy after allowing for time required for application.

5. Apply epoxy adhesive to concrete surface by brush, roller, broom, squeegee, or spray equipment. The minimum average application thickness shall be between 50-70 mils. Application shall be in strict accordance to manufacturer's instructions.

D. Skid-Resistant Aggregate Application: Apply the skid-resistant aggregate while the epoxy coating is still fluid at the rate of 11-13 pounds per square yard. The aggregate shall be spread uniformly over the entire surface of the concrete.

E. Cleanup

1. Protect surfaces surrounding the work area against spillage.

2. Epoxy spillages shall be cleaned before they set and become difficult to remove.

3. Cleanup whatever portions of the existing structure that are soiled or stained in the process of applying epoxy adhesive.

F. Testing

1. The Testing Laboratory shall evaluate that the thickness of the epoxy adhesive and the amount of skid-resistant aggregate complies to the specifications.

2. The Testing Laboratory shall perform pullout tests on the cured skid-resistant surface. The rate of testing shall be one test for every 1000 square feet of surface area, with a minimum of three tests. The pullout strength (tested in accordance with Appendix A of ACI 503 R-93) shall be at least 100 psi. All
failures shall be in the concrete. Any failure that occurs in the adhesive shall be cause for rejection of the coating application.

3. The cost of replacement and any retesting required by the Engineer shall be borne by the Contractor.

3.7 EPOXY PENETRANT SEALER

A. Applicator's Qualifications

1. Work requiring epoxy penetrant sealer on concrete surfaces shall only be performed by contractors who have had successful experience in applying epoxy on at least three projects of similar scope.

2. Only adequately trained epoxy applicators shall be used on the job. Furnish certificates of training on request.

B. Surface Preparation

1. Remove loose concrete, debris, laitance, oil, grease and other contaminants from surface receiving epoxy. All surfaces shall be clean, sound, and free of surface water.

2. Clean concrete by mechanical abrasion such as abrasive blasting or waterblasting.

3. The Contractor shall obtain all necessary permits from all governmental, environmental and other agencies having jurisdiction over the area where the mechanical abrasion work is to be performed. Abrasive blasting operations shall comply with the requirements of OSHA and NIOSH (National Institute for Occupational Safety and Health) Standard PB-246-697.

4. Where abrasive blasting is used, all abrasive shall be removed from the work area by vacuuming or other appropriate means. Remove blast cleaning residue with compressed air from an oil-and-water-free compressed air source prior to epoxy application.

5. Provide all necessary barriers to contain the abrasive material within the work area. The Contractor is responsible for all damage to property or injury to people as a result of mechanical abrasion process.

C. Epoxy Application

1. Temperature of the epoxy must be above 50° for mixing.

2. Stir each of the two parts of epoxy separately before mixing. Then mix the two parts in a clean container free of contaminants.

3. Thoroughly blend epoxy components using a Jiffy mixer (made by the Jiffy Mixer Co., Irvine, California) powered by a low-speed (300-600 rpm) electric drill for at least three minutes.

4. When mixing has been completed, cover mixed epoxy penetrant sealer container and allow a reaction time as required by the manufacturer before applying.
5. Apply the epoxy penetrant sealer when the surface temperature of concrete is at least 40°F with brush, roller or spray equipment. All spray equipment must employ traps to prevent water and oil from contaminating the sealant. Two applications are required at the following rates:

<table>
<thead>
<tr>
<th>Application</th>
<th>Rate (sqft/gallon)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>200-300</td>
</tr>
<tr>
<td>Second</td>
<td>250-300</td>
</tr>
</tbody>
</table>

The second coat shall be applied as soon as the first coat is tack-free. If a surface film develops on the concrete, the application rate should be reduced. (Second coat is not needed with Sikagard 619 when applied at the rate of 300 sqft/gallon.

D. Cleanup

1. Protect surfaces surrounding the work area against spillage.
2. Epoxy spillages shall be cleaned before they set and become difficult to remove.
3. Cleanup whatever portions of the existing structure that are soiled or stained in the process of applying the epoxy penetrant sealer.

E. Testing: The Testing Laboratory shall monitor the rate of application of the epoxy penetrant sealer.

3.8 HIGH MOLECULAR WEIGHT METHACRYLATE SELF-PENETRATING CONCRETE CRACK FILLER AND SEALER

A. Applicator’s Qualifications

1. Work requiring self-penetrating crack filler and sealer on concrete shall only be performed by contractors who have had successful experience in applying the methacrylate sealer on at least three projects of similar scope.
2. Only adequately trained applicators shall be used on the job. Furnish certificates of training on request.

B. Surface Preparation

1. Remove loose concrete, debris, laitance, oil, grease and other contaminants from surface and cracks receiving sealer. All surfaces shall be clean, sound, and free of surface moisture.
2. Clean concrete by mechanical abrasion such as abrasive blasting.
3. The Contractor shall obtain all necessary permits from all governmental, environmental and other agencies having jurisdiction over the area where the mechanical abrasion work is to be performed. Abrasive blasting operations shall comply with the requirements of OSHA and NIOSH (National Institute for Occupational Safety and Health) Standard PB-246-697.
4. Where abrasive blasting is used, all abrasive shall be removed from the work area by vacuuming or other appropriate means.
5. Remove blast cleaning residue with compressed air from an oil-and-water-free compressed air source prior to self-penetrating crack filler and sealer application. Surface receiving sealer shall be dry, and all cracks shall be free of standing water. Blow cracks clean with compressed air prior to sealer application.

6. All spalls in concrete in the area scheduled to receive the methacrylate sealer shall be repaired using polymer concrete mortar patch prior to sealer application.

7. Temporarily plug all existing drains with rubber plugs or other suitable material to prevent the sealer from getting into the drains.

8. Protect expansion joints from being covered by methacrylate material. All expansion joints which get accidentally covered with the sealer shall be cleaned immediately. All damaged joints shall be repaired or replaced as directed by the Engineer at no cost to the Owner.

C. Methacrylate Application

1. Do not schedule methacrylate sealer work if there is forecast of rain within twelve hours, or if the ambient temperature is expected to fall below 45°F temperature during application or within twelve hours after application of the sealer.

2. Stir each of the two parts of sealer separately before mixing. Then mix the two parts in a clean container free of contaminants.

3. Condition sealer materials at a temperature between 65°-80°F unless otherwise recommended by the manufacturer in writing. Methacrylate materials beyond this temperature range shall not be used.

4. Thoroughly blend the methacrylate components using a Jiffy mixer (made by the Jiffy Mixer Co., Irvine, California) powered by a low-speed (300-600 rpm) electric drill for five to seven minutes until the liquid clears.

5. Apply the material on horizontal surfaces with roller or squeegee at the rate of approximately 130 square feet per gallon. The concrete substrate must be at a temperature of at least 45°F. Material shall be allowed to pond over cracks. After penetration into the substrate and cracks, remove excess material.

6. Application of sealer shall proceed in an orderly manner in widths between 6 to 10 feet across the length of the work. Overlap shall be kept to a minimum with no overlap exceeding 6 inches.

7. Follow additional directions for surface preparation and application given in the manufacturer’s printed technical specifications which are not included in these specifications. The Contractor shall have these specifications with him at the job site prior to start of the work.

8. Apply second coat of methacrylate sealer at the rate of 200 square feet per gallon in the same orderly manner as used for the first coat.

9. Spread sand by mechanical means over the surface treated by the methacrylate sealer at a rate of 0.50 pounds per square yard of surface area. Sand shall be broadcast within 15 to 35 minutes following the application of the sealer. Sand shall be spread over the width which coincides with the width of the methacrylate sealer. Sand spreader equipment used shall be operated at speeds which will
eliminate sand drifts and spread the sand uniformly over the treated area. Excess sand shall be removed completely from the untreated area by brooming or other means prior to application of the methacrylate sealer.

10. Protect sand covered area by covering with a polyethylene sheet. No vehicular traffic shall be allowed on the surface until the methacrylate sealer has cured.

11. Remove all loose sand from the slab prior to opening the area for traffic.

D. Test Area

1. See the drawings for location and size of test area.

2. Contractor shall use the same workers, and materials for applying the methacrylate sealer and the sand to the test area as for the rest of the work. Method of surface preparation and application shall be in strict accordance to these specifications and the manufacturer's printed directions.

3. Contractor shall inform the Owner, Testing Laboratory, Engineer regarding the schedule for performing the work in the test area. It is mandatory that the manufacturer's representative be also present during the application of the material in the test area.

4. The Testing Laboratory and the Contractor shall accurately record the quantity of material used and calculate the rate of coverage. Adjustments shall be made immediately, and the size of test area increased accordingly to apply material at the rate given in the specifications.

5. Provide a watertight dam around the test area capable of holding at least 3 inches of water for 48 hours. Fill with water and mark the level. Ensure that there is no leakage around the perimeter of the dam. Leave the water standing in the test area for 48 hours. Cover area with polyethylene sheet to prevent evaporation.

6. The Testing Laboratory shall measure water level after 48 hours, and also check soffit of slab under test area for evidence of leaks. If no leak is observed, the methacrylate sealer application shall be considered acceptable and the Contractor shall proceed with the work.

7. If leaks are observed, do not proceed with the rest of the work.

E. Cleanup

1. Protect surfaces surrounding the work area against spillage.

2. Sealer spillages shall be cleaned before they set and become difficult to remove.

3. Cleanup whatever portions of the existing structure that are soiled or stained in the process of applying the methacrylate sealer.

F. Testing: The Testing Laboratory shall perform the following work:

1. Check the materials to ensure that they conform to the specifications.

2. Review the storage facility and the temperature at which the material is stored.
3. Review the surface preparation to ensure that the surface is clean as required in the specifications.

4. Review mixing and application procedures.

5. Test sand to ensure that it complies with the specifications.

6. Review procedures for application of sand to ensure that the rate of coverage is in accordance to the specifications.

3.9 POLYMER MODIFIED CEMENTITIOUS MORTAR OVERLAY SYSTEM

A. Applicator's Qualifications

1. Mortar overlay system work shall only be performed by contractors who have successfully used this process on at least three similar structural repairs of equal scope which have performed successfully for a minimum period of five years.

2. Only adequately trained and experienced personnel shall be used on the job.

B. Surface Preparation

1. Concrete surface to which the mortar is to be applied shall be exposed parent concrete free of loose and unsound materials. Surface preparation shall be done by using a scabbler. Obtain a surface profile having a minimum amplitude of ± 1/16".

2. Surface shall then be swept clean or vacuumed to clear off debris and dust.

3. Wash surface with water and brush with hard broom to remove all contaminants and oil drippings. Oil and grease spots shall be removed by using a detergent, and then scrubbing with a power brush or a hard broom. Remove all residue by washing and brushing with water.

4. Surface then shall be wet vacuumed to remove excess water.

5. Surface to be prepared shall be wetted prior to and during scarification by a scabbler to minimize the creation of dust.

6. Provide adequate barricades around the work area to prevent injury to people around the work area from flying debris.

7. Ensure that all edges, corners, areas adjacent to columns, walls and doors are satisfactorily prepared as described above. Use small pneumatic bush-hammer or single-head scabbler for preparing such areas.

8. Any exposed reinforcing steel shall also be cleaned and free of rust and other contaminants. Cleaning shall be accomplished by mechanical means. Use powered wire brushes or abrasive-blasting. All exposed reinforcing steel shall be coated with a corrosion inhibiting product specified elsewhere in this specification prior to mortar application.

C. Concrete Surface Inspection

1. Ensure that the surface and ambient temperature is at least 45°F and rising at the time of application.
2. Inspect surface for loose aggregate and concrete particles. Remove all loose concrete.

3. Inspect surface for cracks. All cracks shall be rebonded prior to application of the overlay system.

D. Crack Repair

1. Rebond cracks using epoxy injection procedures given elsewhere in these specifications.

** OR **

2. Rebond cracks using self-penetrating concrete crack filler and sealer using high molecular weight methacrylates. Procedures for filling cracks are given elsewhere in these specifications.

** OR **

3. Rebond cracks using both epoxy injection and self-penetrating concrete crack filler and sealer using high molecular weight methacrylate procedures. See drawings for areas requiring the different methods of repair.

E. Mortar Application

1. Condition polymer mortar material to 65°F-80°F unless otherwise recommended by the manufacturer. Materials beyond this range of temperature shall not be used.

2. Mix the two components in a clean mortar mixer free of contaminants as recommended by the manufacturer.

3. Thoroughly blend components and aggregates with Jeffy mixers (made by The Jiffy Mixer Co., Irvine, California) to a uniform and homogenous mixture.

4. Mixing should be accomplished within three minutes when using Jiffy mixer.

5. Dampen the surface of concrete receiving the mortar by a portable sprayer just prior to mortar application. The surface shall be saturated surface dry with no standing water.

6. Set the screed to the proper overlay thickness. See drawings for required overlay thickness. Contractor shall use only power vibrating screeds with metal edges to obtain a smooth wet finish.

7. Spread mortar uniformly on the damp surface by broom. Scrub into substrate filling all pores and voids.

8. Consolidate the mortar thoroughly to remove entrapped air.

9. After screeding, wait for a few minutes as recommended by the manufacturer such that the mortar has a desired stiffness. Wait time depends on the ambient temperature and temperature of the applied material. Then finish by power trowel. Small, difficult to reach areas may be finished by hand troweling. Use water from a portable sprayer during the troweling process.
10. After screeding, wait for a few minutes as recommended by the manufacturer such that the mortar has a desired stiffness. Wait time depends on the ambient temperature and temperature of the applied material. Then apply a broom finish on the surface parallel to the direction of flow of traffic.

F. Compressive Strength Test Cubes

1. The Testing Laboratory retained by the Owner shall take a minimum of one set of four cube compressive strength test samples to be tested in accordance with ASTM C-109-99 (modified) for every 10 cubic feet of mortar used in overlay or part thereof in a day's work.

2. Test one cube after 24 hours, second cube after 72 hours (3 days), third cube after 14 days, and fourth cube after 28 days.

G. Joints in Overlay System

1. All joints in the original surface or floor shall be reproduced in the overlay. Provide any additional joints shown in the drawings.

2. Joints in the overlay shall be produced by saw-cutting.
   a. Make saw cut as soon as overlay is able to support weight of workers and sawing equipment without damage to finish surface of overlay.
   b. All joints shall be continuous across the overlay. Do not offset or stagger joints.
   c. Width of saw cut shall be 1/4". Saw cut shall be made through the full thickness of the overlay.

H. Joint Filler Material

1. Joint filler material shall be scheduled to be applied in the last week of the construction work.

2. Joint filler material shall be applied immediately after the sawcut is made. However, a week prior to completion of the entire work, reinspect the joints. Repair and refill any joints that show gaps or tears.

3. Clean joint thoroughly prior to filling the joint. There shall be no water in the joint at the time of filler application.

4. Fill joint with filler material having a Shore A hardness of 80.

5. Fill joint with filler material having a Shore A hardness of 35.

6. Condition the joint material at a temperature between 65°-80°F unless otherwise recommended by the manufacturer. Joint material beyond this range shall not be used.

7. Follow strictly the manufacturer's recommended procedures for applying the joint filler.
I. CURING
1. Cure finished surface by applying a fine mist spray of water over the finished surface. Alternatively, cover with wet burlap. Solvent type curing compounds shall not be used on the overlay system.
2. Curing shall start immediately after the finishing work is completed.
3. Overlay shall be maintained in a moist condition for a minimum of 24 hours.
4. Overlay shall be maintained in a moist condition for a minimum of 72 hours.
5. Protect overlay work from rain and freezing conditions. Contractor shall ensure that the overlay is protected by proper insulation in the event freezing conditions are expected during the curing period.

J. CLEANUP
1. Protect surfaces surrounding the work areas against spillage.
2. Mortar and joint filler material spillage shall be cleaned before they set and become difficult to remove.
3. Cleanup all portions of the existing structure that are soiled or stained in the process of mortar repair work.

K. OVERLAY SERVICE
1. Protect overlay from foot and vehicular traffic as well as equipment loads during the curing period, or until the overlay mortar has attained a compressive strength of 4,000 psi.
2. Strength shall be determined from cube compressive strength tests performed in accordance to ASTM C-109-99 (Modified).

3.10 EPOXY RESIN FLOOR OVERLAY SYSTEM

A. Applicator's Qualifications
1. Work requiring epoxy resin floor overlay system on concrete shall only be performed by contractors who have had successful experience in applying epoxy overlay systems on at least three projects of similar scope which have performed successfully for a minimum period of five years.

2. Only adequately trained epoxy applicators shall be used on the job. Furnish certificates of training on request.

B. Surface Preparation
1. Remove loose concrete, debris, laitance, oil, grease and other contaminants from surface receiving epoxy. All surfaces shall be clean, sound, and free of surface water.
2. Clean concrete by mechanical abrasion such as abrasive blasting, shotblasting, scarifying, waterblasting or as required by the manufacturer. Remove all projections and rough spots to achieve a level clean surface.

3. The Contractor shall obtain all necessary permits from all governmental, environmental and other agencies having jurisdiction over the area where the mechanical abrasion work is to be performed. Abrasive blasting operations shall comply with the requirements of OSHA and NIOSH (National Institute for Occupational Safety and Health) Standard PB-246-697.

4. Where abrasive blasting is used, all abrasive shall be removed from the work area by vacuuming or other appropriate means. Remove blast cleaning residue with compressed air from an oil-and-water-free compressed air source prior to epoxy application.

5. Provide all necessary barriers to contain the abrasive material within the work area. The Contractor is responsible for all damage to property or injury to people as a result of mechanical abrasion process. Wet surface during the surface preparation process to minimize the creation of dust. Alternatively, use equipment designed to perform abrasive blasting and vacuuming operations simultaneously which eliminates dust.

6. Any exposed reinforcing steel shall also be cleaned and free of rust and other contaminants. Cleaning shall be accomplished by mechanical means. Use powered wire brushes or abrasive-blasting. All exposed reinforcing steel shall be coated with a corrosion inhibiting product specified elsewhere in this specification prior to epoxy application.

C. Concrete Surface Inspection

1. Ensure that the surface and ambient temperature is at least 45°F and rising at the time of application.

2. Inspect surface for loose aggregate and concrete particles. Remove all loose concrete.

3. Inspect surface for cracks. All cracks shall be rebonded prior to application of the overlay system.

D. Crack Repair

1. Rebond cracks using epoxy injection procedures given elsewhere in these specifications.

** OR **

2. Rebond cracks using self-penetrating concrete crack filler and sealer using high molecular weight methacrylates. Procedures for filling cracks are given elsewhere in these specifications.

** OR **

3. Rebond cracks using both epoxy injection and self-penetrating concrete crack filler and sealer using high molecular weight methacrylate procedures. See drawings for areas requiring the different methods of repair.
E. Epoxy Primer Application

1. Condition epoxy compound material to be at a temperature between 65°-80°F unless otherwise recommended by the manufacturer. Epoxies beyond this range of temperature shall not be used.

2. Stir each of the two parts of epoxy separately before mixing. Then mix the two parts in a clean container free of contaminants.

3. Thoroughly blend epoxy components for 3 minutes with mechanical mixers having a speed of 400-600 rpm to a uniform and homogenous mixture.

4. Mixing shall be accomplished well within the pot life of the epoxy after allowing for time required for application.

5. Apply epoxy adhesive to concrete surface by brush, roller, broom, or squeegee. The minimum average application thickness shall be between 150-250 square feet per gallon. Application shall be in strict accordance to manufacturer's instructions.

F. Epoxy Mortar Application

1. Mix epoxy in the same manner as described above for epoxy primer.

2. While mixing the epoxy components, slowly add 5 parts by loose volume of oven-dried quartz sand to 1 part of the mixed epoxy material, and mix until uniform in consistency.

3. Place epoxy mortar before primer becomes tack free.

4. Place epoxy mortar with trowel. Compact and trowel with vibrating screed having metal edges. Set the screed for proper overlay thickness. See drawings for areas requiring overlay and overlay thickness required.

5. Finish overlay surface with finishing trowel or other mechanical means.

6. Allow epoxy mortar to cure in accordance to manufacturer's recommendations.

G. Compressive Strength Tests

1. The Testing Laboratory retained by the Owner shall take a minimum of one set of four cube compressive strength test samples to be tested in accordance with ASTM C-109-99 (Modified) for every 1000 square feet of epoxy overlay work or part thereof in a day's work.

2. Test one cube after 24 hours, second cube after 72 hours (3 days), third cube after 7 days, and fourth cube after 28 days.

H. Seal Coat: Allow the overlay system to reach sufficient cure so as not to be damaged by foot traffic (minimum compressive strength 2,000 psi). Then apply a top seal coat of neat epoxy over the epoxy mortar overlay by means of a roller or flat squeegee. Method of mixing the seal coat epoxy resin and its rate of application shall be the same as that of the epoxy primer.

I. Joints in Overlay System
1. All joints in the original surface or floor shall be reproduced in the overlay. Provide any additional joints shown in the drawings.

2. Joints in the overlay shall be produced by saw-cutting.
   a. Make saw cut as soon as overlay is able to support weight of workers and sawing equipment without damage to finish surface of overlay.
   b. All joints shall be continuous across the overlay. Do not offset or stagger joints.
   c. Width of saw cut shall be 1/4". Saw cut shall be made through the full thickness of the overlay.

J. Joint Filler Material
1. Joint filler material shall be scheduled to be applied in the last week of the construction work.
2. Joint filler material shall be applied immediately after the sawcut is made. However, a week prior to completion of the entire work, reinspect the joints. Repair and refill any joints that show gaps or tears.
3. Clean joint thoroughly prior to filling the joint. There shall be no water in the joint at the time of filler application.
4. Fill joint with filler material having a Shore A hardness of 80.

** OR **
5. Fill joint with filler material having a Shore A hardness of 35.
6. Condition the joint material at a temperature between 65°-80°F unless otherwise recommended by the manufacturer. Joint material beyond this range shall not be used.
7. Follow strictly the manufacturer's recommended procedures for applying the joint filler.

K. Testing
1. The Testing Laboratory shall evaluate that the rate of coverage of the epoxy adhesive and the thickness of the overlay complies to the specifications.
2. The Testing Laboratory shall perform pullout tests on the cured overlay surface prior to applying the seal coat. The rate of testing shall be one test for every 1000 square feet of surface area, with a minimum of three tests. The pullout strength (tested in accordance with Appendix A of ACI 503 R-93) shall be at least 100 psi. All failures shall be in the concrete. Any failure that occurs in the adhesive shall be cause for rejection of the overlay system.
3. The cost of replacement and any retesting required by the Engineer shall be borne by the Contractor.
4. Repair all tested areas in the same manner as the overlay system application.

L. Cleanup
1. Protect surfaces surrounding the work area against spillage.
2. Epoxy spillages shall be cleaned before they set and become difficult to remove.
3. Cleanup whatever portions of the existing structure that are soiled or stained in the process of applying epoxy adhesive.

END OF SECTION 036500
SECTION 050110

STEEL FIELD RE-COATING

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 work of this section.

1.2 DESCRIPTION OF WORK

A. Furnish all labor, materials, services, equipment and appliances required in conjunction with or related to the re-coating of concealed structural steel lintels.

B. Furnish all labor, materials, services, equipment and appliances required in conjunction with or related to the re-coating of exposed structural steel architectural features.

1.3 QUALITY ASSURANCE

The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

A. Codes and Standards: Comply with provisions of following, except as otherwise indicated. Certain sections in this specification contain requirements that are more restrictive and/or different than contained in the standards listed. In such cases, the requirements of this specification shall control.


1.4 SUBMITTALS

A. Product Data: Submit producer's or manufacturer's specifications and installation instructions for following products; include laboratory test reports and other data to show compliance with specifications (including the specified standards):

1. Structural steel protective paint system, including primer, intermediate, and finish products.

B. Qualification Data:

1. Submit qualification data for firms and persons specified in Article 1.04 "Qualifications" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of engineers and owners, and other information specified.
1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.

B. Furnish all fuel, maintenance, and equipment required for hoisting and placement of materials under this contract.

PART 2 - PRODUCTS

2.1 PRODUCTS, MANUFACTURERS, AND SUBSTITUTIONS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2. Products: Subject to compliance with requirements, provide one of the products specified.

B. Substitutions: Where specific products or services are specified, Contractor may request a substitution to be reviewed and approved or rejected by Owner and Engineer, following the procedures outlined in Section “Product Substitution Procedures”.

2.2 MATERIALS

A. Exposed Structural Steel Architectural Features

1. Approved Products:

   a. ICI Devoe Coatings, www.devoecoatings.com
      
      Primer Coat: Pre-Prime 167
      Intermediate Coat: Devran 224HS High Build Epoxy
      Finish Coat: Devthane 379H Aliphatic Urethane Enamel

      
      Primer Coat: Macropoxy 920 Pre-Prime
      Intermediate Coat: Macropoxy HS High Solids Epoxy
      Finish Coat: Acrolon 218 HS Acrylic Polyurethane

   c. Tnemec, www.tnemec.com
      
      Primer Coat: Series 27 F. C. Typoxy Polyamide Epoxy
      Intermediate Coat: Series 66 | Hi-Build Epoxoline
      Finish Coat: Series 73 | Endurashield

   d. Approved Equal Paint Systems (with similar performance characteristics to specified painting systems)
      
      Primer Coat: Epoxy Primer
      Intermediate Coat: Hi-Build Epoxy Coating
2.3 SURFACE PREPARATION

A. Specification: Surface preparation, paint, and painting practices shall conform to the "Steel Structures Painting Manual", Volumes 1 and 2, as published by the Society for Protective Coatings (formerly the Steel Structures Painting Council (SSPC)).

Unless recommended otherwise by primer manufacturer, minimum level of clean for existing steel surfaces shall be SSPC-SP 6/NACE No. 3, “Commercial Blast Cleaning”.

B. Surface Preparation and Coating Coordination:

1. Surface Preparation: Prepare the surface of all structural steel specified to be field painted as required by the paint manufacturer or the Society for Protective Coatings specifications, followed by a high pressure water wash at all areas with a minimum 3000 – 5000 lbs. psi at the tip at a rate of 3 – 5 gallons per minute, utilizing an orbital tip. Finish with a clean water rinse.

2. Primer Coat: Apply a test patch to confirm compatibility of primer with existing coating systems prior to applying primer to all cleaned surfaces. Allow primer to dry one week before testing adhesion.

Immediately after surface preparation, apply primer to all structural steel specified to be field primed in strict accordance with manufacturer’s instructions and the Society for Protective Coatings specifications. Apply paint at a rate to conform to the manufacturer’s written instructions to achieve minimum dry film thickness given above. Use coating methods that result in full coverage of joints, corners, edges, welds, and all exposed surfaces.

3. Intermediate Coat: Coordinate primer coat requirements with intermediate coat requirements, including minimum cure time and any between-coat surface preparation. The primer coat selected must be compatible with any specified intermediate and/or finish coats.

4. Finish Coat: Coordinate intermediate coat requirements with finish coat requirements, including minimum cure time and any between-coat surface preparation. The intermediate coat selected must be compatible with any specified finish coats.

Where structural steel is exposed, the finish coat color shall be per Owner's selection from coating manufacturer's standard colors.

PART 3 - EXECUTION

3.1 APPLICATION

A. Steel Field Re-coating:

1. Steel surfaces to be coated shall be clean, i.e. devoid of grease, oil, mill scale, oxidation, loosely adherent rust, paint, etc.
2. Clean steel surfaces as specified above.
3. Mix different coatings per manufacturer’s directions.
4. Use air spray, 1/4-inch synthetic woven nap rollers, or high quality natural bristle brushes to apply coatings.

5. Prepare surfaces and apply specified primer paint. Apply coating by brush or spray at sufficient wet film thickness to achieve a minimum dry film build as given above, using manufacturer’s recoat time directions.

6. Apply intermediate coat (if specified) at sufficient wet film thickness to achieve a minimum dry film build as given above.

7. Apply specified finish coat. Apply coating by brush or spray at sufficient wet film thickness to achieve a minimum dry film build as given above.

8. The Contractor shall ensure that, at the substantial completion of the project, all structural steel required to be painted shall have all necessary steel surfaces painted (including touch-up painting as required) to prevent corrosion bleeding.

B. Clean Up: Clean up all debris caused by the Work of this Section, keeping the premises neat and clean at all times.

END OF SECTION [05122][050110]
SECTION 071800
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. This Section includes traffic coatings for the following applications
   1. Pedestrian traffic.
   2. Vehicular traffic.

B. Contractor shall fully acquaint himself with the existing job site conditions and discuss the accessibility of the work areas with the Owner.

C. Provide barricades around the work area with appropriate signage to keep non-construction people from entering work area.

D. Contractor shall provide all traffic cones, barriers, signage, flagmen, and any other traffic control devices required to direct traffic during the surface preparation and installation of the traffic topping. This work shall be done in consultation with the Owner.

E. Contractor shall implement necessary containment measures to prevent damage from:
   1. Surface preparation, including but not limited to shot blasting, resurfacing, and concrete repair;
   2. Overspray, from mixing of materials, roller mist, striping, and other airborne materials that could damage adjacent property, and/or vehicles on remaining on the parking garage.

1.3 SUBMITTALS

A. Product Data: For each product indicated.


C. Proposed method and details for treatment of cracks.

D. Shop Drawings: Show extent of each traffic coating. Include details for treating substrate joints and cracks, flashings, deck penetrations, termination conditions, and other defects on concrete surface. Include layout of traffic striping and markings.

E. Provide plan for each Phase of the work, noting extents of work area for each Phase, and temporary traffic flow during the work.

F. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors, textures, and patterns available for each type of product indicated.
G. Samples for Verification: For each type of traffic coating required, prepared on rigid backing and of same thickness and material indicated for the Work.

1. Provide one 1-ft by 1-ft stepped samples on backing large enough to illustrate build-up of traffic coatings for each duty grade to be applied.

H. Material Test Reports: From a qualified independent testing agency indicating and interpreting test results for compliance of traffic coatings with requirements, based on comprehensive testing of current product formulations within the last three years including the following information:

1. Static coefficient of friction shall meet minimum requirements of American with Disabilities Act (ADA).

2. Flash point of each component 200 °F. maximum.

3. Written certification from traffic coating manufacturer confirming compatibility with existing underlying coatings and/or substrate.

I. Material Certificates: Signed by manufacturer certifying that traffic coatings comply with requirements, based on comprehensive testing of current product formulations within the last three years.

J. Maintenance Data: To include in maintenance manuals specified in Division 1. Identify substrates and types of traffic coatings applied. Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of traffic coatings.

K. Certification that products and installation comply with applicable EPA, OSHA, and VOC requirements regarding health and safety hazards.

L. Quality control procedures: Traffic coating manufacturer shall submit written quality control plan to Engineer for acceptance 30 days prior to construction for application procedures which specifically address the following items:

1. Surface preparation acceptance criteria.
2. Crack detailing recommendations.
3. Method of application of coats.
4. Primer type and application rate.
5. For each coat, wet mils required to obtain specified dry thickness. Traffic coating system dry mil thickness excluding aggregate.
6. Number and type of coats.
7. Quality control plan for assured specified uniform traffic coating thickness that employs grid system of sufficiently small size to designate coverage area. Average specified wet mil thickness of not less than 90% of average acceptable thickness.
8. Type, gradation and aggregate loading required for each coat.
9. Maximum and minimum allowable times between coats.
10. Temperature, humidity and other weather constraints. Specify substrate moisture testing criteria.
11. Final cure time before resumption of parking and/or paint striping.

M. Three copies of snow removal guidelines for areas covered by guarantee.

N. Signed statement from this Section applicator certifying that applicator has read, understood, and shall comply with all requirements of this Section.
O. Submit three copies of System Maintenance Manual.

1.4 QUALITY ASSURANCE

A. Installer (Applicator) Qualifications: An experienced applicator who has specialized in installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

1. Certification: Written approval or license of applicator by traffic coating manufacturer. Show evidence of minimum 10 projects completed by applicator over previous 5 years using submitted system.

B. Source Limitations: As follows:

1. Use traffic coatings of a single manufacturer.

2. Obtain primary traffic coating materials, including primers, from traffic coating manufacturer. Obtain secondary materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of type and from source recommended by traffic coating manufacturer.

C. Fire-Test-Response Characteristics: For traffic coatings as follows:

1. Fire-response testing was performed by UL, ITS, or another independent testing and inspecting agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.

2. Provide materials identical to those of traffic coatings tested according to ASTM E 108 for deck type and slopes indicated and that comply with requirements for roof-covering Class indicated.

D. Mockups: Engineer will select one representative surface for each traffic coating and each substrate to receive traffic coatings. Apply each coating to at least 100 sq. ft of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.

1. Remove and reapply mockups until they are approved by Owner, Engineer and Manufacturer.

2. Keep approved mockups undisturbed during construction as a standard for judging completed traffic coatings. Undamaged mockups may be incorporated into the Work.

E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1. Before installing traffic coatings, meet with representatives of authorities having jurisdiction, manufacturer's technical representative, Owner, Engineer, consultants, independent testing agency, and other concerned entities. Review requirements for traffic coatings. Notify participants at least seven days before conference.

2. Testing Agency will employ wet mil gauge to monitor thickness during application of each layer of the traffic coating at 100 SF intervals.

   a. Determine overall traffic topping mil thickness:
(1) Contractor shall provide 6 in. by 6 in. membrane coupon on concrete surface for each 50,000 SF of traffic topping to be placed as directed by Engineer and Manufacturer.

(2) Contractor shall assist Testing Agency in removing membrane coupons from concrete surface at completion of manufacturer-specified cure period. Contractor shall repair coupon area per manufacturer's instructions.

(3) Testing Agency shall determine dry mil thickness of completed Traffic Topping System, including bond breaker using precision measurements from cross-sections of the membrane utilizing petrographic equipment. Report individual readings and overall traffic topping system average to Engineer.

3. Testing Agency will perform three (3) quantitative adhesion tests for every 25,000 SF of traffic topping installed. Acceptable tensile stress criterion is 200 psi for each test. Report individual readings to Engineer. Contractor shall repair test areas per manufacturer's instructions.

4. Manufacturer: Provide qualified representative on site for duration of work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels showing the following information:

1. Manufacturer's brand name.
2. Type of material.
3. Directions for storage.
4. Date of manufacture and shelf life.
5. Lot or batch number.
6. Mixing and application instructions.
7. Color.

B. Store materials in a clean, dry location protected from exposure to direct sunlight. In storage areas, maintain environmental conditions within range recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F for a period of 24 hrs., when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point. In addition, do not apply the traffic coating when substrate temperature approaches the critical temperature that will create out gassing. Consult traffic topping manufacturer for special instructions during cold and hot weather installations.

1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of the substrate.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall
be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, signed by traffic coating manufacturer agreeing to repair or replace traffic coatings that do not comply with requirements or that deteriorate during the specified warranty period. Warranty does not include deterioration or failure of traffic coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new substrate cracks exceeding 1/16 inch in width, fire, vandalism, or abuse by snowplow, maintenance equipment, and truck traffic.

1. Deterioration of traffic coatings includes, but is not limited to, the following:
   a. Adhesive or cohesive failures.
   b. Abrasion or tearing failures.
   c. Surface crazing or spalling.
   d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.
   e. Abrasion or tear failure resulting from normal traffic use.
   f. Corrosion staining from the aggregate.

C. Warranty Period: Five years from date of acceptance of work, jointly executed by Manufacturer and Applicator.

D. 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.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Physical Requirements: Provide traffic coatings complying with ASTM C 957.

B. Material Compatibility: Provide joint sealants, primers; base, intermediate, and top coats; and miscellaneous materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

2.2 AGGREGATE

A. Rounded 12/20 grade sand with +6.5 on Mohs scale. Approved aggregate shall be:
   1. Washed, clean and dry
   2. Iron ore/metal fragment free

2.3 TRAFFIC COATING
A. Acceptable traffic coating systems are listed below. Color to be selected by Owner representative:

1. Heavy Duty:
   a. Auto-Gard FC HD-52 FC7540/FC7964 by Neogard
   b. Conipur II- HEAVY TRAFFIC SYSTEM with 295 top coat by BASF

Verify material coverage with product manufacturer taking into consideration the aggregate type, substrate and environmental conditions.

2. Extra Heavy Duty (Turning Lanes at Crossovers):
   a. Auto-Gard E WPM-HD by Neogard
   b. Conipur II WPM System by BASF

Verify material coverage with product manufacturer taking into consideration the aggregate type, substrate and environmental conditions.

B. Substitutions: None for this project.

C. Primer: Required. Manufacturer’s standard factory-formulated primer recommended for substrate and conditions indicated.

D. Recoating Complete System: Provide complete traffic topping system with all the components specify for new, heavy-duty applications, including all waterproofing and wearing courses.

E. Recoating Partial System: Provide all wearing course components specified for new heavy-duty applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Applicator present, for compliance with requirements and for other conditions affecting performance of traffic coatings. All high points, holes, aggregate popouts, ridges, rough surfaces and other miscellaneous defects shall be corrected as acceptable to Engineer prior to installation of traffic coating system at no additional cost to the Owner.

1. For the record, prepare written report, endorsed by Applicator, listing conditions detrimental to performance.
2. Verify compatibility with and suitability of substrates.
3. Begin coating application only after minimum concrete curing and drying period recommended by traffic coating manufacturer has passed, after unsatisfactory conditions have been corrected, and after surfaces are dry.
4. Verify that substrates are visibly dry and free of moisture. Test for moisture by plastic sheet method according to ASTM D 4263 at every 25,000 SF of surface area and provide report to Engineer unless manufacturer requires more stringent requirements.
5. Application of coating indicates acceptance of surfaces and conditions.
3.2 PREPARATION

A. Clean and prepare substrates according to manufacturer's written recommendations to produce clean, dust-free, dry substrate for traffic coating application.

B. Mask adjoining surfaces not receiving traffic coatings, deck drains, and other deck substrate penetrations to prevent spillage, leaking, and migration of coatings.

C. Concrete Substrates: Mechanically abrade concrete surfaces to a uniform CSP-4 profile according to ASTM D 4259. Do not acid etch.

1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
2. Remove concrete fins, ridges, and other projections.
3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion by shotblasting.
4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.
5. Resurface where required shall include a step by step procedure recommended by Manufacturer and approved by Engineer.

3.3 TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C 1127 and manufacturer's written recommendations.

B. Provide sealant cants at penetrations and at reinforced and nonreinforced deck-to-wall butt joints.

C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.

D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

3.4 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and all random cracks in substrates according to ASTM C 1127 and traffic coating manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.

2. All random cracks on concrete surface less than 1/32 in. wide shall receive detail coat unless a more stringent treatment is required by manufacturer.
3. Rout and seal random cracks, construction joints and control joints prior to installation of primer and base coat.
4. Mask off adjoining surfaces not to receive traffic coating and mask off drains to prevent spillage and migration of liquid materials outside coating area. Provide neat lines at terminations.
B. Crack preparation including installation of joint sealant material, where required, is incidental to traffic topping work and shall be installed flush with adjacent surfaces.

3.5 TRAFFIC COATING APPLICATION

A. Apply traffic coating material according to ASTM C 1127 and manufacturer’s written recommendation. Utilize a Jiffy paddle for mixing each of the coats and mix it at the rate recommended by Manufacturer. Do not introduce air into the product during the mixing process.

1. Start traffic coating application in presence of manufacturer’s technical representative.

2. Verify that wet film thickness of each component coat complies with traffic coating requirements. Coating applications that are too thick shall be recoated with the correct mil thickness and sand aggregate broadcasted in accordance to the specified system at no cost to the Owner.

3. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated and omit aggregate on vertical surfaces.

4. Installation shall include all of the following steps:
   a. Surface preparation
   b. Resurfacing (if applicable)
   c. Crack detail
   d. Prime coat
   e. Base coat
   f. Aggregate coat
   g. Aggregate
   h. Top Coat

5. Install a trial section of traffic coating system for each duty grade specified. Do not proceed with further installation until trial section is accepted in writing by Engineer. Remove and replace rejected trial sections with acceptable application.

6. Vertical Surfaces are not required to be coated.

B. Apply traffic paint for striping and other markings with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates for a 15-mil (0.38-mm) minimum wet film thickness.

3.6 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:

1. Samples of material delivered to Project site shall be taken, identified, sealed, and certified in presence of Contractor.

2. Testing agency shall perform tests for characteristics specified, using applicable referenced testing procedures or, if not referenced, using tests cited in manufacturer's product data.

3. Testing agency shall verify thickness of coatings during traffic coating application.
4. If test results show traffic coating materials do not comply with requirements, remove noncomplying materials, prepare surfaces, and reapply traffic coatings.

5. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 CURING AND PROTECTING

A. Cure traffic coatings according to manufacturer's written recommendations. Prevent contamination and damage during application and curing stages.

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

C. Protect traffic coatings from damage and wear during remainder of construction period.

D. All debris shall be removed from site prior to commencement of coating installation. Contractor shall clean the traffic topping membrane in case it gets dirty as a result of any additional repair work.

END OF SECTION 071800
SECTION 071916
CONCRETE PENETRATING SEALERS

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 concrete penetrating sealers and corrosion inhibitors for the following surfaces:
      1. Supported concrete floor and concrete roof surfaces including curbs, walks, islands and pour strips.
      2. Concrete stair treads and landings.
      3. Approach drives and adjoining sidewalks within property limits.
      4. Precast concrete walls.
   B. Contractor shall fully acquaint himself with the existing job site conditions and discuss the accessibility of the work areas with the Owner.
   C. Materials shall be compatible with materials or related work with which they come into contact.
   D. Provide barricades around the work area with appropriate signage to keep non-construction people from entering work area.
   E. Contractor shall provide all traffic cones or barriers to direct traffic during the repair of the facility. This work shall be done in consultation with the Owner.
   F. Related Sections:
      1. Division 03 Section "Cast-in-Place Concrete."
      2. Division 07 Section "Joint Sealants."

1.3 SUBMITTALS
   A. Product Data: Include manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface to be treated, and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.
   B. Applicator Certificates: Signed by manufacturer certifying that the applicator complies with requirements. Evidence shall include complete copy of manufacturer's licensing/certification document, spelling out repair responsibility for warranty claims.
   C. Certification that products and installation comply with applicable EPA, OSHA, and VOC regarding health and safety hazards.
D. Material Test Reports: Indicate and interpret test results for compliance of water repellents with requirements indicated.

E. Supplier shall furnish application rate at which following tests were passed:

1. NCHRP 244 tests:
   a. Four inch cube series II (incorporating 5 days of air drying prior to coating test cubes): Upper limits of average weight gain and net chloride content at completion of cube test series shall be limited to 16% of weight gain and 14% of net chloride gain of untreated control cubes.
   b. Southern climate exposure (Series IV): Upper limits of average content at end of 24 weeks shall be limited to 4% of net chloride content of untreated control cubes.

2. ASTM C672 test (non-air entrained concrete): Acceptable scaling rating shall be “zero plus.”

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who employs only persons trained and approved by sealer manufacturer for application of manufacturer's products.

1. Experience shall include 5 years of verifiable experience with submitted system.
2. Superintendent assigned to project shall have supervised at least 5 previous projects of similar magnitude and design, and shall be present during all operations.

B. Manufacturer: Sealer shall be compatible with all materials to which it would be applied including, but not limited to, curing compounds, sealants, expansion joint, threshold assemblies, caulking, and concrete.

1.5 PROJECT CONDITIONS

A. Weather and Substrate Conditions: Do not proceed with application of water repellent under any of the following conditions, except with written instruction of manufacturer:

1. Ambient temperature is less than 40 deg F.
2. Concrete surfaces and mortar have cured for less than 28 days.
3. Rain or temperatures below 40 deg F are predicted within 24 hours.
4. Application is earlier than 24 hours after surfaces have been wet.
5. Substrate is frozen or surface temperature is less than 40 deg F.
6. Windy condition exists that may cause water repellent to be blown onto vegetation or surfaces not intended to be coated.

1.6 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty, executed by the applicator and sealer manufacturer, covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within the specified warranty period. Warranty does not
include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 inch wide, fire, vandalism, or abuse by maintenance equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable concrete sealers are listed below:

1. Silane 100% solids (solvent free) 200 SF/G:
   a. Protectosil BH-N by Evonik Degussa

2. Proposed substitutions: None for this project.

B. Acceptable corrosion inhibitors are listed below:

1. Silane 100% solids (solvent free) 200 SF/G:
   a. Protectosil CIT by Evonik Degussa

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrate of substances that might interfere with penetration or performance of sealers. Test for moisture content, according to sealers manufacturer's written instructions, to ensure surface is sufficiently dry.

B. Test for pH level, according to sealer manufacturer's written instructions, to ensure chemical bond to silicate minerals.

C. Repair or replace all sealant materials damaged by surface preparation operations.

D. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.

E. Coordination with Sealants: Do not apply sealer until sealants for joints adjacent to surfaces receiving sealer treatment have been installed and cured.

F. Shot blast clean all surfaces to be sealed as acceptable to sealer manufacturer before sealer application. Prepare by sandblasting all surfaces inaccessible to shotblast equipment.

G. Equipment used during floor slab cleaning shall not exceed height limitation of facility and shall not exceed 3,000 lb axle load or vehicle weight (6000 lb.)

3.2 APPLICATION

A. All concrete to be treated shall be cured above 50 deg F. for at least 14 days before applying sealer.
B. All concrete to be treated shall be air dried for at least 72 hours following surface wetting at temperatures above 50 deg F.

C. Ambient and concrete temperatures shall be 50 deg F. or higher during application of sealer.

D. Sealer work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, sealer, and sealant materials identical to those used in the work.

E. Test Application: Before performing sealer work, including bulk purchase and delivery of products, prepare 3 trial applications in an unobtrusive locations to demonstrate the final effect (visual, physical, and chemical) of planned application. If application of sealer causes problems (i.e. glazing), contractor shall contact sealer manufacturer to obtain written recommendations for solving the problem.

F. Contractor shall not proceed with sealer application following trial section applications until directed to do so in writing by Engineer.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized technical service representative to inspect and approve the substrate before application and to instruct the applicator on the product and application method to be used.

3.4 CLEANING

A. Protective Coverings: Remove protective coverings from adjacent surfaces and other protected areas.

B. Immediately clean sealer from adjoining surfaces and surfaces soiled or damaged by sealer application as work progresses. Repair damage caused by sealer application. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071916
SECTION 079200
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 SUBMITTALS
A. Product Data: Submit manufacturer's technical data for each joint sealant product required, including instructions for joint preparation and joint sealant application.
B. Certificates: Submit certificates from manufacturers of joint sealants attesting that their products comply with Specification requirements and are suitable for the use indicated and are compatible with the traffic coating system elected to be installed (if applicable).

1.3 QUALITY ASSURANCE
A. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required. Provide one year warranty on installation and materials.
B. Review and approve joint details before construction.

1.4 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials to Project Site in original unopened containers, or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multicomponent materials.
B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.5 PROJECT CONDITIONS
A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturers.
2. When joint substrates are wet due to rain, frost, condensation or other causes.
3. Joint Width Conditions: Do not proceed with installation of joint sealants when joint widths are less than allowed by sealant manufacturer for application indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL
A. Compatibility: Provide joint sealants, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

2.2 SEALANT FOR HORIZONTAL (NON-COVE) JOINTS:

A. Products: Acceptable joint sealants:

1. MasterSeal SL 2 (formerly Sonolastic SL-2) by BASF
2. Sikaflex-2c NS TG by Sika

B. Self-leveling sealants require tooling in accordance with details.

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

D. The color of sealants shall match adjacent surfaces.

2.3 SEALANT FOR VERTICAL JOINTS AND COVE JOINTS:

A. Products: Acceptable joint sealants:

1. MasterSeal NP 2 (formerly Sonolastic NP-2) by BASF
2. Sikaflex-2c NS by Sika

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

C. The color of sealants shall match adjacent surfaces.

2.4 JOINT SEALANT BACKING

A. In addition to locations and extent of sealants shown on Drawings, provide sealant at following locations:

1. At all control/construction joint in concrete slabs, pour strips, topping, and all joints between precast double tee flanges, if applicable.
2. Around perimeter of all floor drains and grates.
3. At all exterior horizontal joints.
4. At all vertical and horizontal joints between walls and columns and/or other miscellaneous conditions exposed to weather.

B. General: Provide sealant backings of material and type which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

C. Plastic Foam Joint-Fillers: Preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam of material indicated below, and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

D. Non-gassing, closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer.
E. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing bond between sealant and joint filler or other materials at back surface of joint. Provide self-adhesive taper where applicable.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Provide type recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate and field tests.

B. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.

C. Masking Tape: Provide non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 INSPECTION

A. Require installer to inspect joints indicated to receive joint sealants for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealant performance. Obtain installer's written report listing any condition detrimental to performance of joint sealant work. Do not allow joint sealant work to proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturers and the following requirements:

1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealant, including dust; paint, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; oil; grease; waterproofing; water repellants; water; surface dirt and frost.

2. Clean concrete, substrate surfaces, by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance from concrete.

B. Joint Priming: Prime all joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primers to areas of joint sealant bond. Do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.
3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
2. Do not leave gaps between ends of joint-fillers.
3. Do not stretch, twist, puncture or tear joint-fillers.
4. Remove absorbent joint-fillers which have become wet prior to sealant application and replace with dry material.
5. Install bond breaker tape between sealants and joint-fillers, compression seals or back of joint where required to prevent third-side adhesion of sealant to back of joint.

D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability. Do not smear sealant onto adjacent surfaces.

E. Tooling of Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants in concave joint configuration per ASTM C 1193, unless otherwise indicated to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

F. Contractor and Engineer shall verify sealant profile as follows:

1. Contractor, at Engineer’s direction, shall cut out lesser of 1% of total linear footage placed of total 100 linear ft of joint sealant at random locations for Engineer and Manufacturer’s representative inspection of sealant profile.
2. Contractor to repair all random joint sealant cut out sections at no cost to Owner.

3.4 PROTECTION AND CLEANING

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and reseal joints with new materials to produce sealant installations with repaired areas indistinguishable from original work.
B. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by the manufacturer of the sealants and of the products used in the joints.

END OF SECTION 079200
SECTION 079513

EXPANSION JOINTS

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. Contractor shall fully acquaint himself with the existing job site conditions and discuss the accessibility of the work areas with the Owner.

B. Provide barricades around the work area with appropriate signage to keep non-construction people from entering work area.

C. Contractor shall provide all traffic cones or barriers to direct traffic during the repair of the facility. This work shall be done in consultation with the Owner.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. An expansion joint system is detailed on Drawings. Shop drawings shall include temperature adjustment table with expansion joint opening calculated at 10°F increments. Shop drawing submittal shall show that proposed joint system is of similar gland configuration, capable of equal individual and combined movements in each direction when installed at designated temperature shown on drawings.

C. Where installation temperature is other than specified temperature, submittal shall include calculations showing joint is capable of movement within design temperature range (supplied by Engineer) for “other” temperature, and that design and installation follow manufacturer’s recommendations. Design temperature range is -30° F to +130° F. Material samples.

D. Installation plans and large scale details. Show all conditions including, but not limited to, splices, terminations, and change in section or alignment.

E. Field samples of premolded joint sealant. Width, thickness and durometer hardness of sealant shall be checked by Testing Agency. Upward buckling caused by joint gap closure shall be limited to a maximum of ¼ inch per ADA Guidelines.

F. Other information required to define joint placement or installation.

H. Quality Assurance – Contractor setting expansion joint opening will require a temperature adjustment table to properly size joint gap at time of concrete pour or precast erection.

I. Caution – The expansion joint movement capability and the actual joint gap movement may not coincide if Quality Assurance measure not followed.

J. Submit test reports from accredited laboratory attesting to joint systems’ movement capability and ADA compliance.


1.4 QUALITY ASSURANCE

A. Manufacturer/Applicator: Review and approve all details before construction. Confirm in writing to Engineer/Architect.

B. Applicator: Coordinate services with related Work including layout of joint system and approval of methods for providing joints.

C. Applicator: Inspect site to insure proper joint configuration in field.

D. Testing Agency at owner’s expense shall check Shore A hardness in accordance with ASTM D2240 and ensure the limited upward buckling of ¼ inch or less.

E. Manufacturer: Provide qualified representative for periodic inspection of Work.

F. Expansion joint blockouts shall be floated and troweled before final cure to remove all air pockets, voids and spalls caused by form work.

G. Expansion joint surface areas two feet on each side of joint gap shall be finish graded perpendicular to joint gap creating flush slab-to-slab transition. Elevations on each side shall be identical.

H. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1. Manufacturer: Provide qualified representative on site for duration of work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels showing the following information:

1. Manufacturer's brand name.
2. Type of material.
3. Directions for storage.
4. Date of manufacture and shelf life.
5. Lot or batch number.
6. Mixing and application instructions.
7. Color.

B. Store materials in a clean, dry location protected from exposure to direct sunlight. In storage areas, maintain environmental conditions within range recommended in writing by manufacturer.
1.6 PROJECT CONDITIONS

A. Environmental Limitations: Install expansion joint systems within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1. Special Warranty: Written warranty, signed by expansion joint manufacturer agreeing to repair or replace expansion joint systems that do not comply with requirements or that deteriorate during the specified warranty period.

B. Warranty Period: Five years from date of acceptance of work, jointly executed by Manufacturer and Applicator.

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. Perform any repair under this guarantee at no cost to Owner.

E. Snowplows, vandalism, abnormally abrasive maintenance equipment, and [studded snow tires] are not normal traffic use and are exempted from warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

2. Surfaces accessible to pedestrian traffic: anti-slip construction.
3. Material shall be applied in lengths no shorter than 20 ft, with no joints in the drive aisle.

B. Elastomeric concrete edged, extruded rubber expansion joint sealant system. Acceptable systems (in drive lanes):

1. Wabo®Crete II Membrane System–ME Series by Watson Bowman - BASF
2. Thermaflex Membrane/Nosing System, Type TCR Series by Emseal

C. Premolded Systems: Premold sealant in supplier’s factory. Premolding elsewhere prohibited. Acceptable systems:

1. Wabo®UreFlex by Watson Bowman - BASF
2. Vulkem 255 FM by Tremco
3. MM PPT Expansion Joint – PPT Series by MM Systems Corp.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Coordinate and verify that related Work meets following requirements:

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

C. Acid etching: Prohibited.

D. All openings to occupied space shall be sealed 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.

3.2 PREPARATION

A. General Contractor: Correct unsatisfactory conditions in manner acceptable to installer before installing expansion joint system. All honeycombs and air voids in blockouts shall be patched as acceptable to Engineer prior to installation of Expansion Joint Sealant system.

B. Coordinate expansion joint system with other related Work before installation of expansion joint.

C. Check adhesion to substrates and recommend appropriate preparatory measures.

D. Proceed with expansion joint system only after unsatisfactory conditions have been corrected in manner acceptable to installer and product manufacturer.

E. Clean joints thoroughly in accordance with manufacturer's instructions to remove all laitance, unsound concrete and curing compounds which may interfere with adhesion.

F. Cease installation of expansion joints under adverse weather conditions, or when temperatures are outside manufacturer's recommended limitations for installation.

G. Prepare for installation of extruded expansion joint systems in accordance with manufacturer's recommendations.

H. Cease installation if expansion joint blockouts and/or openings exhibit cracked edges, voids or spalls. Repair with accepted material prior to installation of expansion joint.

I. Check elevations on each side of expansion joint gap utilizing metal straight edge to ensure flush slab-to-slab transition. Present discrepancies to Engineer/Architect.
J. Check anticipated or actual minimum and maximum joint openings with Engineer. Compare to manufacturer’s movement specifications and make joint sizing recommendations.

3.3 INSTALLATION

A. During months when historic mean daily temperature at Project is 20° F. or more colder than annual mean daily temperature, premolded sealant shall be installed on temporary basis to prevent hot weather buckling. Permanent installation shall be done in summer when Engineer/Architect directs.

B. Install extruded expansion joint system in accordance with manufacturer’s instructions.

C. Areas adjacent to the joint must be masked with tape to assure clean joint lines.

D. In-place testing: Prior to opening to traffic, test joint seal for leaks with maintained continuously wet for 12 hrs. Repair leaks revealed by examination of seal underside. Repeat test and repairs until all leaks stopped for full 12 hrs.

3.4 CLEANING

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

3.5 PROTECTION

A. Protect the Expansion Joint System during construction. Heavy construction vehicles will not be permitted to cross the joint without specific and written permission by the Engineer. Subsequent damage to the expansion joint system shall be repaired at the contractor’s expense.

END OF SECTION 079513
SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Standard hollow metal doors and frames.

B. Related Sections:
   1. Section 087100 – Door Hardware

1.3 DEFINITIONS
A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work to comply with the following Steel Door Institute Performance
   Standards:
   1. Hollow metal work fabricated according to ANSI/SDI A250.8 (R2008).
   2. ANSI/SDI A250.4 (2001) - Test Procedure and Acceptance Criteria for Physical
      Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
   3. ANSI/SDI A250.6 (R2009) - Recommended Practice for Hardware Reinforcing on
      Standard Steel Doors and Frames.
   4. ANSI/SDI A250.10 (R2004) - Test Procedure and Acceptance Criteria for Prime
      Painted Steel Surfaces for Steel Doors and Frames.
      Components for Swinging Door Assemblies.
      Steel Doors and Frames.
      and Frames.
1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

B. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.
   9. Details of conduit and preparations for power, signal, and control systems.

C. Other Action Submittals:
   1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
   2. Supplier to submit shop drawing schedules within two weeks of written notification from Contractor in the event to expedite the process of frames to jobsite.
   3. Certificate: current certificate stating the manufacture is a member of SDI.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames from single source manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 and UL10C, embossed labels are acceptable on standard 3 sided door frames.
   1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
   2. Temperature-Rise Limit [At vertical exit enclosures and exit passageways], provide doors that have a maximum transmitted temperature end point of not more than
450 deg F 250 deg C above ambient after 30 minutes of standard fire-test exposure.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

D. Smoke-Control Door Assemblies: Comply with NFPA 105.

E. Pre-installation Conference: Conduct conference at Project site to review anchor methods, electrical conduit connections and custom installation of unusual openings such as pocket frames, single rabbet double egress frames and recessed doors flush with walls.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- 102-mm- high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch 6-mm space between each stacked door to permit air circulation.

2. Any scratches or disfigurements caused in shipping or handling are promptly cleaned and touched up with a rust-inhibitive primer to new conditions.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 Z180 or A60ZF180 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z 12G coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

2.2 STANDARD HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

   1. Design: Flush panel.

   2. Core Construction: Manufacturer's standard polystyrene core.
      a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
      b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 11.0 when tested to ASTM C518 calculated and 3.0 when tested to ASTM C1363 operable.
         1) Locations: All stairwell doors

   3. Vertical Edges for Single-Acting Doors:
      a. Beveled Edges: 1/8 inch in 2 inches 3 mm in 50 mm.
         1) At meeting edges of pairs of doors bevel edge at active leaf, square edge at inactive leaf.
         2) Universal hinge preps for reverse swinging of doors are not acceptable.

   4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- 1.0-mm- thick, end closures or channels of same material as face sheets.


B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.8 for physical performance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Full Flush).

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.3 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.


1. Fabricate frames with mitered or coped corners.

2. Fabricate frames as face welded joints and back weld joints continuously, unless otherwise indicated.

3. Frames to be Level 3: (14 gage) 1.3-mm- thick steel sheet.

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

D. Hollow metal frames shall be welded and fully grouted (hand troweled). Knock down frames are not acceptable.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Post-installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- 9.5-mm- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location. 3” min, embedment.

2. Hot dip galvanize all anchors in exterior walls.

B. Floor Anchors: Formed from same material as frames, not less than 0.067 inch 1.0 mm thick, and as follows:

1. Monolithic Concrete Slabs: Floor anchors shall be provided with two holes for fasteners and shall be fastened inside jambs with at least four (4) spot welds per anchor

2.5 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch 0.8 mm thick, fabricated from same material as door face sheet in which they are installed.

2.6 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inch 0.4 mm thick.
2.7 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

4. Provide A60 Galvannealed coating at frames in exterior walls.

5. Electrical Knock Out Boxes: Factory weld 18 gage electrical knock out boxes to frame for electrical hardware preps; included to electrical thru wire hinges, electrical raceways, door position switches, electric strikes, jamb mount card readers, and magnet locks as noted in door hardware sets in Division 8 Door Hardware.

   a. Electrical knock out boxes are required at door position switches, electric strikes, card readers, and middle hinge locations for all exterior locations regardless of electrical hardware specified in Division 8 Door Hardware and security prints.

   b. Provide electrical knock out boxes with a dual ½-inch and ¾-inch knockouts.

   c. Conduit to be factory installed for electric hardware preps. Frames with factory installed conduit to have weld in place anchors.

   d. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 8 Door Hardware and security prints.

   e. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb, coordinate with hardware supplier

   f. Provide conduit for standardized plug connectors to accommodate up to (12) wires for electrified door hardware specified in hardware sets in Division 8 Door Hardware and security prints.

D. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.

3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

4. Provide loose stops and moldings on inside of hollow metal work.

5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

6. Gap for butted or mitered joints in glass stop should not exceed .0625-inch.

2.8 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Paint: Apply gloss paint to match existing color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory after installation of frame in wall. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch 1.6 mm, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch 1.6 mm, measured at jambs on a horizontal line parallel to plane of wall.

3. Twist: Plus or minus 1/16 inch 1.6 mm, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

4. Plumbness: Plus or minus 1/16 inch 1.6 mm, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer’s written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

   a. At fire-protection-rated openings, install frames according to NFPA 80.

   b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

   c. Install frames with removable glazing stops located on secure side of opening.

   d. Remove temporary braces necessary for installation only after frames have been properly set and secured.

   e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

   a. Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.


4. Masonry/Concrete Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry/concrete wall with grout. Grout to be hand troweled and have max slump of 3”.

5. Field Supplied Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable
wedged or bolted anchorage to frame jamb members. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

6. In-Place Gypsum Board Partitions: Secure frames in place with post-installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

7. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Adjust frames and doors per SDI 122 Installation for trouble shooting openings.

C. Remove grout and other bonding material from hollow metal work immediately after installation.

D. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer. Install joint sealant between frame and existing wall interface.

E. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and application of elastomeric coatings to exterior surfaces.

B. Alternates: Refer to Division 01 Section "Alternates" for description of Work in this Section affected by alternates.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1.4 PERFORMANCE REQUIREMENTS

A. Provide elastomeric coatings that comply with performance requirements specified in MPI 113.

B. Provide elastomeric coating systems with the following properties as determined by test methods indicated:

1. Elongation: Not less than 100 percent with a tensile strength of 200 psi and not less than 88 percent recovery after 1 hour and 90 percent recovery after 24 hours when tested according to ASTM D 2370 using parameters established by MPI 113.

2. Accelerated Weathering: No cracking, peeling, blistering, chalking, or visual deterioration after 1000 hours when tested according to procedures in ASTM G 155.

3. Low-Temperature Flexibility: No crack formation when tested according to ASTM D 1737.

4. Moisture-Vapor Transmission: Not less than 2.0 perms according to ASTM D 1653.

5. Wind-Driven Rain Resistance: No water penetration according to procedures in FS TT-C-555.
6. Minimum Solids Content by Volume: Not less than 45 percent.

1.5 SUBMITTALS

A. Product Data: For each elastomeric coating system specified. Include crack fillers, block fillers, and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Technical information including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Initial Selection: For each type of finish-coat material indicated.

1. After color selection, Contractor will furnish color chips indicating colors selected.

C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.

D. Qualification Data: For Applicator.

E. Material Certificates: For each elastomeric coating material, signed by manufacturers.

F. Product Test Reports: Based on evaluation of comprehensive tests by a qualified testing agency for each elastomeric coating material indicating compliance of elastomeric coatings with requirements based on comprehensive testing within the last five years of current product formulations.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying elastomeric coating systems similar in material and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain crack fillers, block fillers, primers, and other undercoat materials from same manufacturer as finish coats.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Manufacturer's stock number and date of manufacture.

3. Contents by volume, for pigment and vehicle constituents.

4. Thinning instructions (if permitted).

5. Application instructions.

6. Color name and number.

7. Handling instructions and precautions.

8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect elastomeric coating materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.8 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 90 F, unless otherwise permitted by manufacturer's written instructions.

B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; or at temperatures less than 5 F above the dew point; or to damp or wet surfaces.

1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before starting or continuing coating operation.

1.9 WARRANTY

A. Elastomeric Coating Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace elastomeric coatings that fail within specified warranty period. Failures include, but are not limited to, water penetration through the coating.

B. Warranty Period for Elastomeric Coatings: Five year(s) from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra elastomeric coating materials from same production run as materials applied and in quantities described below. Package materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to Owner.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products indicated in other Part 2 articles.

C. Manufacturers Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Benjamin Moore & Co. (Benjamin Moore).
2. ICI Dulux Paint Centers, Inc. (ICI Dulux Paint).
4. PPG Industries, Inc.; Pittsburgh Paints (Pittsburgh Paints).

2.2 ELASTOMERIC COATING MATERIALS, GENERAL

A. Material Compatibility: Provide crack fillers, block fillers, primers, elastomeric finish-coat materials, and related materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality elastomeric coating materials that are factory formulated, comply with requirements in FS TT-C-555, and are recommended by manufacturer for the application indicated. Material containers not displaying manufacturer's product identification are not acceptable.

2.3 CRACK FILLERS

A. Crack Fillers: Factory-formulated acrylic emulsion crack fillers compatible with substrate and finish-coat materials indicated.

1. Crack Filler for Cracks up to 1/16 Inch:
   a. ICI Dulux Paint; Decra-Flex Smooth Brush Grade Elastomeric Patching Compound.
   b. Modac; Acra Lastic Brush Grade 115-004.
   c. Pittsburgh Paints; Buttering Grade Vinyl Sealant 236-2414.
   d. Sonneborn; Hydrocide 750 Brush Grade or Knife Grade Patching Compound.
   e. Sto; Flexible Crack Filler.

2. Crack Filler for Cracks More Than 1/16 Inch:
a. ICI Dulux Paint; Decra-Flex Smooth Knife Grade Elastomeric Patching Compound.

b. Modac; Acra Lastic Knife Grade 115-002.

c. Pittsburgh Paints; Regular Grade Vinyl Sealant 236-2397.

d. Sonneborn; Hydrocide 750 Knife Grade Patching Compound.

e. Sto; Flexible Crack Filler.

f. Tamms; Tamms Thin Patch.

2.4 PRIMERS

A. Concrete and Masonry Primer: Factory-formulated, alkali-resistant, acrylic-latex primer.

1. Benjamin Moore; Moore's Acrylic Masonry Sealer #066: Applied at a dry film thickness of not less than 0.7 mils.

2. ICI Dulux Paint; Aquacrylic GRIPPER 3210 Acrylic Primer: Applied at a dry film thickness of not less than 1.3 mils.

3. Modac; Acrylic Latex Surface Conditioner 019-156: Applied at a dry film thickness of not less than 4.0 mils.

4. Pittsburgh Paints; primer not required.

5. Pittsburgh Paints; Speedhide Alkali Resistant Primer 6-603: Applied at a dry film thickness of not less than 1.5 mils.

2.5 ELASTOMERIC FINISH-COAT MATERIALS

A. Smooth Elastomeric Finish: Smooth, factory-formulated, 100 percent acrylic elastomeric coating.

1. Benjamin Moore; Moorlastic Elastomeric Waterproof Coating #055: Applied at a dry film thickness of not less than 10 mils.

2. ICI Dulux Paint; Decra-Flex 2260-XXXX Smooth Elastomeric Coating System: Applied at a dry film thickness of not less than 6.0 mils.

3. Modac; Elastomeric Acrylic Coating--Smooth Texture 019-146: Applied at a dry film thickness of not less than 7.0 mils.

4. Pittsburgh Paints; Pitt-Flex Exterior Masonry Coating 100 Percent Acrylic Elastomeric 4-110: Applied at a dry film thickness of not less than 5.5 mils.

5. Sonneborn; Sonocoat Colorflex Waterproof Elastomeric Coating: Applied at a dry film thickness of not less than 8.0 mils.
B. Textured Elastomeric Finish: Textured, factory-formulated, 100 percent acrylic elastomeric coating.

1. ICI Dulux Paint; Decra-Flex 2270-XXXX Fine Finish Elastomeric Coating System: Applied at a dry film thickness of not less than 7.0 mils.

2. Modac; Elastomeric Acrylic Coating—Medium Texture 019-027: Applied at a dry film thickness of not less than 7.0 mils.

3. Pittsburgh Paints; Speedhide Texture Coatings 100 Percent Acrylic 4-50: Applied at a dry film thickness of not less than 6.1 mils.

4. Sonneborn; Sonocoat Flextex Textured Elastomeric Coating: Applied at a dry film thickness of not less than 8.0 mils.

5. EXECUTION

2.6 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for coating application. Comply with procedures specified in PDCA P4.

1. Proceed with coating application only after unsatisfactory conditions have been corrected and surfaces are thoroughly dry.

2. Start of coating application will be construed as Applicator's acceptance of surface conditions.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Engineer about anticipated problems when using coatings specified over substrates primed by others.

2.7 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.

1. After completing coating operations, reinstall items removed, using workers skilled in trades involved.

B. Cleaning: Before applying coatings or other surface treatments, clean substrates of substances that could impair bond of coating systems. Remove oil and grease before cleaning.

1. Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.
C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for particular substrate conditions and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Surfaces: Prepare brick, concrete, concrete unit masonry, stucco, and similar surfaces to receive elastomeric coatings. Remove efflorescence, chalk, dust, dirt, release agents, grease, oils, and similar impediments to good adhesion by water blasting followed by a clear water rinse.
   a. Remove mildew and neutralize surfaces according to manufacturer's written instructions before patching materials are applied.
   b. Roughen as required to remove glaze. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
   c. If hardeners or sealers have been used to improve concrete curing, use mechanical methods for surface preparation.
   d. Determine alkalinity and moisture content of surfaces to be coated by performing appropriate tests. If surfaces are sufficiently alkaline to cause finish paint to blister and burn, correct this condition before application. Do not apply coatings over surfaces where moisture content exceeds that permitted in manufacturer's written instructions.

3. Crack Repair: Fill cracks according to manufacturer's written instructions before coating surfaces.

4. Deep Hairline Cracks: Remove dust and dirt from around cracks. Remove mildew by sterilizing before filling. Apply manufacturer's recommended primer to cracks before patching. If shrinkage occurs after applying crack filler, apply additional filler material to cracks before initial application of elastomeric coatings.
   a. Cracks up to 1/16 Inch: Clean surface around cracks. Apply crack filler primer penetrating cracks as deeply as possible, overflowing crack 2 inches on each side. When crack filler primer is dry, apply manufacturer's recommended sealant, forced well into cracks using a brush, putty knife, or trowel. Smooth edges of primed area around cracks. Allow for sealant shrinkage when applying.
   b. Cracks up to 3/8 Inch: Open cracks to 1/4 to 3/8 inch wide and 1/8 inch deep. Clean cracks and surrounding area removing dust, dirt, and other impurities. Apply crack filler primer recommended by manufacturer with a brush to obtain uniform coverage and spread approximately 2 inches on each side of cracks. Fill cracks with manufacturer's recommended crack filler applied with a putty knife or trowel, and allow for shrinkage. If excessive shrinkage occurs, reapply crack filler.

D. Material Preparation: Mix and prepare materials according to coating manufacturer's written instructions.

1. Maintain containers used in mixing and applying elastomeric coatings in a clean condition, free of foreign materials and residue.

2. Stir materials before application to produce a mixture of uniform density. Stir as required during application. If surface film forms, do not stir film into material. If necessary, remove film and strain coating material before using.
3. If manufacturer permits thinning, use only thinners recommended by manufacturer, and only within recommended limits.

2.8 APPLICATION

A. General: Apply elastomeric coatings according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Colors, surface treatments, and finishes are indicated in coating schedule.
2. Do not paint over conditions detrimental to formation of a durable coating film, such as dirt, rust, scale, grease, moisture, and scuffed surfaces.
3. Provide finish coats compatible with primers used.

B. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

C. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Number of coats and film thickness required are same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
2. If undercoats or other conditions show through final coat, apply additional coats until coating film is of uniform finish, color, and appearance. Ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat does not cause undercoat to lift or lose adhesion.

D. Application Procedures: Apply elastomeric coatings by brush, roller, or spray according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for material being applied.
2. Rollers: Use professional-quality quick-release rollers of carpet, velvet back, or high-pile sheep's wool covers with a 1- to 1-1/4-inch nap as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

E. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness as recommended by manufacturer.
1. Wherever spray application is used, apply each coat to provide equivalent hiding of brush-applied coats. Do not double back with spray equipment, building up film thickness of two coats in one pass.

F. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

G. Prime Coats: If recommended by manufacturer, apply a primer to material being coated before applying finish coats.

H. Brush Application: Brush out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.

I. Roller Application: Keep cover wet at all times; do not dry roll. Work in sections. Lay on required amount of material, working material into grooves and rough areas; then level material, working it into surface.

J. Spray Application: Use spray equipment for application only when permitted by manufacturer's written instructions and authorities having jurisdiction.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or recoat work not complying with specified requirements.

2.9 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during coating operations:

1. Owner will engage a qualified independent testing agency to sample coating material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in presence of Contractor.

2. Testing agency will perform appropriate tests for the following characteristics as required by Owner:
   a. Elongation.
   b. Accelerated weathering.
   c. Low-temperature flexibility.
   d. Moisture-vapor transmission.
   e. Wind-driven rain resistance.
   f. Minimum solids content by volume.

3. Owner may direct Contractor to stop coating application if test results show materials being used do not comply with requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. If necessary, Contractor may be required to remove rejected materials from previously coated surfaces if, on recoating with specified materials, the two coatings are not compatible.

2.10 CLEANING
A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. After completing coating work, clean glass and spattered surfaces. Remove spattered coatings by washing, scraping, or other methods, being careful not to scratch or damage adjacent finished surfaces.

2.11 PROTECTION

A. Protect work of other trades from damage whether being coated or not. Correct damage by cleaning, repairing, replacing, and recoating as approved by Engineer. Leave in an undamaged condition.

B. Provide "Wet Paint" signs to protect newly coated finishes. Remove temporary protective wrappings provided by others to protect their work after completing coating operations.

1. After construction activities of other trades are complete, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

2.12 COATING SCHEDULE

A. Concrete: Provide the following elastomeric coating systems over exterior concrete surfaces:

1. Smooth Elastomeric Finish: Two finish coat(s) over a primer.

   a. Primer: Concrete and masonry primer.
   b. Finish Coats: Smooth elastomeric finish.

END OF SECTION 099653
SECTION 099600

HIGH-PERFORMANCE COATINGS

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 includes surface preparation and field application of high-performance coating systems to items and surfaces scheduled.

B. Related Sections include the following:
   1. Division 8 Section "Hollow Metal Doors and Frames".

1.3 DEFINITIONS

A. Standard coating terms defined in ASTM D 16 apply to this Section.

B. Gloss ranges used in this Section include the following:
   1. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
   2. High gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

C. Environments: The following terms are used in Part 2 of this Section to distinguish between different corrosive exposures:
   1. "Severe environments" are highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation and with frequent cleaning using strong chemicals. Environments with heavy concentrations of strong chemical fumes and frequent splashing and spilling of harsh chemical products are severe environments.

1.4 SUBMITTALS

A. Product Data: For each coating system indicated. Include block fillers and primers.
   1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material specified.

B. Certification by manufacturer that products supplied comply with requirements indicated that limit the amount of VOCs in coating products.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

   1. After color selection, Architect will furnish color chips for surfaces to be coated.

D. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.

   1. Provide stepped Samples defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
   2. List of material and application for each coat of each sample. Label each sample for location and application.
   3. Submit samples on the following substrates for Architect's review of color and texture:
      a. Ferrous and Nonferrous Metal: Provide two 4-inch- (100-mm-) square samples of flat metal and two 8-inch- (200-mm-) long samples of solid metal for each color and finish.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed high-performance coating system applications similar in material and extent to those indicated for Project and whose work has a record of successful in-service performance.

B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.

   1. Architect will select one room, area, or surface to represent surfaces and conditions for application of each type of coating and substrate.
      a. Small Areas and Items: Owner will designate items or areas as required.

   2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface as specified. Provide the required sheen, color, and texture of each surface.

      a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
3. Final approval of colors will be from benchmark samples.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:

1. Name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer’s stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. Handling instructions and precautions.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.7 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F (7 and 35 deg C).

B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.

1.8 EXTRA MATERIALS

A. Furnish extra high-performance coating materials from the same production run as materials applied and in quantities described below. Package coating materials in unopened, factory-sealed containers for storage and identify with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

KUMC CAMBRIDGE GARAGE TOPPING REPAIRS
KANSAS CITY, KS
WALTER P. MOORE PROJECT NO. D08.17003.00

HIGH-PERFORMANCE COATINGS
09960 - 3
A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products indicated in the coating system descriptions.

B. Products: Subject to compliance with requirements, provide one of the products indicated in the coating system descriptions.

C. Manufacturers’ Names: The following manufacturers are referred to in the coating system descriptions by shortened versions of their names shown in parenthesis:

1. Carboline Company (Carboline).
3. ICI Dulux Paints; Devoe Coatings (ICI).
4. International Protective Coatings; Courtaulds Coatings (International).
7. Rust-Oleum Corporation (R-O).
8. Sherwin Williams; Industrial and Marine Coatings (S-W).
10. <Insert manufacturer.>

2.2 COATINGS MATERIALS, GENERAL

A. Material Compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer’s highest grade of the various high-performance coatings specified. Materials not displaying manufacturer’s product identification are not acceptable.

C. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that have a VOC classification of 450 g/L or less.

2.3 COLORS

A. Colors: As selected by Owner from manufacturer’s full range.

2.4 EXTERIOR HIGH-PERFORMANCE COATING SYSTEMS

A. Ferrous Metal: Provide the following finish systems over exterior ferrous-metal surfaces:

1. Severe Environment (High-Gloss Finish): One finish coat over an intermediate coat and a primer.
   a. Primer: Epoxy primer applied at spreading rate recommended by manufacturer.
      3) ICI: Devran 224HS High Build Epoxy.
4) International: Intergard 251 Thin Film Polyamide Epoxy Rust Inhibitive Primer.
5) Moore: M36-00/M37 Polyamide Epoxy Clear Sealer/Finish.
6) PPG: 97-14XX Series Pitt-Guard DTR Polyamide Epoxy Coating.
7) R-O: 9100 System High Performance Epoxy.

b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 8.0 mils (0.076 to 0.203 mm).

1) Carboline: 890 2-Component Epoxy.
5) Tnemec: Series 66 Hi-Build Epoxoline II Polyamide Epoxy.

c. Intermediate Coat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils (0.038 to 0.1.02 mm).

1) ICI: Devthane 369 Aliphatic Urethane Gloss Enamel.
2) Moore: M74/M75 Aliphatic Acrylic Urethane Gloss.

d. Topcoat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils (0.038 to 0.102 mm).

3) ICI: Devthane 369 Aliphatic Urethane Gloss Enamel.
4) International: Interthane 990 Low VOC Thin Film Polyurethane.
5) Moore: M74/M75 Aliphatic Acrylic Urethane Gloss.
8) S-W: Corothane II Gloss B65W400 Series.
9) Tnemec: Series 74 Endura-Shield.

2. Severe Environment (Semigloss Finish): One finish coat over an intermediate coat and a primer.

a. Primer: Epoxy primer applied at spreading rate recommended by manufacturer.

3) ICI: Devran 224HS High Build Epoxy.
4) Moore: M36-00/M37 Polyamide Epoxy Clear Sealer/Finish.
5) PPG: 97-14XX Series Pitt-Guard DTR Polyamide Epoxy Coating.

b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.0 mils (0.076 to 0.127 mm).

1) Carboline: 890 2-Component Epoxy.
4) Tnemec: Series 66 Hi-Build Epoxoline.

1) ICI: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
2) Moore: M73/M75 Aliphatic Acrylic Urethane Semi-Gloss.
3) PPG: 97-84XX Series Pitthane High Build Acrylic-Aliphatic Urethane Enamel.

B. Nonferrous Metal: Provide the following finish systems over exterior nonferrous-metal surfaces:

1. Severe Environment (High-Gloss Finish): One finish coat over an intermediate coat and a primer.

a. Primer: Epoxy primer applied at spreading rate recommended by manufacturer.

1) Carboline: Rustbond Penetrating Sealer SG.
3) ICI: Devran 4170 Corrosion Resistant Epoxy Primer.
4) International: Intergard 251 Thin Film Polyamide Epoxy Rust Inhibitive Primer.
5) Moore: M36-00/M37 Polyamide Epoxy Clear Sealer/Finish.
6) PPG: 97-14XX Series Pitt-Guard DTR Polyamide Epoxy Coating.
7) R-O: 9100 System High Performance Epoxy.

b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 8.0 mils (0.076 to 0.203 mm).

1) Carboline: 890 2-Component Epoxy.
5) Tnemec: Intermediate coat not required.

c. Intermediate Coat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils (0.038 to 0.102 mm).

1) ICI: Devthane 369 Aliphatic Urethane Gloss Enamel.
2) Moore: M74/M75 Aliphatic Acrylic Urethane Gloss.
4) R-O: 9800 System Urethane High Build Mastic Coatings.
5) Tnemec: Intermediate coat not required.

d. Topcoat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils (0.038 to 0.102 mm).

3) ICI: Devthane 369 Aliphatic Urethane Gloss Enamel.
4) International: Interthane 990 Low VOC Thin Film Polyurethane.
5) Moore: M74/M75 Aliphatic Acrylic Urethane Gloss.
7) R-O: 9800 System Urethane High Build Mastic Coatings.
8) S-W: Corothane II Gloss B65W400 Series.
9) Tnemec: Series 74 Endura-Shield.

2. Severe Environment (Semigloss Finish): One finish coat over an intermediate coat and a primer.

a. Primer: Epoxy primer applied at spreading rate recommended by manufacturer.

1) Carboline: Rustbond Penetrating Sealer SG.
3) ICI: Devran 4170 Corrosion Resistant Epoxy Primer.
4) Moore: M36-00/M37 Polyamide Epoxy Clear Sealer/Finish.
5) PPG: 97-14XX Series Pitt-Guard DTR Polyamide Epoxy Coating.
b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 8.0 mils (0.076 to 0.203 mm).

1) Carboiline: 890 2-Component Epoxy.
4) Tnemec: Intermediate coat not required.

c. Intermediate Coat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils (0.038 to 0.102 mm).

1) ICI: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
2) Moore: M73/M75 Aliphatic Acrylic Urethane Semi-Gloss.
3) PPG: 97-84XX Series Pitthane High Build Acrylic-Aliphatic Urethane Enamel.
4) Tnemec: Intermediate coat not required.

d. Topcoat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils (0.038 to 0.102 mm).

1) Carboiline: Carboiline 133 HB Aliphatic Polyurethane.
3) ICI: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
4) Moore: M73/M75 Aliphatic Acrylic Urethane Semi-Gloss.
5) PPG: 97-84XX Series Pitthane High Build Acrylic-Aliphatic Urethane Enamel.
6) S-W: Corothane II Satin B65W200 Series.
7) Tnemec: Series 75 Endura-Shield.

PART 3 - EXECUTION

3.1 EXAMINATION

A. With Applicator present, examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.

1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.
2. Start of application is construed as Applicator's acceptance of surfaces within that particular area.

B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.

1. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
3.2 PREPARATION

A. General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.

1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

B. Cleaning: Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.

C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for each substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove primers and reprime substrate.

2. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
   a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

3. Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
   a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 10/NACE No. 2.
   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.

4. Nonferrous-Metal Substrates: Clean nonferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.
a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
3. Use only the type of thinners approved by manufacturer and only within recommended limits.

E. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply high-performance coatings according to manufacturer's written instructions.

1. Use applicators and techniques best suited for the material being applied.
2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
3. Coating colors, surface treatments, and finishes are indicated in the coating system descriptions.
4. Provide finish coats compatible with primers used.
5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.

b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required is the same regardless of application method.

a. Omit primer on metal surfaces that have been shop primed and touchup painted.

b. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.

c. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.

d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or
feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.

2. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.

C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.
   a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
   b. Brush out and work brush coats into surfaces in an even film.
   c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required.

3. Spray Equipment: Use mechanical methods to apply coating if permitted by manufacturer's written instructions and governing regulations.
   a. Use spray equipment with orifice size recommended by manufacturer for material and texture required.
   b. Apply each coat to provide the equivalent hiding of brush-applied coats.
   c. Do not double back with spray equipment building-up film thickness of two coats in one pass, unless recommended by manufacturer.

D. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

F. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.
   1. Reccoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.

G. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:
1. Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.

2. Testing agency will perform appropriate tests for the following characteristics as required by Owner:
   a. Quantitative materials analysis.
   b. Absorption.
   c. Accelerated weathering.
   d. Accelerated yellowness.
   e. Color retention.
   f. Alkali and mildew resistance.
   g. Abrasion resistance.
   h. Apparent reflectivity.
   i. Washability.
   j. Dry opacity.
   k. Recoating.
   l. Skinning.

3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. If necessary, Contractor may be required to remove rejected materials from previously coated surfaces if, on recoating with specified materials, the two coatings are not compatible.

3.5 CLEANING

A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

   1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

   1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
   2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

END OF SECTION 099600
SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS
A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS
A. Field quality-control test reports.

1.4 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES
A. Copper Conductors: Comply with NEMA WC 70.
B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.
C. Multiconductor Cable: Comply with NEMA WC 70 for nonmetallic-sheathed cable, Type NM with ground wire.

2.2 CONNECTORS AND SPLICES
A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. AFC Cable Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.

B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

C. Branch Circuits Concealed Below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test Reports: Prepare a typed report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

E. Provide a copy of the Meg readings of all electrical cables to design professional for review and comment. If any current leakage is found from the Meg reading, it must be corrected.

END OF SECTION 260519
SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Grounding systems and equipment.

1.2 ACTION SUBMITTALS
A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS
A. Field quality-control reports.

1.4 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS
A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
   6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
   1. Pipe Connectors: Clamp type, sized for pipe.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install barecopper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. Armored and metal-clad cable runs.

B. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.
B. Excessive Ground Resistance: If resistance to ground exceeds 5 ohms, notify Design Professional promptly and include recommendations to reduce ground resistance.
SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Hangers and supports for electrical equipment and systems.

1.2 PERFORMANCE REQUIREMENTS

A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

B. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 ACTION SUBMITTALS

A. Product Data: For steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze hangers. Include Product Data for components.
   2. Steel slotted channel systems. Include Product Data for components.
   3. Equipment supports.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.
PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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

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

   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

6. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non- armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

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

      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
2. Mechanical-Expansion Anchors: Insert-wedge-type, steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.
3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529
SECTION 260533
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal conduits, tubing, and fittings.
   2. Nonmetal conduits, tubing, and fittings.
   3. Metal wireways and auxiliary gutters.
   4. Nonmetal wireways and auxiliary gutters.
   5. Surface raceways.

1.2 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
   1. Structural members in paths of conduit groups with common supports.
   2. HVAC and plumbing items and Design Professionalural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. IMC: Comply with ANSI C80.6 and UL 1242.

D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
   1. Comply with NEMA RN 1.
   2. Coating Thickness: 0.040 inch, minimum.
E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
   2. Fittings for GRC, IMC, EMT:
      a. Material: Steel.
      b. Type: Compression. Set screw type fittings shall not be allowed.
   3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
   4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

I. Joint Compound for IMC, or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. LFNC: Comply with UL 1660.

D. Continuous HDPE: Comply with UL 651B.

E. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

F. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

G. Fittings for LFNC: Comply with UL 514B.

H. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

I. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.”

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R unless otherwise indicated, and sized according to NFPA 70.
   1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

J. Gangable boxes are allowed.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed Conduit: GRC.
   2. Concealed Conduit, Aboveground: EMT.
   3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Minimum Raceway Size: 1/2-inch trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
   4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Aluminum conduits shall not be allowed.

E. Install surface raceways only when recessed is not possible.

F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.
3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches of enclosures to which attached.

H. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

N. Surface Raceways:
   1. Install surface raceway with a minimum 2-inch radius control at bend points.
   2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
O. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

P. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

Q. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
   d. Attics: 135 deg F temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

R. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

S. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

T. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

U. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

V. Locate boxes so that cover or plate will not span different building finishes.

W. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

X. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
Y. Set metal floor boxes level and flush with finished floor surface.

Z. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533
SECTION 260544

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
   2. Sleeve-seal systems.
   5. Silicone sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:
   1. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:
   2. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
      b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Advance Products & Systems, Inc.
   b. CALPICO, Inc.
   c. Metraflex Company (The).
   d. Pipeline Seal and Insulator, Inc.
   e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Carbon steel.

4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

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

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.


C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2. Sealant shall have VOC content less than when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services’ "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
   
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      
      a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
      
      b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

   2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
   3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
   4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
   5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Identification for raceways.
   2. Identification of power and control cables.
   3. Identification for conductors.
   4. Equipment identification labels.
   5. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.
B. Comply with NFPA 70.
D. Comply with ANSI Z535.4 for safety signs and labels.
E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
B. Colors for Raceways Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage.
C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.5 FLOOR MARKING TAPE

A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Screwed in with two screws minimum, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service conductors.

   a. Color shall be factory applied.
   b. Colors for 208/120-V Circuits:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

d. 480/277V per NEC.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.

2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
   a. Power transfer switches.
   b. Controls with external control power connections.

I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553
SECTION 265600
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Exterior luminaires with lamps and ballasts.
   2. LED lighting

1.2 ACTION SUBMITTALS
A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.
B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.3 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES
A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
   1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
   2. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.
   3. LED fixtures shall meet latest applicable testing standards.
B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

K. Luminaire Finish: Manufacturer’s paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

2.3 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

2.4 LED Light Fixtures

A. UL listed and ARRA compliant. Include the following features unless otherwise indicated:

B. 1. LED color temperature 4,000 K.
2. Entire fixture and LED system 50,000 hour rated.
3. Full cutoff. No lumens above 90 degrees.
4. Effective Projected Area (EPA) of light fixture shall be 1.5 sq ft or less.
5. Aluminum housing with powder coat paint.
6. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
7. Normal Ambient Operating Temperature: 104 deg F (40 deg C).

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.
B. Fasten luminaire to indicated structural supports.
   1. Use fastening methods and materials selected to resist seismic forces defined for the
      application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming.

3.2 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a
dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In
concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic
tape applied with a 50 percent overlap.

3.3 GROUNDING

A. Ground metal poles and support structures according to Section 260526 "Grounding and
   Bonding for Electrical Systems."
   1. Install grounding electrode for each pole unless otherwise indicated.
   2. Install grounding conductor pigtail in the base for connecting luminaire to grounding
      system.

B. Ground nonmetallic poles and support structures according to Section 260526 "Grounding and
   Bonding for Electrical Systems."
   1. Install grounding electrode for each pole.
   2. Install grounding conductor and conductor protector.
   3. Ground metallic components of pole accessories and foundations.

END OF SECTION 265600