PROJECT MANUAL

Queens College - Steam PRV and Tunnel Repair

Project #: 21-003368

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The City University of New York
Queens College

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SECTION 011200 - CONTRACT SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and Individual Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a summary of each Contract for the Project, including responsibilities for coordination and temporary facilities and controls.

B. Specific requirements for the work of each Contract are also indicated in individual Specification Sections and on Drawings for each Contract.

C. Related Sections:
1. Section 013100 - Project Management and Coordination.
2. Section 013200 - Construction Progress Documentation.
3. Section 015000 - Temporary Facilities and Controls.

1.3 CONTRACTOR'S PROJECT MANAGER

A. Contractor and each Sub-contractor shall identify a project manager who shall be responsible for coordination between and among each and all contractors and subcontractors for the Project and the Owner.

1.4 COORDINATION ACTIVITIES

A. Coordination activities of Contractor's project manager include, but are not limited to, the following:
1. Provide overall coordination of the Work.
2. Coordinate use of access shared with other contractors to workspaces and workspaces shared with other contractors.
3. Coordinate product selections for compatibility with either product selected under this Contract and under other contracts for the Project. Identify to Owner and Design Professional incompatibilities between products selected under this Contract and products selected under other contracts for the Project.
4. Provide overall coordination of temporary facilities and controls.
5. Coordinate, schedule, and approve interruptions of permanent and temporary utilities, including those necessary to make connections for temporary services.

6. Coordinate construction and operations of the Work with work performed by each other separate Contract for the Project and the Owner's construction forces.
7. Prepare Coordinated Composite Drawings, in collaboration with each other contractor for the Project, to coordinate the work of the contracts for the Project.
8. Coordinate sequencing and scheduling of the Work. Include the following:
   a. Initial Coordination Meeting: At earliest possible date, the Owner will arrange and conduct a meeting with all contractors for the Project for sequencing and coordinating the work of the Project.
9. Provide quality assurance and quality control services specified in Section 014000 – Quality and Code Requirements.
10. Coordinate sequence of activities to accommodate tests and inspections, and coordinate schedule of tests and inspections.
11. Provide information necessary to adjust, move, or relocate existing utility structures affected by construction.
12. Provide progress cleaning of all Contract work areas and coordinate progress cleaning of areas or pieces of equipment where more than one contractor has worked.
13. Coordinate cutting and patching.
14. Coordinate protection of the Work.
15. Coordinate firestopping.
16. Coordinate completion of punch list items.
17. Coordinate preparation of As-built drawings and specifications.
18. Print and submit all required project turnover documents.
19. Coordinate preparation of operation and maintenance manuals.
20. Responsibilities of project manager for construction contract includes coordination for temporary facilities and controls, include, but are not limited to, the following:
21. Provide common-use field office for use by all personnel engaged in construction activities.
22. Provide telephone service for common-use facilities.

1.5 GENERAL REQUIREMENTS OF CONTRACTS

A. Extent of Contract: Requirements indicated on drawings and in specification sections determine which Contract includes a specific element of the Work of the Contract.
   1. The work described in this section for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the respective contract documents.
   2. Trenches and other excavation for the work of each contract shall be the work of such contract.
   3. Blocking, backing panels, sleeves, and metal fabrication supports for the work of each contract shall be the work of such Contract.
   4. Furnishing of access panels for the work of each contract shall be the work of such Contract. Installation of access panels located in the substrate of ceilings, walls and floors shall be the work of the construction contract.
   5. Equipment pads for the work of each contract shall be the work of such contract.
   6.
   7. Painting for the work of each contract shall be the work of such contract.

8. Cutting and Patching: Each contract shall perform its own cutting and patching.
9. Firestopping for the work of each contract shall be provided by such contract.

B. Redundant with Section 13200 Substitutions: Each contractor's project manager shall cooperate with all other contractor's project managers involved to coordinate approved substitutions with remainder of the work of the Project.

C. Temporary Facilities and Controls: In addition to specific responsibilities for temporary facilities and controls indicated in this Section and in Section 015000 - Temporary Facilities and Controls, Contractor is responsible for the following:
1. Installation, operation, maintenance, and removal of each temporary facility necessary for its own normal construction activity, and costs and use charges associated with each facility, except as otherwise provided for in this Section 011200.
2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
3. Its own field office complete with necessary furniture, utilities, and telephone service.
4. Its own storage and fabrication sheds.
5. Temporary enclosures for its own construction activities.
6. Staging and scaffolding for its own construction activities.
7. General hoisting facilities for its own construction activities.
8. Waste disposal facilities, including collection and legal disposal of its own hazardous, dangerous, unsanitary, or other harmful waste materials.
9. Progress cleaning of work areas affected by its operations on a daily basis.
10. Secure lockup of its own tools, materials, and equipment.
11. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.

1.6 GENERAL CONSTRUCTION

A. Work in the General Construction includes, but is not limited to, the following:
1. Remaining work not identified as work under other contracts.
2. Site preparation, including clearing, building demolition and relocations, and earthwork.
3. Site improvements, including roadways, parking lots, pedestrian paving, site development furnishings and equipment, and landscaping.
4. Site storm drainage.
5. Tunnels for site utilities.
6. Selective demolition.
7. Foundations, including footings, foundation walls.
8. Slabs-on-grade, including earthwork, subdrainage systems, and insulation.
9. Below-grade building construction, including excavation, backfill, and thermal and moisture protection.
10. Roofing, including coverings, flashings roof specialties and glazed openings.
11. Stairs, including railings and finishes.
12. Equipment, including the following:
    a. Stage equipment.

B. Temporary facilities and controls in the General Construction Contract include, but are not limited to, the following:
   1. Temporary facilities and controls that are not otherwise specifically assigned to other contracts.
   2. Sediment and erosion control.
   3. Unpiped sewers and drainage, including drainage ditches, dry wells, stabilization ponds, and containers.
   4. Stormwater control.
   5. Unpiped temporary toilet fixtures, wash facilities, and drinking water facilities, including disposable supplies.
   6. Temporary enclosure for building exterior.
   7. Temporary roads and paved areas.
   8. Dewatering facilities and drains.
   9. Excavation support and protection for the Work of the contract.
   10. Project identification and temporary signs.
   11. General waste disposal facilities.
   12. Pest control.
   13. Temporary stairs.
   14. Temporary fire-protection facilities.
   15. Barricades, warning signs, and lights.
   16. Site enclosure fence.
   17. Covered walkways.
   18. Security enclosure and lockup.
   19. Environmental protection.
   20. Restoration of Owner's existing facilities used as temporary facilities.
   21. Temporary heating, cooling, and ventilation for General Construction Contract Work before weathertight enclosure of building is complete.
   22. Temporary heating, cooling, and ventilation after permanent enclosure of building is complete.

1.7 PLUMBING WORK

A. Work in the Plumbing Work includes, but is not limited to, the following:
   1. Storm water drainage.
   2. Plumbing connections to equipment furnished by all other contracts.

1.8 HVAC WORK

A. Work in the HVAC Work includes, but is not limited to, the following:
   1. Site steam distribution.
   2. HVAC systems and equipment.
   3. HVAC instrumentation and controls.
   4. HVAC testing, adjusting, and balancing.
   5. Building automation system.
   6. Mechanical connections to equipment furnished by all other contracts.

1.9 ELECTRICAL WORK

A. Work in the Electrical Work includes, but is not limited to, the following:
   1. Electrical service and distribution.
   2. Electrical connections to equipment furnished by all other contracts.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011200

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and Individual Specification Sections, Notice to Proceed and Allowance Allocation Form apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.
   1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor.

B. Types of allowances include the following:
   1. Procurement Exemption (Lump-sum) allowances.
   2. Quantity of Work (Unit-cost) allowances.
   3. Quantity of Funds (Contingency) allowances.

C. Related Sections:
   1. General Conditions, Article 7 – Changes in the Work.
   2. General Conditions, Article 8 – Payment.
   3. Section 012900 – Payment Procedures.
   4. Section 013300 – Submittal Procedure.
   5. Individual Specification Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise the Owner of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At the Owner's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by the Design Professional from the designated supplier.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

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

1.5 COORDINATION

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

B. The Contractor shall include the dollar value of each scheduled allowance number as a separate line item in the Schedule of Values and identify each allowance with Section number 012100.

C. The Owner shall provide the Contractor with the Notice to Proceed, and request the Contractor to sign an Allowance Allocation form, prior to proceeding with the Work of an allowance.

1.6 PAYMENT

A. Refer to Section 012900 – Payment Procedures, for processing an Application for Payment.

B. The Contractor shall include a copy of the approved Allowance Allocation form issued by the Owner, with the Application for Payment, for payment of lump sum or unit cost allowance work.

C. The Contractor shall complete and provide an Allowance Allocation form, provided by the Owner, and supporting documentation in accordance with General Conditions, Article 7 – Changes in the Work for payment of a contingency allowance.

1.7 LUMP-SUM AND QUANTITY OF WORK [UNIT-COST] ALLOWANCES

A. Allowance shall include cost to the Contractor of specific products and materials ordered by the Owner or selected by the Design Professional under allowance and shall include taxes, freight, and delivery to the Project site.

B. The Contractor's costs for receiving and handling at the Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by the Owner selected by

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

1.8 QUANTITY OF FUNDS [CONTINGENCY] ALLOWANCES

A. Use the quantity of funds [contingency] allowance only as directed by the Owner for the Owner's purposes and only by Change Orders in accordance with General Conditions, Article 7 – Changes in the Work that indicate amounts to be charged to the allowance.

B. The Contractor's overhead, profit, and related costs for products and equipment ordered by the Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and overhead and profit margins in accordance with General Conditions, Article 7.

D. At Project closeout, the unused amounts remaining in the contingency allowance shall be credited to the Owner by Change Order.

1.9 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts and scope of Work, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   1. Include installation costs in purchase amount only where indicated as part of the allowance.
   2. If requested, prepare an explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
   3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
   4. The Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
   5. No change to the Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Quantity Allowance: Include 2000 cu. yd. (1529 cu. m) of unsatisfactory soil excavation and disposal off-site and replacement with satisfactory soil material from off-site, as specified in Section 312000 "Earth Moving."
   1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."

B. Allowance No. 2: Quantity Allowance: Include 1000 cu. yd. (765 cu. m) of rock removal and replacement with satisfactory soil material, as specified in Section 312000 "Earth Moving."
   1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."

C. Allowance No. 6: Contingency Allowance: Include a contingency allowance of $100,000.00 for use according to Owner's written instructions.

D. Allowance No. 7: Testing and Inspection Allowance: Include the sum of $1,000.00 for testing concrete to be provided by Owner as specified in Section 033000 "Cast-in-Place Concrete."

END OF SECTION 012100

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and Individual Specification Sections, Schedule of Values, Contractor Pencil Copy and Application for Payment, apply to this Section.

1.2 SUMMARY

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

B. Related Sections:
1. General Conditions, Article 8 - Payment, for requirements governing provisions for payment.
2. General Conditions, Article 20 – Opportunity Programs, for requirements governing minority participation.
3. Section 012100 – Allowances, for procedural requirements governing the handling and processing of allowances.
4. Section 017700 – Contract Closeout Requirements, for administrative contract closeout requirements.

1.3 DEFINITIONS

A. Schedule of Values: A form in the Contract Documents, which establishes minimum level of payment detail to formulate an initial Application for Payment.

B. Contractor’s Pencil Copy: A form provided by the Owner, which estimates a billing request from the Contractor. When approved by the Owner, formulates the Application for Payment.

C. Application for Payment: A form provided by the Owner, which provides certification by the Contractor for payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with the Owner.

B. The Contractor shall allocate portions of the Contract Sum to labor, material and major equipment costs to various portions of the Work as indicated on the form.

1. Submit the Schedule of Values to the Owner, for approval at earliest possible date after award of the Contract.
2. The Owner shall not approve any billing request until the Schedule of Values is approved.

C. Format and Content: Use model form provided in Contract Documents as a guide to establish line items for the Schedule of Values.
1. Arrange the Schedule of Values with separate columns to indicate the following for each item listed:
   a. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
      1) Labor.
      2) Materials.
      3) Major Equipment.
2. Provide a breakdown of Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of Contract Sum.
   a. Include separate line items under Contractor and principal subcontracts for LEED documentation, if applicable and other project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
3. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
4. Allowances: If applicable, provide a separate line item in the schedule of values for each allowance.
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, except Lump Sum and Quantity of Work Allowances.
6. Schedule of Values Updating: The Owner may require the Contractor to revise its Schedule of Values. Further, the Owner reserves the right to accept only those cost distributions which, in the Owner's opinion, are reasonable, equitably balanced and correspond to estimated quantities in Contract Documents.

1.5 MONTHLY APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as approved by the Owner and paid for by the Owner.
1. Initial Application for Payment, the Owner shall not approve any billing request until the Schedule of Values and Construction Schedule is approved.
2. Payment for allowance items and stored materials involve additional requirements.
3. Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: Billing request may be submitted to the Owner once each month.
1. Submit Contractor’s Pencil Copy billing request seven days prior to due date for review by the Owner.

C. Payment Forms: All forms and documents required for payment shall be provided by the Owner. Template forms and documents may also be available on the Dormitory Authority's web site www.dasny.org.

D. Preliminary Procedure: The Contractor may request from the Owner a Contractor's Pencil Copy form. Where indicated on the form, the Contractor shall enter a billing request, either dollar amount or percentage complete for each item number requesting payment.
   1. If applicable, the Contractor shall obtain from the Owner, an Allowance Notice to Proceed for Allowance items and an Agreement for Materials Stored Off-Site prior to billing.
   2. Submit Contractor's Pencil Copy billing request to the Owner for approval.
   3. The Contractor shall provide updated documentation to the Owner in accordance with General Conditions, Article 20 – Opportunity Programs.

E. Procedure: Upon the Owner's approval of the Contractor's Pencil Copy billing request, payment documents will be provided to the Contractor. The Contractor shall complete each document and submit two copies of all documents with original signature & notary where indicated on forms, the following:
   1. Application for Payment.
   2. Compliance Report.
   3. Contractor and Subcontractor Certifications Form
   4. Contractor's Certified Payroll Form.
   5. Allowance Allocation Form, if applicable

F. Payroll Forms: The Contractor and all Sub-contractors to the Contractor shall submit original copies of the Contractor and Subcontractor Certifications Form and Contractor's Certified Payroll Form.

G. Transmittal: Sign and notarize where indicated on each document, submit two original copies to Owner.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about payment.

H. Stored Materials: The Owner will provide an Agreement for Materials Stored Off-Site and specific forms that the Contractor must complete and submit to the Owner, including but not limited to;
   1. Include in the Contractor's Pencil Copy billing request amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed.
   2. Differentiate between items stored on-site and items stored off-site.
   3. Provide certificate of insurance, evidence of transfer of title to the Owner, and consent of surety to payment, for stored materials.
   4. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
   5. Provide summary documentation for stored materials indicating the following:
      a. Materials previously stored and included in previous Applications for Payment.
      b. Work completed for this Application utilizing previously stored materials.

c. Additional materials stored with this Application.
d. Total materials remaining stored, including materials with this Application.

I. Payment: Timely payment by the Owner to the Contractor is governed by Section 2880 of the Public Authorities Law.

J. Liens: Upon receipt of a lien, the Owner shall deduct a sum of one and one-half (1 ½) times the amount stated to be due in the notice of lien from the application for payment. Upon official receipt of discharge of lien, the Owner shall provide payment as stated above.

1.6 APPLICATION FOR PAYMENT AT SUBSTANTIAL COMPLETION

A. Preliminary Procedure: After issuance of the executed Notice of Substantial Completion, submit a Contractor's Pencil Copy billing request showing 100 percent completion for portion of the Work claimed as complete at Substantial Completion.
1. Submit Contractor's Pencil Copy billing request to the Owner for approval.
2. The Contractor shall provide final documentation to the Owner in accordance with General Conditions, Article 20 – Opportunity Programs.

B. Reduction of Retainage: The Contractor may request a reduction of retainage upon Substantial Completion of the Work or when a phase of Work is accepted by the Owner.
1. The Contractor submits to the Owner a written request to have retainage reduced and provides a cost estimate and schedule to complete all remaining Work items indicated on the executed Notice of Substantial Completion.
2. The Owner shall deduct from the sum two times the value of remaining items of Work to be completed or corrected.
3. The Owner will provide the Contractor with General Release and Consent of Surety forms based on the amount of reduction. The Contractor shall complete each document and submit three copies of each document with original signature & notary where indicated on forms.
4. The Owner shall hold payment until receipt of completed General Release and Consent of Surety forms.

C. Procedures: Upon the Owner approval of Contractor's Pencil Copy billing request, payment documents will be provided to the Contractor. The Contractor shall complete each document and submit two copies of all documents with original signature & notary where indicated on forms, the following:
1.
2. Application for Payment.
3. Compliance Report.
4. Contractor and Subcontractor Certifications Form
5. Contractor's Certified Payroll Form.

D. Payroll Forms: The Contractor and all Sub-contractors to the Contractor shall submit original copies of the Contractor and Subcontractor Certifications Form and Contractor's Certified Payroll Form.

E. Transmittal: Sign and notarize where indicated on each document, submit two original copies to Owner.

F. Payment: Timely payment by the Owner to the Contractor is governed by Section 2880 of the Public Authorities Law.

G. Liens: Upon receipt of a lien, the Owner shall deduct a sum of one and one-half (1 ½) times the amount stated to be due in the notice of lien from the application for payment. Upon official receipt of discharge of lien, the Owner shall provide payment as stated above.

1.7 FINAL APPLICATION FOR PAYMENT (same as contract closeout documents)

A. Contract Compliance: The Contractor shall comply with the Requirements of General Conditions, Section 10.08 – Limitations on Actions.

B. Preliminary Procedure: All Work and Extra Work of the Contract and all requirements of Section 017700 – Contract Closeout Requirements must be complete and approved prior to commencement of final Application for Payment.
1.
2. The Contractor shall request and submit to the Owner a final Contractor's Pencil Copy that will formulate the final Application for Payment.
3. The Contractor shall provide outstanding documentation to the Owner in accordance with General Conditions, Article 20 – Opportunity Programs.

C. Procedures: Upon the Owner approval of Contractor's Pencil Copy billing request, final Application for Payment and Contract closeout documents will be provided to the Contractor. The Contractor shall complete each document and submit two copies of all documents with original signature & notary, where indicated on the forms, the following:
1.
2. Final Application for Payment including remaining Retainage.
3. Final Compliance Report.
4. Contractor and Subcontractor Certifications Form
5. Contractor's Certified Payroll Form.
6. Release Form -- Final Payment to Contractor.
7. Consent of Surety -- Final Payment to Contractor, with power of attorney.

D. Payroll Forms: The Contractor and all Sub-contractors to the Contractor shall submit original copies of the Contractor and Subcontractor Certifications Form and Contractor's Certified Payroll Form.

E. Transmittal: Sign and notarize where indicated on each document, submit two original copies to the Owner.

F. Final Payment: Timely payment by the Owner to the Contractor is governed by Section 2880 of the Public Authorities Law.

G. Liens: Upon receipt of a lien, the Owner shall deduct a sum of one and one-half (1 ½) times the amount stated to be due in the notice of lien from the final application for payment. Upon official receipt of discharge of lien, the Owner shall provide final payment as stated above.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and individual Specification Sections and Contract Manager, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on the Project including, but not limited to, the following:
   1. General project coordination procedures.
   2. Administrative and supervisory personnel.
   3. Coordination drawings.
   4. Requests for Information (RFIs).
   5. Contract Manager software site.
   6. Project meetings.

B. Each contractor shall participate in coordination requirements. Refer to Section 011200 – Contract Summary of Work for certain areas of responsibility that are assigned to a specific contractor.

C. Related Sections:
   1. Section 011200 - Contract Summary of Work, for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
   2. Section 013200 - Project Scheduling and Progress Documentation, for preparing and submitting Contractor's construction schedule.
   3. Section 017700 – Contract Closeout Requirements, for coordinating closeout of the Contract.
   4. Section 019113 - General Commissioning Requirements, for coordinating the Work with Owner's commissioning authority.

1.3 DEFINITIONS

A. RFI: Request from the Owner, Design Professional, or Contractor seeking information from each other during construction.

1.4 COORDINATION

A. 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. Coordination of the Owner's P6 Project Management CPM schedule.
2. Coordination of the commissioning process and activities.
3. Preparation of the schedule of values.
4. Entering dates each required submission item listed on the Contractor's Submission Schedule will be submitted, coordinated with the CPM Schedule.
5. Installation and removal of temporary facilities and controls.
6. Delivery and processing of submittals.
7. Progress meetings.
8. Preinstallation conferences.
9. Project closeout activities.
10. Startup and adjustment of systems.

B. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1.5 COORDINATED COMPOSITE DRAWINGS

A. Coordinated Composite Drawings, General: Prepare coordinated composite drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordinated composite drawings on standard printed data. Include the following information, as applicable:
    a. Use applicable Drawings as a basis for preparation of coordinated composite drawings. Prepare sections, elevations, and details as needed to describe the relationship of various systems and components.
    b. Coordinate the addition of trade-specific information to the coordinated composite drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    e. Show location and size of access doors required for access to concealed dampers, valves, and other controls, including space required opening the access door.
    f. Indicate required installation sequences.
    g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to the Design Professional indicating

proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordinated Composite Drawing Organization: Organize drawings as follows:
   1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
   2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on the Drawings. Indicate areas of conflict between light fixtures and other components.
   3. Mechanical Rooms: Provide coordinated composite drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
   4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
   5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
   6. Mechanical and Plumbing Work: Show the following:
      a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
      b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   7. Electrical Work: Show the following:
      a. Runs of vertical and horizontal conduit 1-1/4 inch diameter and larger.
   8. Review: The Design Professional will review coordinated composite drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Design Professional determines that the coordinated composite drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Design Professional will so inform the Contractor, who shall make changes as directed and resubmit.

C. Coordination Digital Data Files: Prepare coordination digital data files in accordance with the following requirements:
   1. File Preparation Format: The Contractor shall coordinate with the Design Professional and use the same digital data software program, version, and operating system as the original Drawings.

1.6 KEY PERSONNEL

A. Key Personnel Names: Within 15 days after receipt of the Notice to Proceed, submit a list of key personnel assignments with resume and job qualifications, including project manager, project scheduler, commissioning agent, superintendent and other personnel in attendance at the Project site. Identify individuals and their duties and responsibilities; list addresses and

telephone numbers, including home, office, and cellular telephone numbers, and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to the Project.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, the Contractor shall prepare and submit an RFI in the form specified.
   1. Coordinate and submit RFIs in a prompt manner so as to avoid delays in the Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Project number.
   3. Date.
   4. Name of Contractor.
   5. Name of Design Professional.
   6. RFI number, numbered sequentially.
   7. RFI subject.
   8. Specification Section number and title and related paragraphs, as appropriate.
   9. Drawing number and detail references, as appropriate.
   10. Field dimensions and conditions, as appropriate.
   11. Contractor's suggested resolution. If Contractor's solution(s) impacts the date of Substantial Completion or the Contract Sum, Contractor shall state impact in the RFI.
   12. Contractor's signature.
   13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
      a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: The Owner’s Contract Manager-generated form with substantially the same content as indicated above.

D. Design Professional’s Action: The Design Professional will review each RFI, determine action required, and respond. Allow a reasonable amount of working days for the Design Professional’s response for each RFI. RFIs received by the Design Professional after 1:00 p.m. will be considered as received the following working day.
   1. The following RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for coordination information already indicated in the Contract Documents.
      d. Requests for adjustments in the date for Substantial Completion or the Contract Sum.

e. Requests for interpretation of the Design Professional's actions on submittals.
f. Incomplete RFIs or inaccurately prepared RFIs.

2. The Design Professional's action may include a request for additional information, in which case the Design Professional's time for response will date from time of receipt of additional information.
3. The Design Professional's action on RFIs that may result in a change to the date of Substantial Completion or the Contract Sum may be eligible for the Contractor to submit a Claim in accordance with procedures in General Conditions, Article 10 – Claims and Disputes.
   a. If the Contractor believes the RFI response warrants change in the date of Substantial Completion or the Contract Sum, notify the Owner in writing within fifteen (15) days of receipt of the RFI response.

E. On receipt of the Design Professional's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify the Owner and Design Professional within five days if the Contractor disagrees with response.

F. RFI Log: Coordinate and cooperate with the Owner to prepare, update and maintain the use of the Contract Manager RFI log. The RFI log will include not less than the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Design Professional.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Design Professional's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 CONTRACT MANAGER SOFTWARE SITE

A. Coordinate and cooperate with the Owner for managing project communication and documentation until Contract Closeout. The Contract Manager software site may include, but is not limited to, the following functions:
1. Project directory.
2. Project correspondence.
3. Meeting minutes.
4. Contract modifications forms and logs.
5. RFI forms and logs.
6. Task and issue management.
7. Submittals forms and logs.
8. Payment application forms.
9. Online document collaboration.
10. Reminder and tracking functions.

11. Archiving functions.

1.9 PROJECT MEETINGS

A. General: The Owner and/or Design Professional will schedule and conduct meetings at the Project site, unless otherwise indicated.
   1. Attendees: The Owner and/or Design Professional will inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
   2. Agenda: The Owner and/or Design Professional will prepare the meeting agenda through the use of the Owner's Contract Manager software and distribute the agenda to all invited attendees.
   3. Minutes: The Owner and/or Design Professional will record significant discussions and agreements achieved in Contract Manager and distribute the meeting minutes to everyone concerned.

B. Construction Kick-off Meeting: The Owner will schedule and conduct a construction kick-off meeting before starting construction, at a time convenient to the Owner and Design Professional, upon issuance of the Notice to Proceed.
   1. The meeting shall review responsibilities and personnel assignments.
   2. Attendees: The Owner, Owner's Commissioning Authority, Design Professional, and their consultants; the Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the meeting shall be familiar with the Project and authorized to make binding decisions on matters relating to the Work.
   3. Agenda: The meeting agenda will include items of significance that could affect progress, including the following:
      a. Tentative construction schedule.
      b. Phasing.
      c. Critical work sequencing and long-lead items.
      d. Designation of key personnel and their duties.
      e. Lines of communications.
      f. Procedures for processing field decisions and Change Orders.
      g. Procedures for RFIs.
      h. Procedures for testing and inspecting.
      i. Procedures for processing Applications for Payment.
      j. Distribution of the Contract Documents.
      k. Submittal procedures.
      l. Sustainable design requirements.
      m. Preparation of As-builts and turnover documents.
      n. Use of the premises.
      o. Work restrictions.
      p. Working hours.
      q. Owner's occupancy requirements.
      r. Responsibility for temporary facilities and controls.
      s. Procedures for moisture and mold control.
      t. Procedures for disruptions and shutdowns.

u. Construction waste management and recycling.
v. Parking availability.
w. Office, work, and storage areas.
x. Equipment deliveries and priorities.
y. First aid.
z. Security.
aa. Progress cleaning.
bb. Safety.

4. Minutes: The Owner and/or Design Professional will use Contract Manager to record and distribute meeting minutes.

C. Progress Meetings: The Owner will conduct progress meetings at regular intervals.
1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: The Owner's Commissioning Authority, and Design Professional, 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 meeting shall be familiar with the Project and authorized to make binding decisions on matters relating to the Work.
3. 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 the Project.
a. The Project Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to the 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.
1) Review schedule for next scheduled progress meeting period.
b. Review present and future needs of each entity present, including the following:
1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

4. Minutes: The Owner and/or Design Professional entity responsible for conducting the meeting will use Contract Manager to record and distribute the meeting minutes to each party present and to parties requiring information.
    a. Schedule Updating: Coordinate with the Owner to revise the Project Schedule after each progress meeting where revisions to the schedule have been made or recognized. The Owner will issue revised schedule concurrently with the report of each meeting.

D. Preinstallation Meetings: The Owner may conduct preinstallation meetings at the Project site before each construction activity that requires coordination with other construction and major assemblies of the Work requiring tight control and coordination.
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. The Owner to advise the Contractor, Design Professional and Owner's Commissioning Authority 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:
    a. Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.
    i. Possible conflicts.
    j. Compatibility problems.
    k. Time schedules.
    l. Weather limitations.
    m. Manufacturer's written recommendations.
    n. Warranty requirements.
    o. Compatibility of materials.
    p. Acceptability of substrates.
    q. Temporary facilities and controls.
    r. Space and access limitations.
    s. Regulations of authorities having jurisdiction.
    t. Testing and inspecting requirements.
    u. Installation procedures.
    v. Coordination with other work.
    w. Required performance results.
    x. Protection of adjacent work.
    y. Protection of construction and personnel.
3. The Owner and/or Design Professional will use Contract Manager to record significant meeting discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: The Owner and/or Design Professional will distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the meeting cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the meeting at earliest feasible date.

E. Project Closeout Conference: The Owner may schedule and conduct a Project closeout conference, at a time convenient to the Owner and Design Professional, but no later than sixty (60) days prior to the scheduled inspection date for Substantial Completion.
1. The Owner will conduct the conference to review requirements and responsibilities related to the Project closeout.
2. Attendees: The Owner, Owner's Commissioning Authority, Design Professional, and their consultants; the Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with the Project and authorized to make binding decisions on matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay the Project closeout, including the following:
    a. Submission of turnover documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Requirements for demonstration and training.
    d. Preparation of Contractor's punch list.
    e. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    f. Coordination of separate contracts.
    g. Owner's partial occupancy requirements.
    h. Installation of Owner's furniture, fixtures, and equipment.
    i. Responsibility for removing temporary facilities and controls.
4. Minutes: The Owner and/or Design Professional conducting meeting will use Contract Manager to record and distribute meeting minutes.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - PROJECT SCHEDULING AND PROGRESS DOCUMENTATION - MULTIPLE PRIME CONTRACTS WITH A CONSTRUCTION MANAGER AS AGENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and individual Specification Sections and Bid Milestone Schedule, apply to this Section.

1.2 SUMMARY

A. The Owner has employed a Construction Manager as Agent (CMA) on this project. This is a Multiple Prime contract project therefore each Prime Contractor is responsible for the scheduling and documentation requirements as outlined in this Section 013200.

B. Section includes administrative and procedural requirements to plan, schedule and document the progress of construction during the performance of the Work, including the following:
   1. Critical Path Method (CPM) schedule and reports.
   2. Material location reports.
   3. Field condition reports.`
   4. Special reports.

C. Related Sections:
   1. Section 011200 – Contract Summary of Work, for preparing a combined CPM Schedule.
   2. Section 013300 – Submittal Procedure, for submitting schedules and reports.
   3. Section 014000 – Quality and Code Requirements, for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Project: Work at the Site carried out pursuant to one or more Contracts.

B. Activity: A discrete part of the Contract that can be identified for planning, scheduling, monitoring, and controlling the Project. Activities included in a CPM schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that has no total float.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

C. Bid Milestone Schedule: Interim milestones, included in the Contract Documents, which the Contractor utilizes to formulate the Baseline Schedule.

D. Baseline Schedule: Initial schedule, prepared by each Contractor, to complete the Work of the Contract in accordance with the Contract duration and starting point to which schedule updates are compared.

E. CPM: Critical Path Method is a scheduling method used to plan and schedule construction projects where activities are arranged based on activity relationships creating a time scaled network diagram.

F. PDM: Precedence Diagram Method follows the standard CPM calculations and allows for special logic relationships creating an interdependent relationship throughout the network.

G. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no total float.

H. Data Date: The date when the status of the CPM schedule is determined, showing the calendar start date for the update period.

I. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either the Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Substantial Completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Substantial Completion date.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in both electronic (PDF) file format and as electronic backup file in native software format.

B. CPM Schedule: Schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (baseline or updated) and date on label.

C. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain; activity ID number, activity description, original duration, remaining duration, actual duration, early and late start and finish dates and total float in calendar days.
   1. Activity Report: List of all activities sorted by early or actual start date in each phase, area and level following the physical divisions of the Work.
   2. Short Term Activity Report: Lists all activities occurring from the update data date in a two month forward and one month back window.

3. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by early or actual start date. Include activity ID number and float path(s).
4. Total Float Report: Provide a cumulative list of total float from each update period with comments associated to any and all variances.
5. Procurement Report: List all procurement activities sorted in order of the item being procured.
6. Narrative Report: The project scheduler shall describe the nature of the submission, interpretation of calculations, issues affecting progress and a milestone analysis comparing progress against the baseline and update schedules.

D. Material Location Reports: Submit at monthly intervals.

E. Field Condition Reports: Submit at time of discovery of differing conditions.

F. Special Reports: Submit at time of unusual event.

G. Qualification Data: For project scheduler.

1.5 QUALITY ASSURANCE

A. Project Scheduler Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within timeframes requested by the Owner. The project scheduler shall have or be able to obtain certification as a Planning and Scheduling Professional (PSP) or have a minimum of five years of demonstrated experience scheduling large capital projects.

B. Prescheduling Conference: The Owner may conduct conference at the Project site to comply with requirements in Section 013100 - Project Management and Coordination. Review methods and procedures related to the Baseline Schedule and the CPM schedule, including, but not limited to, the following:
1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss coordination, including phasing, work stages, area separations, interim milestones and Beneficial Occupancy.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review time required for review of submittals and resubmittals.
7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for completion and startup procedures.
9. Review and finalize list of construction activities to be included in schedule.
10. Review submittal requirements and procedures.
11. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate preparation and processing of CPM schedules and reports with the performance of the Work and with CPM scheduling and reporting of separate Contractors.
   1. The CMA shall coordinate new Baseline Schedules and CPM schedule updates with each prime contractor and provide a consolidated Baseline Schedule and consolidated CPM schedule updates to the Owner that include schedule input from each prime contractor.

B. Each contractor shall coordinate CPM schedules with the Contractor's Submission Schedule, progress reports, and other required schedules and reports.
   1. Each contractor shall coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CRITICAL PATH METHOD SCHEDULE, GENERAL

A. Bid Milestone Schedule: The Owner shall provide a Bid Milestone Schedule, which is attached to this section as a template for the Baseline Schedule. Nothing in the Bid Milestone Schedule, Baseline Schedule or CPM schedule shall preclude each Contractor from advancing the Work of the Contract.
   1. Include milestones indicated in the Contract Documents in Baseline Schedule, including, but not limited to, the Notice to Proceed, interim milestones, Substantial Completion, and Contract close-out.
   2. Substantial Completion date shall not be changed by submission of a schedule that shows an early completion date, unless approved by the Owner.
   3. No time for weather will be apportioned for foreseeable occurrences in a specific regional area. Each Contractor shall be responsible to determine reasonable averages and make allowances in the performance of the Work.

B. Activities: Treat each numbered activity as a consumable resource for each principal element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 15 days, unless specifically allowed by the Owner.
   2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 - Submittal Procedures in schedule. Coordinate submittal review times in the CPM schedule with dates entered in the Contractor's Submission Schedule.
   4. Startup and Testing Time: Include not less than 15 days for startup and testing.
   5. Substantial Completion: Indicate completion on the date established for Substantial Completion, and allow time for the Owner's administrative procedures necessary to execute the Notice of Substantial Completion (NOSC).

6. Incomplete Work items and Contract Closeout: Include not more than 60 days for incomplete Work items and Contract Closeout Requirements.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents, or approved by the Owner prior to use and show how date constraints affect the sequence of the Work.
   1. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities.

D. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
   1. Unresolved issues.
   2. Unanswered RFIs.
   3. Rejected or unreturned submittals.
   4. Notations on returned submittals.

E. Recovery CPM Schedule: When periodic update indicates the Work is 15 or more calendar days behind the current approved CPM schedule, submit a separate recovery CPM schedule indicating means by which each Contractor intends to regain compliance with the CPM schedule. Indicate changes to working hours, working days, crew sizes, and equipment required achieving compliance, and dating by which recovery will be accomplished, subject to Owner's approval.

F. Computer Scheduling Software: Prepare CPM schedules using current version of a program that has been developed specifically to manage CPM schedules and interface with the Owner's electronic file of the Bid Milestone Schedule.
   1. Utilize Primavera P6 or P3 Primavera Project Planner operating system.

2.2 CRITICAL PATH METHOD SCHEDULE (CPM SCHEDULE)

A. Baseline Schedule: Prepare schedule using a time-scaled PDM network diagram representing the Work of the Contract. Total float time shall be equal to or greater than zero in the Baseline Schedule.
   1. Within 15 days of the date established for the Notice to Proceed each contractor shall provide a baseline schedule to the CMA. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work based on indicated activities.
   2. Within 30 days following receipt of the last baseline schedule from each Contractor, the CMA shall provide to the Owner a consolidated Baseline Schedule.
      a. Failure to include any work item required for the performance of the Work shall not excuse each Contractor from completing the Work of the Contract within applicable completion dates, regardless of the Owner's approval of the schedule.

B. CPM Schedule: Prepare contemporaneous schedules using a time-scaled PDM network for sequencing the Work and showing the progress of the Work.

1. Establish procedures for monitoring and updating the CPM schedule and for reporting progress. Coordinate procedures with the progress meeting and payment request date.
2. Coordinate the Work occurring concurrently through the integration of other Contractors Baseline Schedules into the CPM schedule.
3. Conduct educational workshops to train and inform the Contractor's key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to correlate with Contract durations.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work of the Contract. At minimum, each individual specification section, including General Requirement sections, as indicated in the Project Manual, shall be listed as an activity.
   1. Activities ID: Provide a unique identifier to each activity. No activity ID shall be recycled or reused.
   2. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
      a. Preparation and processing of submittals.
      b. Mobilization and demobilization.
      c. Purchase of materials.
      d. Delivery.
      e. Fabrication.
      f. Utility interruptions.
      g. Installation.
      h. Work by Owner that may affect or be affected by the Contractor's activities.
      i. Testing and commissioning.
      j. Incomplete Work items and Contract closeout.
   3. Actual Activity Dates: Once an activity has been assigned an actual date of occurrence, the status of that activity shall not change. Any change to actual dates must be accompanied with supporting data and approved by the Owner. No actual start date shall occur ahead of the data date.
   4. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with the Bid Milestone Schedule dates.
   5. Processing: Process data to produce output data status on a computer-drawn, PDM network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract duration.
   6. Calculations: The schedule network shall be calculated allowing activities to retain their original logic. Progress override shall not be used when calculating the network status.
   7. Logic: Leads and lags will not be used when the creation of an activity will perform the same function. Lag durations contained in the schedule shall not have negative value. Lead and lag durations shall not exceed the durations of the activity they are assigned.
      a. There shall be only two open ended activities; (1) Notice to Proceed, with no predecessor logic, and (2) Final Payment, with no successor logic. All intermediate activity logic shall be connected.

b. Out of sequence activities that have progressed before all preceding logic will be allowed only on a case by case basis, as approved by the Owner. The Contractor shall propose logic corrections to eliminate all out of sequence progress and correct out of sequence progress that continues for more than two update cycles by logic revisions, as approved by the Owner.

8. Float: The Owner shall reject the schedule and schedule updates for the use of float suppression techniques such as preferential sequencing, special lead lags logic constraints, zero total or zero free float constraints, extended activity times, or imposing constraint dates other than what is required by the Contract.
   a. The use of resource leveling used for the purpose of artificially adjusting activity durations to consume float and influence the critical path is prohibited.
   b. A schedule showing work completing in less time than the Contract duration and accepted by the Owner, will be considered to have float.
   c. Any float generated during the performance of the Work, due to efficiencies of the Owner or any Contractor is not for sole use of the party generating the float.
   d. Negative float will not be a basis for requesting time extensions and will not be construed as a means of acceleration or schedule extension.
9. Format: Follow the applicable individual specification sections of the Work as the bases for the content of the CPM schedule. Organize the CPM schedule to provide the necessary detail for each area, level, quadrant and section as needed in the performance of the Work.

D. Changes in the Work: For each proposed change and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall CPM schedule.

E. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
   1. Identification of activities that have changed, including the reason each adjustment was necessary.
   2. Changes in early and late finish dates.
   3. Changes in activity durations in workdays.
   4. Changes in the critical path.
   5. Changes in total float or slack time.
   6. Changes in the duration for Substantial Completion.

2.3 REPORTS

A. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for

Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.4 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, and response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise the Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CPM SCHEDULE

A. Project Scheduler: Engage a consultant or person skilled in construction planning and scheduling to provide planning, scheduling, evaluation, and reporting services using CPM scheduling.
   1. In-House Option: The Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
   2. Meetings: Project scheduler shall attend all meetings related to the Project progress, alleged delays, and time impact.

B. CPM Schedule and CPM Reports Updating: On a monthly basis the CMA shall update the CPM schedule to reflect actual construction progress and activities. The CMA shall coordinate with each prime contractor to obtain input from each prime contractor for each CPM schedule update. The CMA shall issue schedule and reports one week before each regularly scheduled progress meeting.
   1. The CMA shall revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Each contractor shall provide input to the CMA as necessary to accomplish said revisions. Issue updated schedule concurrently with the CPM reports of each such meeting. As a minimum, schedule update submissions shall occur monthly and within 30 days of the schedule Data Date.
   2. Include CPM reports with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate final remaining duration for each activity.

C. Distribution: Submit one electronic copy, in format specified, to the Owner and distribute copies of approved schedule and reports to the Owner, Design Professional, separate

contractors, testing and inspecting agencies, and other parties identified by the Owner with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules and reports to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and individual Specification Sections and Contractor's Submission Schedule, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections:
1. Section 013200 – Construction Progress Documentation, for submitting schedules and reports, includes Contractor's construction schedule.
2. Section 017700 – Contract Closeout Requirements, for documents required to closeout contract.
3. Section 017823 – Operation and Maintenance Manuals, for submitting operation and maintenance manuals.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require the Design Professional's responsive action. Action submittals are those submittals indicated in individual specification sections as action submittals.

B. Informational Submittals: Written and graphic information and physical samples that do not require the Design Professional's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual specification sections as informational submittals.

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

D. Required Submittal List Utility application: Interacts with and to be used with the Owner's Contract Manager system. The Design Professional uses the utility to itemize the list of submission items needed to be submitted by the Contractor in order to insure the design intent will be satisfied and inclusive of all Project turnover documents and/or Contract Closeout Requirements.

E. Contractor's Submission Schedule: The itemized list of project submission requirements printed as a report from Contract Manager. The Contractor enters the date each item needs to be submitted in order to meet the CPM schedule and returns this document to the Owner.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: The Contractor's Submission Schedule is attached to this section, prepared by the Design Professional. The Contractor is to coordinate and cooperate with the Owner and Design Professional to arrange in chronological order by dates required by the construction schedule. Coordinate time required for review, ordering, manufacturing, fabrication, and delivery to establish dates. Coordinate additional time required for making corrections or modifications to submittals noted by the Design Professional and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate the Contractor's Submission Schedule with list of subcontracts, the schedule of values, and coordinated CPM schedule.
   2. Initial Submittal: Submit in accordance with start-up CPM schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   3. Final Submittal: Submit concurrently in accordance with the complete CPM schedule.
      a. Coordinate with the Owner and Design Professional revised Contractor's Submission Schedule to reflect changes in current status and timing for submittals.

B. Format for Submittals: Submit required submittals in electronic (PDF) file format.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Design Professional's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by the Design Professional for the Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with the performance of the Work.
   1.
   2. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   3. Commissioning Authority will review submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the Design Professional review and approval.
   4. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   5. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
   6. 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. Submit Operation and Maintenance Manuals concurrent with action submittal.
b. The Owner or Design Professional reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for re-submittals, as follows. Time for review shall commence on the Design Professional's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. The Design Professional will advise the Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Re-submittal Review: Allow 15 days for review of each re-submittal.
4. Sequential Review: Where sequential review of submittals by the Design Professional's consultants, the Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

D. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by the Design Professional.
3. Include the following information for processing and recording action taken:
   a. Project name.
   b. Date.
   c. Name of Design Professional.
   d. Name of Construction Manager (if applicable).
   e. Name of Contractor.
   f. Name of subcontractor.
   g. Name of supplier.
   h. Name of manufacturer.
   i. Submittal number including revision identifier.
      1) Submittal number shall be the submittal item number and Submittal Package number designated in the Contractor's Submission Schedule.
   j.
   k. Drawing number and detail references, as appropriate.
   l. Location(s) where product is to be installed, as appropriate.
   m. Other necessary identification.

E. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

3. Provide means for insertion to permanently record the Contractor's review and approval markings and action taken by the Design Professional.
4. Include the following information on an inserted cover sheet:
   a. Project name.
   b. Date.
   c. Name and address of Design Professional.
   d. Name of Construction Manager (if applicable).
   e. Name of Contractor.
   f. Name of firm or entity that prepared submittal.
   g. Name of subcontractor.
   h. Name of supplier.
   i. Name of manufacturer.
   j. Number and title of appropriate Specification Section.
   k. Drawing number and detail references, as appropriate.
   l. Location(s) where product is to be installed, as appropriate.
   m. Related physical samples submitted directly.
   n. Other necessary identification.
5. Include the following information as keywords in the electronic file metadata:
   a. Project name.
   b. Number and title of appropriate Specification Section.
   c. Manufacturer name.
   d. Product name.

F. Options: Identify options requiring selection by the Design Professional.

G. Deviations: Identify deviations from the Contract Documents on submittals.

H. Additional Copies: Unless the Design Professional observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

I. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. The Design Professional will return submittals, without review**,** received from sources other than the Contractor.
1. Transmittal Form: Use the Contractor’s office form.
2. 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. Specification Section number and title.
   i. Indication of full or partial submittal.
   j. Drawing number and detail references, as appropriate.
   k. Transmittal numbered consecutively.
   l. Submittal and transmittal distribution record.

m. Remarks.
n. Signature of transmitter.

3. On an attached separate sheet, prepared on the Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by the Design Professional on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

J. Re-submittals: Make re-submittals in same form and format.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from the Design Professional's action stamp.

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

L. Use for Construction: Use only final submittals that are marked with approval notation from the Design Professional's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Submit electronic submittals via email as electronic (PDF) files, to the Design Professional. If applicable, the Design Professional will forward submittals to the Commissioning Authority for systems being commissioned. The Owner may request paper copies of certain submittals for onsite coordination.
a. The Design Professional, through the Owner, will return annotated file. Annotate and retain one copy of file as an electronic Project turnover document file.
b. The Commissioning Authority through the Design Professional will return annotated file.
2. Operation and Maintenance Manual Submittals: Submit concurrent with the Action Submittal, as related in individual Specification Sections.
3. Closeout Submittals: Comply with requirements specified in Section 017700 – Contract Closeout Requirements and as listed in the Contractor's Submission Schedule.
4. Permits, Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Permits, Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

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 published 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. Submittal Package number and Submittal Item number.
      b. Manufacturer's catalog cuts.
      c. Manufacturer's product specifications.
      d. Standard color charts.
      e. Statement of compliance with specified referenced standards.
      f. Testing by recognized testing agency.
      g. Application of testing agency labels and seals.
      h. Notation of coordination requirements.
      i. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams showing factory-installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Submit Product Data concurrent with Samples.
   6. Submit Product Data in electronic (PDF) file format.

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: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Submittal Package number and Submittal Item number.
      b. Identification of products.
      c. Schedules.
      d. Compliance with specified standards.
      e. Notation of coordination requirements.
      f. Notation of dimensions established by field measurement.
      g. Relationship and attachment to adjoining construction clearly indicated.
      h. Seal and signature of professional engineer if specified.
   2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   2. Identification: Attach label on unexposed side of Samples that includes the following:
      a. Submittal Package number and Submittal Item number.
      b. Generic description of Sample.

c. Product name and name of manufacturer.
d. Sample source.
e. Number and title of applicable Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: For turnover purpose, submit six full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. The Design Professional, through the Owner, will return submittal with options selected.
5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit six sets of Samples. The Design Professional, through the Owner, will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a turnover sample.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least six sets of paired units that show approximate limits of variations.

E. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.
   4. Submit subcontract list in PDF electronic file, to the Owner.

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

G. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

H. OSHA Certificates: Upon the Owner's request, submit certificates of the OSHA 10-hour Construction Safety and Health Course – S1537-A, for all laborers, workers and mechanics working on site.

I. Installer Certificates: Upon the Owner's request, submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

J. Manufacturer Certificates: Upon the Owner's request, submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

K. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

L. Preconstruction Test Reports: Submit 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 in the Contract Documents.

M. Field Test Reports: Submit reports 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 in the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to the Design Professional.

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 the Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 DESIGN PROFESSIONAL'S ACTION

A. General: The Design Professional will not review submittals that do not bear the Contractor's approval stamp and will return them without action.

B. Action Submittals: The Design Professional will review each submittal, make marks to indicate corrections or modifications required, and return it through the Owner. The Design Professional will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

C. Informational Submittals: The Design Professional will review each submittal and will return it if it does not comply with requirements.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from the Design Professional.

E. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

G. On projects that have commissioning, the Commissioning Authority will receive copies of the submittals through the Design Professional and will provide comments on the submittals via the Design Professional.

3.3 CONTRACTOR'S SUBMITTAL SCHEDULE

A. The Contractor's Submission Schedule: The Contractor's Submission Schedule, prepared by the Design Professional is attached following the end of this section. The Contractor shall provide the dates each item needs to be submitted to the Owner no later than 30 days after approval of CPM schedule. The schedule shall include the date of all shop drawings, samples, materials that shall be submitted and the date approval is required. The Contractor shall adhere to the submittal processing time as describe in paragraph 1.5 above when developing the submittal schedule. The Contractor is to coordinate and cooperate with the Owner and Design Professional to complete scheduling in accordance with the approved CPM schedule.

END OF SECTION 013300

SECTION 014000 - QUALITY AND CODE REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and Individual Specification Sections and/or New York City (NYC) Statement of Special Inspections and Tests, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit the Contractor's other quality assurance and quality control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for the Contractor to provide quality assurance and quality control services required by the Owner or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections:
   1. Section 012100 - Allowances, for testing and inspecting allowances.
   2. Section 013200 - Construction Progress Documentation, for developing a schedule of required tests and inspections.
   3. Individual Specification Sections, for specific inspections and tests requirements.

1.3 DEFINITIONS

A. Quality Assurance Services: Activities, actions, and procedures performed during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements.

C. Product Testing: Tests and inspections that are performed by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

D. Field Quality Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

E. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

F. Installer/Applicator/Erector: The Contractor or another entity engaged by the Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

G. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
   1. Indicate manufacturer and model number of individual components.
   2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality Control Plan: For quality assurance and quality control activities and responsibilities.

B. Contractor's Quality Control Manager Qualifications: For supervisory personnel.

C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.
   8. Requirements for obtaining samples.

9. Unique characteristics of each quality control service.

1.6 CONTRACTOR'S QUALITY CONTROL PLAN

A. Quality Control Plan, General: Submit quality control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to the Owner. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality assurance and quality control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality assurance and quality control procedures similar in nature and extent to those required for Project.
   1. Project quality control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: Include in quality control plan a comprehensive schedule of the Work requiring tests or inspections, including the following:
   1. The Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and the Contractor-elected tests and inspections.
   2. Special inspections required by authorities having jurisdiction and indicated on the "NYS or NYC Statement of Special Inspections and Tests."

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work the Owner has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.

5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical 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.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.8 PERMITS, LICENSES, AND CERTIFICATES:

A. The Contractor shall obtain, maintain and pay for all applications, permits, filings, and licenses necessary for the execution of the Work and for the use of such Work when completed as required by any and all authorities having jurisdiction. The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of authorities having jurisdiction bearing on performance of the Work.

B. The Contractor shall promptly assist the Owner in securing all approvals from authorities having jurisdiction. Without limitation, the Contractor shall assist the Owner in making

application for Project approval, variances or other approvals, Letters of Completion, Temporary Certificates of Occupancy, and Certificates of Occupancy, including completion of all necessary applications and supporting documentation.

C. The Contractor shall comply with all regulations governing conduct, access to the premises, operation of equipment and systems and conduct while in or near the premises and shall perform the Work in such a manner as not to unreasonably interrupt or interfere with the conduct of business of the Institution.

D. For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, material certificates/affidavits, approvals, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

E. Dormitory Authority Permits: Prior to commencement of the Work, the Dormitory Authority shall provide the Contractor, at no costs, a Construction Permit for performance of the Work and post a copy at the Project site.
   1. The Contractor shall secure and pay for all other work permits, applications, filings, and approvals that are associated with the Work of the Contract and pay all other permits, fees, licenses and inspections necessary for the proper execution and completion of the Contract as required by all other applicable authorities having jurisdiction.

F. New York City Permits: The Contractor shall secure and pay for all work permits, applications, filings, and approvals that are associated with the Work of the Contract and pay all other permits, fees, licenses and inspections necessary for the proper execution and completion of the Contract as required by applicable New York City agencies and departments (i.e. Department of Buildings, Bureau of Electrical Control, Fire Department, Department of Environmental Protection, etc.).
   1. The Contractor shall secure required work permits and approvals prior to commencement of the Work, provide a copy to the Owner and post a copy of the permit at the Project site.
   2. The Contractor shall be responsible to maintain updated work permits and approvals.
   3. Upon Substantial Completion of the Work of the Contract, the Contractor shall secure all required approvals from applicable New York City agencies and departments. The Contractor shall provide a copy to the Owner.

G. Municipal Permits: The Contractor shall secure and pay for a building permit and all work permits, applications, filings, and approvals that are associated with the Work of the Contract and pay all other permits, fees, licenses and inspections necessary for the proper execution and completion of the Contract as required by applicable authorities having jurisdiction.
   1. The Contractor shall secure required building permit or work permits and approvals prior to commencement of the Work, provide a copy to the Owner and post a copy of the permit at the Project site.
   2. The Contractor shall be responsible to maintain updated permits and approvals.
   3. Upon Substantial Completion of the Work of the Contract, the Contractor shall secure all required approvals from applicable authorities having jurisdiction. The Contractor shall provide a copy to the Owner.

1.9 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

F. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329**,** and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality control services are indicated as the Owner's responsibility, the Owner will engage a qualified testing agency to perform these services.
   1. The Owner will furnish the Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to the Owner are the Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of the Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as the Contractor's responsibility, engage a qualified testing agency to perform these quality control services.
   a. Contractor shall not employ same entity engaged by the Owner, unless agreed to in writing by the Owner.
3. Notify testing agencies at least 24 hours in advance of time (excluding weekends and holidays) when Work that requires testing or inspecting will be performed.
4. Where quality control services are indicated as the Contractor's responsibility, submit a written report, in duplicate, of each quality control service.
5. Testing and inspecting requested by the Contractor and not required by the Contract Documents are the Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 - Submittal Procedures.

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting:
1. Regardless of whether original tests or inspections were the Contractor's responsibility, provide quality control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents, or costs attributable to the Contractor’s lack of coordination in properly scheduling the Work requiring testing and inspection will be charged to Contractor and the Contract Sum will be adjusted by Change Order.

F. Testing Agency Responsibilities: Cooperate with the Owner and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify the Owner and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a written report, in duplicate, of each test, inspection, and similar quality control service through Contractor.

5. Does not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of the Contractor.

G. Associated Services: The Contractor shall cooperate with agencies performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. The Contractor shall provide the following:
1. Access to the Work, including equipment required to access the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
1. Distribution: Distribute schedule to the Owner, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 NYC SPECIAL INSPECTIONS AND TESTS

A. Special Inspections and Tests: The Owner will engage a qualified testing agency to conduct special inspections and tests required by authorities having jurisdiction as the responsibility of the Owner, as indicated in the NYC Statement of Special Inspections and Tests, attached to this Section, and as follows:
1. Notifying Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Submitting a written report of each test, inspection, and similar quality control service to the Owner with copy to the Contractor and to authorities having jurisdiction. The frequency of reporting shall be determined in consultation with the Owner.
3. Submitting a final report of special tests and inspections at Substantial Completion, this includes a list of unresolved deficiencies.
4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents or code requirements.
5. Retesting and reinspecting corrected work.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve a Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specified tests, inspections, and related actions do not limit Contractor's quality control procedures that facilitate compliance with the Contract Document requirements.
   2. Inspections and tests performed by the testing agency shall in no way relieve the Contractor of the responsibility to construct in accordance with the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to the Design Professional.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for the Owner’s reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

B. Protect construction exposed by or for quality control service activities.

C. Repair and protection are the Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and Individual Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Sections:
   1. Section 011200 – Contract Summary of Work, for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. General: Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the Owner**,** the Design Professionals, occupants of the Project, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from the Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from the Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion and Sedimentation Control Plan: Show compliance with requirements of New York State Department of Environmental Conservation Stormwater General Permit or authorities having jurisdiction, whichever is more stringent.

C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage; including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.
   1. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

D. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
   1. Locations of dust-control partitions at each phase of the work.
   2. HVAC system isolation schematic drawing.
   3. Location of proposed air filtration system discharge.
   4. Other dust-control measures.
   5. Waste management plan.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations and requirements of authority having jurisdiction for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ANSI A117.1.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before the Owner's acceptance, regardless of previously assigned responsibilities. Temporary use of permanent facilities during construction may be allowed at the sole discretion of the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 0.148-inch thick, galvanized steel, chain-link fabric fencing; minimum 8 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts.

B. Portable Chain-Link Fencing: Minimum 0.148-inch thick, galvanized steel, chain-link fabric fencing; minimum 8 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top and bottom rails. Provide galvanized steel bases for supporting posts.

C. Wood Enclosure Fence: Plywood, 8 feet high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.

D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.

E. Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

F. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Owner's-Use Field Office: Of sufficient size to accommodate needs of the Owner and construction personnel office activities and to accommodate project meetings. Keep office clean and orderly. Furnish and equip offices as follows:
   1. Furniture required for the Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
   2. Conference room of sufficient size to accommodate meetings of 2**0** individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot square tack and marker boards.
   3. Drinking water and private toilet and sink with hot and cold water.
   4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
   5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
   6. Cleaning services for all rooms on a bi-weekly basis. Provide bathroom supplies.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless the Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   3. Permanent HVAC System: If the Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in the system and replace as needed in accordance with the filter manufacturers recommendations. Remove at end of construction.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, the Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
   1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction. Obtain all required permits.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Obtain all required permits.

D. Water Service: Connect to the Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to the Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Toilets: Use of the Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to the Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
   1. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings.
      a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
      b. Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
   2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
   3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

H. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

I. Electric Power Service: Connect to the Owner's existing electric power service. Maintain equipment in a condition acceptable to the Owner. Obtain all required permits.
   1. Connect temporary service to the Owner's existing power source, as directed by the Owner.

J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
   2. Install lighting for the Project identification sign.

K. Telephone Service: Provide temporary telephone service in Owner's-use facilities for use by all construction personnel. Install two telephone lines for each field office.
   1. Provide additional telephone lines for the following:
      a. Provide a dedicated telephone line for each facsimile machine in each field office.
   2. At each telephone, post a list of important telephone numbers.
      a. Police and fire departments.
      b. Ambulance service.
      c. Contractor's home office.
      d. Design Professional's office.
      e. Testing Consultant's offices.
      f. Owner's office.
      g. Principal subcontractors' field and home offices.
   3. Provide superintendent with cellular telephone for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
   2. Maintain support facilities until Substantial Completion inspection date is scheduled. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
   1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
   2. Prepare subgrade and install subbase and base for temporary roads and paved areas specified in Individual Specification Sections.
   3. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
   2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Provide temporary parking areas for construction personnel.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain the Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding the Project or adjoining properties nor endanger permanent Work or temporary facilities.

2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as specified in the Contract Documents.
2. Temporary Signs: Provide other signs as required to inform public and individuals seeking entrance to the Project.
   a. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

I. Temporary Elevator Use: Use of elevators is not permitted.

J. Existing Elevator Use: Use of the Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to the Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
1. Do not load elevators beyond their rated weight capacity.
2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

L. Existing Stair Usage: Use of the Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to the Owner. At Substantial Completion, restore stairs to condition existing before initial use.
1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

M. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to authorities having jurisdiction.
   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
   2. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
   3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from the project site during the course of the project.
   4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Tree and Plant Protection: Install temporary fencing outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

E. Site Enclosure Fence: Before construction operations begin furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to the Owner.

F. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

H. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

I. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.
   1. Construct covered walkways using scaffold or shoring framing.

2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
3. Paint and maintain appearance of walkway for duration of the Work.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

K. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by the Owner from fumes and noise.
1. Construct dustproof partitions with fire rated gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.
2. Where fire-resistance-rated temporary partitions are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
3. Insulate partitions to control noise transmission to occupied areas.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

L. Fire Safety During Construction: Comply with all requirements identified herein as well as the more stringent requirements of the applicable codes (New York State Building and Fire Codes or New York City Building and Fire Codes).
1. No smoking: Smoking shall be prohibited throughout the project/construction site. “No Smoking” signs shall be conspicuously posted at all entrances and throughout the site.
2. The Contractor shall designate a Fire Prevention Program Superintendent/ Fire Safety Manager who shall be responsible for all fire safety efforts until completion and acceptance of the Work described in the Contract Documents that include but are not limited to the following:
    a. Prefire Plans. Develop in cooperation with the local Fire Chief and Fire Code Official. Any changes affecting the utilization of information contained in the plan shall result in notification to the local Fire Chief and Fire Code Official.
    b. Training. Job site personnel shall be trained in fire safety practices and procedures and the proper use of fire protection equipment, including hand-held fire extinguishers, hose lines, fire alarm and sprinkler systems.
    c. Fire Protection Devices. Fire protection and detection equipment shall be maintained and serviced.
    d. Hot Work Operations. Welding, cutting, open torches, torch-applied roof system activities, and other hot work operations shall be conducted under a permit system. A fire watch and fire extinguishers shall be provided.
    e. Impairment of Fire Protection Systems. Coordinate planned, emergency or accidental impairments of fire protection systems to include tagging of impaired systems and notification of Fire Department, Alarm Company, Building Owner/Operator, and Contractors.

f. Temporary Covering of Fire Protection Devices. Coverings placed on or over fire protection devices for protection from damage shall be immediately removed upon the completion of the Work in the room or area in which the devices are installed.

3. Provide readily accessible telephone service for fire calls at a location or locations approved by the Owner.
   a. The Contractor shall pay all costs thereof until completion and acceptance of the Work or as otherwise directed by the Owner.
   b. Provide/post the street address of the construction site and the emergency telephone number of the Fire Department adjacent to the telephone.
4. Provide or maintain a Temporary or Permanent Standpipe system for Fire Department use in accordance with the following:
   a. Buildings subject to the New York State Building Code: In buildings that require a standpipe system, such standpipe shall be installed when the progress of construction reaches a height of 40 feet.
   b. Buildings subject to the New York City Building Code: In buildings that require a standpipe system, such standpipe shall be installed when the progress of construction reaches a height of 75 feet. The standpipe shall be equipped with an air pressurized alarm system.
   c. Buildings being demolished: An existing standpipe system shall be maintained in operation on all floors, starting one floor directly below the floor being demolished. The existing standpipe can be converted to a dry standpipe if freezing conditions exist.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
   1. Protect porous materials from water damage.
   2. Protect stored and installed material from flowing or standing water.
   3. Keep porous and organic materials from coming into prolonged contact with concrete.
   4. Remove standing water from decks.
   5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
   1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
   2. Keep interior spaces reasonably clean and protected from water damage.
   3. Periodically collect and remove waste containing cellulose or other organic matter.
   4. Discard or replace water-damaged material.
   5. Do not install material that is wet.
   6. Discard, replace or clean stored or installed material that begins to grow mold.

7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
   a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
   b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to the Design Professional.
   c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves right to take possession of the Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 – Contract Closeout Requirements.

END OF SECTION 015000

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - 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 general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Requirements:
   1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
   2. Section 311000 "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at a height 6 inches (150 mm) above the ground for trees up to and including 4-inch (100-mm) size at this height and as measured at a height of 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.

B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape or the average of the smallest and largest diameters at a height 54 inches (1372 mm) above the ground line for trees with caliper of 8 inches (200 mm) or greater as measured at a height of 12 inches (300 mm) above the ground.

C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated defined by a circle concentric with each tree with a radius 12 times the tree's caliper size and with a minimum radius of 96 inches (2400 mm) unless otherwise indicated.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at project site.
   1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
      a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
      b. Arborist's responsibilities.
      c. Quality-control program.
      d. Coordination of Work and equipment movement with the locations of protection zones.
      e. Trenching by hand or with air spade within protection zones.
      f. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
   2. Detail fabrication and assembly of protection-zone fencing and signage.
   3. Indicate extent of trenching by hand or with air spade within protection zones.

C. Samples: For each type of the following:
   1. Organic Mulch: 1-pint (0.5-L) volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
   2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components
   3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

D. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
   1. Species and size of tree.
   2. Location on site plan. Include unique identifier for each.
   3. Reason for pruning.
   4. Description of pruning to be performed.
   5. Description of maintenance following pruning.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
   1. Use sufficiently detailed photographs or video recordings.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.7 QUALITY ASSURANCE

A. Arborist Qualifications: Licensed arborist in jurisdiction where Project is located.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.8 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Moving or parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Stockpiled soil from location shown on Drawings of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
   1. Mixture: Well-blended mix of two parts stockpiled soil to one part commercial grade planting soil.

B. Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
   1. Type: Wood and bark chips.
   2. Size Range: 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum.
   3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements:
   1.
   2. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch (50-mm) maximum opening in pattern and weighing a minimum of 0.4 lb/ft. (0.6 kg/m); remaining flexible from minus 60 to plus 200 deg F (minus 16 to plus 93 deg C); inert to most chemicals and acids; minimum tensile yield strength of 2000 psi (13.8 MPa) and ultimate tensile strength of 2680 psi (18.5 MPa); secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet (2.4 m) apart.

D. Plywood Wood for Protection Zone Vehicle Crossing:
   1. 1. ¾ inch thick, exterior grade plywood veneer sheathing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain (or to be relocated). Tie a 1-inch (25-mm) blue vinyl tape around each tree trunk at 54 inches (1372 mm) above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.
   1. Apply 2-inch (50-mm) uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches (150 mm) of tree trunks.

3.3 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and equipment from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
   1. Install protection fencing in accordance with details on site plans.
   2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Engineer.
   3. Access Gates: Install as required to access preservation areas; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Engineer. Install one sign spaced approximately 50 feet on protection-zone fencing.

C. Maintain protection zones free of weeds and trash.

D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
   1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.

2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

C. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Roots that are affected by temporary and permanent construction. Prune roots as follows:
1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots. Many plant authorities do not consider it beneficial to paint cut root ends.
2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches (300 mm) outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.
   1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
   2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
   3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).

B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
   1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 1 inch or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Engineer.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Engineer.

B. Trees: Remove and replace trees indicated to remain that are more than 50 percent dead or in an unhealthy condition or are damaged during construction operations that Engineer determines are incapable of restoring to normal growth pattern.
1. Small Trees: Provide one tree of 1.5-2” caliper size for each tree that measures 6 inches or smaller in caliper size.
2. Large Trees: Provide one tree of 2.5-3” caliper size for each tree being replaced that measures more than 6 inches in caliper size.
   a. Species: Native to Pinelands as selected by Engineer.
3. Plant and maintain new trees as specified in Section 329300 "Plants."

C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch (50-mm) uniform thickness to remain.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and Individual Specification Sections and Contractor's Submittal Schedule, apply to this section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in the Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Sections:
   1. Section 012100 – Allowances, for products selected under an allowance.
   2. Section 013300 – Submittal Procedure, for product submittals.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work of the Contract and purchased new for the Project. The term "product" includes the terms "material," "equipment," and "system."
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Procurement Exemption Approval Product Specification: A specification in which a specific manufacturer's product is named including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes as a single source or sole source provider.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include data to indicate compliance with the requirements specified in "Comparable Products" from Article 5, Section 5.04 of the General Conditions.
   2. Design Professional's Action: If necessary, the Design Professional will request additional information or documentation for evaluation within one week of receipt of a comparable product request. The Design Professional will notify the Contractor through the Owner of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
      a. Form of Approval: As specified in Section 013300 - Submittal Procedure.
      b. Use product specified if the Design Professional does not issue a decision on use of a comparable product request within time allocated.

B. Procurement Exemption Approval Product Specification Submittal: Comply with requirements in Section 013300 - Submittal Procedure. Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If the Contractor is given option of selecting between two or more products for use on the Project, select product compatible with products previously selected, even if previously selected products were also options.
   1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   2. If a dispute arises between contractors over concurrently selectable but incompatible products, the Design Professional will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at the Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to the Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger the Project structure.
3. Store products that are subject to damage by the elements under cover in a weather tight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store foam plastic protected from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to the Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for the Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Refer to individual specification sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 013300 – Submittal Procedure.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. The Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," the Design Professional will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
7. Provide products that do not contain asbestos.

B. Product Selection Procedures:
1. Product: Where Specifications include a procurement exemption approval and name a single source, sole source, manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for the Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications include a procurement exemption approval and name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for the Contractor's convenience will not be considered.
3. Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

C. Visual Matching Specification: Where Specifications require "match sample", provide a product that complies with requirements and matches sample. The Owner's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's full range", select a product that complies with requirements. The Design Professional will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: The Design Professional will consider the Contractor's request for comparable product when the following conditions are satisfied. If the following conditions

are not satisfied, the Design Professional may return requests without action, except to record noncompliance with these requirements:

1. Action Submittal shall be provided in accordance with Submittal Procedures within 60 days after Notice to Proceed.
2. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
3. Detailed comparison of qualities of proposed product with those named in the Specifications, including attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
4. Evidence that proposed product provides specified warranty.
5. List of similar installations for completed projects with project names and addresses and names and addresses of design professionals and owners, if requested.
6. Samples, if requested.

B. Comparable Products Costs: Any costs savings to an approved Comparable Product identified and realized by the Contractor shall be shared equal between the Owner (50%) and Contractor (50%).

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and Individual Specification Sections, apply to this Section.

1.2 SUMMARY

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

B. Responsibility: Each Contractor is responsible for the cutting and patching to permit installation or performance of Work of their contract.

C. Related Sections include the following:
   1. Individual Specification Sections.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of Work of the contract.

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

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: At each occurrence, describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
   2. Changes to In-Place 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. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems 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. Design Professional'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 result in increased maintenance or decreased operational life or safety.

C. Fire Rated Elements: Do not cut and patch fire rated elements (i.e. floors, walls, roofs, shafts, etc.) in a manner that results in reducing their capacity to perform as intended or that results in decreased fire rating.

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

E. 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 Design Professional's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

F. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including other 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.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place 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 in-place materials, unless specified otherwise in other Sections.

C. Fire Rated Elements: Provide firestopping products/systems specified in system design listings by approved testing agencies that conform to the construction type, penetrating item, annular space requirements and fire rating involved in each separate assembly. Refer to applicable Individual Specification Sections.

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 in-place 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 in-place 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 Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting or patching to minimize interruption 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 in-place 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 in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction.
   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. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. 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.
   5. 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.
   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.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.
   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 in-place 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 in-place 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.
6. Fire Rated Elements: Install firestopping systems to comply with applicable Individual Specification Sections and firestopping manufacturer's written installation instructions and published drawings for products and applications.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329

NOTE: THIS SECTION IS A COMMON DOCUMENT ON A MULTI-CONTRACT PROJECT.

USE AND EDIT THIS SECTION WHEN GREEN BUILDINGS CRITERIA (LEED, SUSTAINABLE DESIGN, ETC.) ARE BEING USED ON THE PROJECT. CONFIRM USE OF THIS ARTICLE WITH THE PROJECT MANAGER.

SECTION 017419 – CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for Construction Waste Management (CWM), with criteria for recycling and/or salvaging demolition and construction waste generated during the project. A Construction Waste Management Plan shall be developed for approval by the Construction Manager and DASNY Project Manager. The Plan shall be implemented throughout the duration of the project, and shall be documented in accordance with the SUBMITTALS Article below.

B. Responsible parties:
   1. Locations for removal bins or dumpsters shall be coordinated with DASNY's Project Manager.
   2. Each contractor shall supply a CWM plan detailing the means and methods for recycling job site waste. Following the award of contract, the Contractors shall identify a single entity to act as the construction waste manager.
   3. All Contractors will receive and sign-off on the CWM plan. They will be responsible for adherence to the plan through management of their work on-site and the waste generated under their contract.
      a. Sign-off and adherence to the plan applies even when a separate bid package is established for the CWM

C. Resources

NY CD Resource Center
727 East Washington Street
Syracuse, New York 13210
Bgriffin@syracusecoe.org
(315) 443-9747

D. Initiated with support from Empire State Development, The NY CD Resource Center supports and promotes the growth of C&D recycling and building materials reuse (BMR) in New York State through a variety of market-development and network-building activities. Key among these activities is the provision of C&D materials management training to New York contractors and haulers, many of whom want to increase recycling at construction sites but need help getting started. The program also offers on-site assistance at construction sites.

1. ESD Recycling Market Information Database.
2. http://appcenter.nylovesbiz.com/esdrecycling/.

1.2 PERFORMANCE REQUIREMENTS

A. Each Contract shall prepare and submit a CWM Plan to the Design Professional for approval. The CWM Plan shall outline the provisions to be implemented to salvage for reuse or to recycle demolition and construction waste generated during the project.
   1. The end-of-project recycling rate when possible shall equal, at minimum, 75 percent for 2 LEED credits (by weight) of the total waste from construction, demolition, and land clearing activities.
      a. Contractors are encouraged to achieve higher levels of diversion from landfill if possible, as this benefits long-term landfill management and the LEED rating system awards additional points if exemplary performance levels are reached.

B. The approved CWM Plan shall be implemented throughout the duration of the project and documented in accordance with the SUBMITTALS Article below.

C. CWM Plan shall include, but not be limited to, the following components:
   1. Re-Used materials/equipment: Materials or equipment to be removed from the site or turned over to the State shall be documented.
      a. Documentation shall include the materials turned over, weight or quantity of materials/equipment and a letter on company letterhead indicating the intended use of items.
   2. Listing of Targeted Materials: Develop a list of the waste materials from the Project that will be targeted for reuse, salvage, or recycling. The following materials shall be accounted for (materials that will not be recycled shall be indicated as such):
      a. Cardboard, paper, packaging
      b. Acoustical Ceiling Tiles
      c. Clean dimensional wood, palette wood
      d. Beverage containers
      e. Land clearing debris
      f. Concrete
      g. Stone
      h. Concrete Masonry Units (CMU)
      i. Asphalt
      j. Metals from banding, stud trim, ductwork, piping, rebar, roofing, windows, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze
      k. Gypsum board
      l. Carpet and pad
      m. Paint
      n. Asphalt roofing shingles if applicable for any existing building demolition
      o. Rigid Foam
      p. Glass
      q. Plastics

r. Woods

3. Sorting Method: Provide a description of the proposed means of sorting and transporting the recyclable materials (whether materials will be on-site sorted and then hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site for off-site sorting).
4. Recycling facilities: Provide the name of the recycling facilities(s) where materials will be sent for recycling, how it will be recycled, and the applicable fee(s).
5. Landfill Information: Provide the name of the landfill(s) where trash will be disposed of and the applicable landfill tipping fee(s).
6. Additional Information: Include any additional information deemed relevant to describe the scope and intent of the CWM Plan to the Design Professional.
7. Subcontractor Requirements: Construction Waste Management and recycling requirements shall be incorporated into all Subcontractors' contracts.

1.3 SUBMITTALS

A. Submittal Requirements:
1. A copy of the CWM Plan, as defined in the PERFORMANCE REQUIREMENTS Article above.
2. Contractors shall submit a monthly Waste Management submission.
   a. This submission shall include waste receipts and a completed Waste Management Form. (a sample form is included at the end of this Section identified as Exhibit "A")
3. Calculations and supporting documentation to demonstrate end-of–project recycling rates meeting the requirements of the CWM Plan. Note: These calculations and supporting documentation are required regardless of method of processing (on-site or off-site separations). Use these Solid Waste Conversion Factors only if tipping tickets are not available if the weight in each dumpster or container is not directly measured.

Solid Weight Conversion Factors	
Mixed Waste	350 lbs/cubic yard
Wood	300 lbs/cubic yard
Cardboard	100 lbs/cubic yard
Gypsum Board	500 lbs/cubic yard
Rubble	1,400 lbs/cubic yard
Steel	1,000 lbs/cubic yard

   a. Record and document the total weight (in tons) of all demolition and construction waste materials sent to the landfill, or recycled or salvaged. Monthly Waste Management Reporting Forms shall be used as the basis for determining the total amount of waste recycled or salvaged for the project. The monthly reporting forms shall specify:
      1) The number of dumpsters or other containers of recycled or salvaged materials for that month.
      2) The volume (in cubic yards) of each dumpster or container of recycled or salvaged materials for that month.

3) The type of recycled or salvaged material contained in each dumpster or container.
4) The weight of the recycled or salvaged material in each dumpster or container. For materials not contained in the Solid Waste Conversion Factors above propose a conversion factor for review by the Design Professional.
5) In addition, provide the name of the receiving facilities/companies that will be purchasing or accepting the recycled or salvaged materials. Receipts or other proof of facility reception of materials is required.
6) For materials separated for recycling off-site, establish a method for tracking the weight of the recycled material. The method shall be included in the CWM Plan for the Design Professional review and approval.

b. In the case of off-site separation, ensure the transfer station used will provide tickets with required information on delivery weights (or volume with appropriate conversions), and proof of recycling rates for reporting.
c. Calculate the end-of-project recycling rate percentage by dividing the recycled and salvaged waste (in tons) by the total waste generated (recycled, salvaged, and landfilled waste – also in tons), and multiplying by 100.
d. For materials turned over to others for reuse, provide documentation on company letterhead indicating the material(s), the quantity (either by weight or units), the date and the intended reuse of the product.

PART 2 - EXECUTION

2.1 IMPLEMENTATION

A. The following implementations of the CWM Plan will be the responsibility of either the Contractor for the Construction Work or the CWM Contractor if that work is bid out under separate contract.
1. Containers: Provide containers and the removal of all waste, non-returned surplus materials, and rubbish from the site in accordance with the Waste Management Plan. Oversee and document the results of the Plan. The Prime Contractors shall be responsible for collecting, sorting, and depositing in designated areas, their waste, non-returned surplus materials, and rubbish, as per the CWM Plan.
2. Instruction: Provide on-site instruction of appropriate separation, handling and recycling, salvage, reuse and return methods to be used by all parties in appropriate stages of the Project.
3. Separation of materials: Recycling and waste bin areas are to be kept neat and clean, and clearly marked.
a. On-site separation: Lay out a specific area(s) to facilitate separation of materials for potential recycling, salvage, reuse and return. Each potential material shall be collected and stored to avoid being mixed with other materials
b. Off-site separation: Lay out an area for collection of mingled recyclable and waste materials, to be picked up and sorted off-site for recycling.

2.2 MEETINGS

A. Conduct Construction Waste Management meetings. Meetings shall include Subcontractors affected by the CWM Plan. At a minimum, waste management goals and issues shall be discussed at the following meetings:
   1. Pre-bid meeting.
   2. Pre-construction meeting.
   3. Regular job-site meetings.

B. B. Any non-compliant practices in the field will be addressed at regular job-site meetings.

2.3 MONTHLY WASTE MANAGEMENT REPORTING FORMS

A. Monthly Waste Management Reporting Forms, as required in the SUBMITTALS Article above, shall be submitted to the Design Professional for review throughout the duration of the project.

END OF SECTION 017419

(Project Name) (Exhibit "A")
CONTRACTOR C&D WASTE MANAGEMENT FORM
For Waste Generated On-Site

Company: _____

Contact: _____

Phone: _____

Material Description (Include packaging waste if applicable)	**Total Weight**	**% Reused on-site**	**% Recycled off-site**	**% Sent to landfill**	**Material Recipient**

Recycled Material: Material that would otherwise be destined for landfill but is diverted from the waste stream, reintroduced as material feedstock and reprocessed into new end products.

Reused Material: Materials that can be reused in their original form without any reprocessing.

SECTION 017700 – CONTRACT CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and Individual Specification Sections and Notice of Substantial Completion (NOSC) Form, apply to this section.

1.2 SUMMARY

A. Section includes administrative requirements for preparation and submission of final Contract Closeout Documents, including, but not limited to, the following:
   1. Contract Closeout Meeting
   2. Notice of Substantial Completion (NOSC) Requirements
      a. List of Incomplete Work Items
      b. Contract Turnover Documents
         1) As-built Drawings
         2) As-built Specifications
         3) As-built Schedule
         4) Permits, Licenses and Certificates
         5) Hazardous Wastes Documents
         6) Commissioning Authority's Deficiency Log
      c. General Guarantee
      d. Operation and Maintenance Manuals
   3. Contract Closeout
   4. Final Cleaning

B. Related Sections:
   1. General Conditions, Article 8 – Payment
   2. General Conditions, Article 13 – Inspection and Acceptance
   3. Section 014000 – Quality and Code Requirements
   4. Section 017823 – Operation and Maintenance Manuals
   5. Section 017839 – As-built Documents

1.3 CONTRACT CLOSEOUT Meeting

A. Contract Closeout Meeting: The Owner will schedule and conduct a Contract closeout meeting, at a time convenient to the Owner and Design Professional, but no later than sixty (60) days prior to the scheduled inspection date for Substantial Completion.
   1. The Owner will conduct the meeting to review requirements and responsibilities related to Contract closeout.

2. Attendees: Representatives of the Owner, testing agency, commissioning authority, Design Professional**,** and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to make binding decisions on matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Contract closeout, including the following:
    a. Status of Contract Turnover Documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Requirements for submitting final operation and maintenance manual.
    d. Requirements for Permits, Licenses and Certificates.
    e. Preparation of Contractor's list of incomplete Work items.
    f. Procedures for processing Application for Payment at Substantial Completion and final payment.
    g. Submittal procedure.
    h. Responsibility for removing temporary facilities and controls.
4. Minutes: The Owner or Design Professional will record and distribute meeting minutes.

1.4 NOTICE OF SUBSTANTIAL COMPLETION (NOSC)

A. Substantial Completion: After the Work of the Contract is determined by the Owner, to be at Substantial Completion, the Contractor shall submit a written request to the Owner for a date of inspection. The date of Substantial Completion establishes the start of the guarantee period.

B. Documentation: The Notice of Substantial Completion (NOSC) form shall be executed at the end of inspection documenting incomplete Work items and submission of documents in accordance with this section that includes but is not limited to:
    a. Preparation of a list of Work to be completed and corrected, the value of Work items on the list, and completion date of each Work item.
    b. Submittal of contract turnover documents.
    c. Submittal of operation and maintenance manuals, testing, adjustment and balance records.
    d. Delivery of tools, spare parts, extra materials, and similar items to location designated by the Owner. Label with manufacturer's name and model number where applicable.
    e. Termination and removal of temporary facilities from Project site, along with mockups, construction tools, and similar elements.
    f. Completion of final cleaning requirements.

C. SAMPLE FORM - NOTICE OF SUBSTANTIAL COMPLETION

DORMITORY AUTHORITY – STATE OF NEW YORK

NOTICE OF SUBSTANTIAL COMPLETION

INSTITUTION:		CONTRACTOR:	
PROJECT TITLE:		CONTRACT NO:	
PROJECT NO:	9999	CONTRACT VALUE:	

With exception of the list of incomplete Work and status of Contract Turnover Documents, the Dormitory Authority accepts the Work of the Contract Documents as Substantial Completion on (date) _____, in accordance with the General Conditions. This date also constitutes start of the guarantee period.

ITEM	LIST OF INCOMPLETE WORK	SCHEDULED COMPLETION DATE
1.		
2.		
3.		
4.		
5.		
6.		

NOTE: Attach additional pages if necessary.

STATUS of CONTRACT TURNOVER DOCUMENTS:	PROVIDED YES	DUE DATE	Not Applicable
As-built drawings & specifications transmitted to Design Professional	☐		☐
Certified As-built schedule transmitted to Owner	☐		☐
Sustainable documentation submitted to Owner	☐		☐
Permits, licenses and certificates submitted to Authority having jurisdiction	☐		☐
Hazard waste documentation approved by Owner	☐		☐
Operation and maintenance manual submitted to Owner in final form	☐		☐
Spare products stock stored on site per Owner's direction	☐		☐
Identify any other Contract specific turnover document	☐		☐
Identify any other Contract specific turnover document	☐		☐
Final cleaning	☐		☐

Acknowledged by the Contractor (signature& title)	Email Address	Date
Recommended by the Design Professional (signature & title)	Email Address	Date
Recommended by the Project Manager (signature)		Date
Approved by the Director/Chief (signature)		Date

Distribution by PM:
Contractor
Design Professional
Facility Representative

Distribution by PA:
Code Compliance Unit
Risk Management
Procurement Contract File (original)

NOTICE OF SUBSTANTIAL COMPLETION
May '10

Page 1

1.5 LIST OF INCOMPLETE ITEMS

A. Organization of List: Submit list of incomplete items in *EXCEL* spreadsheet electronic format. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:
      a. Project name & number.
      b. Date.
      c. Name of Contractor & Contract number.
      d. Page number.

B. Reinspection: Submit a written request for reinspection. On receipt of request, the Owner will either proceed with inspection or notify the Contractor of unfulfilled requirements. After inspection, the Owner will notify the Contractor of items, either on the Contractor's list or additional items identified, that must be completed or corrected.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis to proceed with commencement of Contract Closeout Documents.

1.6 CONTRACT TURNOVER DOCUMENTS

A. Procedure: Contract turnover documents shall be transmitted to the Owner or if stated to the Design Professional, fifteen (15) days prior to requesting inspection date for Substantial Completion.

B. As-built Drawings: Transmit one paper copy set of marked-up As-built Drawings to the Design Professional, with copy of transmittal to Owner. Print each Drawing, whether or not changes and additional information were recorded.

C. As-built Specifications: Transmit one paper copy set of marked-up as-built specifications, including addenda and contract modifications to the Design Professional, with copy of transmittal to Owner.

D. As-built Schedule: Submit one electronic (PDF) copy, certified by the Contractor, of the schedule that reflects the exact manner in which the project was actually constructed, to the Owner.

E. Sustainable Documentation: Submit one electronic (PDF) copy of product data, costs, invoices, material lists, manifest, certifications, etc to obtain project LEED certification. Refer to Individual Specification Section 018113 – Sustainable Design Requirements for record-keeping and submittals required for USGBC LEED prerequisites.

F. Permits, Licenses and Certificates Documents: Submit one copy of original permits, licenses, certifications, inspection reports, material certificates/affidavits, approvals, and related documents required by authorities having jurisdiction to obtain Letter of Completion, Certificate of Occupancy, or Code Compliance Certificate. Coordinate and respond to requirements from the Owner, NYC Department of Buildings, or Municipality and all other authorities having jurisdiction for issuance of approval/documents required for the Owner use and occupancy.
   1. Cooperate and help coordinate with agency testing materials as specified in Section 014000 – Quality and Code Requirements. Testing Agency is required to submit final report of special inspections.
   2. The Contractor to provide one copy of original certification from agency or firm certifying the following and as required by Individual Specification Sections:
      a. Sprinkler System – NFPA Forms for;
         1) Contractor's Material and Test Certificate for Underground Piping
         2) Contractor's Material and Test Certificate for Aboveground Piping
      b. Fire Alarm System – NFPA 72 Form for;
         1) Record of Completion
      c. Elevator – Certification Form from;
         1) Qualified Elevator Inspector (QEI)
      d. Electrical – Certification Form from;
         1) Authority having jurisdiction
         2) Independent electrical inspection agency acceptable to the Owner

G. Hazardous Waste Documents: Submit four (4) paper copies of documents to the Owner thirty (30) days prior to requesting inspection date for Substantial Completion. Refer to Individual Specification Sections for all requirements.

H. Miscellaneous Record Submittals: Refer to Individual Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one electronic (PDF) copy of each submittal.

I. Reports: Submit written report indicating items incorporated in Contract Documents concurrent with progress of the Work, including modifications, concealed conditions, field changes, product selections, and other notations incorporated.

1.7 GUARANTEE

A. General Guarantee: Comply with General Conditions, Article 13 – Inspection and Acceptance. The date established on the Notice of Substantial Completion form constitutes commencement of the Guarantee period.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Final Manuals Submittal: Submit an electronic copy of a compiled set of complete Operation and Maintenance Manuals in final form as indicated in Section 017823 – Operation and Maintenance Manuals, to the Owner fifteen (15) days prior to requesting date of inspection for Substantial Completion.

1.9 CONTRACT CLOSEOUT (same as final application for payment)

A. Contract Compliance: The Contractor shall comply with the requirements of General Conditions, Section 10.08 – Limitations on Actions.

B. Preliminary Procedure: All Work and Extra Work of the Contract and requirements of this section must be complete and approved prior to commencement of Contract closeout.
   1.
   2. The Contractor shall request and submit to the Owner a final Contractor's Pencil Copy billing request that will formulate the final Application for Payment.
   3. The Contractor shall provide outstanding documentation to the Owner in accordance with General Conditions, Article 20 – Opportunity Programs.

C. Procedures: Upon the Owner's approval of the Contractor's Pencil Copy billing request, Contract closeout documents will be provided to the Contractor. The Contractor shall complete each document and submit all documents with original signature & notary as indicated on forms, the following:
   1.
   2. Final Application for Payment that includes remaining Retainage.
   3. Final Compliance Report.
   4. Contractor and Subcontractor Certifications Form.
   5. Contractor's Certified Payroll Form.
   6. Release Form -- Final Payment to Contractor.
   7. Consent of Surety -- Final Payment to Contractor, with power of attorney.

D. Payroll Forms: The Contractor and all Sub-contractors to the Contractor shall submit original copies of the Contractor and Subcontractor Certifications Form and Contractor's Certified Payroll Form.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
   1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with allowable VOC levels.

PART 3 - EXECUTION

3.1 DEMOBILIZATION

A. Deliver tools, spare parts, extra materials, and similar items to location designated by the Owner. Label with manufacturer's name and model number where applicable.

B. Make final changeover of permanent locks and deliver keys to the Owner. Advise the Owner's personnel of changeover.

C. Terminate and remove temporary facilities from the Project site, along with mockups, construction tools, and similar elements.

3.2 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for contract turnover document purposes. Post changes and modifications to contract turnover documents as they occur; do not wait until the end of the Project.

B. Maintenance of Turnover Documents and Samples: Store turnover documents and Samples in the field office apart from the Contract Documents used for construction. Contract turnover documents shall not be used for construction purposes. Maintain turnover documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to contract turnover documents for the Owner’s reference during normal working hours during performance of Contract.

3.3 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations as applies to Work of the contract.
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.

e. Remove snow and ice to provide safe access to building.
f. 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.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain. Replace if soil or stains remain after shampooing.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. 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 already show evidence of repair or restoration.
    1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
q. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in all other applicable sections.

END OF SECTION 017800

SECTION 017823 - OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and Individual Specification Sections and Contractor's Submission Schedule, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance manual for systems, subsystems, and equipment.
   2. Product maintenance data.
   3. Systems and equipment maintenance data.

B. Related Sections:

C.
   1. Section 013300 – Submittal Procedures
   2. Section 017700 – Contract Closeout Requirements
   3. Section 019113 – General Commissioning Requirements

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Required Manuals: see Section 017700 – Contract Closeout Requirements for additional requirements.

B. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to the Design Professional.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS

A. Organization: Organize the manual into separate sections by CSI number based on the table of contents of the project manual, for each system and subsystem, and a separate section for each piece of equipment not part of a system. The manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents:
      a. Operation data.
      b. Product maintenance data.
      c. Systems and equipment data

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Construction Manager.
   7. Name and contact information for Design Professional.
   8. Name and contact information for Commissioning Agent.
   9. Names and contact information for major consultants to the Design Professional that designed the systems contained in the manuals.
   10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one media volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents by CSI Section number and then by system, subsystem, and equipment. .

E. Manuals, Electronic Copy: Submit electronic (PDF) copy of the manual, to the Design Professional, concurrent with Action Submittal.

2.2 OPERATION DATA

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Section and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Operating standards.
3. Operating procedures.
4. Operating logs.
5. Wiring diagrams.
6. Control diagrams.
7. Piped system diagrams.
8. Precautions against improper use.
9. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.3 PRODUCT MAINTENANCE DATA

A. Content: Organize data into a separate section, within the O & M Manual, for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in section identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   4. Material and chemical composition.
   5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Guarantees: Include copies of warranties and guarantees lists of circumstances and conditions that would affect validity of warranties.
   1. Include procedures to follow and required notifications for warranty claims.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE DATA

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in a separate section within the O & M Manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.

4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Warranties: Include copies of warranties and lists of circumstances and conditions that would affect validity of warranties.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation shall be provided for review, concurrent, with Action Submittal specified in Individual Specification Section.
1. Correct or modify the manual to comply with the Design Professional’s and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Design Professional’s and Commissioning Authority's comments and prior to commencing demonstration and training.

B. Product Maintenance Data: Assemble a complete set of maintenance data, in a separate section, within the O & M Manual, indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Data: Assemble a complete set of operation and maintenance data, in a separate section, within the O & M Manual, indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate section within the O & M Manual, for each system and subsystem, in the form of an instructional manual for use by operating personnel.

D. Manufacturers' Data: Where manual contain manufacturers' standard printed data; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in As-built Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.

END OF SECTION 017823

SECTION 017839 – AS BUILT DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and Individual Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for As-built documents, including the following:
   1. As-built Drawings
   2. As-built Specifications
   3. As-built Schedule
   4. Record Product Data
   5. Miscellaneous record submittals

B. Related Sections:
   1. Section 013200 – Construction Progress Documentation
   2. Section 013300 – Submittal Procedure; Required Submittal List
   3. Section 017700 – Contract Closeout Requirements
   4. Section 017823 – Operation and Maintenance Manuals

C. Administrative and procedural requirements for contract turnover documents, including, but not limited to the following, as provided in Individual Specifications Sections.
   1. Commissioning Documents
   2. Hazardous Waste Documents

1.3 CLOSEOUT SUBMITTALS

A. Required Documents: Section 017700 – Contract Closeout Requirements, describes administrative requirements for submission, number and type of copies required for contract closeout requirements.

PART 2 - PRODUCTS

2.1 AS-BUILT DRAWINGS

A. As-built Drawings: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings onsite. Review As-built Drawings and shop drawings monthly with the Owner, for approval.

1. Preparation: Daily mark As-built Drawings to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up As-built Drawings.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an acceptable drawing technique.
   c. Record data as soon as possible after obtaining it.
   d. Record and check the markup before enclosing concealed installations.
2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order.
   k. Changes made by Bulletin.
   l. Changes made following the Owner’s written orders.
   m. Details not on the original Contract Drawings.
   n. Field records for variable and concealed conditions.
   o. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up as-built prints.
4. Mark as-built sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.2 AS-BUILT SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
   5. Note related Change Orders**,** record Product Data**,** and turnover Drawings where applicable.

2.3 AS-BUILT SCHEDULE

A. Final Schedule: Submit to the Owner a final schedule update. The As-built Schedule shall reflect the exact manner in which the project was actually constructed including actual start and finish dates, activities, sequences and logic.
   1. The Contractor shall certify the final schedule update as being a true reflection of the way the project was actually constructed.

2.4 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to the Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders**,** As-built Specifications, and As-built Drawings where applicable.

2.5 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by Individual Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals.
   1. Include miscellaneous record submittals directory organized by specification section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Maintain Change Log: Maintain and submit written change log to the Owner, monthly for review indicating items incorporated in contract turnover documents concurrent with progress of the Work, including modifications, concealed conditions, field changes, product selections, and other notations incorporated.

B. Recording: Maintain one copy of each submittal during the construction period for contract turnover document purposes. Post changes and modifications to contract turnover documents as they occur; do not wait until the end of the Project.

C. Maintenance of Turnover Documents and Samples: Store turnover documents and Samples in the field office apart from the Contract Documents used for construction. Contract turnover documents are not to be used for construction purposes. Maintain turnover documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to contract turnover documents for the Owner's reference during normal working hours during performance of Contract.

END OF SECTION 017839

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contract Documents, including but not limited to, the Drawings and Individual Specification Sections and the Commissioning Plan, apply to this Section.

1.2 SUMMARY

A. Section includes general, procedural, and administrative requirements that apply to implementation of commissioning.

B. General Provisions for Commissioning:
   1. Selected building systems and equipment to be commissioned are identified in Division 24.
   2. The commissioning process shall be directed by the Commissioning Authority, provided by the Owner.
   3. The responsible Contractor shall act as the Commissioning Agent, and shall be responsible for executing the commissioning process as directed by the Commissioning Authority, and as defined in Division 24.
   4. The commissioning process is defined in Division 24 and includes responsibilities for each Commissioning Team member including the Commissioning Agent.

C. Related Sections:
   1. Specification Sections referenced in Division 24, Commissioning, apply to this Section.

D. References:
   1. Owner's Project Requirements (OPR), Basis of Design (BoD), and Design Intent (DI) documents.
   2. Dormitory Authority State of New York: Building Commissioning Guidelines – 2006 http://www.dasny.org/construc/build_comm_guide/index.php
   3. ASHRAE Guideline 0-2005: The Commissioning Process
   4. ASHRAE Guideline 1.1-2007: HVAC & R Technical Requirements for the Commissioning Process.

1.3 DEFINITIONS

A. Basis of Design (BoD): A document prepared by the Design Professional that records how the designer has met the owner's project requirements. It includes the concepts, calculations, decisions, and product selections and how applicable regulatory requirements, standards, and guidelines have been met. The document includes descriptions and lists of individual items that support the design process.

B. Commissioning (Cx): A quality assurance process that documents specified systems and components that are provided and tested to meet the Owner's needs and the design intent in accordance with the Contract Documents.

C. Commissioning Agent (CA): The Contractor. For the purposes of commissioning the Contractor shall assume the role, tasks, and responsibilities of the Commissioning Agent. Note that per the Owner's Building Commissioning Guidelines, the Owner does not allow the Commissioning Authority and Commissioning Agent to be the same organization or person. The Commissioning Agent shall assign a representative with expertise and authority to act on its behalf to participate in the commissioning process.

D. Commissioning Authority (CxA): The Professional, appointed by the Owner, to direct and coordinate the commissioning process.

E. Commissioning Plan (Cx Plan): A document, prepared by the Commissioning Authority, defining the commissioning process including schedules, responsibilities, documentation requirements, and functional performance test requirements.

F. Commissioning Team: Individuals and entities, as deemed appropriate by the CxA, appointed by the Owner and Contractor, having the authority to act on their behalf, explicitly organized to implement the commissioning process, through coordinated action and defined in the contract documents and the Commissioning Plan.

G. Design Intent (DI): A document prepared by the Design Professional that summarizes design goals of the design phase.

H. Owner's Project Requirements (OPR): A document prepared by the Design Professional that defines the functional requirements and the expectations for operation.

I. Systems and Energy Management Manual: A composite document that expands the scope of the operation and maintenance manual by including additional information gathered by the commissioning process as required by the New York State Green Building Tax Credit, Section 638.8 (k)(2).

1.4 COMMISSIONING TEAM

A. The Commissioning Team shall consist of, but not be limited to, the Owner, Design Professional, Commissioning Authority, Commissioning Agent, suppliers, and specialists, in accordance with the Commissioning Plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 019113

SECTION 028213 – ASBESTOS ABATEMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Scope of Work;
   2. References;
   3. Submittals;
   4. Training and Qualifications; and
   5. Regulatory Requirements.

B. Related Sections:
   1. Division 01 Section “Summary”.
   2. Division 01 Section “Temporary Facilities and Controls”.

1.3 SCOPE OF WORK

A. Contractor shall furnish all facilities, labor, materials, tools, supervision, transportation, and equipment necessary to perform abatement of asbestos-containing materials (ACMs) as specified herein. ACMs have been identified in the following locations and quantities

Location	Material	Estimated Quantity
Fitzgerald Gym	12-inch valve and fitting insulation	6 valves/fittings
Fitzgerald Gym	8-inch valve and fitting insulation	6 valves/fittings
Fitzgerald Gym	6-inch aluminum encased pipe insulation	55 linear feet
Fitzgerald Gym	4-inch aluminum encased pipe insulation	30 linear feet
Rathaus Hall	6-inch block-type pipe insulation	25 linear feet
Rathaus Hall	Valve and fitting insulation associated with 6-inch block-type insulation	2 valves/fittings
Rathaus Hall	4-inch block-type pipe insulation	80 linear feet
Rathaus Hall	Valve and fitting insulation associated with 4-inch block-type insulation	12 valves/fittings

B.

C. The Contractor is responsible for verifying and determining his/her own quantities and abatement/disposal of all ACMs as described herein.

D. Asbestos abatement Work includes, but is not limited to, the following:
   1. Submit notifications and obtain permits and variances (if desired) to/from New York State Department of Labor (NYSDOL), and New York City Department of Environmental Protection (NYCDEP) as necessary to complete the Work;
   2. Proper removal, cleaning, collection, containerization, on-site management, transportation, and off-site disposal of ACM identified accordance with the Specifications and Figures; and

3. Third party air clearance testing and visual inspections for asbestos at the completion of asbestos abatement activities. The Contractor will perform personnel air monitoring required for performance of the Work.

1.4 REFERENCES

A. It is the responsibility of the Contractor to perform Work at the Site in accordance with these publications and all other applicable state, federal, local laws, regulations, and statutes.

1. American National Standards Institute (ANSI);
   a. ANSI A10.6 (1990) Demolition Operations,
2. Code of Federal Regulations (CFR);
   a. 40 CFR 61 – Subpart M – National Emissions Standard for Asbestos,
   b. 40 CFR 763 – Subpart E – Asbestos Hazard Emergency Response Act,
3. Occupational Safety and Health Administration (OSHA);
   a. OSHA 29 CFR 1910.134 – Respiratory Protection,
   b. OSHA 29 CFR 1910.1001 – General Industry Standard for Asbestos,
   c. OSHA 29 CFR 1926.55 – Gases, Vapors, Fumes, Dusts, and Mists,
   d. OSHA 29 CFR 1926.62 – Lead in Construction,
   e. OSHA 29 CFR 1926.95 – Criteria for PPE, and
   f. OSHA 29 CFR 1926.1101 – Asbestos Construction Standard.
4. Industrial Code Rule Part 56 (ICR 56):
   a. New York State Department of Labor
5. Title 15
   a. New York City Department of Environmental Protection

1.5 SUBMITTALS

A. Prepare and submit a project-specific Asbestos Abatement Work Plan in sufficient detail to identify how the Contractor intends to perform and sequence the Work. The Contractor's Asbestos Abatement Work Plan shall at a minimum address the following:

1. Methods the Contractor shall use to abate, properly handle, store and dispose of all ACMs;
2. Necessary permits, notifications, and waivers prior to the start of any abatement or demolition activities;
3. Required certification/licensure of Contractor and workers;
4. Coordination of emergency egress, fire alarm, and other life safety issues;
5. Sealing of critical barriers to include adjacent doorways, windows, HVAC ducts/grills, fixtures, stationary items and other surface openings;
6. Complete restriction of Work areas from non-Work area spaces utilizing asbestos caution tape and/or fire retardant polyethylene sheeting sealed with duct tape;
7. Erection of a wet decontamination unit with air lock chambers;
8. Safety Data Sheets for all chemicals and cleaning supplies to be used on site;
9. Detailed description of abatement, removal, encapsulation, and cleaning techniques to be employed;
10. Worker protection including medical surveillance, P-100-filtered respirators, protective clothing, and gloves;

11. Decontamination procedures including wet wiping and HEPA vacuuming of all Work area surfaces, materials, equipment and workers within or exiting the Work area;
12. Procedure for the capture and proper disposal of all wastewater and debris generated by the Work;
13. The Contractor shall at a minimum provide the following documents on site as part of the Asbestos Abatement Work Plan during asbestos abatement operations;
    a. Copies of personnel training records for each individual associated with asbestos abatement operations indicating proper training as required by federal and State regulations,
    b. Current state/local licenses and United States Environmental Protection Agency (EPA) certifications for each asbestos abatement worker,
    c. Report of medical examination conducted within last 12 months as part of compliance with OSHA medical surveillance requirements for each worker,
    d. A statement that worker is able to wear and use the type of respiratory protection proposed for the project, and is able to work safely in an environment capable of producing stress on the worker,
    e. Respirator fit test documentation within the last 12 months for each worker wearing respiratory protection,
    f. Certification by an officer of the Contractor stating that exposure measurements, medical surveillance, and worker training records are being kept in conformance with 29 CFR 1926.1101, and
    g. Written Respiratory Protection Program as required by OSHA 29 CFR 1910.134 including the selected level of respiratory protection for each task of this project and any supporting historical air monitoring data;
14. The Contractor shall submit copies of notifications, variances, and permits for review and acceptance prior to proceeding with the Work covered by the permit. Notifications are to be submitted or obtained from the appropriate federal, State and local agency in accordance with current regulatory requirements. The Contractor shall update and submit revised permits, variances, and notifications to the appropriate agency and Engineer; and
15. Indicate proposed variances from the Specifications and Drawings.

B. Prepare and submit an asbestos-abatement-related section of the project-specific Waste Handling and Disposal Plan to outline procedures to be used in management of waste materials generated during abatement Work including, but not limited to, identified ACMs. The Waste Handling and Disposal Plan shall address, at a minimum, the Contractor's intended methods for handling, preparing, storing, treating, loading, decontamination, transporting, and disposing of waste and outline the areas of the Site in which waste handling activities will occur. The Waste Handling and Disposal Plan shall include names and locations of proposed waste disposal facilities and haulers along with proposed waste streams, documentation of applicable permits, and regulatory status and compliance history (including documentation of violations and resolution thereof) of each facility and hauler for approval by CUNY. The Waste Handling and Disposal Plan shall also include a waste tracking log to be utilized throughout the

entire duration of the project to document all materials transported off site for disposal. The waste tracking log shall include, but not be limited to, pertinent shipping information such as date, time, material, transporter ID, estimated quantity/volume, and disposal facility for the material being transported.

C. Contractor shall submit daily disposal truck logs. Log shall include date, waste characterization, transporter, disposal facility identification and location, manifest number, vehicle number, driver, and approximate volume and/or weight of waste.

D. Submit Project Record Documents upon completion of ACM abatement.
   1. Recorded actual quantities of materials removed on a volume and/or mass basis and provide copies of waste characterization data, profile forms, and shipping papers;
   2. Copies of daily Site and Work area logs including personnel on site, visitations, inspections, and testing;
   3. Copies of analytical results including personnel monitoring completed by the Contractor during asbestos abatement activities;
   4. Photographic documentation of Work; and
   5. Copies of waste shipment records for all asbestos waste generated during course of Work.

1.6 TRAINING AND QUALIFICATIONS

A. Worker Training
   1. All workers who work on this project shall be provided training, at a minimum, on the following topics and in accordance with the requirements of the site-specific Health and Safety Plan:
   2. The health hazards of asbestos including the nature of asbestos-related diseases, routes of exposure, known dose-response relationships, the synergistic relationship between asbestos exposure and cigarette smoking, latency periods, and health basis for standards;
   3. Personal protective equipment including the types and characteristics of respirator classes, limitations of respirators, proper selection, inspection, donning, use, maintenance and storage of respirators, field testing the face piece to face seal (positive and negative pressure fit tests), qualitative and quantitative fit testing procedures, variations between laboratory and field fit factors, factors that affect respirator fit, selection and use of disposable clothing, use and handling of washable clothing, non-skid shoes, gloves, eye protection, and hard hats;
   4. Medical monitoring requirements for workers including required and recommended tests, reasons for medical monitoring and employee access to records;
   5. Air monitoring procedures and requirements for workers including description of equipment and procedures, reasons for monitoring, types of samples and current standards with recommended changes;
   6. Work practices for asbestos abatement including purpose, proper construction and maintenance of airtight plastic barriers, job set-up of airlocks, posting of warning signs, engineering controls, electrical and ventilation system lockout, proper working techniques, waste cleanup, storage and disposal;

7. Personal hygiene including entry and exit procedures for the Work area, use of showers and prohibition of eating, drinking, smoking, and chewing in the Work area;
8. Special safety hazards that may be encountered including electrical hazards, air contaminants (carbon monoxide (CO), wetting agents, encapsulants), fire and explosion hazards, scaffold and ladder hazards, lifts, slippery surfaces, confined spaces, heat stress, and noise;
9. Workshops allowing both supervisory personnel and abatement workers the opportunity to observe and experience the construction of containment barriers and decontamination facilities; and
10. Lockout/Tagout, Hot Work, and Confined Space Entry procedures.

B. Site Supervisor Qualifications
1. The Contractor shall provide at least one New York State and New York City licensed Site Supervisor, whose responsibilities include coordination, safety, security, and execution of all phases of the asbestos abatement project. The individual and his/her qualifications shall be clearly identified in the Contractor's Asbestos Abatement Work Plan. The Site Supervisor shall not be used as an abatement worker, shall be assigned full-time to the project and be responsible-in-charge of all abatement activities;
2. The Site Supervisor shall be fully qualified in all aspects of asbestos abatement practices and procedures, and have a one- week asbestos training course for asbestos prior to the commencement of asbestos related work. The asbestos training course shall cover all topics listed above as well as training in contract specifications, liability insurance and bonding, legal considerations related to abatement, establishing respiratory protection medical surveillance programs, EPA and OSHA record-keeping programs, as well as any other topics requested by CUNY; and
3. The licensed asbestos Site Supervisor shall be certified in CPR and Emergency First Aid by an appropriate authority, as well as having received the required training under the OSHA Blood borne Pathogen Standard;

1.7 REGULATORY REQUIREMENTS

Adhere to work practices and procedures set forth in all applicable, coded, regulations, and standards. Conform to applicable federal, State, and local codes (as applicable) for asbestos abatement activities.

A. The Asbestos Contractor shall be currently licensed by the State of New York as an asbestos abatement contractor.
B. Provide all required agency notifications of commencement of the Work, obtain permits, waivers, licenses, inspections, and similar documentation, as well as payments and similar requirements associated with codes, regulations, and standards including, but not limited to:
1. Notify the New York State Department of Labor and New York City Department of Environmental Protection in writing; and
2. Post notification signs on-site at least 10 days prior to removal.

PART 2 PRODUCTS

2.1 SUMMARY

A. Section Includes:
   1. Materials and Equipment;
   2. Protective Equipment;
   3. Disposal Bags/Drums;
   4. Disposal Labels and Signs; and
   5. Run-Off Controls.

2.2 MATERIALS AND EQUIPMENT

A. The Contractor shall provide new materials and new or used equipment in undamaged and serviceable condition. Only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards, are to be used during the project.

B. Fire Extinguishers
   1. The Contractor shall provide multi-purpose ABC minimum rating to A40BC fire extinguishers. The Contractor shall comply with the applicable recommendations of NFPA Standard 10 "Standard for Portable Fire Extinguishers." Fire extinguishers shall be located where they are most convenient and effective for their intended purpose, but provide not less than one extinguisher inside each Work area in the equipment room and one outside each Work area in the clean room.

C. Construction Lumber
   1. Construction lumber for critical barrier walls shall consist of nominal, two (2) inch x four (4) inch framing, sixteen inches center to center.
   2. Solid critical barriers to prevent entry at access points including entry doors, access hallways, and stairs shall consist of solid construction such as plywood.

D. Plastic Sheeting
   1. The Contractor shall provide non-combustible, fire-retardant, 6-mil thick clear, frosted, or black polyethylene sheeting in the largest size possible to minimize seams in accordance with local fire department requirements. Spray plastic will not be allowed for use on this project.

E. Adhesive Materials
   1. The Contractor shall provide duct tape in two- (2-) inch or three- (3-) inch widths, with an adhesive that is formulated to aggressively stick to plastic sheeting. The Contractor may also provide spray adhesive in aerosol cans that is specifically formulated to stick tenaciously to plastic sheeting.

F. Shower Assembly
   1. The Contractor shall provide a leak tight decontamination enclosure with integrated drain pan fabricated from fiberglass or other durable waterproof material.
   2. The Contractor shall provide a factory made shower-head producing a spray of water that can be adjusted for spray size and intensity. The Contractor shall feed shower with water mixed from hot and cold supply lines, arranged so that control of water temperature, flow rate, and shutoff is from inside shower without outside aid.

The Contractor shall provide a totally submersible waterproof sump pump with an integral float switch. The unit shall be sized to pump two times the flow capacity of all showers or hoses supplying water to the sump, through 5.0 micron filters when they are loaded to the extent that replacement is required. The unit

shall be capable of pumping debris, sand, plaster or other materials washed off during decontamination procedures without damage to mechanism of pump. The Contractor shall adjust float switch so that a minimum of three (3) inches remains between top of liquid and top of sump pan.

G. HEPA Vacuum

The Contractor shall utilize high efficiency filter vacuums to filter particles of 0.3 micrometers or larger at 99.97% efficiency or greater. The Contractor shall obtain HEPA vacuum attachments, such as various size brushes, crevice tools, and angular tools to be used for varied application, and service the HEPA vacuum routinely to assure proper operation. Caution shall be used any time the vacuum is opened for HEPA filter replacement or debris removal. Operators shall wear protective clothing and respirators when using the HEPA vacuum. Vacuuming by conventional means is unacceptable.

H. Amended Water

For wetting prior to disturbance of asbestos-containing materials, the Contractor shall use an amended water solution. The Contractor shall provide water to which a commercial surfactant (i.e., not dish detergent) has been added. The Contractor shall use a mixture of surfactant and water, which results in wetting of the asbestos-containing material and retardation of fiber release during disturbance of the material, equal to or greater than that provided by the use of one ounce of a surfactant, consisting of 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with five gallons of water.

2.3 PROTECTIVE EQUIPMENT

A. The Contractor will provide health and safety equipment required to protect workers and to comply with the Contractor's site-specific Health and Safety Plan, OSHA, including 29 CFR 1926.1101, and State of New York regulations.

2.4 DISPOSAL BAGS/DRUMS

A. Disposal bags: Provide 6mil (0.15mm) thick leak-tight polyethylene bags.

B. Fiberboard Drums of Equivalent: Provide sufficient quantity of fiber board drums or equivalent (as determined by Engineer) for packaging of ACMs with rough edges.

2.5 DISPOSAL LABELS AND SIGNS

A. Provide leak-tight waste bags or containers for disposal of asbestos-containing materials with labels in accordance with OSHA, EPA, and the latest revisions to the US Department of Transportation requirements, not limited to material identification number (#NA2212), material packaging group (PGIII), and labels. Warning labels will also include:

B. Legend:

Danger
Contains Asbestos Fibers
Avoid Creating Dust
Cancer and Lung Disease Hazard

C. In accordance with NESHAPS, label each waste bag with the name of the waste generator and address where the material was generated. Include the Contractor name and address on each label also. Attach label in a sufficient manner such that they are properly sealed to or on the containers.

D. Label all waste bags, containers, and transport vehicles as required by applicable U.S. Department of Transportation Rules and Regulations.

PART 3 EXECUTION

3.1 SUMMARY

A. Section Includes:
1. General Requirements;
2. Access Control;
3. ACM Location Preparation and Removal;
4. Housekeeping;
5. Quality Control;
6. Personal Protection; and
7. General Waste Handling Procedures.

3.2 GENERAL REQUIREMENTS

A. Asbestos abatement includes proper cleaning, removal, collection, containerization, on-site management, transportation, and off-site disposal of all ACMs.

B. CUNY is not liable to Contractor for lost Work time due to federal, State, or local government actions including project inspections, data review, Work stoppage, or other unforeseen actions.

C. If the Contractor encounters undiscovered, encased or suspect ACMs during the course of the Work other than those identified in the Specifications, cease Work in affected area only and immediately notify the Engineer of such discovery. Do not proceed with Work in such areas until authorized by the Engineer. Continue Work in other areas.

D. The Contractor is responsible for determining the proper abatement procedures and proper disposal of ACMs in accordance with current regulatory requirements.

E. The Contractor is responsible for implementing proper engineering controls for protection of public, employees, subcontractors, and building occupants or trades during the Work and to prevent contamination of the buildings outside of the designated Work areas.

F. Protect abutting properties and structures, appurtenances, and utilities during asbestos abatement activities. Cease operations immediately if abutting structures appear to be in danger. Structures, fencing, and other improvements damaged by Contractor that are intended to remain shall be repaired or replaced at no cost to CUNY.

G. The Contractor will provide a source of electrical power and CUNY will provide a source of water within 100 feet as indicated in the Specifications and Figures. The Contractor shall obtain necessary permits, pay all fees, and supply all labor, materials, and equipment to distribute water and electrical power to the Work area(s) in accordance with local, state, and federal regulations.

H. Conduct operations with minimum interference to site access. Always maintain site egress and access.

I. Access to adjacent properties outside the Limits of Work for Work is not permitted.

3.3 ACCESS CONTROL

A. The Contractor shall be responsible for controlling access to the Work area(s) and shall maintain a daily log of personnel entering the Work area(s).

B. At all times, access to exits, stairways, etc. for egress shall be free of obstacles including building debris, equipment, etc.

C. The Contractor shall provide temporary lighting as necessary to safely perform removal. Temporary lighting shall adequately illuminate all area for abatement.

D. Make safe all energized circuits and components in the Work area. The Contractor is responsible for the complete isolation of any energized circuits that are not protected by a ground-fault circuit interrupter (GFCI) in all abatement Work areas.

E. Restrict or isolate the Work area to prevent entry by unauthorized personnel and the public into the Work area or surrounding controlled areas. Notify CUNY of all entry points that must be secured to restrict the Work area. Access to stairwells and building exits must be maintained.

F. Arrange access to Work area so that only access into Work area is through securable doors to personnel and equipment decontamination units.

G. Provide and maintain construction barriers to prohibit unauthorized access to the Work area. The Contractor shall report to the Engineer and immediately repair any damage to barriers. Work inside the Work area shall stop until all damaged areas are repaired to the satisfaction of CUNY and Engineer.

H. Provide warning signs at each door and barrier leading to the Work area as follows:

Danger Keep Out Beyond This Point Construction Work In Progress

I. Post a manufactured caution sign, approximately twenty- (20-) inch by fourteen- (14-) inch, outsi

Danger Asbestos Cancer and Lung Disease Hazard Authorized Personnel Only Respirators and Protective Clothing Are Required In This Area

J. The signs shall be posted at the perimeters of asbestos removal, demolition or construction areas where the asbestos-containing material to be removed exists.

K. The Contractor shall maintain all temporary barriers, facilities and controls as long as necessary for the safe and proper completion of the Work. All floor areas

within the regulated Work area shall be covered with two (2) layers of 6-mil poly sheeting, except in those instances where such surfaces are deemed contaminated or are to be abated.

L. The regulated status of the Work area shall be maintained during the Workday by the Contractor. Work will not be allowed to commence until all control systems are in place and operable.

M. No barriers shall be removed until the Work areas are thoroughly cleaned and all debris has been properly bagged and removed from Work areas, and the air has passed final clearance tests, in accordance with provisions detailed herein.

3.4 ACM LOCATION PREPARATION AND REMOVAL

A. Area Cleaning And Preparation

1. All pre-cleaning will be inspected by the Engineer. During pre-cleaning activities, the Work area shall have its primary and critical barriers in place and be under adequate negative pressure as described herein. Any changes to this shall be at the approval of the Engineer. It should be noted that pre-cleaning shall take place in all Work areas prior to commencement of abatement. Pre-cleaning shall include wet wiping and HEPA vacuuming of the floor areas and non-movable items. In addition, all cleanable movable items deemed "contaminated" by the Engineer shall also be pre-cleaned;
2. Due to existing equipment and appurtenances, the regulated Work area shall be established with a minimum of two (2) layers of 6-mil thickness, fire-rated polyethylene sheeting.
3. The Contractor shall take all steps necessary to ensure that asbestos fibers do not escape the Work area. Work will cease until cleaning is completed to the satisfaction of the Engineer and steps have been initiated to prevent further contamination; and
4. Project Monitor shall conduct an inspection of the Work area(s) preparations and engineering controls prior to the Contractor commencing asbestos abatement activities. Such inspections may include smoke testing potential routes of migration from the Work area(s).

B. ACM Removal

1. Asbestos removal in a Work area will not begin until given authorization to proceed. This authorization will be given after the removal area has passed a visual inspection by the Project Monitor based on the criteria presented herein. The Engineer reserves the right to inspect the Work area at any time and to order the Contractor to stop Work;
2. During all abatement Work, workers shall wear OSHA-approved and required safety equipment and clothing;
3. The Contractor shall provide equipment as necessary to gain access to all interior and exterior ACMs. The Contractor shall provide all training as appropriate to all workers and supervisors required to operate lifts, ladders, etc. The Contractor shall provide fall protection training and OSHA-approved fall protection for all applicable Work;
4. The Contractor may be required to sequence abatement Work as needed to access ACMs. Should the Contractor co-mingle non-asbestos building materials with

asbestos-containing or asbestos-contaminated materials, then the Contractor shall dispose of these materials as asbestos waste at no additional cost to CUNY;

5. The Contractor is responsible for the removal/disposal of all non-asbestos coverings or structures required to access asbestos-containing materials;
6. All ACMs shall be sufficiently saturated/wetted to reduce fiber release so that the airborne fiber concentration does not exceed the established OSHA Permissible Exposure Limits (PELs). All wastewater shall be filtered through 5-micron pore size filters before being discharged or disposed;
7. Dry removal shall not be permitted at any time during this project;
8. All ACMs shall be carefully removed and placed into double 6-mil polyethylene bags, fiber drums, or individually double wrapped with 6-mil polyethylene sheeting for disposal. All bags, containers or wrapped materials transported out of the Work area shall be labeled with preprinted labels required by federal EPA, OSHA and the Department of Transportation regulations. The name of the waste generator (CUNY) and the project location address shall also be placed on each bag/drum;
9. Fine cleaning of residual ACM shall consist of carefully scraping or brushing the material from surfaces. The recommended method for brushing a substrate after gross removal has taken place is to use a nylon brush. Wetting of the substrate shall also occur while this brushing is performed, since the chance of airborne fiber generation during fine cleaning still exists;
10. The Project Monitor shall perform air testing periodically outside the enclosed Work area(s) or exterior perimeter area(s). If fiber concentrations exceed 0.010 fibers per cubic centimeter (fibers/cc), or background levels, Work shall stop and the Contractor shall perform clean-up activities in the affected areas and check the integrity of all barriers and/or Work practices. No Work shall commence until air testing verifies that air quality levels are acceptable.
11. Clean-up activities shall include, but not be limited to, wet-wiping and vacuuming surfaces with a HEPA equipped vacuum. Work may continue only after the source of contamination is identified, corrected, and proper cleaning activities are implemented;
12. After brushing and scraping, surfaces shall be free of visible debris and fibers. A final wipe-down of the substrate with wet, lint-free cloths shall take place in order to ensure proper cleaning. All surfaces including floors, walls, ceilings, and suspended ceiling grid-work shall also be HEPA vacuumed clean; and
13. All visible ACMs are to be removed by the Contractor before encapsulation procedures are allowed to begin. The Engineer will conduct an inspection of the Work area prior to giving approval to begin encapsulation of the Work area. The removal substrate must be clean and bare, and the entire Work area must be free and clear of any suspect material for the Contractor to pass this visual inspection and begin encapsulation.

3.5 HOUSEKEEPING

A. Throughout the Work period, the Contractor shall maintain the building and Site in a standard of cleanliness as described in these specifications.

1. Contaminated disposable clothing, respirator filters, and other debris shall be bagged and sealed at the end of each Workday;

2. All asbestos waste generated by either removal or repair shall be bagged immediately and not be allowed to be left exposed at the end of each Workday;
3. Respirators shall be thoroughly cleaned at the end of each Workday and stored for the next day's use;
4. The Contractor shall retain all stored items in an orderly arrangement allowing maximum access, not impeding traffic, and providing the required protection materials;
5. The Contractor shall not allow the accumulation of scrap, debris, waste material, and other items not required for completion of the Work;
6. The Contractor shall provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the environment;
7. Daily, and more often if necessary, the Contractor shall inspect the Work areas and adjoining spaces, and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage; and
8. The Contractor shall maintain the Site in a neat and orderly condition at all times.

3.6 QUALITY CONTROL

A. The Project Monitor will provide monitoring of Contractor work practices and performance, inspection of the Work sites, bulk fiber identification, perimeter and clearance air sampling and analysis, and visual clearance inspections for asbestos throughout the asbestos abatement project.

B. Air Monitoring
1. The air clearance acceptance criterion for this project is 0.01 f/cc by PCM. PCM sample analysis shall be available within 24 hours;
2. Background (pre-testing) air and appropriate dust samples may be taken to represent conditions before the Contractor starts masking and sealing operations;
3. During removal, area samples shall be collected in the clean room, at other critical points outside the Work area, just outside the clean room, and inside the regulated Work area. The Contractor shall be responsible for all OSHA personal sampling. Final clearance air samples shall be collected by the Engineer inside the removal area after acceptance of visual inspection and encapsulation. Final clearance testing will be conducted using PCM to document air quality post-removal.
4. A sufficient number of samples to reliably characterize the Work place air quality shall be collected. The results of all samples must comply with the requirements set forth in this Specification. Failure to meet the specified criteria will require the Contractor to re-clean the designated Work site and then the Engineer to repeat the final air clearance testing. All repeat air testing shall be the Contractor's financial responsibility. Cleaning and testing will be repeated until the specified criteria are met.

C. Work Review
1. The Engineer will review the Contractor's Work practices prior to the start and during all asbestos-related Work and will report any specification violations to the Contractor. If the Contractor fails to correct deficiencies in a timely manner, the Engineer will notify the Contractor, and Work may be stopped;

2. The Engineer will review the containment structure and negative air conditions before Work begins and after the Contractor Site Supervisor has given approval; and
3. Outside containment airborne fiber concentrations must not exceed 0.010 fibers per cubic centimeter (f/cc) as analyzed using Phase Contrast Microscopy (PCM) or pre-abatement levels, whichever is greater. If concentrations exceed this level, then Work must be stopped, conditions reviewed as to the probable cause, and then corrected by the Contractor at no additional cost to CUNY. The Project Monitor will keep a daily log of the Contractor's Work practices and will make these daily logs a part of the final project documents.

3.7 PERSONAL PROTECTION

A. Respirators and Protective Clothing

1. Protective Clothing
   a. Personal protection, in the form of disposable Tyvek suits, and NIOSH-approved respirators, are required for mechanics, Contractor supervision, CUNY, Engineer, and visitors at the Work site during the set-up, removal, and cleaning operations;
   b. The Contractor shall provide all this protective equipment for workers, CUNY, Engineer, and authorized personnel to access this Work site;
   c. Each worker shall be supplied with a minimum of two complete disposable uniforms every day;
   d. Removal workers shall not be limited to two uniforms, and the Contractor will be required to supply additional uniforms as is necessary. Under no circumstances will anyone entering the removal area be allowed to reuse a contaminated uniform; and
   e. Work clothes shall consist of disposable full body suits, head covers, gloves, footwear, and eye protection. Street clothes are forbidden in the Work area at all times, even under protective suits.
2. Respiratory Protection
   a. The Contractor shall supply workers and supervisory personnel with NIOSH-approved protective respirators and P-100 filters;
   b. Appropriate respirator selection shall be determined by the daily personal samples being taken and strictly follow the guidelines set forth in the OSHA respiratory program outlined in 29 CFR 1910.1101. The respirators shall be sanitized and maintained according to the manufacturer's specifications. Appropriate respirators shall be selected using the information provided in OSHA Title 29 CFR Part 1910 Final Rules;
   c. The Contractor will maintain on site a sufficient supply of disposable HEPA filters to allow workers and supervisory personnel to change contaminated filters at least three times daily. The Contractor is solely responsible for means and methods used and for compliance with applicable regulations;
   d. Respirators shall be individually assigned to removal workers for their exclusive use;
   e. All respiratory protection shall be provided to workers in accordance with the written submitted respiratory protection program, which

includes all items in OSHA 29 CFR 1910.1101 (1-11). A copy of this program shall be kept at the Work site, and shall be posted in the clean room of the decontamination unit;

f. Workers must perform negative and positive pressure fit tests each a time a respirator is put on, whenever the respirator design permits;

g. Workers shall be given a qualitative fit test in accordance with procedures detailed in the OSHA 29 CFR 1910.1025, Appendix D, Qualitative Fit Test Protocols, for all respirators to be used on this abatement project. An appropriately administered quantitative fit test may be substituted for the qualitative fit test; and

h. Upon leaving the active Work area, the pre-filter shall be discarded, cartridges removed, and respirators cleaned in disinfectant solution and clean water rinse. Clean respirators shall be stored in plastic bags when not in use. The Contractor shall inspect respirators daily for broken, missing, or damaged parts.

3. Personal Sampling

a. The Contractor shall provide daily personal sampling to check personal asbestos exposure levels for the purpose of establishing respiratory protection needs;

b. Samples shall be taken for the duration of the Work shift or for eight (8) hours, whichever is less;

c. Personal samples need not be taken every day after the first day if working conditions remain consistent, but must be taken every time there is a change in the removal operation, either in terms of the location or the type of Work, or during any changes in personnel. Sampling will be to determine eight- (8-) hour Time Weighted Averages (TWA). The Contractor is responsible for personal sampling as outlined in OSHA Standard 1926.1101;

d. Sampling personnel shall be proficient in the taking of asbestos air samples as prescribed by NIOSH 7400, and must be supervised by an individual who has completed the NIOSH 582, or equivalent, training course; and

e. Asbestos air sampling results shall be available for posting at the job site in written form no more than 24 hours after the completion of a sampling cycle. The document shall list each sample's results, sampling time and date, individual monitored, flow rate, sampling duration, microscope field area, number of fibers per fields counted, cassette size, and analyst's name and company. Air sample analysis results will be reported in fibers per cubic centimeter.

f.

3.8 GENERAL WASTE HANDLING PROCEDURES

A. Disposal of all wastes generated as a result of Work shall be performed by the Contractor in accordance with all applicable federal, State, and local regulations.

B. Asbestos waste shall be transferred into properly lined (minimum two 6-mil polyethylene sheeting) approved containers to be provided by waste transporter(s) or Contractor. Containers shall be DOT shippable. Shipping containers shall be filled to within legal weight and height limits for shipping. Waste shall be

contained to comply with approved disposal facility requirements. Contractor is responsible for temporarily staging waste in an area designated in Contractor's Waste Handling and Disposal Work Plan and approved by the Engineer. Asbestos waste to be staged/stored on site prior to transportation off site shall be in lockable containers.

C. Care shall be taken not to overload waste containers.

D. Contractor shall coordinate, manage, and pay for (as a part of the bid price) all waste handling activities with transport firm(s) and with disposal facility(ies) unless otherwise noted in these Specifications. Waste handling activities shall be conducted in accordance with approved schedule so as not to delay Work.

E. Contractor shall perform scheduling of all waste shipments, in coordination with the Engineer and with CUNY identified as generator. CUNY will sign profiles and waste manifests prepared by the Contractor. Contractor shall provide waste manifests to CUNY to sign prior to shipment of waste, and CUNY will in turn sign manifests in a timely manner.

F. Any demurrage costs associated with transportation shall be borne by Contractor.

G. Contractor shall be responsible for transport of all waste to disposal facility(ies) unless otherwise noted in these Specifications. Contractor shall provide copies of the waste manifest signed as accepted by the disposal facility. Failure to properly manifest the waste for disposal will result in non-payment by CUNY.

H. Maintain daily log of all waste shipped off site.

END OF SECTION 02821

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 this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
   1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
   2. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete Subcontractor.
   2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, vapor-retarder installation, steel reinforcement installation, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. NA

C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect.

F. Samples: For vapor retarder.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer and testing agency.

B. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Curing compounds.
   6. Bonding agents.
   7. Adhesives.
   8. Vapor retarders.
   9. Semirigid joint filler.
   10. Joint-filler strips.
   11. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:
   1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.8 PRECONSTRUCTION TESTING

A. NA

1.9 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

1.10 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
   1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301.
   2. ACI 117.

2.2 FORM-FACING MATERIALS

A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A706, deformed.

C. Epoxy-Coated Reinforcing Bars: ASTM A615, Grade 60, ASTM A706, deformed bars, ASTM A775 or ASTM A934, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

D. Galvanized-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.

E. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884, Class A coated, Type 1, deformed steel.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A615, Grade 60, plain-steel bars, ASTM A775, epoxy coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775/A775M.

D. Zinc Repair Material: ASTM A780/A780M.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
   3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:
   1. Portland Cement: ASTM C150/C150M, Type I, Type II or Type I/II, gray.
   2. Fly Ash: ASTM C618, Class F or C.
   3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C33/C33M, [Class 3S] [Class 3M] [Class 1N] <Insert class> coarse aggregate or better, graded. Provide aggregates from a single source[with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials].
   1. Maximum Coarse-Aggregate Size: 1 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
   2. Retarding Admixture: ASTM C494/C494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

2.6 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

E. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber

F. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.7 REPAIR MATERIALS

2.8 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, pozzolan slag cement, as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Percentages in six subparagraphs below repeat ACI 301 (ACI 301M) limits for concrete exposed to deicing chemicals. Revise to suit Project.

D. Fly Ash: 25 percent.

E. Slag Cement: 50 percent.

F. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

G. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.9 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Slabs-on-Grade: Normal-weight concrete.
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum W/C Ratio: 0.40 .
3. Slump Limit: for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
4. Air Content: 7.5 percent, plus or minus 1.5 percent at point of delivery for No. 8 nominal maximum aggregate size.
5. Air Content: 6.0 percent, plus or minus 1.5 percent at point of delivery for No.. 57 or 67 stone nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 .

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. 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.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

1. NOT USED

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

D. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

E. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

F. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

G. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

H. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

I. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.4 JOINTS

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

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
   3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   4. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least [**one-fourth**] <**Insert depth**> of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

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

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6

inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

3.6 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces [**not exposed to public view**] <**Insert locations**>.

B. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
   2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
   3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

3.7 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.8 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
      c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
      a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

3.9 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least [**one**] [**six**] month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.10 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.11 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to submit reports.

C. Inspections:
   1. Steel reinforcement placement.
   2. Verification of use of required design mixture.
   3. Concrete placement, including conveying and depositing.
   4. Curing procedures and maintenance of curing temperature.
   5. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd. , plus one set for each additional 50 cu. yd. or fraction thereof.
   2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C31.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
   b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C39/C39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

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

E. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.12

1. END OF SECTION 033000

SECTION 071300 - SHEET WATERPROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Product provided by this Section is a self-adhesive membrane of not less than 60 mils thickness, consisting of a rubberized asphalt membrane laminated to a 4 mil cross-laminated polyethylene film.

B. Sheet Waterproofing:
   1. Self-adhered modified bituminous sheet membrane.

C. Primer

D. Waterstop

E. Liquid Membrane

F. Below-grade waterproofing accessories

G. Termination Bar

H. Filter Fabric

1.3 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete substrate.

1.4 REFERENCE STANDARD

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2015a).

B. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).

C. ASTM D 751 Test Method for Coated Fabrics

D. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2012.

E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.

F. ASTM D5295/D5295M - Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems; 2014.

G. ASTM D 3767 - Standard Practice for Rubber - Measurements of Dimensions

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

I. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a (Reapproved 2013).

J. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

K. UL 790 Tests for Fire Resistance of Roof Covering Materials

1.5 SUBMITTALS

A. See Section 011000 - General Requirements, for submittal procedures.

B. Product Data: Provide data for membrane, primer waterproofing accessories and filter fabric

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in CUNY's name and registered with manufacturer.

G. Schedule of inspections and inspections reports prepared by the manufacturer. Manufacturer's representative shall perform a minimum of three (3) inspections on the work in progress

1.6 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved in writing by the manufacture.

C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer

D. Regulatory Requirements: Comply with applicable codes, regulations, ordinances, and laws regarding use and application of products that contain volatile organic compounds (VOC).

E. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing

1. Manufacturer's representative shall be present at meeting.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
   1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
   2. Protect mastic and adhesive from moisture and potential sources of ignition.
   3. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides.
   4. Protect surface conditioner from freezing.

B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.8 MOCK-UP

A. Construct mock-up consisting of 100 sq. ft. (10 sq. m) of horizontal waterproofed panel; to represent finished work including internal and external corners.

B. Mock-up may remain as part of this Work.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application and until liquid or mastic accessories have cured.

B. Coordinate waterproofing work with other trades. The applicator shall have sole right of access to the specified areas for the time needed to complete the installation.

C. Warn personnel against breathing of vapors and contact of material with skin or eyes. Wear applicable protective clothing and respiratory protection gear.

D. Keep flammable products away from spark or flame. Do not allow the use of spark producing equipment during application and until all vapors have dissipated. Post “NO SMOKING” signs.

E. Maintain work area in a neat and orderly condition, removing empty containers, rags, and rubbish daily from the site.

1.10 WARRANTY

A. See Section 011000 - Closeout Submittals, for additional warranty requirements.

B. Upon completion and acceptance of the work required by this section, the manufacturer will issue a warranty agreeing to promptly replace defective materials for a period of 5 years.

1. Manufactuer and Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to CUNY.

21 WATERPROOFING APPLICATIONS

A. Self-Adhered Modified Bituminous Sheet Membrane:
   1. Cover with drainage fabric.

2.2 MEMBRANE MATERIALS

A. Self-Adhered Modified Bituminous Sheet Membrane:
   1. Thickness: 60 mil, 0.060 inch (1.5 mm), minimum.
   2. Sheet Width: 36 inch (0.914 m), minimum.
   3. Tensile Strength:
      a. Film: 5000 pounds per square inch (34.57 MPa), minimum, measured according to ASTM D882 and at grip-separation rate of 2 inches (50 mm) per minute.
      b. Membrane: 325 pounds per square inch (2.24 MPa), minimum, measured according to ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches (50 mm) per minute.
   4. Elongation at Break: 300 percent, minimum, measured according to ASTM D412.
   5. Water Vapor Permeance: 0.05 perm (2.9 ng/(Pa s sq m)), maximum, measured in accordance with ASTM E96/E96M.
   6. Low Temperature Flexibility: Unaffected when tested according to ASTM D1970 at -45degrees F (- mm) , 180 degree bend on 1 inch (25 mm) mandrel.
   7. Peel Strength: 7 pounds per inch (1226 N/m), minimum, when tested according to ASTM D903.
   8. Lap Adhesion Strength: 5 pounds per inch (875.6 N/m), minimum, when tested according to ASTM D1876.
   9. Puncture Resistance: 60 pounds (27 kg), minimum, measured in accordance with ASTM E154/E154M.
   10. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.
   11. Hydrostatic Resistance: Resists the weight of 230 feet when tested according to ASTM D5385.
   12. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
   13. Manufacturers:

      a. W.R. Grace Construction Products
      b. Carlisle Coatings & Waterproofing Incorporated; MiraDRI 860/861; www.carlisle-ccw.com.
      c. W.R. Meadows, Inc; MEL-ROL: www.wrmeadows.com/#sle.

B. Primer: As recommended by membrane manufacturer.

C. Seaming Materials: As recommended by membrane manufacturer.

D. Membrane Sealant: As recommended by membrane manufacturer.

E. Termination Bars: Aluminum; compatible with membrane and adhesives.

F. Surface Conditioner: type, compatible with membrane and recommended by manufacturer for substate.

G. Adhesives: As recommended by membrane manufacturer.

H. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

2.3 ACCESSORIES

A. Protection Board: Rigid insulation specified in Section 072100.

B. Drainage fabric: Drainage layer with geotextile filter fabric on earth side.
   1. Composition: Dimpled polystyrene core; polypropylene filter fabric.
      a. Products:
         a) Mirafi Waterproofing & Building Products; ArmorDrain 150: www.mar-flex.com/#sle.

C. Waterstop: Carlisle Coating and Waterproofing: CCW MiraStop TDS

D. Flexible Flashings: Type recommended by membrane manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify items that penetrate surfaces to receive waterproofing are securely installed.

D. Condition of Concrete Surfaces:
   1. The concrete surfaces shall be of sound structural grade and shall have a smooth finish, free of fins, ridges, protrusions, rough spalled areas, loose aggregate, exposed course aggregate, voids or entrained air holes. Rough surfaces shall receive a well-adhered parge coat.
   2. Concrete shall be cured by water curing method. Any curing compounds must be of the pure sodium silicate type and be approved by the waterproofing company's representative.
   3. Concrete shall be cured at least 7 days and shall be sloped for proper drainage.
   4. Voids, rock pockets and excessively rough surfaces shall be repaired with approved non-shrink grout or ground to match the unrepaired areas.
   5. Surfaces at cold joints shall be on the same plane

3.2 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Seal cracks and joints with sealant using depth to width ratio as recommended by sealant manufacturer.
   1. All cracks over 1/16" in width and all moving cracks under 1/16" in width shall be routed out to 1/4" minimum in width and depth and filled flush with an approved polyurethane sealant recommended by manufacturer.
   2. Install a 3/4" face, 45 degree cant of polyurethane sealant at all angle changes and inside corners including penetrations through the deck, walls, curbs, etc.
   3. All expansion joints less than 1" wide shall be cleaned, primed, fitted with a backing rod and caulked with polyurethane sealant. For larger joints, contact manufacturer's representative.
   4. Allow all sealant to cure at least overnight.

E. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

F. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate according to ASTM D5295/D5295M.
   1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.
   2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, rutted cracks, ragged corners, deviations in surface plane, spalling and delaminations, as described in the reference standard.
   3. Remove and replace areas of defective concrete as specified in Section 033000.
   4. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in the referenced standard.
   5. Test concrete surfaces as described in the referenced standards. Verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

G. Concrete Substrate: Do not proceed with installation until concrete has properly cured and dried (minimum 7 days for normal structural concrete and minimum 14 days for lightweight structural concrete. Primer as recommended by the manufacture may be used to allow priming and installation of membrane sooner than 7 days. Priming may begin in this case as soon as the concrete will maintain structural integrity.
   1. Fill form tie rod holes with concrete and finish flush with surrounding surface.
   2. Repair bugholes over 13 mm in length and 6 mm deep and finish flush with surrounding surface.
   3. Remove scaling to sound, unaffected concrete and repair exposed area.
   4. Grind irregular construction joints to suitable flush surface.

3.3 INSTALLATION – MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

B. Roll out membrane, and minimize wrinkles and bubbles.

C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.

D. Overlap edges and ends, minimum 3 inches (76 mm), seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.

G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

H. Seal membrane and flashings to adjoining surfaces.

I. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

J. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

K. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.

3.4 INSTALLATION - DRAINAGE FABRIC

A. Install drainage fabric sheets according to manufacturer's written instructions and recommendations. .

B. Place drainage fabric directly against membrane, butt joints, place to encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions.

C. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

D. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 3 inch- minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.

3.5 FIELD QUALITY CONTROL

A. CUNY and AECOM will provide testing services in accordance with Section 011000 - Quality Requirements. Contractor shall provide temporary construction and materials for testing.

B. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by CUNY and AECOM; repeat flood test, and repair damage to building.

3.6 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

B. Vertical Application:

1. Install perimeter drainage System as the first course of drainage composite immediately after membrane has been installed on vertical surfaces. Install protection board Stop drainage fabric 6" below final grade level.

END OF SECTION

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Requirements Division 01, Division 23 Specification Sections, and Common Work Requirements for HVAC apply to the work specified in this Section.

1.2 SUMMARY

A. This Section includes and applies to all work included in Division 23.

B. Work in this Section includes providing labor, materials, equipment, services necessary, fabrication, installation and testing for fully operational and safe systems including all necessary materials, appurtenances and features whether specified or shown in the contract documents or not, in conformity with all applicable codes and authorities having jurisdiction for the following:
   1. Mechanical work covered by all sections within Division 23 of the specifications, including, but not limited to:
      a. Control systems.
      b. Testing and balancing.
      c. Cleaning of piping systems.
      d. Dielectric fittings.
      e. Mechanical sleeve seals.
      f. Escutcheons.
      g. Grout.
      h. Equipment installation requirements common to equipment sections.
      i. Painting and finishing.
      j. Concrete bases.
      k. Supports and anchorages.

C. Provide cutting and patching, for the Mechanical Work.

D. Provide piping from plumbing terminations, 10 feet from equipment, for water, compressed air and as indicated.

E. Provide drainage from noted equipment to floor drains, sink, or funnel drains.

F. Provide piping connections to equipment, as required and as indicated.

1.3 DEFINITIONS

A. "Furnish" or "Provide": to supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically otherwise noted.

B. "Install": to erect, mount and connect complete with related accessories.

C. "Supply": to purchase, procure, acquire and deliver complete with related accessories.

D. "Work": labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

E. "Piping": pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

F. "Wiring": raceway, fittings, wire, boxes and related items.

G. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

H. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

I. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

J. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings, in chases, in enclosures, in trenches or in crawl spaces.

K. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

L. "Indicated," "Shown" or "Noted": as indicated, shown or noted on drawings or specifications.

M. "Approved Equal" of base bid manufacture: in the Engineer's opinion, equal in materials, weight, size, design, and efficiency of specified product, conforming with 2.01 MANUFACTURERS.

N. "Reviewed," "Satisfactory," or "Directed": as reviewed, satisfactory, or directed by or to Engineer.

O. "Motor Controllers": manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.

P. "Control" or "Actuating Devices": automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

1.4 ABBREVIATIONS

A. The following are industry abbreviations for plastic materials.
1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

B. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

C. Following is a list of abbreviations and symbols that are used in the specifications:

Word or Symbol	Abbreviation or Symbol Used in Specifications
ϕ	phase
alternating current	AC
ampere	amp
brake horsepower (bhp)	BHP
British thermal units	Btu
Celsius	C
cfh	CFH
cubic feet per minute	cfm
cubic feet per second	cfs
degree	°
direct current	DC
emergency power system	EPS
etcetera (etc.)	etc.
Fahrenheit	F
feet	ft.
feet per minute	fpm
gallon	gal.
gallons per minute	gpm
hertz	Hz
horsepower	hp
inches	in.
kilovolt	kV
kilowatt	kW
KVA	kVA

Word or Symbol	Abbreviation or Symbol Used in Specifications
length	length
manufacturer	Mfr.
minute	minute
number	No.
ounce	oz.
percent	%
plus and minus	±
pound or pounds	lb. or lbs.
pounds per square inch (psi)	psi
power factor	pf
psig	psig
PVC	PVC
revolutions per minute (rpm)	rpm
square foot or square feet	sq. ft.
times	times (unless used in an equation, then use x)
uninterruptible power supply (UPS)	UPS
Variable Frequency Drive	VFD
volt	V
water gauge	w.g.
width	width
wire-gauge	awg
WWP	WWP

1.5 JOB CONDITIONS

A. Examine all drawings and specifications in a manner to be fully cognizant of all work required under this Division.

B. Adjoining work of other Divisions shall be examined for interferences and conditions affecting this Division.

C. Examine site related work and surfaces before starting work of any Section.
   1. Report to Engineer, in writing, conditions which will prevent proper provision of this work.
   2. Beginning work of any Section without reporting unsuitable conditions to Engineer constitutes acceptance of conditions by Contractor.
   3. Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to CUNY.

D. Connections to existing work.
   1. Verification of existing:

a. Before submitting bid, become thoroughly familiar with actual existing conditions and systems at the building, and of the existing installations to which connections must be made, including any necessary alterations, and existing building engineering practices and requirements. The intent of the work is shown on the drawings and described herein, and no consideration will be granted by reason of lack of familiarity on the part of the contractor with actual physical conditions, requirements, and practices at the site.

2. Install new work and connect to existing work with minimum interference to existing facilities.
3. Temporary shutdowns of existing services:
   a. At no additional charges.
   b. At times not to interfere with normal operation of existing facilities.
   c. Only with written consent of CUNY.
4. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.
5. Restore existing disturbed work to original condition.
6. Perform following work only after regular working hours:
   a. Drilling and jackhammering.

E. Removal and relocation of existing work.
1. Disconnect, remove or relocate material, equipment, plumbing fixtures, piping and other work noted and required by removal or changes in existing construction.
2. Where existing pipes, conduits and/or ducts which are to remain prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits and/or ducts.
3. Provide new material and equipment required for relocated equipment.
4. Plug or cap active piping or ductwork behind or below finish.
5. Do not leave long dead-end branches. Cap or plug as close as possible to active line.
6. Remove unused piping, ductwork and material.
7. Dispose of removed fixtures and equipment as directed.
8. Turn over removed fixtures and equipment to CUNY as directed.

F. Special Traffic Requirements:
1. Maintain emergency and service entrances useable to pedestrian, truck, and ambulance traffic at all times.
2. Where trenches are cut, provide adequate bridging for above mentioned traffic.

G. If asbestos insulation is found when working in existing areas, immediately stop work and notify CUNY. Do not restart work until advised in writing by CUNY that it is safe to do so following abatement, encapsulation, etc.

1.6 CLEARANCE FROM ELECTRICAL EQUIPMENT

A. Piping or ductwork:
1. Prohibited in:
   a. Electric rooms and closets.

b. Telephone rooms and closets.
c. Elevator machine rooms.
d. Electric switchboard room.

2. Prohibited above an area within 5 ft. of:
   a. Transformers.
   b. Motor control centers.
   c. Standby power plant.
   d. Bus ducts.

1.7 SUBMITTALS

A. Submit the following items as hereinafter specified:
   1. Names and qualifications of test and balance agencies.
   2. Layout Drawings.
   3. Coordinated Drawings.
   4. As-built Record Drawings (Submitted to Client).
   5. Record Files (Submitted to Client).
   6. Operating and Maintenance Manuals.
   7. Welding certificates.
   8. Equipment and material submittals as required by sections within this division.

B. Items shall comply with the requirements as hereinafter specified.

C. Submit shop drawings, product data, samples and certificates of compliance required by contract documents.

D. Schedule of submittals, as agreed to by the Engineer, will set the basis of the minimum required submittals. Submittals shall be provided by the Contractor promptly and in accordance with the Schedule of submittals and in such sequence as to cause no delay in work or in work of any other divisions.

E. Resubmission Requirements:
   1. Make any corrections or change in Submittals required. Resubmit for review until no exceptions are taken or a resubmission is not required.
   2. Shop Drawings and Product Data:
      a. Revise initial drawings or data, and resubmit as specified for initial submittal.
      b. Indicate any changes which have been made other than those requested.
   3. Samples: Submit new samples as required for initial submittal.
   4. Clearly identify resubmittal by original submittal date, number and revision number and indicate all changes from previous submittal.

F. Corrections or comments made on the shop drawings during review do not relieve the Contractor from compliance with requirements of the drawings and specifications. Shop drawing checking by the Engineer is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for:
   1. Confirming and correlating all quantities and dimensions.

2. Selecting fabrication processes and techniques of construction.
3. Coordinating his work with that of all subcontractors.
4. Performing his work in a safe and satisfactory manner.

G. Layout (Shop) Drawings:
1. Submit Layout Drawings indicating work within mechanical rooms areas containing boilers, chillers, cooling towers, air handlers or pumps, areas containing acoustically lined ductwork, food service areas and for any areas.
2. Layout Drawings for mechanical rooms shall be at a scale of 3/8"=1'-0".
3. Prepare layout shop drawings for all areas.
4. From the layout drawings, prepare and submit Coordinated Drawings as herein specified below.

H. Coordinated Drawings:
1. This Contractor shall prepare coordinated drawings which shall show work of all subcontractors including, but not limited to:
   a. Piping, including:
      1) HVAC, plumbing and fire protection.
      2) Minor Piping such as drains, air vents, condensate piping, etc.
      3) Sleeves and penetrations.
      4) Expansion devices, anchors, guides and hangers.
   b. Mechanical Equipment.
   c. Supports and suspension devices.
   d. Piping high points and low points.
   e. Electrical Equipment.
   f. Main Electrical conduits and bus ducts.
   g. Equipment support and suspension devices including hangers, supports and bracing.
   h. Structural and architectural constraints including:
      1) Beams, braces, trusses, flanges, constraints, walls, openings ratings, doors, wall types, glazing.
   i. Show location of:
      1) Valves.
      2) Chemical Treatment.
      3) Piping specialties.
      4) Control and electrical panels.
      5) Disconnect switches
2. Provide sections and elevations for all mechanical rooms, mechanical areas, areas with routed duct mains, areas with routed piping mains, and areas adjacent to the existing structure.
3. Preparation of drawings:
   a. Prepare reproducible CADD drawings.
   b. Submit to subcontractors for review of space allocated to all subcontractors.
   c. Revise drawings to compensate for requirements of existing conditions and conditions created by subcontractors.
4. Final prepared drawings shall show that subcontractors affected have made reviews and signed, by each subcontractor, at completion of coordination.

5. Coordinated shop drawings shall be for all areas.
6. Contractor is to assure that each subcontractor has coordinated work with other subcontractors, prior to submittal.

I. As-built (Record) Drawings:
1. Provide after installation is complete. Final signoff and CUNY acceptance will not occur prior to submission of As-built drawings to CUNY.
2. Indicate as-built conditions and all revisions that occurred subsequent to "Coordinated Drawings" submittal, fully illustrating all revisions made by all subcontractors in the course of work.
3. Dimension physical locations of ductwork, and piping with reference elevations and distances above finished floors, below beams, from wall faces, underground (invert elevations) and from column lines.
4. Exact location, type and function of concealed valves, dampers, controllers, piping, air vents, piping drains and isolators.
5. Indicate all equipment sizes and capacities and tag numbers.
6. Provide drawing on reproducible CADD mylar.
7. These drawings shall be for as-built record purposes for CUNY's use and are not considered shop drawings.

J. Record Files:
1. Provide 5 (five) electronic file copies of the As-built CADD drawings in the media (CDROM, Disks, Tape, etc.) of CUNY's choice.
2. Include hard copy and electronic copy of file naming convention, layering standards, drawing index and file descriptions.
3. Electronic files shall be modifiable and shall include all associated referenced background files.

K. Operating Instructions, Maintenance Manuals and Parts Lists:
1. Before requesting acceptance of work, submit one set for review by Engineer.
2. After review, furnish five printed and bound sets.
3. Include:
    a. Manufacturer's name, model number, service manual, spare-parts list, and descriptive literature for all components, cross referenced and numbered on Record Drawings as required.
    b. Maintenance instructions.
    c. Listing of possible breakdown and repairs.
    d. Instruction for starting, operation and programming.
    e. Detailed and simplified one line, color coded flow and wiring diagram.
    f. Field test report, including:
        1) Instrument set points.
        2) Normal operating values.
    g. Name, address and phone number of contractors equipment suppliers and service agencies.
    h. Assemble manufacturer's equipment manuals in chronological order, following the specification alpha-numeric system, in heavy duty 3-ring binders clearly titled on the spine and front cover with appropriate index dividers.

L. Quantity of Submittals Required.
   1. Layout (Shop) Drawings and Coordinated Drawings:
      a. Submit two prints and one electronic copy.
      b. Upon review, electronic copy will be annotated and returned. Prints will be retained by the Engineer.
      c. Copies of the electronic copies will serve as record copies for CUNY.
   2. Product Data (brochures):
      a. Submit one electronic copy**.**
      b. Upon review, electronic copy will be returned.
      c. If comments are required, they will be returned with each copy.
      d. One copy will be retained by the Engineer.

1.8 RELATED WORK AND REQUIREMENTS

A. Carefully check the documents of each section with those of other sections and Divisions. Ascertain the requirements of any interfacing materials or equipment being furnished and/or installed by those sections and Divisions, and provide the proper installation and/or required interface.

B. As a minimum requirement and condition, the Contractor shall provide CADD generated drawings (for the purpose of Layout Drawings, Coordinated Drawings, As-built Drawings and Record Drawings) with a proven layering standard. Deviation from this requirement shall be:
   1. At the discretion of the Engineer and CUNY.
   2. Submitted as a substitution within the specified time frame.

C. Related work specified elsewhere:
   1. Providing temporary heat.
   2. Providing finish painting, including pipe stenciling.
   3. Cutting and patching, except as noted.
   4. Excavating and backfill.
   5. Equipment platforms.

1.9 QUALITY ASSURANCE

A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.

B. Supply all equipment and accessories new and free from defects.

C. Supply all equipment and accessories in compliance with the applicable standards and with all applicable national, state and local codes.

D. All items of a given type shall be the products of the same manufacturer.

E. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

F. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.10 REFERENCE STANDARDS

A. Published codes, specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this Division where cited below:
   1. AABC: Associated Air Balance Council.
   2. ADC: Air Diffuser Council.
   3. AMCA: Air Moving and Conditioning Association.
   4. ANSI: American National Standards Institute.
   5. ARI: Air-Conditioning and Refrigeration Institute.
   6. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers.
   7. ASME: American Society of Mechanical Engineers.
   8. ASSE: American Society of Sanitary Engineers.
   9. ASTM: American Society for Testing and Materials.
   10. AWS: American Welding Standards.
   11. FM: Factory Mutual.
   12. Local Utility Authorities.
   13. National, State and Local Codes of all authorities having jurisdiction.
   14. NEMA: National Electrical Manufacturer's Association.
   15. NFPA: National Fire Protection Association.
   16. OSHA: Occupational Safety and Health Act.
   17. PDI: Plumbing and Drainage Institute.
   18. State Energy Code having jurisdiction
   19. UBC: Uniform Building Code.
   20. UL: Underwriters' Laboratories, Inc.
   21. UMC: Uniform Mechanical Code.
   22. UPC: Uniform Plumbing Code.
   23. New York City Construction Codes.

B. In addition to complying with all other legal requirements, comply with current provisions of governing codes and regulations in effect during progress of the Work, and with the following:
   1. Drawings and specification requirements shall govern where they exceed Code and Regulation requirements.
   2. Where requirements between governing Codes and Regulations vary, the more restrictive provisions shall apply.
   3. Nothing contained in Contract Documents shall be construed as authority or permission to disregard or violate legal requirements. The Contractor shall immediately draw the attention of the Engineer to any such conflicts noted in the Contract Documents.

1.11 DESCRIPTION OF BID DOCUMENTS

A. Specifications:
   1. Specifications, in general, describe quality and character of materials and equipment.
   2. Specifications are of simplified form and include incomplete sentences.
   3. Words or phrases such as "The Contractor shall," "shall be," "furnish," provide," "a," "an," "the," and "all" etc. have been omitted for brevity.

B. Drawings:
   1. Drawings in general are diagrammatic and indicate scope, sizes, routing, locations, connections to equipment and methods of installation, but not necessarily offsets, obstructions or structural conditions. Locations on drawings may be distorted for purposes of clearness and legibility.
   2. Contractor to provide additional offsets, fittings, hangers, supports, valves, drains as required for construction and coordination with work of subcontractors.
   3. Scaled and figured dimensions are approximate and are for estimating purposes only, but shall be followed with sufficient accuracy to coordinate with other work and structural limitations.
   4. Before proceeding with work, check and verify all dimensions and carefully check space requirements with other Work to ensure that all equipment and materials can be installed in spaces allotted.
   5. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
   6. The Contractor is responsible for installing the work in such a manner that it will conform to the structure and architectural elements, avoid obstructions, maintain headroom, leave adequate clearance for proper maintenance and repairs, and provide clearances and access required by codes.
   7. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of subcontractors.
   8. Above items to be performed at no additional cost to CUNY.

C. If any part of Specifications or Drawings appears unclear or contradictory, consult with CUNY and/or Engineer for interpretation and decision as early as possible during bidding period. Do not proceed with such work without CUNY's and/or Engineer's decision.

D. Typical details, where shown on the drawings, apply to each and every item of the project where such items are applicable. Typical details are not repeated in full on the plans, and are diagrammatic only, but with the intention that such details shall be incorporated in full.

1.12 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces.

1.13 SPECIAL TOOLS

A. Furnish to CUNY at completion of work:
   1. One set of any special tools required to operate, adjust, dismantle or repair equipment furnished under any section of this Division.
   2. "Special tools": those not normally found in possession of mechanics or maintenance personnel.
   3. One pressure grease gun for each type of grease required.
      a. With adapters to fit all lubricating fittings on equipment.
      b. Include lubricant for lubricated plug valves.
   4. Tag each item and cross reference in Maintenance Manual.
   5. Turn over to CUNY's representative or temporarily secure to unit at Engineer’s instruction.

1.14 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

C. Check dimensions of access route through the site from delivery point to final location. Where necessary, ship in crated sections of size to permit passing through available space. Dismantle and/or reassemble, reprovision and retest equipment too large to pass through available access route to final location in one piece.

D. Ship equipment in original packages, to prevent damaging or entrance of foreign matter.

E. Handle and ship in accordance with manufacturer's recommendations.

F. Provide protective coverings during construction.

G. Replace at no expense to CUNY, equipment or material damaged during storage or handling, as directed by Engineer.

H. Tag all items with weatherproof tag, identifying equipment by name and purchase order number.

I. Include packing and shipping lists.

J. Special requirements as specified in individual sections.

1.15 PROTECTION OF MATERIALS

A. Protect from damage, water, dust, etc., material, equipment and apparatus provided under this Division, both in storage and installed, until Notice of Completion has been filed.

B. Provide temporary storage facilities for material and equipment.

C. Arrange with CUNY for storage facilities for materials and equipment.

D. Material, equipment or apparatus damaged because of improper storage or protection will be rejected.
   1. Remove from site and provide new, duplicate, material equipment or apparatus in replacement of that rejected.

E. Cover motors and other moving machinery to protect from dirt and water during construction.

F. Protect premises and work of other Divisions from damage arising out of installation of work of this Division.
   1. Repair or replace, as directed by Engineer, materials and parts of premises which become damaged as result of installation of work of this Division.
   2. Remove replaced parts from premises.

1.16 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by representatives of CUNY.

B. Advise Engineer in writing that work is ready for review at following times:
   1. Prior to backfilling buried work.
   2. Prior to concealment of work in walls and above ceilings.
   3. When all requirements of Contract have been completed.

C. Do not conceal work without CUNY's consent.

1.17 SCHEDULE OF WORK

A. Arrange work to conform to schedule of construction established or required to comply with Contract Documents.

B. In scheduling, anticipate means of installing equipment through available openings in structure.

C. Confirm in writing to Engineer, within 30 days of signing of contract, anticipated number of days required to perform test, balance, and acceptance testing of mechanical systems:
   1. This phase must occur after completion of mechanical systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.

2. Submit for approval at this time, names and qualifications of test and balancing agencies to be used.

D. Arrange with CUNY schedule for work in each area.

E. Unless otherwise directed by CUNY, perform work during normal working hours.

F. Work delays:
1. In case noisy work interferes with CUNY's operations, CUNY may require work to be stopped and performed at some other time, or after normal working hours.

1.18 NOISE REDUCTION

A. Cooperate in reducing objectionable noise or vibration caused by mechanical systems.
1. To extent of adjustments to specified and installed equipment and appurtenances.

B. Correct noise problems caused by failure to install work in accordance with Contract Documents. Include labor and materials required as result of such failure.

1.19 PERMITS, LICENSES, AND INSPECTIONS

A. Permits and Licenses:
1. Secure required permits and licenses including payments of all charges and fees.

B. Inspections:
1. Obtain certificates of final inspection approval from authorities having jurisdiction, and submit to CUNY before acceptance of the Work.
2. Obtain inspections during the Work as required to allow timely progress of these and subcontractors.

1.20 GUARANTEE

A. Guarantee all materials, equipment, apparatus and workmanship to be free of defective materials and faulty workmanship for period of one year from date of filing of Notice of Completion, unless extended guarantee periods are specified in individual sections.

B. Furnish guarantee covering all work in accordance with general requirements of the Contract.

C. Provide new materials, equipment, apparatus and labor to replace that determined by CUNY to be defective or faulty.

D. This guarantee also applies to services such as Instructions, Adjusting, Testing, Noise, Balancing, etc.

E. Equipment manufacturers shall include extended warranty to give full coverage during warranty period, unless longer period is specified.

F. After a one year parts and labor warranty, provide an additional 4 year, parts only warranty on all components.

1.21 PRELIMINARY OPERATION

A. Any portion of the system or equipment shall be placed in operation at the request of CUNY prior to the final completion and acceptance of the work. Such operation shall be under the direct supervision of the Contractor, but the expense thereof will be paid separately and distinct from any money paid on account of the Contract.

B. Preliminary operation or payment thereof shall not be construed as acceptance of any part of the Work.

1.22 REMOVALS

A. General:
1. Perform demolition work in such a manner as not to interfere with CUNY's use of building. Take care not to damage any portion of building during demolition. Should any damage occur as a result of demolition activities, Contractor shall repair to original condition at no additional cost to CUNY.
2. Take care not to cause noise or vibration objectionable to CUNY.
3. Where cutting and welding are performed, take care to prevent transmission of fumes and objectionable odors to occupied spaces. Provide temporary ductwork and equipment as necessary to exhaust all fumes. Ensure work area is maintained at negative pressure relative to adjacent spaces.
4. CUNY may choose to retain possession of any items indicated to be removed. Should CUNY exercise this option, Contractor shall place items in locations as directed by CUNY.
5. Where CUNY does not exercise option to retain an item, this item shall become the property of the Contractor. Contractor shall then remove item, cart it away and dispose of it in accordance with all governing regulations.

B. Piping
1. Remove all unused piping, including valves, hangers, anchors, supports, insulation, etc. Remove piping back to those existing mains which remain in service.

C. Housekeeping Pads and Curbs
1. Demolish and remove existing housekeeping pads and curbs as indicated on the Drawings.

D. Equipment
1. Coordinate with electrical contractor to disconnect power.

2. Remove all auxiliary equipment, piping and components associated with the equipment to be removed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Division 23 Sections where articles and subparagraphs introduce lists, the following requirements apply for product selection:
   1. Contractor's Options:
      a. For products specified only by reference standard, select product meeting that standard, by any manufacturer.
      b. For products specified by naming several products or manufacturers, select any one of products and manufacturers named which complies with Specifications.
      c. For products specified by naming one product or manufacturer, use that product or manufacturer only.
      d. Wherever catalog numbers and specific brands or trade names are used, they are used to establish standards of quality, utility and appearance required.

B. Submission of equipment of manufacturers' other than those specified shall detail equality and difference, item by item.

2.2 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.3 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.
   1. Cement: ASTM C 150, Type I, portland.
   2. Density: 115- to 145-lb/cu. ft. (1840- to 2325-kg/cu. m).
   3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
   4. Water: Comply with ASTM C 94/C 94M.
   5. Strength: 100 to 200 psig (690 to 1380 kPa) at 28 days.

2.4 PAINTING

A. Manufacturers:
   1. Sherwin-Williams.

2. Pittsburgh Plate Glass Co.
3. Pratt and Lambert.
4. Rust-Oleum.
5. Or approved equal.

B. Materials:
1. Best grade for its purpose.
2. Deliver in original sealed containers.
3. Apply in accordance with manufacturers instructions.
4. Heat resistant paint for hot piping, equipment and materials.
5. Colors as selected.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of approved equal capacity and quality.

3.2 PIPED UTILITY DEMOLITION

A. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to CUNY.

B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of approved equal capacity and quality.

3.3 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
   1. New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type with spring clips.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
      f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
      h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
   2. Existing Piping: Use the following:
      a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
      b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
      c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.

d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
e. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
f. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.

O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten

bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install equipment to allow right of way for piping installed at required slope.

D. Access to Valves and Equipment.
1. Access shall be possible where valves, expansion joints, fire dampers, motors, filters, control devices, and any other equipment requiring access for servicing, repairs, or maintenance are located in walls, chases, and/or above ceilings.
2.
3. Definition of Accessible:
a. Valves and dampers may be operated.

b. Control devices may be adjusted.
c. Equipment access panels may be opened.
d. Normal maintenance work such as replacement of filters, lubrication of bearings, etc., may be performed readily within arm's reach of access opening.

4. Group concealed valves, expansion joints, controls, dampers and equipment requiring service access, so as to be freely accessible through access doors and to minimize the number of access doors required.
5. Relocate piping equipment and accessories as required, at no extra cost to afford proper maintenance access.
6. Coordinate location of access panels with subcontractors installing walls or ceiling.
   a. Coordinate panel locations with lights and other architectural features.
   b. Submit proposed panel locations to Engineer for review.
7. Access doors or panels will be installed by the subcontractor furnishing surface on which panels are installed.
8. Arrange for location and marking of removable tiles in splined ceilings where access panels are not installed.
9. Existing Structures:
   a. When installation requires access openings through existing construction, provide necessary panels, and arrange for subcontractors to provide openings and framing which may be required.
   b. Restore adjoining existing surfaces to original condition after new access panels have been installed.

3.7 PAINTING

A. Painting under this Division:
   1. Uncoated hangers, supports, rods and inserts: dip in zinc chromate primer.
   2. Factory prime coat for following except as noted.
      a. Pumps.
      b. Fans.
      c. Motors.
      d. Equipment.
   3. Marred surfaces of prime coated equipment and piping: spot prime coat to match adjacent coat.
   4. Shop prime coat for following, except as noted:
      a. Structural frames.
      b. Platforms.
      c. Ladders.
      d. Railings.
      e. Tanks.

B. General:
   1. Labor, materials and equipment necessary for field painting.
   2. Protect flooring and equipment with drip cloths.
   3. Paint and materials stored in location where directed.
   4. Oily rags and waste removed from building every night.

5. Furnish each space containing stored painting materials with approved 2½ gallon fire extinguisher.
6. Wire brush and clean off all oil, dirt and grease areas to be painted before paint is applied.
7. Mixing:
    a. Mixed and strained as required by manufacturer.
    b. Use thinners only in accordance with manufacturers recommendation.
    c. Follow printed instructions on paint containers. If none are available, instructions shall be obtained in writing from manufacturer.
8. Workmanship:
    a. No painting or finishing shall be done with:
        1) Dust laden air.
        2) Unsuitable weather conditions.
        3) Space temperature below 60°F.
    b. Pipes being painted: containing no heat and to remain cold until paint is dried.
    c. Paint spread: uniform and proper film thickness showing no runs, sags, crawls or other defects.
    d. Finished surfaces shall be uniform in sheen, color, and texture.
    e. All coats to be thoroughly dry before succeeding coats are applied, minimum 24 hours between coats.
    f. Priming undercoat: slightly different color for inspection purposes.
9. Exposed, uninsulated, ungalvanized sheet metal other than stainless steel and aluminum: Two coats of aluminum paint or alkyd paint color as directed.
10. Exposed, uninsulated, galvanized sheet metal in finished space including mechanical equipment rooms:
    a. One coat galvanized iron primer.
    b. Two coats alkyd oil paint, color as directed.
11. Exposed, insulated piping and equipment covering:
    a. One coat primer sealer.
    b. Two coats alkyd oil paint, color as directed.
12. Finned tube radiation: One coat factory or field applied coat of heat resisting paint.
13. Paint following with two coats alkyd oil paint, color as directed:
    a. Exposed steel and metal work not furnished with factory-painted finish.
    b. Structural steel supports for piping ductwork and equipment.
    c. Exposed, uninsulated piping.
14. Exposed, uninsulated aluminum sheet metal in finished space:
    a. One coat zinc chromate primer.
15. No paint on exposed, uninsulated stainless steel sheet metal in finished space.

C. Finish painting:
1. Consisting of two finished coats of high gloss medium or long alkyd paint over prime coat.
2. Submit color shade for approval.
3. Piping continuously painted in all exposed areas.

D. Uncoated hangers, supports, rods and inserts: dip in zinc chromate primer.

E. Factory finish:
   1. Equipment.

F. Factory prime coat, except as noted:
   1. Pumps.
   2. Fans.
   3. Motors.
   4. Equipment.

G. Marred surfaces of prime coated equipment and piping: spot prime coat to match adjacent coat.

H. Shop prime coat for following except as noted:
   1. Structural frames.
   2. Platforms.
   3. Ladders.
   4. Railings.
   5. Tanks.

3.8 CONCRETE WORK

A. On concrete floors, install equipment on concrete housekeeping pads:
   1. Pads 4 in. high unless otherwise noted.
   2. Extend 6 in. minimum beyond equipment base, all sides.
   3. Concrete work, including forming and reinforcing.
      a. Coordinate size and location with General Contractor.
      b. Furnish and locate anchors and anchor bolts.

B. Miscellaneous Concrete Items:
   1. Concrete work, including forming and reinforcing.
   2. Concrete for:
      a. Anchor and thrust blocks.
   3. Refer to details on drawings.

C. Provide foundations for:
   1. Pumps.
   2. Fans.
   3. Boilers.
   4. Floor mounted control panels.
   5. Motors.
   6. As noted.

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.10 GROUTING

A. Clean surfaces that will come into contact with grout.

B. Provide forms as required for placement of grout.

C. Avoid air entrapment during placement of grout.

D. Place grout, completely filling equipment bases.

E. Place grout on concrete bases and provide smooth bearing surface for equipment.

F. Place grout around anchors.

G. Cure placed grout.

3.11 EXCAVATION AND BACKFILL

A. Excavate, backfill and restore surfaces outside building.

B. Excavation:
1. Minimum depth, unless otherwise indicated:
   a. Metallic pipe: 24 in.
   b. Non-metallic pipe: 30 in.
   c. Below frost line.
2. If rock encountered:
   a. Excavate to 6 in. below bottom of piping.
   b. Refill with well tamped sand and gravel.
3. Bank excavated materials adjacent to trench as directed.
4. Bank supports:
   a. Sheet-piling, shoring or otherwise properly supported.
5. Install and maintain barricades, signs and lights.
6. Keep excavation free of water with attended pumping equipment.
7. No extra compensation:
   a. For quicksand, hardpan, or other material encountered in excavating.
   b. Except rock on unit price basis.
8. Remove bog or other swampy conditions encountered in excavating to 1 ft. below bottom of piping.
   a. Backfill with well tamped sand, finely crushed stone or gravel.

C. Installation of Underground Piping:
1. On solid undisturbed ground.
   a. Provide firm bed of sand for pipes with any form of protective covering.
2. On concrete or brick piers or cradles:

a. Unsuitable ground, as directed.
b. Trench crossings.
c. Crossing excavation adjacent to building wall or foundations.

3. Bottom of trenches:
   a. Tamped hard.
   b. Graded for required pitch.
   c. Shaped to give uniform support to lower third of full length of pipe.
   d. Recesses excavated for bells and joints.
4. Support and protect piping so it remains in place without settling or damage during and from backfilling.
   a. Replace damaged pipe.

D. Backfilling:
1. Immediately after piping installed, inspected, tested and accepted:
2. Remove sheet piling and bracing.
3. Backfill around piping with special care to solidly fill voids without damage to piping.
4. Backfill material.
   a. Clean loam, clay, sand, gravel or lightweight aggregate:
      1) Sand only up to 6 in. above top of piping with any form of protective covering.
      2) Remainder to be excavated earth free from frozen materials, lumps of clay, rocks, cinders, slag, ashes, organic materials, building or other debris, or refuse.
5. Backfill:
   a. Up to 2 ft. above pipe, hand fill in 4 in. layers.
   b. Remainder, fill in 6 in. layers.
   c. Tamp and puddle each layer before placing next layer.
   d. No stones larger than 2 in. diameter allowed in fill up to 2 ft. above piping.
   e. No stones larger than 4 in. diameter allowed in fill above.
   f. Backfill in manner to prevent future settlement.
   g. Backfill to required compaction; per ASTM D-1557-587:
      1) 90% outside of building.

E. Restore existing surfaces disturbed or damaged by excavation and backfilling, including, but not limited to:
1. Turf.
2. Plants.
3. Concrete walks.
4. Asphaltic paving.
5. All other surface improvements.

F. Dispose of acceptable surplus excavation on site as directed.

G. Remove surplus and unsuitable excavated materials from site as directed.

3.12 CUTTING AND PATCHING

A. All carpentry, cutting and patching to be done by subcontractors doing that work.

B. Provide all carpentry, cutting and patching required for proper installation of material and equipment specified in this Division.

C. Do not cut or drill structural members without consent of Engineer.

3.13 WATER PROOFING

A. Where any work pierces waterproofing, installation shall be subject to review.
   1. Provide all necessary sleeves, caulking, flashing and flashing fittings required to make openings absolutely watertight.

B. Flashing:
   1. 6 lb. lead.
   2. 16 oz. lead coated copper.
   3. No.22 USSG aluminum.
   4. Fittings for piping through roof:
      a. Galvanized cast iron bottom recess roof type.
      b. Josam No. 26440 or No. 26450, or an approved equal.

C. Provide weather protection canopies, hoods or enclosures over out-of-door equipment which could be damaged by exposure to weather.
   1. This requirement applies to:
      a. Damper operators.
      b. Damper bearings.
      c. Controls.
      d. Instruments.
   2. See other sections in this Division for application of this requirement to motors, drives, ducts, and fans, etc.
   3. Identify items under such covers if entirely enclosed.

3.14 CLEANING AND ADJUSTING

A. Brush and clean work prior to concealing, painting and acceptance. Perform in stages if directed.

B. Painted or exposed work soiled or damaged: clean and repair to match adjoining work before final acceptance.

C. Remove debris from inside and outside of materials and equipment.

D. Flush out piping after installation.

E. Clean piping systems as described in other Division 23 sections.

F. Adjust valves and automatic control devices.

G. Traps, wastes and supplies: unobstructed.

3.15 FIELD QUALITY CONTROL

A. Tests:
   1. Perform as specified in individual sections, and as required by authorities having jurisdiction.
   2. Duration as noted.

B. Provide required labor, material, equipment, and connections.

C. Furnish written report and certification that tests have been satisfactorily completed.

D. Repair or replace defective work, as directed.

E. Pay for restoring or replacing damaged work due to tests, as directed.

F. Pay for restoring or replacing damaged work of others, due to tests, as directed.

3.16 TRAINING

A. Provide training by qualified manufacturers' representatives for equipment as specified in this Division.

B. Training to include:
   1. Site-specific training.
   2. Minimum hours as specified in each Section.
   3. Training materials (minimum six sets).
   4. Videotapes (2 copies) of each training session upon completion.

C. Each training session to be scheduled with CUNY at least 30 days in advance.

END OF SECTION 230500

PART 1 - SECTION 230519 – METERS AND GAGES FOR HVAC PIPING

PART 2 - GENERAL

2.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Requirements Division 01, Division 23 Specification Sections, and Common Work Requirements for HVAC apply to the work specified in this Section.

2.2 SUMMARY

A. Section Includes:
   1. Thermometers.
   2. Gages.
   3. Test plugs.

B. Related Sections:
   1. Division 23 Section "Steam and Condensate Heating Piping" for steam and condensate meters.

2.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

2.4 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves and installation instructions.

B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.

C. Product Certificates: For each type of thermometer and gage signed by product manufacturer.

2.5 QUALITY ASSURANCE

A. Comply with applicable portions of American Society of Mechanical Engineers (ASME) and Instrument Society of America (ISA) standards pertaining to construction an installation of meters and gauges.

B. Design Criteria: The drawings indicate types, sizes, capacities, ranges, profiles, connections, and dimensional requirements of meters and gauges and are based on the specific manufacturer types and models indicated. Meters and gauges having approved equal performance characteristics by other approved manufacturers may be considered, provided that deviations do not change the design concept or intended performance as judged by the Engineer.

2.6 EXTRA MATERIALS

A. Furnish extra materials described below to match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Provide six spare pressure gauges for use with valved pressure gauge outlets.
   2. Provide six spare thermometers for use with pressure-temperature test stations.

PART 3 - PRODUCTS

3.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Moeller Instrument Co.
   2. Palmer - Wahl Instruments Inc.
   3. Taylor Instrument Process Control Div.
   4. Trerice, H. O. Co.
   5. Weiss Instruments, Inc.
   6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
   7. Or approved equal.

B. Case: Die-cast aluminum or brass, 9 inches (229 mm) long.

C. Tube: Red or blue reading organic-liquid filled, with magnifying lens.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Window: Glass or plastic.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of stem length to suit installation pipe size.
   1. Below NPS 4: 3 1/2 inch stem, elbow mounted.
   2. NPS 4 – NPS 8: 3 1/2 inch stem.
   3. NPS 10 – NPS 14: 6 inch stem.
   4. NPS 16 – NPS 20: 9 inch stem.
   5. NPS 24: 12 inch stem.
   6. Over NPS 24: Stem length equal to 50% pipe diameter.

H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

3.2 THERMOWELLS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AMETEK, Inc.; U.S. Gauge Div.
   2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
   3. Ernst Gage Co.
   4. Marsh Bellofram.
   5. Moeller Instrument Div.
   6. Palmer - Wahl Instruments Inc.
   7. Taylor Instrument Process Control Div.
   8. Trerice, H. O. Co.
   9. Weiss Instruments, Inc.
   10. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
   11. Or approved equal.

B. Manufacturers: Same as manufacturer of thermometer being used.

C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer. Provide with separable brass socket connection, cap and chain.

3.3 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AMETEK, Inc.; U.S. Gauge Div.
   2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
   3. Ernst Gage Co.
   4. Eugene Ernst Products Co.
   5. Marsh Bellofram.
   6. Moeller Instrument Co.
   7. Palmer - Wahl Instruments Inc.
   8. Taylor Instrument Process Control Div.

9. Trerice, H. O. Co.
10. Weiss Instruments, Inc.
11. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
12. Or approved equal.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
1. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch (114-mm) diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4 (DN 8), bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, stainless steel, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass or plastic.
8. Ring: Metal.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:
1. Valves: NPS 1/4 (DN 8) brass or stainless-steel needle type.
2. Syphons: NPS 1/4 (DN 8) coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 (DN 8) brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

3.4 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
7. Watts Industries, Inc.; Water Products Div.
8. Or approved equal.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air, water, oil, or gas service at 20 to 200 deg F (minus 7 to plus 93 deg C) shall be CR.
2. Insert material for air or water service at minus 30 to plus 275 deg F (minus 35 to plus 136 deg C) shall be EPDM.

E. Test Kit: Furnish one test kit containing one pressure gage and adaptor, two thermometers, and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.
1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be 0 to 200 psig (0 to 1380 kPa).
2. Low-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 deg F (minus 4 to plus 52 deg C).
3. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F (minus 18 to plus 104 deg C).
4. Carrying case shall have formed instrument padding.

PART 4 - EXECUTION

4.1 THERMOMETER APPLICATIONS

A. Install liquid-in-glass thermometers in the following locations:
1.
2. Condensate discharge line from condensate coolers.
3. Other locations as noted on drawings.

B. Provide the following temperature ranges for thermometers:
1.
2. Steam and Condensate: 50 to 400 deg F, with 5-degree scale divisions (10 to 205 deg C, with 3-degree scale divisions).

4.2 GAGE APPLICATIONS

A. Install dry-case-type pressure gages at first stage inlet of pressure reducing valve stations and at discharge of each pressure-reducing valve.

B. Install dry-case-type pressure gauges in steam piping at exit of equipment rooms.

C. Install pressure gauges at other locations as noted on the drawings.

D. Pressure gauge ranges shall be selected so that normal system operating pressures occur at the center portion of the scale range.

4.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.

C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

D. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).

E. Install needle-valve and syphon fitting in piping for each pressure gage for steam.

F. Install test plugs in tees in piping.

G. Install pressure-temperature test stations adjacent to each bulb for controllers, remote temperature indication and recording thermometers, and at other points where noted on drawings.

4.4 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

4.5 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 230519

SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Requirements Division 01, Division 23 Specification Sections, and Common Work Requirements for HVAC apply to the work specified in this Section.

1.2 SUMMARY

A. Section Includes:
1. Ball valves.
2. Butterfly valves.
3. Check valves.
4. Gate valves.
5. Globe valves.
6. Plug valves.
7. Safety and relief valves.
8. Chainwheels.

B. Related Sections:
1. Division 23 Section “Steam and Condensate Heating Piping”.
2. Division 23 Section “Identification for HVAC Piping and Equipment” for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP or WSP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Manufacturer's data indicating body material, valve design, design pressure and temperature ratings and classification, end connection details, seat materials, trim materials, dimensions, required clearances, and installation instructions.

B. Valve Schedule: Schedule listing type, make, and model number, size, and service for valves.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. Codes and Standards: Provide valves conforming to the requirements of the following:
1. Published Specifications' standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this Section.
2. Comply with all applicable national, state, and local codes.

C. ASME Compliance:
1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

D. In addition, comply with all standards or associations as specified herein, including, but not limited to, the following:
1. American National Standards Institute (ANSI).
2. American Society for Testing and Materials (ASTM).
3. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:
1. Maintain valve end protection: Install temporary end caps and closures and maintain in place until installation.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves.
4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:
1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.
5. Socket Weld: With socket ends according to ASME B16.11.
6. Butt Weld: With butt weld ends according to ASME B16.25.

G. Valve Bypass and Drain Connections: MSS SP-45.
1. Bypass Globe Valves: NPS ¾ for NPS 8 gate valves, and NPS 1 for NPS 10 and larger gate valves.
2. Bypass Valves shall be of the same pressure rating as the gate valves.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Conbraco Industries, Inc.; Apollo Valves.
      b. Crane Co.; Crane Valve Group; Crane Valves.
      c. Hammond Valve.
      d. Lance Valves; a division of Advanced Thermal Systems, Inc.
      e. Milwaukee Valve Company.
      f. NIBCO INC.
      g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      h. Or approved equal.
   2. Description:
      a. Standard: MSS SP-110.
      b. SWP Rating: 150 psig (1035 kPa).
      c. CWP Rating: 600 psig (4140 kPa).
      d. Body Design: Two piece.
      e. Body Material: Bronze.
      f. Ends: Threaded.
      g. Seats: PTFE.
      h. Stem: Stainless steel, blow-out proof.
      i. Ball: Stainless steel, vented.
      j. Port: Full.

2.3 HIGH-PERFORMANCE BUTTERFLY VALVES

A. Class 150, Single-Flange, High-Performance Butterfly Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a.
      b. Bray Controls; a division of Bray International.
      c. Cooper Cameron Valves; a division of Cooper Cameron Corp.
      d. Crane Co.; Crane Valve Group; Flowseal.
      e. Crane Co.; Crane Valve Group; Stockham Division.
      f. DeZurik Water Controls.
      g. Jamesbury; a subsidiary of Metso Automation.
      h. Milwaukee Valve Company.
      i. NIBCO INC.
      j. Tyco Valves and Controls.
      k. Or approved equal.
   2. Description:
      a. Standard: MSS SP-68.
      b. CWP Rating: 285 psig at 100 deg F (38 deg C).
      c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.

d. Body Material: Carbon steel, ductile iron, or stainless steel.
e. Seat: Reinforced PTFE.
f. Stem: Stainless steel; offset from seat plane.
g. Disc: Ductile iron or stainless steel.
h. Service: Bidirectional.

B. Operator:
1. Lever with memory stop: Smaller than NPS 8.
2. Gear Operator: NPS 8 and larger.

2.4 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Or approved equal.
2. Description:
a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.5 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Watts; Watts Water Technologies Company.
k. Or approved equal.
2. Description:
a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig (1380 kPa).

c. Body Design: Horizontal flow with screw-in cap.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze with stainless steel hinge pin.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Or approved equal.
2. Description:
a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Design: Horizontal flow with screw-in cap.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze with stainless steel hinge pin.

2.6 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Powell Valves.
i. Watts; Watts Water Technologies Company.
j. Or approved equal.
2.
3. Description:
a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.

f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.

B. Class 250, Iron Swing Check Valves with Metal Seats:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts; Watts Water Technologies Company.
h. Or approved equal.
2. Description:
a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig.NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.

2.7 BRONZE GATE VALVES

A. Class 125, RS Bronze Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Or approved equal.
2. Description:
a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig (1380 kPa).
c. Description: Inside screw, rising stem.
d. Body Material: ASTM B 62, bronze with integral seat and union bonnet.
e. Ends: Threaded.
f. Stem: Bronze.
g. Disc: Solid wedge; bronze.
h. Packing: Asbestos free.

i. Handwheel: Malleable iron.

B. Class 150, RS Bronze Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Or approved equal.
2. Description:
a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig (2070 kPa).
c. Description: Inside screw, rising stem.
d. Body Material: ASTM B 62, bronze with integral seat and union bonnet.
e. Ends: Threaded.
f. Stem: Bronze.
g. Disc: Solid wedge; bronze.
h. Packing: Asbestos free.
i. Handwheel: Malleable iron.

2.8 IRON GATE VALVES

A. Class 125, OS&Y, Iron Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Or approved equal.
2.
3. Description:
a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Disc: Solid wedge.
h. Packing and Gasket: Asbestos free.

B. Class 250, OS&Y, Iron Gate Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Stockham Division.
      c. Hammond Valve.
      d. Milwaukee Valve Company.
      e. NIBCO INC.
      f. Powell Valves.
      g. Or approved equal.
   2. Description:
      a. Standard: MSS SP-70, Type I.
      b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig.
      c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig.
      d. Body Material: ASTM A 126, gray iron with bolted bonnet.
      e. Ends: Flanged.
      f. Trim: Bronze.
      g. Disc: Solid wedge.
      h. Packing and Gasket: Asbestos free.

2.9 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Stockham Division.
      c. Hammond Valve.
      d. Milwaukee Valve Company.
      e. NIBCO INC.
      f. Powell Valves.
      g. Or approved equal.
   2. Description:
      a. Standard: MSS SP-80, Type 1.
      b. CWP Rating: 200 psig (1380 kPa).
      c. Body Material: ASTM B 62, bronze with integral seat and union bonnet.
      d. Ends: Threaded.
      e. Stem and Disc: Bronze.
      f. Packing: Asbestos free.
      g. Handwheel: Malleable iron.

B. Class 250, Bronze Needle Globe Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Stockham Division.

c. Milwaukee Valve Company.
d. NIBCO INC.
e. Or approved equal.

2. Description:
a. CWP Rating: 400 psig (2760 kPa).
b. Body: ASTM B 62, bronze.
c. Ends: Threaded.
d. Stem: Bronze.
e. Seat: Bronze.
f. Needle Disc: Bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron or aluminum.

2.10 IRON GLOBE VALVES

A. Class 125, OS&Y, Iron Globe Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Or approved equal.
2.
3. Description:
a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc and Seat: Bronze.
g. Packing and Gasket: Asbestos free.

B. Class 250, OS&Y, Iron Globe Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Or approved equal.
2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 500 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc and Seat: Bronze.
g. Packing and Gasket: Asbestos free.

2.11 LUBRICATED PLUG VALVES

A. Class 250, Regular, Screwed-Gland, Lubricated Plug Valves with Threaded Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Nordstrom Valves, Inc.
b. Or approved equal.
2. Description:
a. Standard: MSS SP-78, Type II.
b. CWP Rating: 400 psig.
c. Body Material: ASTM A 48 or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular.
e. Tapered Plug: Cast iron or bronze with sealant groove.

B. Class 250, Regular Bolted Cover-Gland, Lubricated Plug Valves with Flanged Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Nordstrom Valves, Inc.
b. Or approved equal.
2. Description:
a. Standard: MSS SP-78, Type II.
b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig.
c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig.
d. Body Material: ASTM A 48 or ASTM A 126, cast iron with lubrication-sealing system.
e. Pattern: Regular.
f. Tapered Plug: Cast iron or bronze with sealant groove.

2.12 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.
3. Trumbull Industries.
4. Or approved equal.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
   1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
   2. Attachment: For connection to ball, butterfly and plug valve stems.
   3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.
   4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Test operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Test operate temperature and pressure relief valves at least three times.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem upright or horizontal, not inverted.

D. Install valves in position to allow full stem movement and locate wheel handles to clear obstructions with hand.

E. Install chainwheels on operators for ball, butterfly, gate, globe, and plug valves NPS 4 (DN 100) and larger and more than 96 inches (2400 mm) above floor. Extend chains to 60 inches (1520 mm) above finished floor.

F. Install check valves for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level.

2. Lift Check Valves: With stem upright and plumb.

G. Install valves with cast directional arrows in direction of flow.

H. Install globe valves to close against pressure.

I. Install valves to be removable without separating or lifting piping in which installed.

J. Where valves abut flanged strainers or similar devices, position valve with respect to device so as to permit removal of bolts.

K. Locate equipment shut-off valves to be accessible without climbing over equipment.

L. Piping adjacent to lugged valves shall be flanged and removable while valve is in use.

M. Install shut-off valves at inlets and outlets of equipment, on branch connections to mains, at the base of each riser, and elsewhere as noted.

N. Install drain valves at main shut-off valves, at low points of piping, at bases of vertical risers, and at equipment.

O. Pressure class for valves for pressure reducing valve stations shall be based on steam pressure at inlet to station.

P. Install gate valves or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

Q. Install globe or ball valves for throttling, by-pass, or manual flow control service.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
1. Shutoff Service: Ball, butterfly, or gate valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling and By-Pass Service Except Steam: Globe, ball, or butterfly valves.
4. Throttling and By-Pass Service, Steam: Globe valves.
5. Lubricated plug valves may be used for throttling service, except steam. Non-lubricated plug valves may be used only when shut-off or isolating valves are also provided.
6. Install drain valves, with cap and chain, as noted.
   a. For steam service use 3/4 inch gate valves.
   b. All other applications use 3/4 inch ball valves.

7. Provide 1/4 inch ball valve as gauge cocks, except for steam service use needle globe valves.

B. Safety and Relief Valves:
1. Constructed, rated and stamped in accordance with ASME.
   a. Install relief valves for unheated liquids.
   b. Install safety relief valves for heated liquids.
   c. Install safety valves for steam.
2. Set Pressures and Ratings:
   a. Suitable and rated for system pressure and temperature.
      1) For Safety Relief Valves: Minimum temperature rating, shall be equal to saturated steam temperature corresponding to pressure 10 percent higher than valve set pressure.
   b. Set pressure as shown; not to exceed pressure rating of protected equipment.
3. Valves to open, under test, at set pressure with following tolerance:
   a. Set pressure up to 70 psi: Plus or minus 2 psi.
   b. Set pressure, above 70 psi: Plus or minus 3 percent.
4. Capacities: Selected and sized to:
   a. Relieve maximum possible generated energy.
   b. Maintain pressure in protected equipment at not more than following:
      1) Low Pressure Boilers: 5 psi above boiler working pressure.
      2) High Pressure Boilers: 6 percent above boiler working pressure.
      3) Unfired Pressure Vessels: 10 percent above vessel working pressure.
5. Provide multiple valves if required to meet capacity requirements even though only one valve may be shown.

C. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

D. Select valves, with the following end connections:
1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

3.5 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:
1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
3. Bronze Swing Check Valves: Class 150, bronze disc.

4. Bronze Gate Valves: Class 150, RS.
5. Bronze Globe Valves: Class 150, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:
1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
2. High-Performance Butterfly Valves: Class 150, single flange.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Gate Valves: Class 125, OS&Y.
5. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125.

3.6 LOW-PRESSURE STEAM VALVE SCHEDULE (15 PSIG (104 kPa) OR LESS)

A. Pipe NPS 2 (DN 50) and Smaller:
1. Ball Valves: Two piece, full port, brass or bronze with stainless-steel trim.
2. Bronze Swing Check Valves: Class 125, Class 150, bronze disc.
3. Bronze Gate Valves: Class 125, Class 150, RS.
4. Bronze Globe Valves: Class 125, Class 150, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:
1. Iron Swing Check Valves: Class 125, metal seats.
2. Iron Gate Valves: Class 125, OS&Y.
3. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125.

3.7 MEDIUM-PRESSURE STEAM VALVE SCHEDULE (16 PSIG) TO (60 PSIG)

A. Pipe NPS 2 and Smaller:
1.
2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Gate Valves: Class 150, RS, bronze.
5. Globe Valves: Class 150, bronze, bronze disc.

B. Pipe Sizes NPS 2-1/2 and Larger:
1.
2. Iron Swing Check Valves: Class 250, metal seats.
3. Iron Gate Valves: Class 250, OS&Y.
4. Iron Globe Valves, NPS 2-1/2 to NPS 12: Class 250.

3.8 HIGH-PRESSURE STEAM VALVE SCHEDULE (MORE THAN 60 PSIG (420 kPa))

A. Pipe NPS 2 (DN 50) and Smaller:
1. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
2. Bronze Swing Check Valves: Class 150, bronze disc.
3. Bronze Gate Valves: Class 150, RS, bronze.

4. Globe Valves: Class 150, bronze, bronze disc.

B. Pipe Sizes NPS 2-1/2 (DN 65) and Larger:
1. Iron Swing Check Valves: Class 250, metal seats.
2. Iron Gate Valves: Class 250, OS&Y.
3. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 250.

3.9 STEAM-CONDENSATE VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:
1. Ball Valves: Two piece, full port, brass or bronze with stainless-steel trim.
2. Bronze Swing Check Valves: Class 125, Class 150, bronze disc.
3. Bronze Gate Valves: Class 125 Class, 150, RS.
4. Bronze Globe Valves: Class 125, Class 150, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:
1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
2. High-Performance Butterfly Valves: Class 150, single flange.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Gate Valves: Class 125, OS&Y.
5. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125.

END OF SECTION 230523

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Requirements Division 01, Division 23 Specification Sections, and Common Work Requirements for HVAC apply to the work specified in this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:
   1. Steel pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Thermal-hanger shield inserts.
   5. Fastener systems.
   6. Pipe stands.
   7. Equipment supports.

B. Related Sections include the following:
   1. Division 23 Section "Steam and Condensate Heating Piping" for pipe hangers for steam piping.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

D. Where thermal movement in pipe line occurs, hanger assembly shall support pipe line in all operating conditions.

1.5 SUBMITTALS

A. Product Data: Manufacturer's catalog data, including load ratings, dimensions and installation instructions, for the following:
   1. Steel pipe hangers and supports.
   2. Thermal-hanger shield inserts.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze pipe hangers. Include Product Data for components.
   2. Metal framing systems. Include Product Data for components.
   3. Pipe stands. Include Product Data for components.
   4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel" and ASME Boiler and Pressure Vessel Code: Section IX.

B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   2. ASME Boiler and Pressure Vessel Code: Section IX.

C. Codes and Standards: Provide pipe hangers and supports conforming to the following:
   1. American Society of Mechanical Engineering:
      a. B31.1 Power Pipin
      b. B31.2 Fuel Gas Pi
      c. B31.5 Refrigeratin
      d. B31.9 Building Se
   2. American Society for Testing and Materials (ASTM):
      a. A36 Standar
      b. A123 Standar Iron
      c. A307 Standar Ten
      d. A575 Standar M-C
      e. D695 Compre
      f. D790 Properti Insu
      g. F708 Standar

3. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
   a. SP58 Pipe Ha
   b. SP69 Pipe Ha
   c. SP89 Pipe Ha
   d. SP90 Guidelin

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:
   1. AAA Technology & Specialties Co., Inc.
   2. Bergen-Power Pipe Supports.
   3. B-Line Systems, Inc.; a division of Cooper Industries.
   4. Carpenter & Paterson, Inc.
   5. Empire Industries, Inc.
   6. ERICO/Michigan Hanger Co.
   7. Globe Pipe Hanger Products, Inc.
   8. Grinnell Corp.
   9. GS Metals Corp.
   10. National Pipe Hanger Corporation.
   11. PHD Manufacturing, Inc.
   12. PHS Industries, Inc.
   13. Piping Technology & Products, Inc.
   14. Tolco Inc.
   15. Or approved equal.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods , nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.
8. Or approved equal.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:
1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.
7. Or approved equal.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Manufacturers:
      a. B-Line Systems, Inc.; a division of Cooper Industries.
      b. Empire Industries, Inc.
      c. Hilti, Inc.
      d. ITW Ramset/Red Head.
      e. MKT Fastening, LLC.
      f. Powers Fasteners.
      g. Or approved equal.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
   1. Manufacturers:
      a. ERICO/Michigan Hanger Co.
      b. MIRO Industries.
      c. Or approved equal.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
   1. Manufacturers:
      a. MIRO Industries.
      b. Or approved equal.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
   1. Manufacturers:
      a. ERICO/Michigan Hanger Co.
      b. MIRO Industries.
      c. Portable Pipe Hangers.
      d. Or approved equal.
   2. Base: Stainless steel.

3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
1. Manufacturers:
   a. Portable Pipe Hangers.
   b. Or approved equal.
2. Bases: One or more plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

C. Hanger Rods: ASTM A 575, hot rolled Steel, ANSI B1.1 threads, continuously threaded, with electro-galvanized finish.

D. Steel Pipe Columns: ASTM A 53, Schedule 40, black steel.

E. Bolts and Nuts: ASTM A 307, Grade A, regular hexagon-head type.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
   3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
   4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
   5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
   6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).
   7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1.
   2. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
   3. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
   4. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
   5. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
   6. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
   7. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
   8. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
   9. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
      a. Horizontal (MSS Type 54): Mounted horizontally.
      b. Vertical (MSS Type 55): Mounted vertically.
      c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

S. Supports of wire rope, wood, chain, strap perforated bar or any other makeshift device shall not be permitted.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

N. Insulated Piping: Comply with the following:
1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate insulation inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

O. Miscellaneous Steel: Provide miscellaneous framing, steel members, beams, brackets, etc. for support of work in Division, unless specifically included in other Divisions.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.6 PAINTING

A. Touch Up: 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 (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Requirements Division 01, Division 23 Specification Sections, and Common Work Requirements for HVAC apply to the work specified in this Section.

1.2 SUMMARY

A. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, manufacturer's catalog data, including size, color and materials.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with ASME A 13.1 "Scheme for the Identification of Piping Systems."

1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
   1. Material and Thickness: Brass, 0.032-inch (0.8-mm), Stainless steel, 0.025-inch (0.64-mm), Aluminum, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
   3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   4. Fasteners: Stainless-steel rivets or self-tapping screws.
   5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
   2. Letter Color: White.
   3. Background Color: Black.
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
   6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   7. Fasteners: Stainless-steel rivets or self-tapping screws.
   8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
   1. NPS 5 and smaller: Attach to pipe without fasteners or adhesive.
   2. NPS 6 and larger: Attach to pipe with stainless steel spring fasteners.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches (38 mm) high.

D. Maximum Temperature: Able to withstand temperatures up to 180 deg F.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping (32 mm) and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.
1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.
   1. Identification Paint: Use for contrasting background.
   2. Stencil Paint: Use for pipe marking.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:
   1. Steam Piping:
      a. Background Color: Black.
      b. Letter Color: Yellow.
   2. Steam Condensate Piping:
      a. Background Color: Black.
      b. Letter Color: Yellow.
   3. Vent and Relief Piping:
      a. Background Color: Black.

b. Letter Color: Yellow.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:
   a.
   b. (50 mm)Steam: 2 inches (50 mm), round.
   c. Steam Condensate: 2 inches round.
   d. Vent and Relief: 2 inches (50 mm), round.
2. Valve-Tag Color:
   a.
   b. Steam: Natural.
   c. Steam Condensate: Natural.
   d. Vent and Relief: Natural.
3. Letter Color:
   a.
   b. Steam: Black.
   c. Steam Condensate: Black.
   d. Vent and Fill: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Requirements Division 01, Division 23 Specification Sections, and Common Work Requirements for HVAC apply to the work specified in this Section.

1.2 SUMMARY

A. Section Includes:
   1. Insulation Materials:
      a. Calcium silicate.
      b. Cellular glass.
      c. Flexible elastomeric.
      d. Mineral fiber.
   2. Insulating cements.
   3. Adhesives.
   4. Mastics.
   5. Lagging adhesives.
   6. Sealants.
   7. Factory-applied jackets.
   8. Field-applied fabric-reinforcing mesh.
   9. Field-applied cloths.
   10. Field-applied jackets.
   11. Tapes.
   12. Securements.
   13. Corner angles.

B. Related Sections:
   1. Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
   2. Division 23 Section "Steam and Condensate Heating Piping."

1.3 DEFINITIONS

A. Exposed: Indoor, piping or equipment located in mechanical equipment rooms and in areas in which they will be visible without removing ceilings or opening access panels.

B. Concealed: Indoor piping or equipment which are not exposed.

C. Outdoor: Piping or equipment which are exposed to the weather.

D. Underground: Piping or equipment which are buried, whereas piping or equipment located in a trench below grade are considered concealed.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. LEED Submittal:
1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

C. Shop Drawings:
1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties, equipment connections, and access panels.
5. Detail application of field-applied jackets.
6. Detail application at linkages of control devices.
7. Detail field application for each equipment type.

D. Schedule:
1. List of work that will be insulated and a description of insulation materials and finishing procedures.
2. A certificate indicating compliance with all applicable codes.

E. Qualification Data: For qualified Installer.

F. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

G. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Insulation Materials: All products shall carry ISO 9000 certification or guarantee to meet the ISO quality standards.

C. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
   3. Flame proofing treatments which are subject to deterioration from moisture or humidity are not acceptable.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Calcium Silicate:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Industrial Insulation Group (The); Thermo-12 Gold.
      b. Johns Manville; Thermo-12 Gold
      c. Pabco Gold, Inc.
      d. Or approved equal.
   2. Thermal Conductivity (k-value) at 300°F mean temperature is 0.40 Btu x in./hr. x ft. x degree F or less.
   3. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
   4. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
   5. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cell-U-Foam Corporation; Ultra-CUF.
      b. Pittsburgh Corning Corporation; Foamglas Super K.
      c. Or approved equal.
   2. Thermal Conductivity (k-value) at 75°F mean temperature is 0.27 Btu x in./hr. x ft. x degree F or less.
   3. Block Insulation: ASTM C 552, Type I.
   4. Special-Shaped Insulation: ASTM C 552, Type III.
   5. Board Insulation: ASTM C 552, Type IV.
   6. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
   7. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
   8. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

H. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Aeroflex USA Inc.; Aerocel.
   b. Armacell LLC; AP Armaflex.
   c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
   d. Or approved equal.
2. Thermal Conductivity (k-value) at 75°F mean temperature is 0.27 Btu x in./hr. x ft. x degree F or less. Water absorption not be more than 0.2% by volume.

I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corp.
      b. Johns Manville; Microlite.
      c. Knauf Insulation.
      d. Manson Insulation Inc.; Alley Wrap.
      e. Owens Corning.
      f. Or approved equal.
   2. Thermal Conductivity (k-value) at 75°F mean temperature is 0.29 Btu x in./hr. x ft. x degree F. (0.043 W/m x K) or less.

J. Mineral-Fiber Board Insulation: For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corp.; Commercial Board.
      b. Fibrex Insulations Inc.; FBX.
      c. Johns Manville; 800 Series Spin-Glas.
      d. Knauf Insulation; Insulation Board.
      e. Manson Insulation Inc.; AK Board.
      f. Owens Corning; Fiberglas 700 Series.
      g. Or approved equal.
   2. Thermal Conductivity (k-value) at 75°F mean temperature is 0.23 Btu x in./hr. x ft. x degree F. (0.033 W/m x K) or less.

K. Mineral-Fiber, Preformed Pipe Insulation:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Fibrex Insulations Inc.; Coreplus 1200.
      b. Johns Manville; Micro-Lok.
      c. Knauf Insulation; 1000 Pipe Insulation.
      d. Manson Insulation Inc.; Alley-K.
      e. Owens Corning; Fiberglas Pipe Insulation.
      f. Or approved equal.
   2. Thermal Conductivity (k-value) at 75°F mean temperature is 0.23 Btu x in./hr. x ft. x degree F or less.

3. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

L. Thermal Blanket, Custom Fit Insulation System:
1. Products; Subject to compliance with requirement, provide one of the following:
a.
b. Applegate Industrial Materials, Inc.
c. Carrier Corporation; a United Technologies Company.
d. Coverflex Manufacturing, Inc.
e. Drake Specialties.
f. Indelac Controls, Inc.
g. Shannon Enterprises of Western New York, Inc.
h. Or approved equal.
2. Maximum Service Temperature: 450^{o}F.
3. Core Material: Fiberglass needled mat, Type “E” fiber. Comply with ASTM C1086.
4. Nominal Density: 11.0 lb/cu. ft.
5. Inner and Outer Jacket: Silicone impregnated fiberglass cloth and sewn together. Material nominal weight of 17 oz/sq. yd.
6. Include fasteners for easy installation and removal.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Insulco, Division of MFS, Inc.; Triple I.
b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.
c. Or approved equal.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Insulco, Division of MFS, Inc.; SmoothKote.
b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
c. Rock Wool Manufacturing Company; Delta One Shot.
d. Or approved equal.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-97.

b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
c. Marathon Industries, Inc.; 290.
d. Mon-Eco Industries, Inc.; 22-30.
e. Vimasco Corporation; 760.
f. Or approved equal.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Cellular-Glass Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-96.
b. Foster Products Corporation, H. B. Fuller Company; 81-33.
c. Or approved equal.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:
a. Aeroflex USA Inc.; Aeroseal.
b. Armacell LCC; 520 Adhesive.
c. Foster Products Corporation, H. B. Fuller Company; 85-75.
d. RBX Corporation; Rubatex Contact Adhesive.
e. Or approved equal.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.
f. Or approved equal.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.
f. Or approved equal.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Speedline Vinyl Adhesive.
e. Or approved equal.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-10.
b. Foster Products Corporation, H. B. Fuller Company; 35-00.
c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
d. Marathon Industries, Inc.; 550.
e. Mon-Eco Industries, Inc.; 55-50.
f. Vimasco Corporation; WC-1/WC-5.
g. Or approved equal.
2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-52.
b. Foster Products Corporation, H. B. Fuller Company; 81-42.
c. Marathon Industries, Inc.; 130.
d. Mon-Eco Industries, Inc.; 11-30.
e. Vimasco Corporation; 136.

f. Or approved equal.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment, and pipe insulation.
4. Service Temperature Range: Minus 50 to plus 180 deg F.
5. Color: White.

2.6 SEALANTS

A. Joint Sealants:
1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Products, Division of ITW; CP-76.
   b. Foster Products Corporation, H. B. Fuller Company; 30-45.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Pittsburgh Corning Corporation; Pittseal 444.
   f. Vimasco Corporation; 750.
   g. Or approved equal.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Products, Division of ITW; CP-76-8.
   b. Foster Products Corporation, H. B. Fuller Company; 95-44.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Vimasco Corporation; 750.
   f. Or approved equal.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Products, Division of ITW; CP-76.
   b. Or approved equal.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
   3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
   4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Vimasco Corporation; Elastafab 894.
      b. Or approved equal.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.
      b. Or approved equal.

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto PVC Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.
e. Or approved equal.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
5. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; Metal Jacketing Systems.
      b. PABCO Metals Corporation; Surefit.
      c. RPR Products, Inc.; Insul-Mate.
      d. Or approved equal.
   2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
      a. Sheet and roll stock ready for shop or field sizing.
      b. Finish and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
      d. Factory-Fabricated Fitting Covers:
         1) Same material, finish, and thickness as jacket.
         2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
         3) Tee covers.
         4) Flange and union covers.
         5) End caps.
         6) Beveled collars.
         7) Valve covers.
         8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
      b. Compac Corp.; 104 and 105.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
      d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

e. Or approved equal.
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
b. Compac Corp.; 110 and 111.
c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
e. Or approved equal.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
b. Compac Corp.; 130.
c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
d. Venture Tape; 1506 CW NS.
e. Or approved equal.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.
d. Or approved equal.

2. Stainless Steel: ASTM A 167 or ASTM A 240, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.
1. Manufacturers: Subject to compliance with requirements, provide one of the following:
a. C & F Wire.
b. Childers Products.
c. PABCO Metals Corporation.
d. RPR Products, Inc.
e. Or approved equal.

2.13 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240, Type 304 or 316.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

B. Coordinate insulation installation with the subcontractor installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:
   1.
   2. Pipe: Install insulation continuously through floor penetrations.
   3. Seal penetrations through fire-rated assemblies. Comply with requirements for firestopping.

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
   2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
   3. Protect exposed corners with secured corner angles.
   4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
      a. Do not weld anchor pins to ASME-labeled pressure vessels.
      b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
      c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
      d. Do not overcompress insulation during installation.
      e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
      f. Impale insulation over anchor pins and attach speed washers.

g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe

insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover

and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

E. Install removable thermal insulation blankets on high pressure, medium pressure, and low pressure valves, strainers, and specialties as noted on drawings.
1.
2. Install at PRV stations for high, medium, low pressure steam and on all steam isolation shut-off valves.
3. Install insulation over gate valves, expansion joints, steam traps, strainers, control valves, pressure reducing valves and other specialties.
4. Extend blanket beyond mating flanges unto existing insulation for a minimum of 2 inches.
5. Where blanket cannot fit over existing oversized insulation, blanket will butt up to existing insulation with a friction fit closing seam.

3.7 CALCIUM SILICATE INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.
3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
4. Finish flange insulation same as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
3. Finish fittings insulation same as pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   2. Install insulation to flanges as specified for flange insulation application.
   3. Finish valve and specialty insulation same as pipe insulation.

3.8 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
   2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of cellular-glass insulation to valve body.
   2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.

3.9 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.10 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.12 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by CUNY. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:
   1. Inspect field-insulated equipment, randomly selected by CUNY, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
   2. Inspect pipe, fittings, strainers, and valves, randomly selected by CUNY, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.14 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Steam condensate tank and receiver insulation shall be one of the following:
   1. Calcium Silicate: 3 inches (75 mm) thick.

2. Cellular Glass: 3 inches (75 mm) thick.
3. Mineral-Fiber Board: 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
4. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.

D. Steam flash-tank, flash-separator, and blow-off-tank insulation shall be one of the following:
1. Calcium Silicate: 3 inches (75 mm) thick.
2. Cellular Glass: 3 inches (75 mm) thick.
3. Mineral-Fiber Board: 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
4. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.

3.15 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
2. Underground piping.

3.16 INDOOR PIPING INSULATION SCHEDULE

A. Steam and Steam Condensate, 250 Deg F (122 Deg C) and below:
1.
2. NPS 1¼ and Smaller: Insulation shall be one of the following:
a. Calcium Silicate: 1½ inches thick.
b. Cellular Glass: 1½ inches thick.
c. Mineral-Fiber, Preformed Pipe, Type I or II: 1½ inches (38 mm) thick.
3.
4. NPS 1½ and Larger: Insulation shall be one of the following:
a. Calcium Silicate: 2 inches thick.
b. Cellular Glass: 2 inches thick.
c. Mineral-Fiber, Preformed Pipe, Type I or II: 2 inches (50 mm) thick.
5.
6. Valves and Strainers: Insulation shall be thermal blanket type.

B. Steam and Steam Condensate, 251 Deg F (123 Deg C) to 350 Deg F (177 Deg C).
1.
2. NPS 1¼ and Smaller: Insulation shall be one of the following:
a. Calcium Silicate: 2 inches (50 mm) thick.
b. Cellular Glass: 2 inches (50 mm) thick.
c. Mineral-Fiber, Preformed Pipe, Type I or II: 2 inches thick.
3.
4. NPS 1½ and Larger: Insulation shall be one of the following:

a. Calcium Silicate: 3 inches (75 mm) thick.
b. Cellular Glass: 3 inches (75 mm) thick.
c. Mineral-Fiber, Preformed Pipe, Type I or II: 3 inches (75 mm) thick.

5.

6. Valves and Strainers: Insulation shall be thermal blanket type.

C. Steam and Steam Condensate, above 350 Deg F:
1. NPS 1¼ and Smaller: Insulation shall be one of the following:
a. Calcium Silicate: 2 inches thick.
b. Cellular Glass: 2 inches thick.
c. Mineral-Fiber, Preformed Pipe, Type I or II: 2 inches thick.
2. NPS 1½ and Larger: Insulation shall be one of the following:
a. Calcium Silicate: 3 inches thick.
b. Cellular Glass: 3 inches thick.
c. Mineral-Fiber, Preformed Pipe, Type I or II: 3 inches thick.
3.
4. Valves and Strainers: Insulation shall be thermal blanket type.

D. Hot Service Drains:
1. All Pipe Sizes: Insulation shall be one of the following:
a. Calcium Silicate: 1-1/2 inches thick.
b. Cellular Glass: 1-1/2 inches thick.
c. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

E. Hot Service Vents:
1. All Pipe Sizes: Insulation shall be one of the following:
a. Calcium Silicate: 1-1/2 inches thick.
b. Cellular Glass: 1-1/2 inches thick.
c. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

3.17 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
1. None.

D. Piping, Exposed:
1. Aluminum, Corrugated: 0.016 inch thick.

END OF SECTION 230700

SECTION 230800 - COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Requirements Division 01, Division 23 Specification Sections, and Common Work Requirements for HVAC apply to the work specified in this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for HVAC&R and associated controls systems, assemblies, and equipment.

B. Related Sections:
   1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements as well as the Commissioning Plan, found as an Appendix to that Specification.

1.3 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority.

C. EOR: Engineer of Record

D. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 ALLOWANCES

A. Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing are covered by the "Schedule of Allowances" Article in Division 01 Section "Allowances."

1.5 UNIT PRICES

A. Commissioning testing allowance may be adjusted up or down by the "List of Unit Prices" Article in Division 01 Section "Unit Prices" when actual man-hours are computed at the end of commissioning testing.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Document equipment installation and startup activities as defined by the manufacturer and provide such documentation to the CxA prior to the start of commissioning tests.

C. Attend Commissioning Meetings during construction as designated by the CxA

D. Attend construction phase controls coordination meeting.

E. Attend testing, adjusting, and balancing review and coordination meeting.

F. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as called out in the installation specifications.
   1. Provide the CxA with sample training curricula for review and approval a minimum of four (4) weeks prior to the scheduled training.
   2. Provide EOR and CxA copies of O&M Manuals for review a minimum of four weeks prior to submission for substantial completion.

G. Provide information requested by the CxA for final commissioning documentation.

H. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

I. Provide site and equipment specific operating manuals detailing all manufacturer recommended maintenance procedures, spares lists,

1.7 CxA'S RESPONSIBILITIES

A. Provide Project-specific commissioning checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Develop and coordinate the Commissioning Plan.

C. Schedule and conduct Commissioning Meetings during construction as necessary to coordinate commissioning activities within the project delivery team.

D. Direct commissioning testing.

E. Verify testing, adjusting, and balancing of Work are complete.

F. Provide test data, inspection reports, and certificates in Systems Manual.

1.8 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:
   1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
   2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
   3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
   4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
   5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
   6. Test and inspection reports and certificates.
   7. Corrective action documents.
   8. Verification of testing, adjusting, and balancing reports.

1.9 SUBMITTALS

A. Certificates of readiness.

B. Certificates of calibration for all test equipment used

C. Certificates of completion and completed checklists for installation, prestart, and startup activities for each piece of commissioned equipment prior to the start of commissioning testing activities.

D. Marked up “As-Built” documentation showing locations valve numbers, connection points, and sizes of installed equipment, piping, ductwork and other ancillary equipment.

E. Operations and Maintenance Manuals

F. Training information, including all curricula, manuals, visual aides and trainer qualifications for each piece of equipment so called out in the installation specifications. Information shall be submitted for approval to the CxA a no later than three (3) weeks prior to proposed training.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 Testing AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.
   1. The CxA will notify testing and balancing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
   2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
   3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing,

adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.

4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the HVAC&R Contractor, testing and balancing Contractor, and HVAC&R Instrumentation and Control Contractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. Where ever possible, actual conditions will be created to test sequences of operations. The CxA may direct that set points be altered for simulation when creating actual conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Boiler Testing and Acceptance Procedures: Testing requirements are specified in Division 23 boiler sections. Provide submittals, test data, inspector record, and boiler certification to the CxA.

B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the CxA with preparation of testing plans.

C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 23 piping Sections. HVAC&R Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:
   1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
   2. Description of equipment for flushing operations.
   3. Minimum flushing water velocity.
   4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
   5. The plan shall be provided to the CxA for review a minimum of one (1) week prior to scheduled cleaning and flushing activities. Plan shall be approved prior to the commencement of such activity.
   6. The contractor shall confirm in writing the date and time of the start of flushing activity to the CxA 48 hours prior start.

D. Energy Supply System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of steam systems and equipment at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. Steam Pressure Reducing Valves

END OF SECTION 230800

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Requirements Division 01, Division 23 Specification Sections, and Common Work Requirements for HVAC apply to the work specified in this Section.

1.2 SUMMARY

A. This Section includes the following for LP, MP and HP steam, condensate and pumped condensate piping:
   1. Pipe and fittings.
   2. Strainers.
   3. Steam pressure reducing stations.
   4. Steam traps.
   5. Thermostatic air vents and vacuum breakers.

1.3 DEFINITIONS

A. HP and MP Systems: High-pressure piping and medium pressure piping operating at more than 15 psig as required by ASME B31.1.

B. LP Systems: Low-pressure piping operating at 15 psig (104 kPa) or less as required by ASME B31.9.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures:
   1. HP Steam Piping: 125 psig.
   2. MP Steam Piping: 65 psig.
   3. LP Steam Piping: 15 psig.
   4. Condensate Piping: 50 psig at 250 deg F (121 deg C).
   5. Makeup-Water Piping: 80 psig (552 kPa) at 150 deg F (66 deg C).
   6. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
   7. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
   8. Safety-Valve-Inlet and –Outlet Piping: Equal to pressure of the piping system to which it is attached.

1.5 SUBMITTALS

A. Product Data: For each type of the following:
   1. Pressure-reducing and safety valve.
   2. Steam trap.
   3. Air vent and vacuum breaker.
   4. Pipe and fittings.
   5. Unions and flanges.
   6. Gaskets.
   7. Sleeves and packing.

B. Shop Drawings: Detail, 1/4 inch equals 1 foot (1:50) scale, flash tank assemblies and fabrication of pipe anchors, hangers, pipe, multiple pipes, alignment guides, and expansion joints and loops and their attachment to the building structure. Detail locations of anchors, alignment guides, and expansion joints and loops. Provide shop drawings for the following locations:
   1. Mechanical equipment room layouts.
   2. Air handling equipment room layouts.
   3. Pipe tunnels.
   4. Heating coils.
   5. Heat exchangers.
   6. All floor plan layouts.

C. Qualification Data: For Installer.

D. Welding certificates.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For valves, safety valves, pressure-reducing valves, steam traps, air vents, vacuum breakers, and meters to include in emergency, operation, and maintenance manuals.

G. Schedules: Submit a schedule of pipe materials, fittings, unions, and flanges, along with ratings, for each system.

H. Submit stress calculations signed and sealed by a Professional Engineer registered in the State of New York.

I. Submit calculations for anchors signed and sealed by a Professional Engineer registered in the State of New York.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code - Steel."

C. Pipe Welding: Qualify processes and operators according to the following:
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. ASME Compliance: Comply with ASME B31.1, "Power Piping" and ASME B31.9, "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. Codes and Standards: Provide steam and steam condensate piping and specialties conforming to the following:
   1. American Society of Mechanical Engineers (ASME):
      a. B16.1: Cast iron threaded flanges and fittings.
      b. B16.3: Malleable iron threaded fittings.
      c. B16.4: Cast iron threaded fittings.
      d. B16.5: Wrought steel flanges and flanged fittings.
      e. B16.9: Factory-made wrought steel buttwelding fittings.
      f. B16.11: Forged steel fittings, socket-welding and threaded.
      g. B16.39: Malleable iron threaded pipe unions classes 150, 250, and 300.
      h. B31: Code for pressure piping.
      i. B31.1: Power piping.
      j. Z49.1: Safety in welding and cutting.
   2. American Society for Testing and Materials (ASTM):
      a. A53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded Seamless.
      b. A105: Standard Specification for Forgings, Carbon Steel for Piping Components.
      c. A106: Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service.
      d. A126: Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
      e. A193: Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Services.
      f. A194: Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service.
      g. A216: Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding for High Temperature Service.
      h. A234: Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
      i. A307: Standard Specification for Carbon Steel Bolts and Studs, 60,000 Tensile Strength.
      j. B61: Standard Specification for Steam or Valve Bronze Castings.
      k. B62: Standard Specification for Composition Bronze or Ounce Metal Castings.

3. American Welding Society, Inc. (AWS): Welding and safety procedure shall conform to the requirements of the AWS B2.1, "Welding Procedure and Performance Qualification," and ANSI Z491, "Safety in Welding and Cutting."

F. Qualification of Welders: Welders performing work under this Contract shall be certified and qualified in accordance with tests prescribed by the National Certified Welding Bureau (NCWB) or by other approved test procedures using methodology and procedures covered in the ASME Boiler and Pressure Vessel Code, Section IX, "Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators."
1. Submit for approval names, identification, and welder's assigned number, letter or symbol for each welder assigned to this project.
2. The assigned identification symbol shall be used to identify the work of each welder and shall be indelibly stamped immediately upon completion of each weld.
3. Welders shall be tested and certified for all positions.
4. Submit identifying stenciled test coupons made by each operator, if requested.
5. Welder will retake welding certifying test, at no additional expense if requested.
6. When so requested, a welder shall not be permitted to work as a welder on this project until he has been recertified in accordance with NCWB.
7. Recertification of the welder shall be resubmitted after the welder has taken and passed the required tests.
8. Where piping 1-1/2 inches and smaller is butt or socket welded, submit 3 samples of test welds for approval.

G. Qualifications of Radiographic Examiner: Personnel conducting radiographic examinations shall conform to the qualification requirements of the American Society for Nondestructive Testing, Inc. (ASNT) Publication SNT-TC-1A, "Recommended Practice for Personnel Qualifications and Certification."

H. Published specifications standards, tests, or recommended methods or trade, industry or governmental organizations apply to work in this section.

1.7 STORAGE AND PROTECTION

A. Storage: Store piping on this project site so as to preclude the entrance of construction dirt and debris into the open ends of piping. Do not install piping fouled with construction dirt.

B. Storage of Fittings: Store fittings under cover, protected from construction dirt and rain.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type A).

C. Wrought-Copper Fittings and Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53, black steel, plain ends, Type, Grade, and Schedule as indicated in Part 3 piping applications articles.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300 as indicated in Part 3 piping applications articles.

C. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated in Part 3 piping applications articles.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 piping applications articles.

E. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250 as indicated in Part 3 piping applications articles; raised ground face, and bolt holes spot faced.

F. Wrought-Steel Fittings: ASTM A 234, butt weld type, wall thickness to match adjoining pipe.

G. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
   1. Material Group: 1.1.
   2. End Connections: Butt welding.
   3. Facings: Raised face.

H. Forged Steel Fittings: ASME 16.11: Class 2000 (threaded) and Class 3000 (socket welded) as indicated in Part 3 piping applications articles.

I. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, black steel of same Type, Grade, and Schedule as pipe in which installed.

J. Stainless-Steel Bellows, Flexible Connectors:
   1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforced, protective jacket.
   2. End Connections: Threaded or flanged to match equipment connected.
   3. Performance: Capable of 3/4-inch (20-mm) misalignment.
   4. CWP Rating: 150-psig (1035-kPa).
   5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.3 BRASS PIPE AND FITTINGS

A. Brass Pipe: ASTM B43, seamless, annealed, 85% copper.

B. Threaded Fittings: ASTM B16.15, cast bronze, bonded.

C. Flanges and Fittings: ASTM B16.24, cast bronze.

D. Unions: All bronze, ground joint seat.

2.4 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. ASME B16.20, metallic, spiral wound, asbestos free, 1/8 inch maximum thickness, for services above 250 deg F.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
   1. Bolts: ASTM A193 Grade B7, chrome-molybdenum bolt stud, with full length threads.
   2. Nuts: ASTM A194 Grade 2, carbon steel, hexagon heavy series type.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12 (AWS D10.12M) for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Capitol Manufacturing Company.
      b. Central Plastics Company.
      c. Hart Industries, International Inc.
      d. Watts Water Technologies, Inc.

e. Zurn Plumbing Products Group.
f. Or approved equal.

2. Factory-fabricated union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

D. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Watts Water Technologies, Inc.
d. Or approved equal.
2. Factory-fabricated companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.
e. Or approved equal.
2. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
3. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

2.6 FLASHINGS AND SLEEVES

A. Flashings for Pipes Through Roofs:
1. M.D. Products No. 65 or approved equal.
2. M.D. Products No. 67 with vandal caps for vents or approved equal.
3. Provide counter-flashing sleeves.
4. Other Flashings shall be galvanized sheet metal.

B. Sleeves; of Following Types as Required:
1. Schedule 40, galvanized steel pipe sleeves.
2. Adjustable, telescopic metal sleeves:
a. Adjust-o-crete or approved equal.
3. For insulated piping, sleeve diameter shall not be less than diameter of insulation.

C. Packings:
1. Though Fire Rated Partitions: One of the following:
a. 3M Penetration Sealing System (PSS 7904) and 3M Fire Barrier Caulk and Putty.
b. Dow-Corning LTV silicone foam.

c. Or approved equal.

2.7 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

2.8 STRAINERS

A. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for strainers NPS 2 (DN 50) and smaller; flanged ends for strainers NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: Stainless-steel, 20 mesh strainer, and perforated stainless-steel basket with 50 percent free area.
4. Tapped blowoff plug.
5. CWP Rating: 250-psig (1725-kPa) working steam pressure.

B. Basket Strainers:
1. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for strainers NPS 2 (DN 50) and smaller; flanged ends for strainers NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: Stainless-steel, 20 mesh strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 250-psig (1725-kPa) working steam pressure.

2.9 STEAM PRESSURE-REDUCING STATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Fisher
2. Leslie Controls, Inc.

B. Provide pneumatic PRV stations. Each station to have a safety shut-off valve because the final operating pressures are different. Each also has a pressure limiting pilot that will reset the primary PRV to the final pressure should the secondary PRV fail.

C. PRV shall be pneumatically actuated locally controlled with local alarm panel.

D. Contractor shall furnish and install the pressure reducing valve station with all devices and controls specified below and as shown on the drawing.

E. Contractor shall furnish and install the pressure reducing valve station specified below and as shown on the drawing.

F. STEAM PRESSURE REDUCING VALVE STATION – Two Stage Regulation w/ Pressure Limiting Pilot and Safety Shut Off.
   1. Contractor shall furnish and install the pressure reducing valve station specified below and shown on the detail drawing.
   2. Pressure Reducing Valves (Fisher E series control valve)
   3. Air operated diaphragm control valves.
   4. Cast Iron with ANSI 250 psi rating or Steel with ANSI 300 psi rating.
   5. Normally closed, air to open.
   6. Renewable stainless-steel seat.
   7. 416 hardened stainless steel or stellited inner valve trim with equal percent or modified linear flow characteristic.
   8. Valves 2-1/2" and larger shall have a pressure balanced inner valve to minimize diaphragm actuator size.
   9. Suitable for dead end service.
   10. Actuator shall be bolted to valve bonnet and capable of closing off control valve against 200 psig pressure drop.
   11. Actuator shall have a manual handwheel override.
   12. All internal parts of the valve shall be replaceable without removing valve from line or disturbing pipe connections.
   13. Valve shall be heavy duty industrial grade similar to Fisher ET, EZ or approved equal.
   14. Automatic Safety Shutdown System w/ Manual Reset - Contractor shall furnish and install the number of Safety Shutdown valves as indicated in the PRV schedule. The automatic shutdown system shall consist of the following components.
   15. Pneumatically operated diaphragm control valve similar to that specified for the pressure reducing valves above. Fisher ET, EZ series as indicated in the schedule.
   16. Air filter regulator for dedicated supply to 3 way solenoid valve. Similar to Fisher 67CFR series.
   17. Primary pressure control to be pneumatic indicating controls and Pressure Limiting control can be non indicating.
   18. Furnish with Fisher 67CFR air filter regulator.
   19. Similar to Fisher Model 4195K and C1 or approved equal.

G. Pneumatic Indicating Controllers
   1. Pneumatic indicating pressure controllers shall have dual pointer indicating set pressure and actual pressure, two mode control including gain (1-50) and Integral Reset (.1-20 rpm), stainless steel bourdon tube pressure sensing element, stainless steel internal pneumatic tubing, 6-30 psi air output with output gage and all stainless steel internal linkage. Controller shall be industrial grade, Fisher 4195K or approved equal.

H. Pneumatic Accessories
   1. Pneumatic controllers shall be furnished with an air filter regulator with output gage.
   2. Aluminum body, enclosed spring case and filter case.
   3. Rated supply pressure 200 psig air.
   4. Adjusted output range as specified by manufacturer for the intended application.
   5. Supply pressure effect shall be minimum 65 to 1.
   6. Fisher 67CFR or approved equal.

I. Pressure Switches
   1. Valve supplier shall furnish 2-stage dual high/low pressure switches for purpose of activating PRV station alarms. ASCO SC10D/TG10A21 or approved equal.
   2. Diaphragm type mercury free with minimum static pressure rating of the brass transducer as follows:
      a. For high pressure lines 400 psig
      b. For medium pressure lines 200 psig
      c. For low pressure lines 150psig
   3. Construction shall be modular type with transducer, switch housings and adjustments in separate areas.
   4. In applications where the switch is used in conjunction with a Safety Shut Off system it shall be proved with a manual reset button. ASCO SD20D/TE20121 or approved equal.
   5. Switches shall be field wired as indicated on the detail drawing to the Local alarm panel.
   6. Mount all pressure switches on pigtail siphon to isolate transducer from steam temperatures.

J. Alarm Panel to Interface with PRV Station Pressure Switches. – Contractor shall furnish and install a local 6 point alarm panel which shall be located in accordance with the building owner's instruction or as specified herein. Power to this panel shall be 120VAC/60HZ and shall be furnished by this contractor or his electrical sub-contractor. Panel shall meet the following requirements:
   1. NEMA 1 enclosure with hinged door.
   2. Fused on/off switch with power on light (Green).
   3. Common alarm light (Red).
   4. One common alarm bell (85dba).
   5. Common alarm silencing buttons. The silencing of one point shall not effect the remaining points which shall remain active.
   6. Extra set of terminals for interface with remote alarm.
   7. Numbered terminal strip for wiring of PRV station pressure switches.
   8. Similar to Boulay 6PAlarm.

K. Noise suppressors
   1. The contractor shall provide sound attenuator equipment attached to the outlet of the pressure reducing valve, to reduce noise to a level of 80dBA or lower.
   2. A low attenuation (less than 5dBA) sound diffractor containing an inlet flow nozzle with holes shall be provided.
   3. Diffusers are constructed of all welded carbon steel pipe, plate and fittings.
   4. Design is to the procedures of ASME code Section 8, Div. 1, excluding hydrotesting and stamp.

L. Sequence of operation
   1. Each reducing valve shall open gradually without chatter or vibration and shall maintain set pressure throughout its rated travel
   2. PRV shall be capable of operating with the full primary pressure at the inlet and shall maintain a desired setpoint while operating under the condition.
   3. Should the PRV fail to maintain proper pressure, then the safety shut off shall automatically close to prevent system from exceeding desired setpoint.

4. A failure of the PRV shall cause an alarm indication at the local alarm panel.
5. Each reducing valve shall be equipped with is own dedicated pneumatic controller. Use of positioners and booster relays shall not be permitted.

M. Automatic safety shutdown system with manual reset:
1. Contractor shall furnish and install the number of safety shutdown valves as indicated on the drawing. The automatic shutdown system shall consist of the following components.
2. Pneumatically operated diaphragm control valve. Fisher V300 or approve equal.

2.10 STEAM TRAPS

A. Steam trap ratings shall be based on the following:
1. 300 percent of maximum load.
2. Condensate at steam temperature.
3. Pressure differential across trap at maximum capacity: 1 psig, unless noted otherwise:
   a. Low Pressure Systems (5 psi and less): 1/4 psi.
   b. Low Pressure Systems (15 psi maximum): 1 psi.
   c. Medium Pressure Steam (65 psig maximum): 15 psi.
   d. High Pressure Steam (150 psig maximum): 40 psi.
4. Standards of Steam Heating Equipment Manufacturers Association.
5. Minimum trap size: 3/4 inch.

B. Thermostatic Traps:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong International, Inc.
   b. Barnes & Jones, Inc.
   c. Dunham-Bush, Inc.
   d. Hoffman Specialty; Division of ITT Industries.
   e. Spirax Sarco, Inc.
   f. Sterling.
   g. Or approved equal.
2. Body: Bronze angle-pattern body with integral union tailpiece and screw-in cap.
3. Trap Type: Balanced-pressure.
4. Bellows: Corrugated, stainless steel or monel.
5. Head and Seat: Replaceable, hardened stainless steel or cast brass.
6. Pressure Class: 125.

C. Thermodynamic Traps:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong International, Inc.
   b. Barnes & Jones, Inc.
   c. Dunham-Bush, Inc.
   d. Hoffman Specialty; Division of ITT Industries.
   e. Spirax Sarco, Inc.

f. Or approved equal.
2. Body: Stainless steel with screw-in cap.
3. End Connections: Threaded.
4. Disc and Seat: Stainless steel.
5. Maximum Operating Pressure: 600 psig (4140 kPa).
6. Operation:
   a. Disc, only moving part; tight shut off at no load condition.
   b. Air and condensate discharged as soon as same reaches trap.
   c. Not to be used for equipment utilizing control valves.

D. Float and Thermostatic Traps:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong International, Inc.
   b. Barnes & Jones, Inc.
   c. Dunham-Bush, Inc.
   d. Hoffman Specialty; Division of ITT Industries.
   e. Spirax Sarco, Inc.
   f. Sterling.
   g. Or approved equal.
2. Body and Bolted Cap: ASTM A 126, cast iron.
3. End Connections: Threaded.
4. Float Mechanism: Replaceable, stainless steel.
5. Head and Seat: Hardened stainless steel.
6. Trap Type: Balanced pressure.
7. Thermostatic Bellows: Stainless steel or monel.
8. Thermostatic air vent capable of withstanding 45 deg F (25 deg C) of superheat and resisting water hammer without sustaining damage.
9. Vacuum Breaker: Thermostatic with phosphor bronze bellows, and stainless steel cage, valve, and seat.
10. Maximum Operating Pressure: 125 psig (860 kPa).

2.11 THERMOSTATIC AIR VENTS AND VACUUM BREAKERS

A. Thermostatic Air Vents:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong International, Inc.
   b. Barnes & Jones, Inc.
   c. Dunham-Bush, Inc.
   d. Hoffman Specialty; Division of ITT Industries.
   e. Spirax Sarco, Inc.
   f. Sterling.
   g. Or approved equal.
2. Body: Cast iron, bronze or stainless steel.
3. End Connections: Threaded.

4. Float, Valve, and Seat: Stainless steel.
5. Thermostatic Element: Phosphor bronze bellows in a stainless-steel cage.
6. Pressure Rating: 125 psig (861 kPa) .
7. Maximum Temperature Rating: 350 deg F (177 deg C).

B. Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong International, Inc.
   b. Dunham-Bush, Inc.
   c. Hoffman Specialty; Division of ITT Industries.
   d. Johnson Corporation (The).
   e. Spirax Sarco, Inc.
   f. Or approved equal.
2. Body: Bronze, or stainless steel.
3. End Connections: Threaded.
4. Sealing Ball, Retainer, Spring, and Screen: Stainless steel.
5. O-ring Seal: EPR.
6. Pressure Rating: 210 psig (861 kPa).
7. Maximum Temperature Rating: 350 deg F (177 deg C).

2.12 MISCELLANEOUS DEVICES

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. Drip-Pan Elbows:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anvil International, Inc.
   b. Keckley.
   c. Kunkle Valve; a Tyco International Ltd. Company.
   d. Or approved equal.
2. Body Material: Cast iron or welded steel.
3. End Connection: Threaded or flanged inlet.
4. Drain Tapping: Threaded.

C. Exhaust Heads:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anderson.
   b. Bryan Steam.
   c. Wright-Austin; Division of Hayward Filtration.
   d. Or approved equal.

2. Type: Muffler type atmospheric exhaust head with drip gutter and drain to remove moisture entrainment from steam discharge.
3. Body Material: Cast iron.
4. End Connection: Threaded or flanged inlet.
5. Drain Tapping: Threaded.

D. Steam Separators:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Anderson.
b. Centrifix.
c. Penn Separator Corp.
d. Wright-Austin; a Division of Hayward Filtration.
e. Or approved equal.
2. Type: Centrifugal type, steam separator with internal impingement plates, capable of separating more than 97% of moisture and oil entrained in steam by both impingement and centrifugal action.
3. Body Material: Welded steel, according to ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for 150 psig rating and 450 deg F, and bearing ASME label.
4. End Connection: Flanged inlet and outlet.
5. Drain Connection: Threaded.

E. Local alarm to interface with PRV station switches:
1. Description: Local alarm panel to be used with ASCO pressure alarm switches or approved equal for visual and audible indication of pressure failure in the PRV station shall be located in accordance with the building Owner's instructions or as specified herein. Panel shall include the following:
a. NEMA 12 enclosure with hinged door.
b. Fused on/off switch with power on light (green).
c. Alarm lights (red) dedicated to specific alarm points.
d. One common alarm bell (85 dBa).
e. Silencing button dedicated to specific alarm points. The silencing of one alarm shall not affect the remaining alarm points.
f. Numbered terminal strip for wiring of PRV station switches.
g. Suitable for use with 120V AC, 1-phase, 60 Hz electric power

PART 3 - EXECUTION

3.1 LP STEAM PIPING APPLICATIONS

A. LP Steam Piping, NPS 2 (DN 50) and Smaller: Schedule 40, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

B. LP Steam Piping, NPS 2-1/2 through NPS 12 (DN 65 through DN 300): Schedule 40, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

C. LP Steam Piping, NPS 14 through NPS 18: Schedule 30, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

D. Condensate piping, NPS 2 (DN 50) and smaller, shall be the following:
   1. Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

E. Condensate piping, NPS 2-1/2 (DN 65) and larger, shall be the following:
   1. Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

3.2 MP STEAM PIPING APPLICATIONS

A. MP Steam Piping, NPS 2 (DN 50) and Smaller: Schedule 40, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

B. MP Steam Piping, NPS 2-1/2 through NPS 12 (DN 65 through DN 300): Schedule 40, Type S, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

C. Condensate piping, NPS 2 (DN 50) and smaller, shall be the following:
   1. Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

D. Condensate piping, NPS 2½ and larger, shall be the following:
   1. Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

3.3 HP STEAM PIPING APPLICATIONS

A. HP Steam Piping (125 psig to 225 psig), NPS 2 (DN 50) and Smaller: Schedule 80, Type S, Grade B, steel pipe; Class 250 cast-iron fittings; and threaded joints.

B. HP Steam Piping, NPS 2-1/2 through NPS 12 (DN 65 through DN 300): Schedule 40, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

C. Condensate piping above grade, NPS 2 (DN 50) and smaller, shall be the following:
   1. Schedule 80, Type S, Grade B, steel pipe; Class 250 cast-iron fittings; and threaded joints.

D. Condensate piping, NPS 2-1/2 (DN 65) and larger, shall be the following:
   1. Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

3.4 ANCILLARY PIPING APPLICATIONS

A. Makeup-water piping shall be either of the following:
   1. Drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
   2. Schedule IPS, red brass pipe, Class 150 cast bronze fittings; and threaded ends.

B. Pumped Condensate Return Piping: Schedule 80, Grade B, steel pipe, Class 125 cast iron fittings; and threaded joints.

C. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

D. Air-Vent Piping:
   1. Inlet: Same as service where installed.
   2. Outlet: Type K (A) annealed-temper copper tubing with soldered or flared joints.

E. Vacuum-Breaker Piping: Outlet, same as service where installed.

F. Safety-Valve-Inlet and -Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

G. Instrument Piping: Standard weight, red brass pipe; cast bronze fittings and threaded joints.

3.5 VALVE APPLICATIONS

A. Install shutoff duty valves at risers and branch connections to steam supply mains, at steam supply connections to equipment, and at the outlet of steam traps.

B. Install safety valves on pressure-reducing stations and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

3.6 PIPING INSTALLATION

A. See Section 230500 Part 3 – Execution.

B. Install piping approximately as indicated and modify to suit building conditions, to avoid interference with subcontractors, to maintain access and clearance and to maintain pitch. Where modifications are required provide necessary offsets, drains, vents, valves, and required pipe and fittings.

C. Maintain maximum headroom and ceiling height; offset as necessary and coordinate with work of subcontractors.

D. Install piping to allow for expansion and contracting of the piping systems. Provide offset and swing joint connections at tanks, coils, and other equipment to eliminate undue strain to the equipment connections.

E. Install piping to permit valve servicing.

F. Install piping free of sags and bends.

G. Install standard manufactured fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

K. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) full port-ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

L. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.

M. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side down for horizontal piping and concentric reducers for vertical piping.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to top of main pipe.
   1. Equal to Main and to 2 Pipe Sizes Smaller: Use weld trees.
   2. Three or More Pipe Sizes Than Main:
      a. Up to NPS 2: Use weld-o-lets, thread-o-lets, or threaded nip-o-lets.
      b. NPS 2/1/2 and larger: Use weld-o-lets.

P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated. Use dielectric unions where joining dissimilar materials.

R. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.

S. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and full port ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).

T. Install no piping in elevator machine rooms, electric rooms and closets, and telephone rooms and closets.

U. Install expansion loops, expansion joints, anchors, and pipe alignment guides as required by pipe stress analysis calculations."

V. Identify piping as specified in Division 23 Section “Identification for HVAC piping and Equipment.”

W. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.
1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 100 feet (30 m).
2. Size drip legs same size as main. In steam mains NPS 6 (DN 150) and larger, drip leg size can be reduced, but to no less than NPS 4 (DN 100).

X. Flash Tank:
1. Pitch condensate piping down toward flash tank.
2. If more than one condensate pipe discharges into flash tank, install a check valve in each line.
3. Install thermostatic air vent at tank top.
4. Vent to LP steam main.
5. Install safety valve at tank top.
6. Install full-port ball valve, and swing check valve on condensate outlet.
7. Install inverted bucket or float and thermostatic trap at low-pressure condensate outlet, sized for three times the calculated heat load.
8. Install pressure gage on low-pressure steam outlet according to Division 23 Section "Meters and Gages for HVAC Piping."

3.7 STEAM-TRAP INSTALLATION

A. Install steam traps in accessible locations as close as possible to connected equipment.

B. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, and full-port ball valve downstream from trap unless otherwise indicated.

3.8 PRESSURE-REDUCING VALVE INSTALLATION

A. Install pressure-reducing valves in accessible location for maintenance and inspection.

B. Install bypass piping around pressure-reducing valves, with globe valve equal in size to area of pressure-reducing valve seat ring, unless otherwise indicated.

C. Install gate valves on both sides of pressure-reducing valves.

D. Install unions or flanges on both sides of pressure-reducing valves having threaded- or flanged-end connections respectively.

E. Install pressure gages on low-pressure side of pressure-reducing valves after the bypass connection according to Division 23 Section "Meters and Gages for HVAC Piping."

F. Install strainers upstream for pressure-reducing valve.

G. Install safety valve with discharge elbow, downstream from pressure-reducing valve station.

3.9 SAFETY VALVE INSTALLATION

A. Install safety valves according to ASME B31.1, "Power Piping" and ASME B31.9, "Building Services Piping."

B. Pipe safety-valve discharge without valves to atmosphere outside the building.

C. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.

D. Install exhaust head with drain to waste, on vents equal to or larger than NPS 2-1/2 (DN 65).

3.10 HANGERS AND SUPPORTS

A. Install hangers and supports according to Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with requirements below for maximum spacing.

B. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
   2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet (6 m) or longer.
   3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
   4. Spring hangers to support vertical runs.

C. Install hangers with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4 (DN 20): Maximum span, 9 feet (2.7 m); minimum rod size, 1/4 inch (6.4 mm).
   2. NPS 1 (DN 25): Maximum span, 9 feet (2.7 m); minimum rod size, 1/4 inch (6.4 mm).
   3. NPS 1-1/2 (DN 40): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (10 mm).

4. NPS 2 (DN 50): Maximum span, 13 feet (4 m); minimum rod size, 3/8 inch (10 mm).
5. NPS 2-1/2 (DN 65): Maximum span, 14 feet (4.3 m); minimum rod size, 3/8 inch (10 mm).
6. NPS 3 (DN 80): Maximum span, 15 feet (4.6 m); minimum rod size, 3/8 inch (10 mm).
7. NPS 4 (DN 100): Maximum span, 17 feet (5.2 m); minimum rod size, 1/2 inch (13 mm).
8. NPS 6 (DN 150): Maximum span, 21 feet (6.4 m); minimum rod size, 1/2 inch (13 mm).
9. NPS 8 (DN 200): Maximum span, 24 feet (7.3 m); minimum rod size, 5/8 inch (16 mm).
10. NPS 10 (DN 250): Maximum span, 26 feet (8 m); minimum rod size, 3/4 inch (19 mm).
11. NPS 12 (DN 300): Maximum span, 30 feet (9.1 m); minimum rod size, 7/8 inch (22 mm).
12. NPS 14 (DN 350): Maximum span, 32 feet (9.8 m); minimum rod size, 1 inch (25 mm).
13. NPS 16 (DN 400): Maximum span, 35 feet (10.7 m); minimum rod size, 1 inch (25 mm).
14. NPS 18 (DN 450): Maximum span, 37 feet (11.3 m); minimum rod size, 1-1/4 inches (32 mm).
15. NPS 20 (DN 500): Maximum span, 39 feet (11.9 m); minimum rod size, 1-1/4 inches (32 mm).

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 1/2 (DN 15): Maximum span, 4 feet (1.2 m); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).
4. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
5. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
6. NPS 2-1/2 (DN 65): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
7. NPS 3 (DN 80): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).

E. Support vertical runs at roof, at each floor, and at 10-foot (3-m) intervals between floors.

3.11 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube ends. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12 (AWS D10.12M), using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Swing Joints: Use 3 elbow type joints on steam and condensate return connections to equipment and piping systems.

3.12 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install traps and control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install vacuum breakers downstream from control valve, close to coil inlet connection.

E. Install a drip leg at coil outlet.

3.13 EQUIPMENT PIPING AND CONNECTIONS

A. Install steam, condensate return, drip and vent piping connections as noted and as recommended by the equipment manufacturer. Verify location, number, and size of connections

B. Equipment connections for the following applications:
   1. Boiler plant.

C. Piping and Connections:
   1. Install a gate valve in each steam connection.
   2. In each return connection install a globe valve at equipment, trap, strainer upstream of trap, check valve and gate valve a trap discharge and globe valve in trap by-pass.
   3. Exposed uninsulated steam, return and drip piping, including valves, strainers, and traps shall be chromium plated. Chromium plated valves shall be provided with heat-resisting composition cone handle.

4. Install single stage, self-contained pressure reducing valves in steam connections to equipment, as noted, with a strainer at inlet side. Exposed pressure reducing valves and strainer shall be chromium plated.

D. Locate condensate return traps to preclude freezing.

3.14 FIELD QUALITY CONTROL

A. Prepare steam and condensate piping according to ASME B31.1, "Power Piping" and ASME B31.9, "Building Services Piping," and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Prior to cleaning, remove steam traps and provide temporary spool pieces.
4. Flush system with clean water. Clean strainers.
5. Blowdown system with steam after water cleaning, and before steam traps are installed.
6. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

B. Weld Tests: Perform the following tests on welded steam and condensate piping.
1. Retain the services of an independent testing agency for visual and radiographical examination of welds in conformance with ASME B31.
2. Visual Tests: All welds shall be visually inspected. Visual examination of weld joints shall be viewed before, during, and after fabrication, assembly and erection to verify conformance with Contractor's written qualified welding procedure.
3. Radiographic Tests: Radiographic examination for butt welded joints in steam piping shall be performed in accordance with Article 2 of Section V of the ASME Boiler and Pressure Vessel Code. The extent of radiographic examination shall be as per the following:
a.

b.	Steam Piping Pressure	c.	Percentage Radiograph
d.	90 psig and Under	e.	Not required
f.	91 psig to 150 psig	g.	10% at Random
h.	Over 150 psig	i.	100%

j.
4. Defects: All defects in welds of base materials shall be removed. Repair all welds in accordance with Contractor's written qualified welding procedure. All repairs shall be done at no additional cost to CUNY.

C. Perform the following tests on steam and condensate piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel,

pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.

3. After hydrostatic test pressure has been applied for at least 2 hours, with system valves capped and pressure apparatus disconnected, and no change in test pressure, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

D. Prepare written report of testing.

END OF SECTION 232213

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. NA
6. Removing above- and below-grade site improvements.
7. Disconnecting, capping or sealing, and removing/abandoning site utilities.
8. Temporary erosion and sedimentation control.

B. Related Requirements:
1. Section 015000 "Temporary Facilities and Controls"
2. Section 312000 "Earth Moving"
3. Section 024116 "Structure Demolition"
4. Section 024119 "Selective Demolition"

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. NA.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction as indicated on Drawings.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. NA

1.5 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.6 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or video recordings.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. NA

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

E. NA

1.7 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

B. NA

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: NA.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises.

D. Utility Locator Service: Notify **Call Before You Dig** for areas where the project is located before site clearing. For areas outside this service, contact College Facilities Department for approximate utility locations. However, there is no guarantee implied to conveyed that any utilities can be mapped with any accuracy. It is the contractors responsibility to pursue and secure the location of utilities running through each work zone.

E. Do not commence site clearing operations until temporary erosion and sediment control and plant-protection measures are in place.

F. Tree and Plant Protection Zones: Protect according to requirements in the plans.

G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in the plans.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in the plans.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain that are damaged by construction operations to the owner’s satisfaction.

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
   1. Arrange with utility companies or facility department to shut off indicated utilities.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Do not proceed with utility interruptions without Architect's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

G. The contractor is to contact the College to obtain utility mapping as produced by Medina Consultants dated 01/06/2010. Plans indicate there are gas, water, electric, telecommunications, storm and sanitary services in the area. The contractor shall locate said utilities prior to digging.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
   3. Use only hand methods or air spade for grubbing within protection zones.
   4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Limit height of topsoil stockpiles to 6 foot.
   2. Do not stockpile topsoil within protection zones.

3.7 STOCKPILING ROCK

A. NA

3.8 SITE IMPROVEMENTS

A. Remove existing above and below grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Burning of waste and debris is prohibited.

C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

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. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, sidewalks, pavements, turf, grasses and plants.
3. Excavating and backfilling for buildings and structures.
4. Subbase course for concrete sidewalks and pavements.
5. Subbase course and base course for asphalt paving.
6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:
1. Section 013200 "Construction Progress Documentation"
2. Section 013233 "Photographic Documentation" for recording pre-excavation and earth-moving progress.
3. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
4. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
5. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
6. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: NA

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Bulk Excavation: NA
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: NA

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct pre-excavation conference at Project site.
   1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
      a. Personnel and equipment needed to make progress and avoid delays.
      b. Coordination of Work with utility locator service.
      c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
      d. Extent of trenching by hand or with air spade.
      e. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
   1. Geotextiles.
   2. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:
   1. Geotextile: 12 by 12 inches.
   2. Warning Tape: 12 inches long; of each color.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D2487.
   2. Laboratory compaction curve according to ASTM D1557.

C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.7 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: NA

C. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing" are in place.

E. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

F. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, SW, and SP, according to ASTM D2487 or a combination of these groups; free of rock or gravel larger than 1.5-inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

D. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Sand: ASTM C33/C33M; fine aggregate.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
   1. Survivability: Class 2; AASHTO M 288.
   2. Survivability: As follows:
      a. Grab Tensile Strength: 157 lbf; ASTM D4632.
      b. Sewn Seam Strength: 142 lbf ; ASTM D4632.
      c. Tear Strength: 56 lbf; ASTM D4533.
      d. Puncture Strength: 56 lbf; ASTM D4833.
   3. Apparent Opening Size: No. 40 sieve, maximum; ASTM D4751.
   4. Permittivity: 0.5 per second, minimum; ASTM D4491.
   5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

2.3 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. 12 inches outside of concrete forms at footings.
   3. 6 inches outside of minimum required dimensions of concrete cast against grade.
   4. 6 inches beneath bottom of concrete slabs-on-grade.
   5. 6 inches beneath pipe in trenches and 24 inches wider than pipe.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:
1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
1. Clearance: As indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

3.9 OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring, bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: NA

D. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete." Backfill voids with satisfactory soil while removing shoring and bracing.

E. Initial Backfill:
   1. Soil Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Final Backfill:
1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Detectable Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.12 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry density.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D1557:
1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.

3.14 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch.
   3. Pavements: Plus or minus 1/2 inch.

3.15 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
   1. Shape subbase course and base course to required crown elevations and cross-slope grades.
   2. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
   3. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   4. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D1557.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D1557.

3.16 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material classification and maximum lift thickness comply with requirements.
   3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: NA

E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
   2. Foundation Wall Backfill: NA
   3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 321216 - ASPHALT PAVING

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. Hot-mix asphalt paving.
   2. Hot-mix asphalt overlay.

B. Related Requirements:
   1. Section 024116 "Structure Demolition" for demolition and removal of existing asphalt pavement.
   2. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
   3. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.
   4. Section 079200 Joint Sealants

1.3 PREINSTALLATION MEETINGS

A. NOT USED .

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include technical data and tested physical and performance properties.
   2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.

B. Material Certificates: For each paving material.[Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.]

C. Material Test Reports: For each paving material, by a qualified testing agency.

D.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by NYSDOT.

B. Testing Agency Qualifications: Contractor will request for special inspections.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of NYC DOT for asphalt paving work.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
   1. Prime Coat: Minimum surface temperature of 60 deg F.
   2. Tack Coat: Minimum surface temperature of 60 deg F.
   3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
   4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D692/ and C136, sound; angular crushed stone, or crushed gravel.

C. Fine Aggregate: ASTM D1073and C136, sharp-edged natural sand or sand prepared from stone, gravel, or combinations thereof.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: [ASTM D6373] binder designation PG 64-22.

B. Asphalt Cement: ASTM D946/D946M for penetration-graded material.

C. Emulsified Asphalt Prime Coat: ASTM D977.

D. Tack Coat: ASTM D977.

E. Water: Potable.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled glass from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

C. Sand: ASTM D1073, Grade No. 2 or No. 3.

2.4 MIXES

A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by NYCDOT.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph
   2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.3 COLD MILLING

3.4 NAPATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd.
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 REPAIRS

3.6 SURFACE PREPARATION

A. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
   2. Protect primed substrate from damage until ready to receive paving.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.7 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Place hot-mix asphalt base course in two lifts.
   2. Place hot-mix asphalt surface course in single lift.
   3. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
   2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.8 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat to joints.
   2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
   3. Offset transverse joints, in successive courses, a minimum of 24 inches.
   4. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
   5. Compact asphalt at joints to a density within 2 percent of specified course density.
   6. Paving any one section or area shall be completed in a single shift.

3.9 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F .

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Average Density: 96 percent of reference laboratory density according to ASTM D6927, but not less than 94 percent or greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 ASPHALT CURBS

A. NA

3.11 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Base Course: Plus or minus 1/2 inch.
   2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
   1. Base Course: 1/4 inch.
   2. Surface Course: 1/8 inch.
   3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.12 SURFACE TREATMENTS

1. NA

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D3549/D3549M.

C. General: Handle asphalt-paving waste according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

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 Concrete Paving **.**
   1. Curbs and gutters.
   2. Walks.

B. Related Requirements:
   1. Section 033000 “Cast-in-Place Concrete”
   2. Section 079200 “Joint Sealants”

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with , slag cement.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to concrete paving, including but not limited to, the following:
      a. Concrete mixture design.
      b. Quality control of concrete materials and concrete paving construction practices.
   2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
      a. Contractor's superintendent.
      b. Concrete paving Subcontractor.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete paving mixture. Include list of admixtures to be used and include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Ready-mix concrete manufacturer and testing agency.
   1. Company specializing in the production of concrete shall be certified by the National Ready Mixed Concrete Association (NRMCA) and shall have certification by either a New York City Agency or the NYS Department of Transportation and complies with ASTM C94 requirements for production facilities and equipment. The plant shall use NYSDOT approved trucks and drivers shall be certified by the NRMCA
   2. Rebar Detailer: Company shall be specialized in the detailing of reinforcing bar shop drawings with a minimum of three years experience.
   3. Concrete Installer: Company specializing in performing the Work of this Section shall have three years minimum experience on successful projects of similar size.

B. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Welded wire fabric.
   4. Admixtures.
   5. Curing compounds.
   6. Applied finish materials.
   7. Bonding agent or epoxy adhesive.
   8. Expansion joint fillers.
   9. Expansion joint sealants

C. Material Test Reports: For each of the following:
   1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1. The College will assign, under the requirements of Section BC 1704.4, a Special Inspector who will supervise the testing of the materials and the inspection of concrete construction. The Special Inspector is responsible any required filing with the Building Department, as well as maintaining a log book of the concrete work.
2. The Special Inspector will check that all required tests are made and the results submitted. The Special Inspector will also report to the Building Department Superintendent any deviation from the requirements of the Code, as indicated by records of inspection and reports of tests.
3. Perform tests during construction as required by Section BC 1905.6.2. The Laboratory will obtain samples at the mixer and when directed by the Engineer at the point of placement
   a. The contractor shall notify the College in writing at least forty-eight hours in advance of each concrete placement. The College will notify the Testing Laboratory immediately to order out the necessary concrete technicians to cover the work.
   b. Once the concrete technicians are ordered out and a cancellation follows, the Contractor will be charged Four Hundred Fifty Dollars for each technician so ordered to appear, unless a cancellation order is issued to the Laboratory by 3 PM the day before the concrete placement.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.9 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
   1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms[, steel reinforcement,] and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
   1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064, flat sheet.

B. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884, Class A, plain steel.

C. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.

D. Epoxy-Coated Reinforcing Bars: ASTM A775 or ASTM A934; with ASTM A615, Grade 60 deformed bars.

E. Deformed-Steel Wire: ASTM A1064.

F. Epoxy-Coated-Steel Wire: ASTM A884, Class A; coated, deformed.

G. Tie Bars: ASTM A615, Grade 60; deformed.

H. Hook Bolts: ASTM A307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

I. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports

according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

J. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

2.4 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C150, gray Portland cement Type II, , non air-entrained
   2. Slag Cement: ASTM C989, Grade 100 or 120.
   3. Maximum Coarse-Aggregate Size: 1 inch nominal.
   4. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

B. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
   1. Aggregate Sizes: ASTM No. 57,67 or No. 8 nominal.

C. Air-Entraining Admixture: ASTM C260.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
   1. Water-Reducing Admixture: ASTM C494, Type A.
   2. Retarding Admixture: ASTM C494, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C1017, Type II.

E. Water: Potable and complying with ASTM C94.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

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

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C881, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
   1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.7 STAMPED DETECTABLE WARNING MATERIALS

A. NOT USED

2.8 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
   1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
   2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Use slag cement as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: **6** percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.
2. Air Content: 7 percent plus or minus 1-1/2 percent for 3/8 inch nominal maximum aggregate size.

D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing admixture, high-range, water-reducing admixture, high-range, water-reducing and retarding admixture and/or plasticizing and retarding admixtures in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3.

E. Concrete Mixtures: Normal-weight concrete.
1. Compressive Strength (28 Days): 4000 psi .
2. Maximum W/C Ratio at Point of Placement: 0.45for curbs, 0.40 for pavements.
3. Slump Limit: 3 inches, plus or minus 1 inch shall be verified at the job site prior to adding any admixtures.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M]. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. The concrete producer shall provide a redosage chart onsite to maintain proper slump or slump-flow. The chart must indicate dosage per remaining concrete and expected slump or slump flow increase.
1. Concrete shall be air-entrained with an air content for the grading size of coarse aggregate as follows:
   a. No.8.....$7^1/_2$%
   b. No.57 or 67.....6%
   c. Tolerance on air content as delivered shall be $\pm$1.5%.

C. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches from 1 cu. yd. to 2 cu.yd, increase mixing time by 15 seconds

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
   1. Proof-rolling is not required. However, should the special inspector detect soft spots and/or compaction cannot be achieved, correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M.

F. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
   1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
   1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
   2. Provide tie bars at sides of paving strips where indicated.
   3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 20 feet unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
   4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:
   1. Sawed Joints: When matching adjacent patterns, form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation**,** and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

F. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcementand joint devices.

G. Screed paving surface with a straightedge and strike off.

H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

I. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
   1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.8 SPECIAL FINISHES

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:
   1. Elevation: 3/4 inch.
   2. Thickness: Plus 3/8 inch , minus 1/4 inch.
   3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/2 inch.
   4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
   5. Joint Spacing: 3 inches.
   6. Contraction Joint Depth: Plus 1/4 inch, no minus.
   7. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each **5000 sq. ft.** or fraction thereof of each concrete mixture placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C31, cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C39; test one specimen at seven days and two specimens at 28 days.
      a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

F. Concrete paving will be considered defective if it does not pass tests and inspections.

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

H. Prepare test and inspection reports.

3.12 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373 – CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cold-applied concrete paving joint sealants.

1.2 RELATED REQUIREMENTS

1. Section 321316 "Asphalt Paving" for formation of joints between concrete and asphalt pavement.

1.3 REFERENCES

A. References, General: Versions of the following cited standards current as of the date of issue of the project apply to the Work of this Section.

B. ASTM International (ASTM):
1. ASTM C 661 - Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of a Durometer.
2. ASTM C 719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
3. ASTM C 794 - Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
4. ASTM C 920 - Specification for Elastomeric Joint Sealants.
5. ASTM C 1193 - Guide for Use of Joint Sealants.
6. ASTM C 1247 - Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids.
7. ASTM C 1330 - Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
8. ASTM D 412 - Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
9. ASTM D 624 - Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
10. ASTM D 5893/D 5893M - Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate required profile for joint sealants with details of forming, tooling, and finishing concrete joints.
2. Coordinate installation of joint sealants with cleaning of joint sealant substrates and other operations that may impact installation or finished joint sealant work.

B. Preinstallation Conference: Conduct conference at Project Site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of paving joint sealant product specified, including:
   1. Preparation instructions and recommendations.
   2. Standard drawings illustrating manufacturer's recommended sealant joint profiles and dimensions applicable to Project.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and qualified applicator.

B. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

C. Warranty: Sample of unexecuted manufacturer and installer special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience with record of successful product in-service use.
   1. Single Source Responsibility: Provide paving joint sealants by a single manufacturer responsible for testing of Project substrates to verify compatibility and adhesion of joint sealants.

B. Installer Qualifications: A firm with minimum three years of experience installation of specified products in successful use on similar projects, including a full-time on-site supervisor with a minimum of three years of experience installing similar work, able to communicate verbally with a contractor.

1.8 DELIVERY, STORAGE AND HANDLING

A. Accept materials on site in manufacturer's unopened original packaging.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install joint sealants during inclement weather or when such conditions are expected. Allow wet surfaces to dry.
   1. Do not install primers or sealants when atmospheric temperatures or joint surface temperatures are less than 40 deg. F (4 deg. C).
   2. Do not install sealant when temperature is less than 5 deg F (3 deg C) below dew point.

1.10 SCHEDULING

A. Ensure sealants are cured before concealing behind other materials.

1.11 WARRANTY

A. Special Manufacturer's Warranty:
   1. Warranty Period for Silicone Sealants: Five years date of Substantial Completion.

B. Special Installer's Warranty:
   1. Warranty Period: [Two] years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. VOC Content: Comply with requirements of authorities having jurisdiction.

B. Compatibility: Provide joint sealants and accessory materials that are compatible with one another, and with adjacent materials, as demonstrated by sealant manufacturer using ASTM C 1087 testing and related experience.

C. Joint Sealant Standard: Comply with ASTM C 920 and other specified requirements for each joint sealant.
   1. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M,
   2. Grade NS, Class 25, for Use T.
   3. Products: Sikaflex® 1c SL, or approved equal.

2.2 COLD-APPLIED SILICONE PAVING JOINT SEALANTS

A. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL; ASTM C 920, Type SL, Class 100/50, Use T; jet fuel resistant; gun-grade.

B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type NS; ASTM C 920, Type S, Grade NS, Class 100/50, Use T; gun-grade.

2.3 COLD-APPLIED URETHANE PAVING JOINT SEALANTS

A. Immersible, Multiple-Component, Pourable, Traffic Grade Polyurethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 35, Use T and I; jet fuel resistant.
   1.

B. Immersible, Single-Component, Pourable, Traffic Grade Polyurethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 100/50, Use T and I; jet fuel resistant.

2.4 JOINT SEALANT ACCESSORIES

A. Cylindrical Sealant Backing: ASTM D 5249, type as recommended by sealant manufacturer for application.

B. Backer Strips: ASTM D 5249; Type 2, compatible with joint sealant and adjacent materials and recommended by sealant manufacturer.

C. Joint Substrate Primers: Substrate primer recommended by sealant manufacturer for application.

D. Masking tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine paving joint profiles and surfaces to determine if work is ready to receive joint sealants. Verify joint dimensions are adequate for development of sealant movement capability. Verify joint surfaces are clean, dry, and adequately cured. Proceed with joint sealant work once conditions meet sealant manufacturer's written recommendations.

3.2 PREPARATION

A. Paving Joint Surface Cleaning: Clean joints prior to installing joint sealants using materials and methods recommended by sealant manufacturer. Comply with ASTM C 1193.
   1. Remove curing compounds, laitance, form-release agents, dust, and other contaminants.
   2. Clean nonporous and porous surfaces utilizing chemical cleaners acceptable to sealant manufacturer.
   3. Protect elements surrounding the Work of this section from damage or disfiguration. Apply masking tape to adjacent surfaces when required to prevent damage to finishes from sealant installation.

3.3 SEALANT APPLICATION

A. Sealant and Primer Installation Standard: Comply with ASTM C 1193 and manufacturer's written instructions.

B. Paving Joint Backing: Select joint backing materials to support joint sealants in configuration recommended by sealant manufacturer and as compatible with sealant and adjacent materials. Install backing material at depth required to produce profile of joint sealant allowing optimal sealant movement.
   1. Install joint backing to maintain the following joint ratios:
      a. Joints up to 1/2 inch (13 mm) wide: 1:1 width to depth ratio.
      b. Joints greater than 1/2 inch (13 mm) wide: 2:1 width to depth ratio; maximum 1/2 inch (13 mm) joint depth.

C. Masking: Mask adjacent surfaces to prevent staining or damage by contact with sealant or primer.

D. Joint Priming: Prime joint substrates when recommended by sealant manufacturer or when indicated by preconstruction testing or experience. Apply recommended primer using sealant manufacturer's recommended application techniques.

E. Paving Joint Sealant Application: Install sealants using methods recommended by sealant manufacturer, in depths recommended for application. Apply in continuous operation from bottom to top of joint vertically and horizontally in a single direction. Apply using adequate pressure to fill and seal joint width. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Tooling of Non-Sag Sealants: Tool sealants recommended for tooling by manufacturer immediately with appropriately shaped tool to force sealants against joint backing and joint substrates, eliminating voids and ensuring full contact.
   1. Tool exposed joint surface concave using tooling agents approved by sealant manufacturer for application.

G. Cleaning: Remove excess sealant using materials and methods approved by sealant manufacturer that will not damage joint substrate materials.
   1. Remove masking tape immediately after tooling joint without disturbing seal.
   2. Remove excess sealant from surfaces while still uncured.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Retain manufacturer's technical representative to observe sealant mockup installation, perform field pre-construction testing, and to issue reports of observations.

B. Field-Adhesion Testing: Perform adhesion tests in accordance with manufacturer’s instructions and with ASTM C 1193, Method A.
   1. Perform [5] tests for the first [1000 feet (300 m)] of joint length for each kind of sealant and joint substrate, and one test for each [1000 feet (300 m)] of joint length thereafter or 1 test per each floor per building elevation, minimum.
   2. For sealant applied between dissimilar materials, test both sides of joint.

C. Remove sealants failing adhesion test, clean substrates, reapply sealants, and re-test. Test adjacent sealants to failed sealants.

D. Submit report of field adhesion testing indicating tests, locations, dates, results, and remedial actions taken.

END OF SECTION

SECTION 329200
TURF AND GRASSES

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all Planting Work as indicated on the Drawings and as specified herein.

B. Not used

1.02 PLANTING PERMITS

A. Not Used

1.03 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive cri
applicable to the Work.

B. American Joint Committee on Horticultural Nomenclature:

Standard Plant Names (Current Edition).

C. American Association of Nurserymen:

Horticultural Standards (Current Edition).

D. American National Standards Institute (ANSI).

E. U.S. Department of Agriculture.

F. Federal Specifications (FS).

G. Association of Official Agriculture Chemists.

1.04 SUBMITTALS

A. Tests

Submit t

1. Topsoil meets specified requirements.

2.

1.05 QUALITY ASSURANCE

A. A single landscaping firm with a minimum of 5 years of successful landscaping work shall perform the Work of this Section.

B.Ship materials with certificates of inspection in compliance with governing authorities; comply with applicable reg

C. For packaged materials, include manufacturer's certified analysis. For other materials, provide an independent reputable laboratory analysis, made in compliance with Association of Official Agriculture Chemists methods.

D. Make no substitutions for materials specified and scheduled, without prior approval by the College.

E. Provide natural top soil from a recognized acceptable source.

1.07 RECEIPT OF MATERIALS

A. Furnish a receipt for all bulk deliveries of top soil and humus, brought to job each day, prior to unloading.

B. Provide tags on all bags identifying material and weight for all bagged items delivered to job.

C. Material not complying with above requirements will not be accepted.

1.08 GUARANTEE

A. Planting, seeding and sodding are subject to the one year Guarantee requirements set forth in the Contract for the entire work of this Contract, provided that Landscaping has been completed and accepted at the start of the Contract Guarantee period. If planting occurs after the complete Contract guarantee period has begun, the one-year guarantee shall begin from the date of planting.

B. At the end of this period, all planted material (planting and sodding) that is dead or in a dying condition shall be replaced.

C.Inspect the planted material during the one year guarantee period. The Contractor is to provide watering durin

1.09 DELIVERY, STORAGE AND HANDLING

A. Promptly notify the College, in advance, when the landscape material is to be delivered and the manner of shipment; and furnish therewith an itemized list in each delivery, in order to expedite the required inspection at the point of delivery.

B. The itemized list in duplicate of the ~~plant~~ material for each delivery shall include the pertinent data in the form as specified in the list of plants to be furnished.

C. Deliver packaged materials in unopened packages or containers, labeled with manufacturer's name, name of product, and other pertinent information.

D. Sod shall be placed within 24 hours after stripping; time delivery to site accordingly.

E. Storage of materials on site shall be in areas approved by the College.

PART 2 - PRODUCT

2.01 TOP SOIL

A. Re-use approved topsoil stockpiled on site, if any.

B. New topsoil: natural topsoil of good, rich, uniform quality, free from a mixture of subsoil, weeds, clay lumps, brush, poison ivy roots and other undesirable material harmful to plant growth. Meet the following requirements:

1. pH: 5.0 to 7.0 inclusive

2. Organic Matter: 5% to 9% (loss on ignition)

3. Specific Conductance: less than 2,000 microohms/cm

4. Texture: sandy loam

5. Good internal rate of percolation

6. Clay content: 10%-20%

7. Sieve Analysis, as follows:

C. Include the following information in soil testing reports:

1. Color

2. pH

3. Specific Conductance: Micro-ohms/cm

4. Organic Matter (loss on ignition)

5. Texture

6. Mechanical Analysis: % passing 1", 1/2", #10, #40, #60, #100 and #200 sieves.

7. Available nutrients.

8. Corrective recommendations in 1bs/AC for nutrients and pH.

D. Additional tests shall be taken by the College at the site during the planting operations. Should the on-site tests differ from the approved tests to an extent that would indicate the topsoil delivered to the site is of poorer quality (higher clay content, lower organic matter, lower or higher pH, lower available nutrients, or lower permeability) than the approved test, the Contractor shall be responsible for its removal and replacement, or for incorporating appropriate corrective measures as recommended by the testing laboratory, at no additional cost to the College.

2.02 BONE MEAL

A. Commercial raw bone meal shall be finely ground and have a minimum analysis of 4% nitrogen and 20% phosphoric acid. It shall be delivered in standard size bags showing weight, analysis and name of manufacturer. It shall be kept in a weatherproof storage place on the job.

2.03 COMMERCIAL FERTILIZER

A. Commercial Fertilizer shall have the following composition by weight:

Nitrogen 10%; Phosphoric Acid 6%; Potash 4%; these elements may be organic, inorganic or a combination, and shall be available according to the methods adopted by the Association of Official Agricultural Chemists. The nitrogen content shall have 50% total from approved organic sources.

B. The College reserves the right to reject on, or after delivery any material which does not, in its opinion, meet these specifications.

C. All Commercial Fertilizer shall be delivered in standard size bags of manufacturer, showing weight, analysis and name of manufacturer. It shall be stored in such a manner that its effectiveness will not be impaired.

2.04 GROUND LIMESTONE (Calcium Carbonate)

A. At least 50% of the material shall pass through a 200 mesh sieve and at least 90% shall pass through a 100 mesh sieve and 100% shall pass through a 10 mesh sieve. For purposes of calculation, total carbonates shall be considered as calcium carbonate. The total carbonates shall be not less than 80%, or 44.8% calcium oxide equivalent.

B. Deliver the ground limestone in standard size bags of the manufacturer showing weight, analysis and name of the manufacturer. Store in a manner to ensure preservation of its qualities and fitness for the work.

2.05 HUMUS

A. Humus shall consist of reed peat or sedge peat of such physical condition that it can be passed through a 1" screen and can be readily incorporated with the topsoil. It shall be free from sticks, stones, woody roots and other objectionable materials. Comply with FS Q-P-166.

B. Furnish a certified report of an approved analytical chemist showing the mechanical and chemical analysis of representative samples of the Humus proposed for use. Deliver no Humus until the approval of samples by the College, but such approval does not constitute a final acceptance.

2.06 GRASS SEED

A. All grass seed shall be fresh, recleaned grass seed of the latest crop mixed in the following proportions by weight and meeting the following standards of pure live seed (P.L.S.) content, purity and germination.

60-80%
10-20%
10 -20%

B. Present a certificate of P.L.S. test of the grass seed intended for use, obtained from a well recognized seed test laboratory that is not engaged in the business of selling seeds. This certificate shall state the true quality of the seeds that the Contractor proposes to furnish.

C. Samples of the seed taken from the stock proposed to be supplied may be subjected to tests for purity, viability and seed content and acceptance or rejection will be made on the basis of such tests.

D. Grass seed shall meet the tolerance for germination and purity according to the standards tabulated on pages 22 and 23 of U.S. Department of Agriculture, Service and Regulatory Announcements No. 156. Deliver all grass seed in sealed bags of the vendor showing the weight, analysis and vendor's name.

2.07 SOD

A. Cultivated, from a farm growing sod for commercial application; a mixture of Kentucky bluegrass and Fescue creeping grass, with at least 50% Kentucky present; square cut for uniform laying, and 1" minimum depth of soil around the roots. Sod that is dried out or overheated shall not be used.

PART 3 - EXECUTION

3.01 PLANTING TIME

A. Grass

Seed.....March 15 - May 1 Aug. 15 - Oct. 1
Sod.....May be laid at any time except during the months of June and July, provided that the ground is not frozen. (Sodding for athletic fields - March 15 - Oct. 15).

3.02 LAYING TOPSOIL

A. Clear the sub-soil upon which topsoil is to be placed of all stones, woody roots, rubbish and other objectionable matter, scarify the surface thoroughly and loosen to a depth of at least 4"; spread the topsoil to a smooth even surface and to the depth required, then rake or otherwise manipulate to form smooth drainage grades to the levels shown on the Drawings.

B. Deposit topsoil and spread to a minimum depth of 6" over earth where seeded and sodded areas are indicated.

3.03 SEEDING

A. After topsoil has been placed, rake all areas indicated on the Drawings or specified to be seeded to true lines, free from all unsightly variations, bumps, ridges and depressions.

Remove all sticks, stones, roots, and other objectionable material which might interfere with the formation of a finely pulverized seed-bed from the soil.

B. Thoroughly roll the prepared lawn area with an approved lawn roller and level all low spots.

C. Apply ground limestone at the rate of 46 pounds per thousand square feet and evenly distribute and work lightly into the top of the soil to a depth of 3" either by hand or by machine at least 5 days before applying commercial fertilizer.

D. Apply acceptable Commercial Fertilizer at a rate of 25 pounds per thousand square feet and work lightly in to the top 3" of topsoil.

E. The rate of seeding shall be 10 pounds per thousand square feet. Sow the grass seed by approved machine in such a manner that a uniform stand shall result. After seeding, evenly rake the surface with a fine-toothed rake and roll with approved roller weighing at least 200 pounds.

F. Sow grass seed only in periods listed in Par. 3.01 or at such other times as are approved by the College. All seeding is to be done in dry or moderately dry soil and at times when the wind does not exceed a velocity of 5 miles per hour.

3.04 SODDING

A. Place topsoil to the required depth so that the sod may be laid to finished grade. Lay sod to provide close joints. Thoroughly tamp sod to a true even surface at the required finished grade. Water and mow and maintain sod in first class condition as hereinafter specified, until final payment. Remove any unsatisfactory sod and replace with acceptable material at the Contractor's expense.

B. Sod shall be laid only in periods listed in Par. 3.01, providing the ground is not frozen. No sod shall be laid without the approval of the College.

3.05 GROUND LIMESTONE

A. Distribute the ground limestone evenly over all lawn, hedge, and ground-cover areas (except over Ericaceous plant areas), by machine, at least five (5) days before applying Commercial Fertilizer. The ground limestone shall be incorporated with the soil as specified under Par. 3.03 - "SEEDING".

3.06 COMMERCIAL FERTILIZER

A.Add to all shrub, ground cover and garden areas at the rate of 25 lbs. per thousand square feet and work lightly int

3.07 HUMUS

A. Evenly spread humus over all seeded and sodded areas at the rate of 3 cu. yds. per 1000 sq. ft. and thoroughly incorporate with the top 3" of the topsoil for tree pits, garden and planted areas at the rate of 1 cu. yd. of Humus to 7 cu. yds. of topsoil. Soil containing 10% or more of organic matter as determined by the test described in Part 2 shall have lesser amounts of Humus added to give a maximum of approximately 15% organic content present. Substitution with peat moss for Humus is prohibited.

3.08 MAINTENANCE OF SEEDING AND SODDING

A. Maintain all seeded and sodded areas until final acceptance of the Contract and provide regrading, refertilizing, reseeding and resodding as required to keep area healthy and neat in appearance. After the grass is started, any parts or areas which fail to show a uniform stand, for any reason whatsoever, shall be reseeded with the same mixture as originally used, and such reseeding shall be repeated until all required areas are covered with grass. Reseeding shall be carried on only during the seeding periods.

B. Establish and maintain a neat edge where planted areas meet grass areas. Perform edging in workmanlike manner with spade or edging tool. Exercise particular care in edging to establish good flowing curves, as shown on the Drawings. Do not provide edging before grass is fully established.

C. Properly water, mow and otherwise maintain all seeded and sodded areas throughout the life of the contract, and until Work is accepted. Maintain the grass at a maximum height of 2½".

3.09 ACCEPTANCE OF THE WORK

A. Maintain all landscaping installed until acceptance is granted upon total completion of planting. Maintenance includes cutting of grass and all other plant operations.

B. Acceptance shall be granted upon a healthy growth and satisfactory and complete stand of grass in all lawn areas.

END OF SECTION

SECTION 334200 - STORMWATER CONVEYANCE

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. PVC pipe and fittings.
   2. Polymer-concrete, channel drainage systems.
   3. Stormwater inlets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations and inverts of existing system as indicated on drawing C04 and submit to the EOR for further analysis and design. Show other piping and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and existing and proposed proximate structures.

B. Product Certificates: For each type of pipe and fitting, from manufacturer.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle stormwater inlets in accordance with manufacturer's written rigging instructions.

1.7 FIELD CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Owner's permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. Source Limitations: Obtain PVC pipe and fittings from single manufacturer.

B. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

C. PVC Gravity Sewer Piping:
   1. Pipe and Fittings: ASTM F679, [T-1] [T-2] wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F477, elastomeric seals for gasketed joints.

2.2 DRAINS

A. Cast-Iron Trench Drains:
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. Source Limitations: Obtain cast-iron trench drains from single manufacturer.
   3. Description: ASME A112.6.3, 6-inch- (150-mm-) wide min. top surface, rectangular body with anchor flange or other anchoring device, and rectangular secured grate. Include units of total length indicated and quantity of bottom outlets with inside caulk or spigot connections, of sizes indicated.
   4. Top-Loading Classification(s): Heavy Duty.

B. Grate Openings: ADA compliant covers/grates

2.3 CONCRETE

A. General: Cast-in-place concrete in accordance with ACI 318 (ACI 318M), ACI 350 (ACI 350M), and the following:
   1. Cement: ASTM C150/C150M, Type II.
   2. Fine Aggregate: ASTM C33/C33M, sand.

3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

2.4 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

A. Narrow, Sloped-Invert, Polymer-Concrete Channel Drainage Systems:
1. Source Limitations: Obtain narrow, sloped-invert channel drainage systems from single manufacturer.
2. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
3. Channel Sections: Narrow, interlocking-joint, sloped-invert, polymer-concrete modular units with end caps.
   a. Include rounded bottom, with built-in invert slope of 0.6 percent min. and with outlets in number, sizes, and locations indicated.
   b. Include extension sections necessary for required depth.
   c. Dimensions: 6-inch inside width. Include number of units required to form total lengths indicated.
   d. Frame: [Gray-iron or galvanized steel for grates].
4. Grates: Manufacturer's designation "heavy duty," ADA compliant opening.
   a. Material: Ductile, gray iron or Galvanized steel.
      1) Locking Mechanism: Manufacturer's standard device for securing grates to channel sections
5. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
6. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.5 Inlets

A. Standard Precast Concrete inlets:
1. Description: ASTM C478 (ASTM C478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 8-inch (150-mm) minimum thickness for floor slab and 5-inch minimum thickness for walls.
3. Pipe Connectors: ASTM C923 (ASTM C923M), resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20), structural loading. Include 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange, and 26-inch- (660-mm-) diameter flat grate with small square or short-slotted drainage openings.

1. Grate Free Area: Approximately 50 percent unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install gravity-flow, nonpressure drainage piping in accordance with the following:
   1. Install PVC sewer piping in accordance with ASTM D2321 and ASTM F1668.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping in accordance with the following:
   1. Join PVC sewer piping in accordance with ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasketed joints.

3.4 INLET INSTALLATION

A. Construct inlets to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete in accordance with ACI 318 (ACI 318M).

3.6 CHANNEL DRAINAGE SYSTEM INSTALLATION

A. Install with top surfaces of components, except piping, flush with finished surface.

B. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

C. Embed channel sections and drainage specialties in 12 inch- minimum concrete around bottom and 6 inches on the sides.

D. Fasten grates to channel sections if indicated.

E. Assemble channel sections with flanged or interlocking joints.

3.7 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." .
   1. Use detectable warning tape over nonferrous piping.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
   1. Submit a report for all systems inspected.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems in accordance with requirements of of these specifications.
   3. Gravity-Flow Storm Drainage Piping: Test:
      a. Test plastic piping in accordance with ASTM F1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.9 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 334200

SECTION 336313 - UNDERGROUND STEAM AND CONDENSATE DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Requirements Division 01, Division 23 Specification Sections, and Common Work Requirements for HVAC apply to the work specified in this Section.

1.2 SUMMARY

A. This Section includes underground piping outside the building for distribution of steam and condensate.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing steam piping systems with the following minimum working-pressure ratings:
   1. Steam Piping: 125 psig (860 kPa).

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Conduit piping.

B. Shop Drawings: Signed and sealed by a qualified professional engineer, registered in the State of New York.
   1. Calculate requirements for expansion compensation for underground piping. Cold springing of piping is expressly forbidden.
   2. Show expansion compensators, offsets, and loops with appropriate materials to allow piping movement in the required locations. Show anchors and guides that restrain piping movement with calculated loads, and show concrete thrust block dimensions.
   3. Show pipe sizes, locations, and elevations. Show piping in trench, conduit, and cased pipe with details showing clearances between piping, and show insulation thickness.

C. Welding certificates.

D. Manufacturer Certificates: Signed by manufacturers certifying that conduit piping complies with requirements.

E. Source quality-control test reports: For shop weld radiographic tests.

F. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

B. ASME Compliance: Comply with ASME B31.1, "Power Piping," for materials, products, and installation.

C. ASME Compliance: Safety valves and pressure vessels shall bear appropriate ASME labels.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by CUNY or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Engineer and CUNY no fewer than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Engineer’s and CUNY's written permission.

1.7 COORDINATION

A. Coordinate pipe-fitting pressure classes with products specified in related Sections.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Application" Article for applications of pipes, tubes, fittings, and joining methods.

B. Refer to Division 23 Section "Steam and Condensate Heating Piping" for commonly used joining materials.

2.3 STEEL PIPES AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type S, Grade A, Standard Weight; with plain ends.

B. Nipples: ASTM A 733, Standard Weight, seamless, carbon-steel pipe complying with ASTM A 53/A 53M.

C. Malleable-Iron, Threaded Fittings: ASME B16.3, Class 150, with threads according to ASME B1.20.1.

D. Cast-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern, with threads according to ASME B1.20.1.

E. Steel Welding Fittings: ASME B16.9 and ASTM A 234/A 234M, seamless or welded.

2.4 CONDUIT PIPING

A. Manufacturers:
1. Insul-Tek Piping Systems, Inc.
2. PERMA-PIPE, Inc.
3. Rovanco Piping Systems, Inc.
4. Thermacor Process, L.P.
5. Or approved equal.

B. Description: Factory-fabricated and -assembled, airtight and watertight, drainable, pressure-tested piping with conduit, inner pipe supports, and insulated carrier piping. Fabricate so insulation can be dried in place by forcing dry air through conduit.

C. Carrier Pipe: Steel pipe complying with ASTM A 53/A 53M, Type S, Grade A with beveled ends for welded joints.

D. Carrier Pipe Insulation:
1. Mineral-Wool Pipe Insulation: ASTM C 547, Type I, molded.
    a. Apparent Thermal Conductivity (k-Value): 0.31 at 200 deg F (0.044 at 93 deg C) mean temperature.
    b. Density: Maximum 10 lb/cu. ft. (160 kg/cu. m) average.
    c. Compressive Strength: 10 psig (69 kPa) minimum at 5 percent deformation.
    d. Bands: ASTM A 666, Type 304, stainless steel, 3/4 inch (19 mm) wide, 0.020 inch (0.5 mm) thick.

E. Minimum Clearance:
1. Between Carrier Pipe Insulation and Conduit: 1 inch (25 mm).
2. Between Insulation of Multiple Carrier Pipes: 3/16 inch (4.75 mm).
3. Between Bottom of Carrier Pipe Insulation and Conduit: 1 inch (25 mm).
4. Between Bottom of Bare, Carrier Pipe and Casing: 1-3/8 inches (35 mm).

F. Conduit: Spiral wound, steel. Finish conduit with 2 coats of fusion-bonded epoxy, minimum 20 mils (0.50 mm) thick. Cover with polyurethane foam insulation with a high-density polyethylene jacket; thickness indicated in Part 3 "Piping Application" Article.

G. Carrier Piping Supports within Conduit: Corrugated galvanized steel with a maximum spacing of 10 feet (3 m).

H. Fittings: Factory-fabricated and -insulated elbows and tees. Elbows may be bent pipe equal to carrier pipe. Tees shall be factory fabricated and insulated, and shall be compatible with the carrier pipe.

I. Expansion Offsets and Loops: Size casing to contain piping expansion.

J. Conduit accessories include the following:
   1. Water Shed: Terminal end protector for carrier pipes entering building through floor, 3 inches (75 mm) deep and 2 inches (50 mm) larger than casing; terminate casing 20 inches (500 mm) above the floor level.
   2. Guides and Anchors: Steel plate welded to carrier pipes and to casing, complete with vent and drainage openings inside casing.
   3. End Seals: Steel plate welded to carrier pipes and to casing, complete with drain and vent openings on vertical centerline.
   4. Gland Seals: Packed stuffing box and gland follower mounted on steel plate, welded to end of casing, permitting axial movement of carrier piping, with drain and vent connections on vertical centerline.
   5. Joint Kit: Half-shell, pourable or split insulation and shrink-wrap sleeve.

K. Source Quality Control: Factory test the conduit to 15 psig (105 kPa) for a minimum of 2 minutes with no change in pressure. Factory test the carrier pipe to 150 percent of the operating pressure of system. Radiographically test all shop welds in carrier pipe. Furnish test certificates.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 23 Section "Common Work Results for HVAC" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATION

A. Steam Piping: Conduit piping with mineral-wool carrier-pipe insulation and with coated and insulated conduit.
   1. Insulation Thickness: 1 inch (25 mm).

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawings indicate general location and arrangement of piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

B. Remove any standing water in the bottom of trench.

C. Bed the pipe on a minimum 6-inch (150-mm) layer of granular fill material with a minimum 6-inch (150-mm) clearance between the pipes.

D. Do not insulate piping or backfill piping trench until field quality-control testing has been completed and results approved.

E. Install piping at uniform grade of 0.2 percent downward in direction of flow or as indicated.

F. Install components with pressure rating equal to or greater than system operating pressure.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Refer to Division 23 Section "Common Work Results for HVAC" for sleeves and mechanical sleeve seals through exterior building walls.

J. Secure anchors with concrete thrust blocks. Concrete is specified as one part Portland cement, two fines fine aggregate, and four parts coarse aggregate, normal weight, 145 pcf, with minimum compressive strength of 3,500 psi in 28 days.

K. Connect to steam piping where it passes through the building wall. Steam piping inside the building is specified in Division 23 Section "Steam and Condensate Heating Piping."

3.4 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Steam and Condensate Heating Piping" for basic piping joint construction.

B. Conduit and Cased Piping Joints: Assemble sections and finish joints with pourable or split insulation, exterior jacket sleeve, and apply shrink-wrap seals as required by manufacturer's written installation instructions.

3.5 IDENTIFICATION

A. Install continuous plastic underground warning tapes during back filling of trenches for underground steam distribution piping. Locate 6 to 8 inches (150 to 200 mm) below finished grade, directly over piping.

3.6 FIELD QUALITY CONTROL

A. Weld Tests: Perform the following tests on welded steam piping.
   1. Retain the services of an independent testing agency for visual and radiographical examination of welds in conformance with ASME B31.
   2. Visual Tests: All welds shall be visually inspected. Visual examination of weld joints shall be viewed before, during, and after fabrication, assembly and erection to verify conformance with Contractor's written qualified welding procedure.
   3. Radiographic Tests: Radiographic examination for butt welded joints in steam piping shall be performed in accordance with Article 2 of Section V of the ASME Boiler and Pressure Vessel Code. All shop welds and field welds in prefabricated steam piping shall be radiographically examined.
   4. Defects: All defects in welds of base materials shall be removed. Repair all welds in accordance with Contractor's written qualified welding procedure. All repairs shall be done at no additional cost to CUNY.

B. Prepare steam piping for testing according to ASME B31.1 and ASME B31.9 and as follows:
   1. Leave joints, including welds, uninsulated and exposed for examination during test.
   2. Isolate equipment. Do not subject equipment to test pressure.
   3. Install relief valve set at pressure no more than one-third higher than test pressure.
   4. Fill system with temperature water. Where there is risk of freezing, air or a safe, compatible liquid may be used.
   5. Use vents installed at high points to release trapped air while filling system. Use drip legs installed at low points for complete removal of liquid.

C. Test steam piping as follows:
   1. Subject steam piping to hydrostatic test pressure that is not less than 1.5 times the design pressure.
   2. After hydrostatic test pressure has been applied for 10 minutes, examine joints for leakage. Remake leaking joints using new materials and repeat hydrostatic test until no leaks exist.

D. Test conduit as follows:
   1. Seal vents and drains and subject conduit to 15 psig (105 kPa) for 4 hours with no loss of pressure. Repair leaks and retest as required.

E. Prepare a written report of testing.

END OF SECTION 336313

NOT FOR CONSTRUCTION

QUEENS COLLEGE

STEAM TUNNEL
GATE 3 ENTRANCE RD.
FLUSHING, NY 11367

STRUCTURAL RESTORATION

DOB FILING SET

The City University of New York

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THE CITY UNIVERSITY OF NEW YORK
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FLUSHING, NY 11367

Seal & Signature

ARCHITECT:

SUPER STRUCTURES + ENGINEERS ARCHITECTS
14 WALL STREET, 25TH FL.
NEW YORK, NY 10005
TEL 212 505 1133
FAX 212 505 1726

Seal & Signature

CIVIL ENGINEER:

Seal & Signature

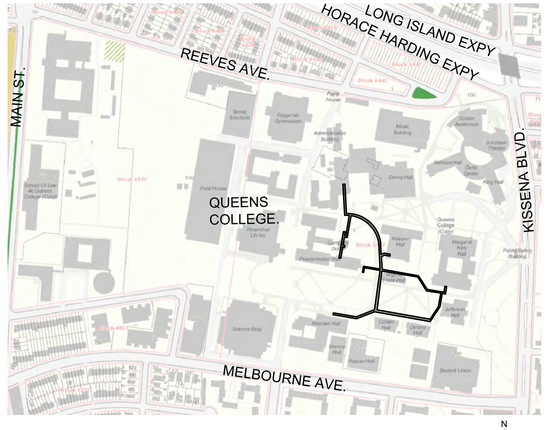
ENVIRONMENTAL:

LIST of DRAWINGS

DWG NO.	DESCRIPTION
T-001	TITLE SHEET, LOCATION PLAN, SITE PLAN, LIST OF DRAWINGS
G-001	NYC DOB NOTES, STRUCTURAL NOTES, LIST OF SPECIAL INSPECTIONS
G-002	STRUCTURAL NOTES, RESTORATION SUMMARY
G-003	ORGANIZATION OF DWGS. AND SPECS, ABBREVIATIONS
S-101	OVERALL SITE PLAN (1 OF 9)
S-102	PARTIAL SITE PLAN 1 (2 OF 9)
S-103	PARTIAL SITE PLAN 2 (3 OF 9)
S-104	PARTIAL SITE PLAN 3 (4 OF 9)
S-105	PARTIAL SITE PLAN 4 (5 OF 9)
S-106	PARTIAL SITE PLAN 5 (6 OF 9)
S-107	PARTIAL SITE PLAN 6 (7 OF 9)
S-108	PARTIAL SITE PLAN 7 (8 OF 9)
S-109	PARTIAL SITE PLAN 8 (9 OF 9)
S-501	DETAILS: COA 01, CON 01
S-502	RESTORATION DETAILS: CON 02
S-503	RESTORATION DETAILS: CON 03 (1 OF 3)
S-504	RESTORATION DETAILS: CON 03 (2 OF 3)
S-505	RESTORATION DETAILS: CON 03 (3 OF 3)
S-506	RESTORATION DETAILS: CON 04
S-507	RESTORATION DETAILS: CON 04A

DWG NO.	DESCRIPTION
S-508	RESTORATION DETAILS: CON 05 (1 OF 2)
S-509	RESTORATION DETAILS: CON 05 (2 OF 2)
S-510	RESTORATION DETAILS: CON 06 (1 OF 2)
S-511	RESTORATION DETAILS: CON 06 (2 OF 2)
S-512	RESTORATION DETAILS: CON 07 (1 OF 2)
S-513	RESTORATION DETAILS: CON 07 (2 OF 2)
S-514	RESTORATION DETAILS: CON 08 (1 OF 2)
S-515	RESTORATION DETAILS: CON 08 (2 OF 2)
S-516	RESTORATION DETAILS: CON 09 (1 OF 2)
S-517	RESTORATION DETAILS: CON 09 (2 OF 2), CON 11
S-518	RESTORATION DETAILS: CON 10
S-519	RESTORATION DETAILS: DEM 01
S-520	RESTORATION DETAILS: DEM 02
S-521	DRESTORATION ETAILS: DEM 03
S-522	RESTORATION DETAILS: JNT 01, JNT 02
S-523	RESTORATION DETAILS: MAS 01
S-524	RESTORATION DETAILS: MAS 02, MAS 03
S-525	RESTORATION DETAILS: MEM 01
S-526	RESTORATION DETAILS: PNT 01, STL 01

LOCATION PLAN

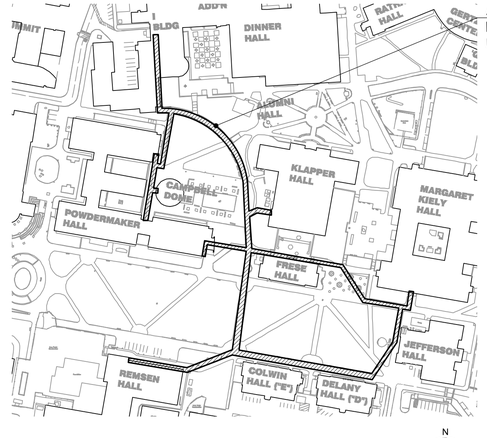


BLOCK: 6517 **LOT: 1**

ZONING: R 4 MAP: 14C
PROPOSED OCCUPANCY GROUP: EDUCATIONAL
EXISTING CONSTRUCTION CLASS: TYPE 1
PROPOSED CONSTRUCTION CLASS: NO CHANGE

LOCATION OF PROPOSED CONSTRUCTION: AT VARIOUS LOCATIONS OF EXISTING BELOW GRADE STEAM TUNNEL.

SITE PLAN



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STRUCTURAL RESTORATION
STEAM TUNNEL

PRICING ONLY SET

Date: 7.9.2025

TITLE SHEET

DASNY Project No: 2881309999

001 039

NYC DOB NOTES - GENERAL

NYC DEPARTMENT OF BUILDINGS NOTES - 2020 NYCBC

SCOPE OF WORK

The following Work is included under the scope of this application:

1. Excavation of existing landscaping, paving, and overburden/fill over existing below grade utility tunnels.
2. Placement and compaction of backfill/soil fill on roof of below grade utility tunnels.
3. Installation of new paving and landscaping to match existing grade.
4. Removal and replacement of the existing waterproofing assembly (membrane, flashing, etc) on the roof and walls of below grade utility tunnel exposed by excavation.
5. Repair of cracked concrete and spalled concrete and deteriorated reinforcement at interior of utility tunnel - ceilings, walls, beams, window openings, and joints.

GENERAL NYC DOB NOTES

- All Work shall conform to the requirements of the New York City Building Code (NYCBC) or (BC).
- All Work shall comply with the requirements of the NYC Plumbing, Mechanical, Electrical and Fire codes, as applicable. All Work shall comply with utility company requirements and the best trade practices.
- Work Permit: Before commencing Work, the Contractor shall file all required Certificates of Insurance with the DOB, obtain a Work Permit and any other required permits for the Work by governing agencies. Copies of the Work Permit, and all other required permits shall be posted in a conspicuous place at the Work site.
- Fees: The initial DOB (Alteration application) filing fee, when applicable, shall be paid by the Owner. All other filing and permit fees to the DOB, DOT and all other agencies shall be paid by the Contractor.
- Violations: The Contractor shall be responsible for the removal of all violations issued by the DOB and/or other governing agencies, related to their operations on this Project, if any. The Contractor shall be responsible for the payment of all penalties and fees resulting from and related to the removal of these violations.
- Plans: The Contractor shall maintain a complete set of the plans and applications approved by the DOB at the site, available to DOB inspectors, at all times.
- Materials: All materials shall be used, tested and approved for use in accordance with the provisions of the NYCBC and DOB Rules, as applicable.
- Licenses and Registration: All Work requiring licenses or registration of trades, including, but not limited to plumbing, electrical, welding, rigging, and site safety shall be performed by persons with such licenses and/or registrations, as governed by the requirements of the NYCBC.
- Noise Control Code: All Work shall be performed in accordance with the provisions of the NYC Noise Control Code as set forth in Chapter 2 of Title 24 of the Administrative Code: Section 24-224 (Construction Activities/After Hours Work Permit -DOB Form PW5); Section 24-219 (Noise Mitigation Rules) and 15 RCNY Chapter 28 (Citywide Construction Noise Mitigation), Sections 28-101 (Required Noise Mitigation Measures for General Construction)

PROTECTION OF EXISTING PROPERTY

- All adjoining property affected by any operations shall be protected per the requirements of Title 27 (Building Code) Chapter 33 (SAFEGUARDS DURING CONSTRUCTION OR DEMOLITION) of the NYC Building Code and Section BC 3309 (PROTECTION OF ADJOINING PROPERTY).
- The Contractor shall provide, erect and maintain all temporary barriers and guards, and all temporary shoring and bracing, as required by DOB rules and regulations.
- The Contractor shall be solely responsible for the protection of conditions and materials within, and adjacent to the proposed construction area. The Contractor shall design and install adequate shoring and bracing for all construction or removal tasks. The Contractor shall have sole responsibility for any damage or injuries caused by, or during the execution of the Work.

SITE SAFETY

- Site Safety Plan: A Site Safety Plan is not required per Section BC 3310.3 (Site safety plan) and 3310.1 (Scope) Item 4.
- Site Safety Monitoring Program: A Site Safety Manager or Coordinator is not required, per Section BC 3310.4 (Site safety monitoring program) and 3310.1 (Scope) Item 4.

OCCUPANT PROTECTION PLAN

The subject building contains no dwelling units.

- Scope of Work: The project involves the following portions of the existing below grade utility tunnels at building's exterior:

1. The project does not involve alterations to occupied spaces within the building interior.
2. Excavation of existing landscaping, paving, and overburden/fill over existing below grade utility tunnels.
3. Placement and compaction of soil fill above below grade utility tunnels.
4. Installation of new paving and landscaping to match existing grade.
5. Removal and replacement of the existing waterproofing assembly (membrane, flashing, etc) on the roof and walls of below grade utility tunnel exposed by excavation.
6. Installing waterproofing at existing below grade utility tunnel joints.
7. Repair of cracked concrete and spalled concrete and deteriorated reinforcement at utility tunnel ceilings, walls, beams, window openings, and joints.

- There will be no one occupying the proposed construction area to be renovated during the course of construction Work.
- General: All Work shall be done in accordance with Chapter 33 BC and regulations of all other agencies having jurisdiction, per the requirements of BC Section 3303.10 Operations in Occupied Buildings
- Occupied Spaces: The building contains spaces that will be occupied during construction. The Contractor shall provide the means and methods required to safeguard the safety and health of the occupants, including, where applicable, details such as temporary fire-rated assemblies, opening protectives, and/or dust containment procedures.
- Egress: At all times in the course of construction, provision shall be made for adequate egress as required by this code, and the tenant plan shall identify the egress that will be provided. Required egress shall not be obstructed at any time except where approved by the commissioner. All existing means of egress for occupants of the building shall be maintained clear and free of all obstructions such as building materials, tools, etc.
- Fire Safety: All necessary laws and controls, including those with respect to occupied dwellings, as well as safety measures necessitated by the construction, shall be strictly observed. The Contractor shall take all necessary steps to both use and store all materials in such a way that insures the fire safety of the building and its occupants. All building materials stored in construction area, and/or in any area of the building shall be secured in a safe manner. Access to such areas to be controlled by Owner and/or Contractor.
- Health requirements: The Contractor shall take all required steps to control dust, dispose of construction debris, institute any required pest control, maintain sanitary facilities, and limit construction-related noise to acceptable levels. Debris, dirt and dust shall be kept to a minimum, be confined to the immediate construction area, and be cleaned up and cleared from building periodically to avoid excessive accumulation.
- The Contractor shall be responsible for compliance with applicable provisions of law relating to dust (including crystalline silica), lead, asbestos, and noise. The following are in addition to applicable State and Federal regulations, as well as applicable Standards and Guidance Documents.

  Dust (Respirable Crystalline Silica): For projects involving exposure to respirable crystalline silica, the Contractor shall comply with the dust control requirements of "Table 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica" contained in OSHA 3902-07R "Small Entity Compliance Guide for Respirable Crystalline Silica Standard for Construction" as applicable for the equipment used and tasks involved in the Work.

  Lead: For projects involving abatement of lead, the Contractor shall comply with the applicable requirements of Section 11-06(d) Work Methods (and other applicable sections) of HPD Rules pertaining to Local Law #1 of 2004, Title 28, Chapter 11 RCNY.

  Asbestos: For any projects involving abatement or encapsulation of asbestos or asbestos containing material (ACM), the Contractor shall comply with "Abatement Procedures" contained in Part 4 (and other applicable sections), of the NYC DEP Bureau of Environmental Compliance Asbestos Rules and Regulations as described in the latest version of Title 15, Chapter 1 RCNY Asbestos Control Program.

  Construction Noise Management: Contractor shall comply with Noise Mitigation Rules for "power tools" and other construction devices employed in the work pursuant to Section 24-219 Administrative Code.
- Structural safety: No structural Work shall be done that may endanger the occupants. Contractor shall provide adequate temporary bracing and shoring wherever any structural Work is involved.
- Noise restrictions: Where hours of the day or the days of the week in which construction Work may be limited pursuant to the NYC Noise Control Code, such limitations shall be stated. Pursuant to Section 24-224 (Construction activities) of the NYC Noise Code (Local Law 113 of 2005), construction activities will be confined to weekdays (Mondays through Fridays) between 7am and 6pm unless an After Hours Work Permit has been obtained from the Department of Buildings.

AFTER HOURS VARIANCES (AHV)

The Contractor shall apply for and obtain an After Hours Variance from the Department of Buildings for any Work that shall occur outside normal working hours: weekdays between 7am and 6pm, pursuant to DOB procedures.

FEMA / NYCDOB FLOOD NOTES

FLOOD ZONE STATEMENT

The subject building is NOT located in a flood zone per effective FIRM. (2013 Preliminary Flood Insurance Rate Map)

COMPLIANCE REQUIREMENTS

The Work included in this project scope is not subject to compliance with Flood Resistant Construction requirements.

EXCAVATION NOTES

DIG SAFELY NEW YORK - 811 BEFORE YOU DIG

- The Contractor shall schedule a utility location request in advance of each and every excavation required for the work. All areas to be excavated will have a utility location request performed prior to commencing excavation.
- The Contractor shall be responsible for repairing at their own cost, any and all existing utilities damaged as a result of their work.
- The Contractor shall submit all utility location tickets from Dig Safely New York, upon request.

NYC DOB NOTES - SPECIAL AND PROGRESS INSPECTIONS

STRUCTURAL TESTS AND SPECIAL INSPECTIONS - 2022 NYCBC

GENERAL NOTES

- Special inspections and other tests and inspections required during the progress of Work shall comply with the (administrative and procedural) requirements of Section 28-116.2.3 of the Administrative Code.
- Tests and inspections required shall be performed by approved agencies or special inspectors, as applicable, meeting the requirements of RCNY (Rules of the City of New York) DOB Rules 101-06 and 101-07. Special inspections shall be performed only by individuals who are special inspectors meeting the requirements of DOB Rule 101-06 Appendix A.
- Where tests and inspections are indicated as Owner's responsibility, the Owner will engage an approved agency or special inspector, as applicable, to perform the required services.
- Where tests and inspections are not explicitly indicated as Owner's responsibility, or where tests and inspections are required but not specifically listed, the Contractor shall engage an approved agency or special inspector, as applicable, to perform the required services.
- Contractor shall notify Architect and relevant inspecting party at least 72 hours in advance of time when Work that requires inspection will be performed.
- Inspectors shall promptly notify the Architect in writing of irregularities and deficiencies observed in the Work.

SPECIAL INSPECTIONS

Items subject to special inspection pursuant to the requirements of Chapter 17 BC include, but are not limited to, those listed in the following table:

REQUIRED SPECIAL INSPECTION ITEMS	RESPONSIBILITY	
	Owner	Contractor
Structural Steel - Welding per BC 1705.2.1	X	
Concrete - Cast-In-Place per BC 1705.3	X	
Concrete Sampling and Testing per BC 1905.6, and BC 1911.10 (TR-2 Required)	X	
Concrete Design Mix per BC 1905.3, and BC 1911.5 (TR-3 Required)	X	
Masonry per BC 1705.4 - Level B Inspection (Table 1705.4.1)	X	
Structural Stability per BC 1705.25	X	
Post-installed Anchors per BC 1705.37	X	

PROGRESS INSPECTIONS

For Energy Code (NYC ECC) Progress Inspections, required per BC 110.3.5, see "NYC Energy Conservation Code Notes".

Based on the scope of work under this application, there are no Progress Inspections required beyond those which may be required by the NYC Energy Conservation Code, listed separately.

FINAL INSPECTION

The following inspection will be made upon the completion of the Work indicated under this application:

- Final Inspection per 28-116.2.4.2 and BC 110.5 and Directive 14 of 1975, and 1 RCNY 101-10.

REQUIRED SUBMITTALS

- Form TR-1 Technical report: Statement of Responsibility shall be filed with the New York City Department of Buildings by the inspection agency designated by the Owner to perform inspections in each of the above mentioned categories.
- Upon successful completion of the Work subject to special inspection, Form TR-1 Technical Report: Certification of Completion, and all required supporting documentation shall be filed with the New York City Department of Buildings by the inspection agency which performed the respective inspections.

STRUCTURAL NOTES - GENERAL

GENERAL NOTES

- Contractor shall file all necessary certificates, pay all fees, obtain all permits and approvals, provide any and all bonds, and arrange for all tests and inspections as required by all authorities having jurisdiction.
- All structural Work, including but not limited to, material stresses and methods of construction shall conform to the latest applicable laws, codes and requirements of all authorities having jurisdiction.
- All existing construction, surfaces and equipment to remain shall be fully protected from damage. Contractor is solely responsible for damage and shall make repairs required without additional cost to Owner.
- Provide all necessary temporary facilities (e.g., barriers, guards, etc.) to protect and maintain site and surrounding properties in a safe, secure and weather-tight condition, and to ensure safe passage of people in the vicinity of the Work.
- Provide interior and exterior temporary shoring, bracing, and structural support of Work in progress and existing to remain to preserve stability and prevent movement, settlement, or collapse. Strengthen and add supports when required.
- If safety of structure appears to be endangered, cease operations immediately, notify Owner and Architect, and take precautions to support structure until determination is made for continuing operations.
- Coordinate all structural Work with the architectural Drawings and Specifications.
- All dimensions indicated on the Drawings are approximate. Verify all dimensions in field prior to ordering or fabricating material.
- Centerlines of footings, walls, columns, and beams shall coincide, unless otherwise noted.
- All elevations are measured with respect to datum indicated on architectural Drawings, unless otherwise noted.
- Remove debris as the Work progresses. No debris shall be allowed to accumulate on-site. Leave site broom clean at end of each workday.

DEMOLITION NOTES

- No structural elements shall be removed unless portions affected are adequately supported by either temporary shoring and bracing, or new structural elements.
- Perform all operations of demolition and removal as indicated on the Drawings and as required by the Work.
- Remove or relocate all wiring, plumbing, and mechanical equipment affected by removal of partitions. Removed pipes and/or lines shall be cut to a point of concealment behind or below finish surfaces, and shall be properly capped or plugged.

2020 NYCECC NOTES

2020 NYC ENERGY CONSERVATION CODE NOTES

PROJECT SCOPE

The project involves the following interior related items of work:

1. Excavation of existing landscaping, paving, and overburden/fill over existing below grade utility tunnels.
2. Placement and compaction of backfill/soil fill on roof of below grade utility tunnels.
3. Installation of new paving and landscaping to match existing grade.
4. Removal and replacement of the existing waterproofing assembly (membrane, flashing, etc) on the roof and walls of below grade utility tunnel exposed by excavation.
- 5. Repair of cracked concrete and spalled concrete and deteriorated reinforcement at interior of utility tunnel - ceilings, walls, beams, window openings, and joints.

APPLICABILITY OF NYCECC: NON-EXEMPT APPLICATION

The project is subject to the requirements of the NYCECC pursuant to ECC 101.4.

CODE COMPLIANCE

The project shall comply with the administrative requirements of Chapter 1 of NYCECC Administration), and with 1 RCNY 5000-01 "Construction document approval requirements for compliance with the New York City Energy Conservation Code," and other applicable rules and regulations.

The project shall comply with the requirements of Chapter C4 Commercial Energy Efficiency, Section ECC C401 General Requirements, and applicable portions of Section ECC C402 Building Envelope requirements, as modified by applicable portions of Chapter C5 Existing Buildings.

ECC 101.5.2.1 Professional Statement. "To the best of my knowledge, belief and professional judgment, these plans and specifications are in compliance with the New York City Energy Conservation Code (NYCECC)."

ECC 101.5.2.2 Energy analysis. The project is a "building alteration project." The energy analysis shall demonstrate how the project design complies with the ECC. For this project the analysis shall compare the proposed design to prescriptive requirements of the ECC, as noted above.

ECC 101.5.3.3 Supporting documentation. The construction documents shall demonstrate conformance with the energy analysis for every element contained in the energy analysis, and shall comply with the applicable requirements of Section ECC 103 Construction Documents.

ECC 103.4 Changes during construction. Changes made during construction that are not in compliance with the approved construction documents shall be re-submitted to the DOB as an amended set of construction documents

APPLICABILITY: EXISTING BUILDINGS (ECC CHAPTER C5)

C501.2 Existing buildings. Except as specified in this chapter, the ECC shall not be used to require the removal, alteration or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of the ECC.

C501.4 Compliance. Alterations, repairs, additions and changes of occupancy to, or relocation of, existing buildings and structures shall comply with (i) all applicable provisions of the ECC, (ii) the provisions for alterations, repairs, additions and changes of occupancy or relocation, respectively, on the NYC Construction Codes, (iii) the NYC Fire Code, and (iv) the NYC Electrical Code.

C501.6 Historic buildings. No provisions of this code relating to the construction, repair, alteration, restoration, and change of occupancy shall be mandatory for historic buildings.

ECC C503 Alterations.

C503.1 General. Alterations to any building or structure shall comply with the requirements of the code for new construction. Alterations shall be such that the existing building or structure is no less conforming to the provisions of the ECC than the existing building or structure was prior to the alteration. Alterations to an existing building, building system or portion thereof shall conform to the provisions of the ECC as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with the ECC. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Exception: The following alterations need not comply with the requirements for new construction, provided that the energy use of the building is not increased:

- Air barriers shall not be required for roof recover and roof replacement where the alterations or renovations to the building do not include alterations, renovations or repairs to the remainder of the building envelope.
- Construction where the existing roof, wall or floor cavity is not exposed.

ECC C504 Repairs.

C504.1 General. Buildings, structures, and parts thereof, shall be repaired in compliance with Section C501.3 and C504.1. Work on non-damaged components that is necessary for the required repair of damaged components shall be considered part of the repair and shall not be subject to the requirements for alterations (C503.1). Routine maintenance required by Section C501.3 (Maintenance), ordinary repairs exempt from permit and abatement of wear due to normal service conditions shall not be subject to the requirements for repairs specified in this section.

BUILDING ENVELOPE REQUIREMENTS (SECTION C402)

ECC C401.2.2 Prescriptive Compliance Path. The project design shall comply with the prescriptive compliance path. A Tabular Prescriptive Analysis is provided.

ENERGY ANALYSIS: 2020 NYCECC CHAPTER C4

Climate Zone: 4A (C301.1)

Commercial - Alteration

2020 NYCECC NOTES - TABULAR ANALYSIS

Energy Code Tabular Analysis

Item Description	Proposed Design Value	Code Prescriptive Value	Supporting Documentation
Concrete crack and spall repairs at Walls, Floor and Ceiling at interior of below grade utility tunnel.	N/A	N/A (See *Note 1 below table)	
Excavation, Backfill and partial removal & replacement of roof slab of below grade utility tunnel.	N/A	N/A (See *Note 1 below table)	
Waterproofing removal & replacement on roof slab of below grade utility tunnel.	N/A	N/A (See *Note 1 below table)	

*Note 1: This item of work does not affect the energy use of the building

DOB NOW JOB NO.
Q00984460-I1
DOB APPROVAL STAMPS

NEW YORK STATE OF OPPORTUNITY | DASNY
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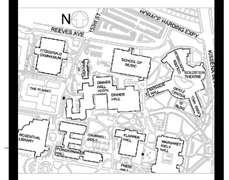
NOT FOR CONSTRUCTION

Project Key



REVISIONS

Rev No	Description	Date:
	ISSUED FOR PRICING ONLY NOT FOR CONSTRUCTION	07/09/2025
	ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION-REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client

QUEENS COLLEGE
THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title

STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title

NYC DOB NOTES
STRUCTURAL NOTE
LIST OF SPECIAL INSPECTIONS

Phase

100% SUBMISSION

Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

DASNY Project No: 2881309999

Drawing Number G-001

Drawing 002 *of* 039

STRUCTURAL NOTES - CONCRETE

CONCRETE

- Concrete shall conform to ACI 318 in accordance with the latest New York City Building Code.
- All coarse aggregate for normal weight concrete shall be crushed stone or gravel, conforming to ASTM C33.
- Concrete for poured in place construction shall have a minimum ultimate strength (f'c) of 4000 p.s.i. at 28 days, unless otherwise noted.
- All concrete to be used above grade shall have an air entraining agent.
- Do not place concrete when the air temperature is below 40 degrees F. Concrete already placed and not yet adequately cured shall be properly protected.
- Contractor shall submit mix designs in conformance with BC 1905.3 for the New York City Building Code, and shall pour no concrete until receiving approval for the proposed mixes. Mixes shall be proportioned by a licensed testing laboratory, retained by the Contractor, and approved by the Architect / Engineer.

CONCRETE MIX REQUIREMENTS

TYPE	INTENDED USE	28 DAY STRENGTH f'c (KSI)	CONCRETE TYPE LW = LIGHT WEIGHT NW = NORMAL WEIGHT	MAX W/C RATIO, INCLUDING FLY ASH	MIN. CEMENT MATERIAL (#/CY), INCLUDING FLY ASH	MAX AGGREGATE SIDE (IN), NOTE a	SLUMP LIMITS (IN), TOLERANCE = +0", -2"	TOTAL AIR CONTENT (%), NOTE b	CEMENT TYPE	REQUIRED ADMIXTURES, NOTE c	OTHER REQUIREMENTS, NOTE d
1	INTERIOR 4" SLABS ON GRADE		NW	0.45	517	1	4	NP	I OR II	WR A	SOG
2	INTERIOR 8" SLABS ON GRADE	5	NW	0.4	564	3/4	4	NP	I	WR A	MCI SOG
3	ALL CONCRETE OTHERWISE NOT SPECIFIED		NW	0.5	517	3/4	4	6	I OR II	AE	-

CONCRETE MIX REQUIREMENTS NOTES:

A. FOR THE MAXIMUM COARSE AGGREGATE SIZE INDICATED, USE THE FOLLOWING AGGREGATE SIZE NUMBERS PER ASTM C33:

3/4" #67 AGGREGATE

1" #57 AGGREGATE

1 ½" #467 AGGREGATE

B. TOTAL AIR CONTENT LIMITS INCLUDE BOTH ENTRAINED AND ENTRAPPED AIR +/- 1-1/2%. 'NP' IN COLUMN INDICATES ADDITION OF ENTRAINED AIR IS NOT PERMITTED.

C. ABBREVIATIONS FOR REQUIRED ADMIXTURES AS FOLLOWS:

AE = AIR-ENTRAINING ADMIXTURE. DO NOT USE ENTRAINED AIR FOR STEEL TROWELED FINISHED FLOORS.

WRA = WATER REDUCING ADMIXTURE.

MRWRA = MID-RANGE WATER REDUCING ADMIXTURE, MAXIMUM SLUMP = 6".

HRWRA = HIGH-RANGE WATER REDUCING ADMIXTURE, MAXIMUM SLUMP = 8".

D. ABBREVIATIONS FOR OTHER REQUIREMENTS AS FOLLOWS:

MCI = MAXIMUM CHLORIDE ION LIMITS, 0.15 FOR CONCRETE EXPOSED TO CHLORIDES IN USE.

MSS = MAXIMUM SHRINKAGE STRAIN LIMITED, REFERENCE SPECIFICATIONS

SOG = CONTRACTOR TO VERIFY ALKALINITY OF CONCRETE SURFACE, SLAB VAPOR TRANSMISSION, AND SLAB FLATNESS/LEVELNESS ARE COMPATIBLE WITH FLOORING SYSTEM AND ADHESIVES PRIOR TO INSTALLING FINISHES. AMOUNT OF CEMENTIOUS MATERIALS LISTED SHALL BE PROVIDED, DO NOT USE LESS AND DO NOT SUPPLY OVER 5% MORE.

e. FOR CONCRETE PLACED BY PUMPING PROVIDE CONCRETE MIX FLOWABILITY TO FACILITATE PUMPING

- The Contractor shall submit signed and sealed shop drawings prepared by licensed Professional Engineer in the State of New York consisting of complete plans and details of reinforcement, location of pour lines, construction joints etc. for approval before proceeding with the work.
- All detailing fabrication, placement and erection of reinforcing bars shall comply with the requirements of the latest ACI 315 and ACI 318-14, Chapters 20 and 25 and section 1907.5 of the New York City Building code.
- The detailing of reinforcement and connection between concrete member as related to requirements for structural integrity shall comply with provisions of BC 1912, ACI 318-14 sections 4.10 and 8.7.4.2.
- Provide chairs for support of all reinforcement. Lifting of bars or mesh during placement of concrete is not permitted
- Welding of reinforcing bars shall confirm to structural welding code AWS D1.4.
- All grout shall be non-shrink, and shall have a minimum compressive strength of 5000 p.s.i. at 28 days, as measured in accordance with ASTM C109.
- Membrane curing compound shall be used on all exposed surfaces as appropriate, and shall conform to ASTM C309.
- Reinforcing bar shall be epoxy coated deformed steel conforming to ASTM A775, Grade 60.
- Plain welded wire reinforcement shall be epoxy coated conforming to ASTM A884, minimum yield strength 65,000 psi.
- All splices shall be in accordance with Chapter 25 of ACI 318-14. The location shall be indicated on the shop drawings and approved by the engineer of record. Generally all splices shall be staggered and located away from the section of maximum tensile stress.
- Provide clearance from the face of concrete to reinforcing as follows, unless otherwise shown.

CONCRETE REINFORCING CLEARANCE

SLABS	3/4"
BEAMS	1-1/2"
FOOTINGS	3"
CONCRETE FORMED AGAINST EARTH	3"
WALL - INTERIOR FACE	3/4"
WALL - EXTERIOR FACE (#6 OR LARGER)	2"
WALL - EXTERIOR FACE (#5 OR SMALLER)	1-1/2"

- Reinforcing shall be held securely in position while placing concrete. If required, additional bars, stirrups, or accessories shall be provided by the Contractor to furnish support for all bars.
- Metal accessories shall be galvanized where legs will be exposed in finished concrete surfaces.
- Design and construction of formwork shall comply with ACI 318 and the latest New York City Building Code as amended. Shoring for formwork shall remain in place until concrete has attained strength to withstand imposed loads without overstress.
- Contractor shall verify dimensions and locations of all slots, pipe sleeves, anchor bolts, etc., and shall install as required by other trades before placing concrete.

RESTORATION SUMMARY

CODE	DESCRIPTION	UNIT	BASE QTY.	DWG
BASE BID ITEMS				
COA 01	Steel Coating	SF	1625	S-501
CON 01	Concrete Crack Restoration (Width Upto 1/4")	LF	1344	S-501
CON 02	Concrete Crack Restoraton With Patch Repair	LF	985	S-502
CON 03	Concrete Spall Repair at Vertical Surface	SF	2867	S-503 S-504 S-505
CON 04	Concrete Spall Repair at Overhead Surface	SF	1258	S-506 S-507
CON 4A	Concrete Beam Restoration : Underside (Full Width)	SF	50	S-507
CON 05	Concrete Spall Restoration at Horizontal Surface	SF	200	S-508 S-509
CON 06	Tunnel Roof Structural slab Repalcement - 10'-0" Span Flat Ceiling	SF	1063	S-510 S-511
CON 07	Tunnel Roof Structural slab Repalcement - 8'-0" Span Flat Ceiling	SF	1419	S-512 S-513
CON 08	Tunnel Roof Structural slab Repalcement - 5'-0" Span Arch Ceiling	SF	225	S-514 S-515
CON 09	Tunnel Wall Replacement	SF	313	S-516 S-517
CON 10	Reinforced Concrete Beam	LF	42	S-518
DEM 01	Removal of Existing Tunnel Structural Slab at Soil Overburden	SF	2250	S-519
DEM 02	Removal of Existing Tunnel Structural Slab Without Overburden	SF	938	S-520
DEM 03	Removal of Existing Tunnel Wall	SF	69	S-521
JNT 01	Expansion Joint Restoration at Slab	LF	539	S-522
JNT 02	Expansion Joint Restoration at Wall	LF	1123	S-522
MAS 01	Spalled Masonry Repair	SF	100	S-523
MAS 02	Masonry Repair at Pipe Penetration	SF	33	S-524
MAS 03	Spalled CMU Restoration	EA	5	S-524
MEM 01	Waterproofing Membrane Installation	SF	3608	S-525
PNT 01	Brick Masonry Pointing	SF	2275	S-526
STL 01	Steel Beam Reinforcement: Bottom Flange	LF	25	S-526
113113				
QUANTITY ALLOWANCE (Unit Price Items)				
COA 01	Steel Coating	SF	163	S-501
CON 01	Concrete Crack Restoration (Width Upto 1/4")	LF	135	S-501
CON 02	Concrete Through-Slab/Wall Crack Restoration	LF	99	S-502
CON 03	Concrete Spall Repair at Vertical Surface	SF	300	S-503 S-504 S-505
CON 04	Concrete Spall Repair at Overhead Surface	SF	130	S-506 S-507
CON 4A	Concrete Beam Restoration : Underside (Full Width)	SF	10	S-507
CON 05	Concrete Spall Restoration at Horizontal Surface	SF	50	S-508 S-509
CON 06	Tunnel Roof Structural slab Repalcement - 10'-0" Span Flat Ceiling	SF	107	S-510 S-511
CON 07	Tunnel Roof Structural slab Repalcement - 8'-0" Span Flat Ceiling	SF	143	S-512 S-513
CON 08	Tunnel Roof Structural slab Repalcement - 5'-0" Span Arch Ceiling	SF	23	S-514 S-515
CON 09	Tunnel Wall Replacement	SF	40	S-516 S-517
CON 10	Reinforced Concrete Beam	LF	8	S-518
CON 11	Concrete Encasement Repair at Steel Beam	LF	38	S-517
DEM 01	Removal of Existing Pavement, Fill And Tunnel Structural Slab	SF	350	S-519
DEM 02	Removal of Existing Tunnel Structural Slab	SF	328	S-520
DEM 03	Removal of Existing Tunnel Wall	SF	40	S-521
JNT 01	Expansion Joint Restoration at Slab	LF	54	S-522
JNT 02	Expansion Joint Restoration at Wall	LF	113	S-522
MAS 01	Spalled Masonry Repair	SF	20	S-523
MAS 02	Masonry Repair at Pipe Penetration	SF	20	S-524
MAS 03	Spalled CMU Restoration	EA	10	S-524
MEM 01	Waterproofing Membrane Installation	SF	362	S-525
PNT 01	Brick Masonry Pointing	SF	228	S-526
STL 01	Steel Beam Replacement: Bottom Flange	LF	5	S-526
ASB 01	Asbestos Abatement of existing steam and utility pipe insulation inside tunnel.	LF	700	H-101 (See in Heating Drawing set)

QUANTITY NOTES:

1. ALL ALLOWANCES ITEMS AND QUANTITIES WILL BE ALLOCATED BY THE EOR/AOR IN THE FIELD DURING CONSTRUCTION UPON VERIFICATION OF EXISTING CONDITIONS. CONTRACTOR SHALL USE OR UTILIZE THE ALLOWANCES WITH PRIOR WRITTEN NOTIFICATION BY EOR/AOR ONLY.
2. QUANTITIES LISTED ON THE DRAWINGS ARE APPROXIMATE, AND ARE PROVIDED FOR THE CONTRACTOR'S CONVENIENCE ONLY. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL QUANTITIES AS INDICATED GRAPHICALLY ON THE DRAWINGS, AND FOR PERFORMING THE INDICATED WORK UNDER THE BASE CONTRACT.
3. LOCATIONS OF ALLOWANCE QUANTITIES ARE APPROXIMATE AND SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO WORKING IN A LOCATION. ENGINEER OF RECORD MUST APPROVE ALL LOCATIONS OF ALLOWANCE ITEM WORK IN WRITING PRIOR TO PROCEEDING WITH THE WORK.

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Project Key

N
QUEENS BLVD
MEMORIAL HIGHWAY DRIVE
PARKING LOT
PARKING LOT
PARKING LOT

ORGANIZATION OF DRAWINGS AND SPECIFICATIONS

RESTORATION ASSEMBLY DETAIL (RAD)

The Work of the Project comprises a series of assemblies, each graphically illustrated by a **RESTORATION ASSEMBLY DETAIL (RAD)**. For example: coping anchorage, flashing at roof drain, etc. (The examples shown are general, and not representative of this Project.) A full listing of RADs can be found in the **RESTORATION SUMMARY**. Depending on the complexity of the RAD, the detail drawing will employ the elements below.

Each Restoration Assembly is identified by its **RAD CODE**. The RAD Code is a five character, alphanumeric notation. For example, the code "PPT 01" identifies a particular parapet reconstruction. The RAD symbol as shown below is used to graphically label the RAD within the drawing set. It consists of the RAD Code and description. In some cases, a RAD encompasses more than one sheet.

The **BASIC ASSEMBLY** illustrates the fundamental configuration of new and existing components of the RAD. It is designated by the symbol shown below, and may include plan, elevation and/or section views as needed to convey the information.

In some cases, a variation of the Basic Assembly is illustrated. This is referred to as an "**@ CONDITION**." For example, a coping RAD may include an @ CORNER condition as designated by the symbol below.

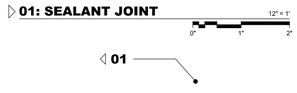
An @ Condition inherits all requirements of the Basic Assembly without repeating them. Only required modifications for the particular condition are explicitly indicated. The scale of the @ Condition may not necessarily match the scale of the Basic Assembly.

In some cases, a **SUBDETAIL** is necessary to provide additional information about the Basic Assembly and/or @ Condition. The additional information may include: an enlarged view of, or a cut through a portion of the RAD, or an illustration or image representing a particular material or product.

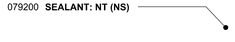
A Subdetail is labeled by the symbol shown above, consisting of a single letter (e.g. A, B, C...), description (e.g. "SEALANT JOINT"), and scale.

Within the context of the same RAD, the Subdetail is then referenced by its letter using the symbol shown below.

In some cases, when a Subdetail is associated with multiple RADs, it will be drawn once as a typical Subdetail, rather than appearing in each RAD. Typical Subdetails are located at the end of the set of RAD drawings. Typical Subdetails are differentiated by the hollow arrow in their symbols, and their numerical designation (e.g., 01, 02, 03 …) as shown below.



The **PRODUCT CALLOUT** is the link between the RAD and the Technical Specifications. A Product Callout is indicated once in the RAD and applies to all instances where the product occurs. In general, new materials and products in the Drawings are shaded.



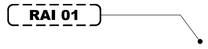
In the example shown above, "SEALANT: NT (NS)" is indicated by the Product Callout, along with its reference to Specification Section 079200 where the specific corresponding product/manufacturer information is found.

Products called out in Specification Section 079200 appear as shown below:

A. Sealant: NT (NS)		
1.	795 Silicone Building Sealant	Dow Corning
2.	Silpruf SCS 2000	Momentive

ADJACENT RAD

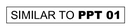
In some cases, one RAD may be another RAD, each with its own requirements and unit costs. For example, a parapet reconstruction RAD might indicate an adjacent railing restoration RAD (RAI 01) using the symbol shown below.



In the example shown, the RAI 01 components would be purchased and installed as part of the railing restoration, not as part of the parapet reconstruction.

SIMILAR RADS

In some cases, one RAD may be similar to another RAD. For example, a low wall parapet reconstruction RAD (PPT 02) may have similar construction requirements to those of a full height parapet reconstruction RAD (PPT 01). In this example, PPT 02 may only show the profile of the parapet indicating the specific height requirement, and then simply refer to PPT 01 using the symbol shown below.



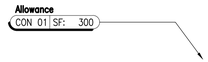
In this example PPT 02 inherits all requirements of PPT 01 without repeating them. Only the required modifications for PPT 02 are explicitly indicated. The scale of PPT 02 may not necessarily match the scale of PPT 01.

RAD TAG

On the plan and elevation drawings, each required RAD is identified by a "**RAD TAG**". Each RAD Tag includes the RAD Code (referencing the applicable RAD), the unit of measure, and the required quantity. For example, the RAD Tag shown below indicates 30 linear feet of parapet reconstruction whose RAD Code is PPT 01.

The quantity indicated in the RAD Tag is approximate, and is provided for the Contractor's convenience only. The Contractor is responsible for verifying all quantities as indicated graphically on the drawings, and for performing the indicated Work under the Base Contract.

A RAD for which quantities cannot be precisely determined until the Project is under construction is designated by an ALLOWANCE TAG. For example, the quantity of concrete deck restoration, under an existing roof membrane, cannot be determined until the membrane has been removed.



The Allowance Tag indicates a quantity allowance that the Contractor is responsible for performing under the Base Contract. Consistent with the example above, the Allowance Tag above indicates an allowance of 300 SF of concrete deck restoration to be included in the Base Contract. Once the actual quantity of Work has been determined, a Change Order will be issued, adjusting the Contract Price in accordance with the Unit Price Schedule.

ABBREVIATIONS

A	
ABV	- ABOVE
ADJ	- ADJACENT
AFF	- ABOVE FINISH FLOOR
AFG	- ABOVE FINISH GRADE
APPD	- APPROVED
ARCHT	- ARCHITECT
ASSEM	- ASSEMBLY
<	- ANGLE
B	
BLDG	- BUILDING
BM	- BEAM
BOTT	- BOTTOM
C	
CJ	- CONTROL JOINT
CF	- CUBIC FEET
CL	- CENTER LINE
CLG	- CEILING
COL	- COLUMN
CONC	- CONCRETE
CONT	- CONTINUOUS
D	
DBL	- DOUBLE
DEG	- DEGREE
DEPT	- DEPARTMENT
DTL	- DETAIL
DIA	- DIAMETER
DIM	- DIMENSION
DN	- DOWN
DR	- DOOR
DWG	- DRAWING
E	
EA	- EACH
EL/ELEV	- ELEVATION
ELEC	- ELECTRIC
ENCL	- ENCLOSURE
EQ	- EQUAL
EQUIP	- EQUIPMENT
EXP	- EXPANSION
EXST	- EXISTING
F	
FIN	- FINISH
FL/FLR	- FLOOR
G	
GA	- GAUGE
GALV	- GALVANIZED
GC	- GENERAL CONTRACTOR
GL	- GLASS
H	
HT	- HEIGHT
HORIZ	- HORIZONTAL
HR	- HOUR
L	
LF	- LINEAR FEET
LI	- LINEAR INCHES
LS	- LUMP SUM
LT	- LIGHT
M	
MTL	- METAL
MATL	- MATERIAL
MAX	- MAXIMUM
MECH	- MECHANICAL
MIN	- MINIMUM
N	
NIC	- NOT IN CONTRACT
NO/NUM	- NUMBER
NTS	- NOT TO SCALE
O	
OC	- ON CENTER
P	
PART	- PARTITION
PAVMT	- PAVEMENT
PERF	- PERFORATED
PL	- PLATE
PROP	- PROPERTY
R	
REINF	- REINFORCING
REPL	- REPLACEMENT
RM	- ROOM
S	
SAE	- SAME AS EXISTING
SECT	- SECTION
SF	- SQUARE FEET
SHT	- SHEET
SI	- SQUARE INCHES
SIM	- SIMILAR
SPEC	- SPECIFICATION
SS	- STAINLESS STEEL
STD	- STANDARD
STOR	- STORAGE
T	
TYP	- TYPICAL
U	
UON	- UNLESS NOTED OTHERWISE
V	
VERT	- VERTICAL
VIF	- VERIFY IN FIELD
W	
W/	- WITH
WT	- WEIGHT
WWF	- WELDED WIRE FABRIC
RESTORATION CODES	
ANC	- ANCHORAGE
BMS	- BEAMS
COA	- COATING
COL	- COLUMN
CON	- CONCRETE
DEM	- DEMOLITION
DOR	- DOOR
FLA	- FLASHING
GRC	- GFRC
INT	- INTERIOR (GENERAL)
JNT	- JOINT
LGT	- LIGHT FIXTURE
MEC	- MECHANICAL
MEM	- WATERPROOFING MEMBRANE
MSC	- MISCELLANEOUS
PAV	- PAVING
PRB	- PROBE
SIT	- SITE WORK
SLB	- SLAB
STL	- STEEL
STN	- STONE
STR	- STRUCTURE
TER	- TERRACE
VLT	- SIDEWALK VAULT
WIN	- WINDOW
WOD	- WOOD

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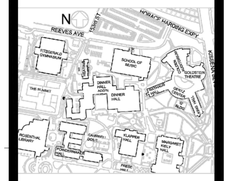
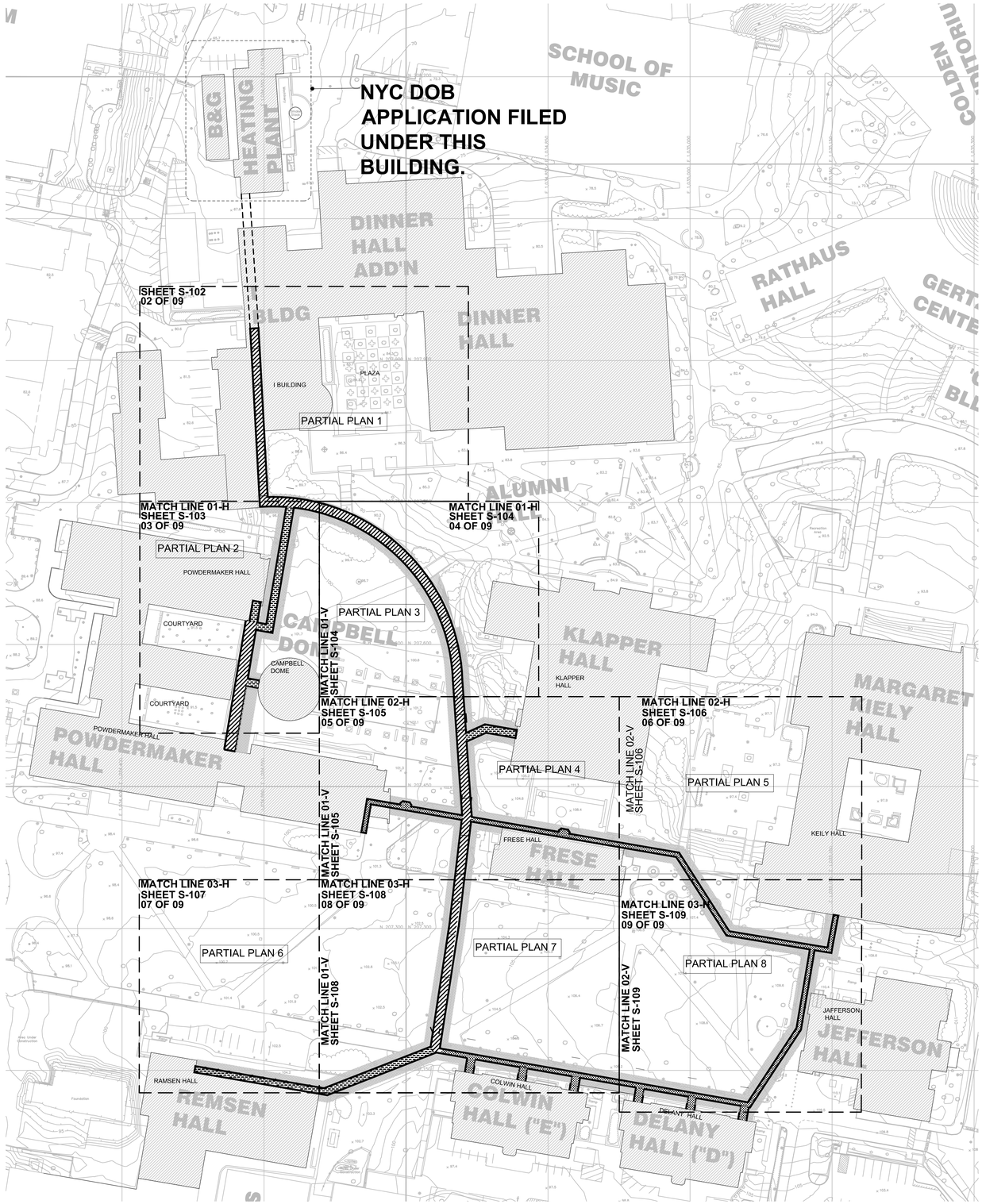

N
REVERE AVE
KISSENA BLVD
PARKING LOT
CHEMISTRY
SCIENCE BUILDING
PARKING LOT
PARKING GARAGE
PARKING LOT
PARKING LOT
PARKING LOT



STEAM TUNNEL SITE PLAN

LEGEND
FOR UNDERGROUND TUNNELS

- DENOTES 10' WIDE UTILITY STEAM TUNNEL WITH FLAT CEILING
- DENOTES 8' WIDE UTILITY STEAM TUNNEL WITH FLAT CEILING
- DENOTES 5' WIDE UTILITY STEAM TUNNEL WITH ARCH CEILING
- DENOTES EXISTING BUILDING
- DENOTES EXISTING UNDERGROUND UTILITY STEAM TUNNEL - NOT IN SCOPE.

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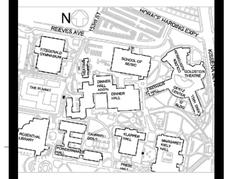


REVISIONS

Rev No	Description	Date:
	ISSUED FOR PRICING ONLY NOT FOR CONSTRUCTION	07/09/2025
	ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION-REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client
CUNY The City University of New York — QUEENS COLLEGE
THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title
STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title
OVERALL SITE PLAN

Phase
100% SUBMISSION

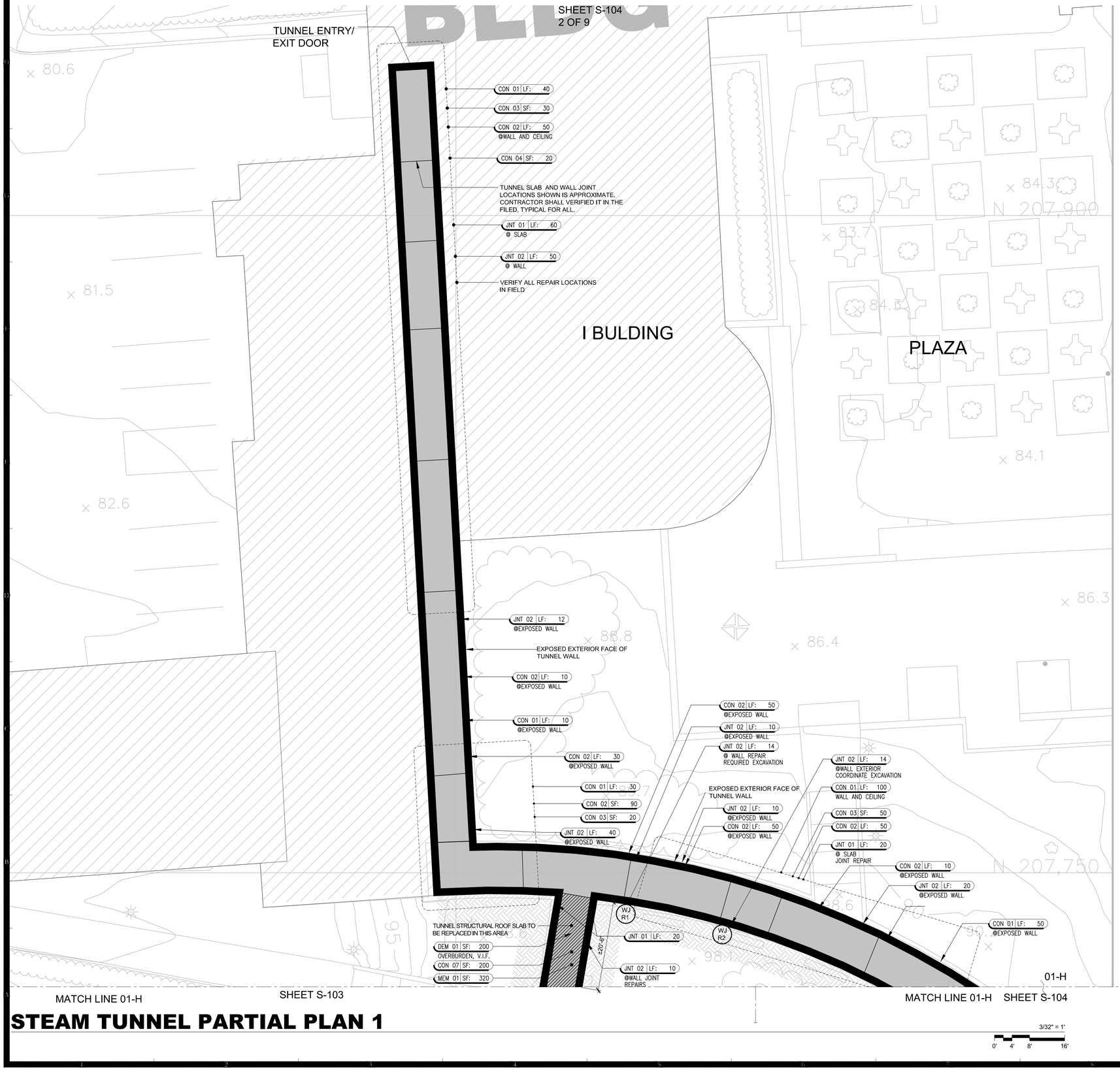
Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

DASNY Project No.
2881309999

Drawing Number
S-101

Drawing
005 of 039

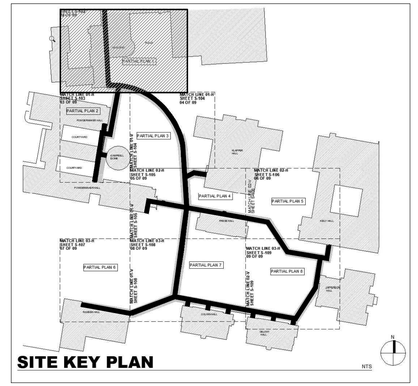


MATCH LINE 01-H SHEET S-103

MATCH LINE 01-H SHEET S-104

STEAM TUNNEL PARTIAL PLAN 1

3/32" = 1'
0' 4' 8' 16'



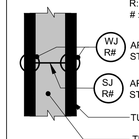
SITE KEY PLAN NTS

LEGEND

WJ R# — APPROXIMATE LOCATION OF EXCAVATION FOR WALL JOINT REPAIRS FROM EXTERIOR OF THE TUNNEL PER REPAIR DETAIL **JNT 02**

SJ R# — APPROXIMATE LOCATION OF EXCAVATION FOR SLAB JOINT REPAIRS FROM EXTERIOR OF THE TUNNEL PER REPAIR DETAIL **JNT 01**

W : WALL
J : JOINT
R: REPAIR
: LOCATION NUMBER



APPROXIMATE LOCATION OF TUNNEL STRUCTURAL WALL EXPANSION JOINT

APPROXIMATE LOCATION OF TUNNEL STRUCTURAL ROOF SLAB EXPANSION JOINT

SCHEMATIC PLAN

NOTES:

1. EXISTING PIPING INSULATION IS DETERMINED BY 'WATTS AE' (HAZMAT CONSULTANT) TO CONTAIN ASBESTOS, IT SHALL BE PROTECTED DURING CONSTRUCTION. CONTRACTOR IS RESPONSIBLE FOR THE REPAIR OF THE DAMAGE TO EXISTING UTILITIES PIPING AND INSULATIONS IN THE TUNNEL, DURING CONSTRUCTION DURATION.
2. PLUMBING, ELECTRICAL CONDUITS, MECHANICAL SYSTEMS TO BE TEMPORARILY ADJUSTED AND SUPPORTED TO FACILITATE THE TUNNEL REPAIRS, AND AREAS OF SLAB/WALL REMOVALS AND REPLACEMENT. EXISTING PIPE SUPPORTS CONNECTED TO WALL AND STRUCTURAL ROOF SLAB IN THE AREA OF REMOVAL AND REPLACEMENT, SHALL BE RESTORED TO MATCH EXISTING, PROVIDE NEW GALVANIZED OR STAINLESS STEEL FASTENERS AND ANCHORS AS NEEDED.
3. PROVIDE TEMPORARY SHORING AND SUPPORT SYSTEMS FOR DURATION OF CONSTRUCTION AS NEEDED, IT SHALL BE DESIGNED BY NY STATE LICENSED PROFESSIONAL ENGINEER.
4. ASSIGNED REPAIR QUANTITIES AND LOCATIONS ARE APPROXIMATE. THE CONTRACTOR IS RESPONSIBLE TO VERIFY IT IN THE FIELD, FOR COORDINATING DETAILS AND ACCURACY OF THE WORK; FOR CONFIRMING AND CORRELATING ALL QUANTITIES AND DIMENSIONS, AND CONFIRMING WITH EOR.
5. ALL REPAIRS ASSIGNED HERE ARE AT THE INTERIOR OF THE TUNNEL UNLESS OTHER WISE NOTED, THE EARTH WORK REQUIRED OR INTENDED AT THE EXTERIOR BY THE REPAIR DETAIL SHALL BE PROVIDED AND COORDINATED WITH CIVIL DRAWINGS.
6. PROVIDE AND INSTALL WATERPROOF ENCLOSURE AT WORK AREA REQUIRING SLAB AND WALL REPLACEMENTS AT TUNNEL.
7. PROTECT AREA OF WORK FROM SURFACE RUNOFF WATER ENTERING THE EXCAVATION. PROTECT AND MAINTAIN TUNNEL AND AREA OF WORK DRY AND REMOVE WATER FROM EXCAVATION REGULARLY AND KEEP IT FROM ENTERING THE TUNNEL.

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Q00984460-I1

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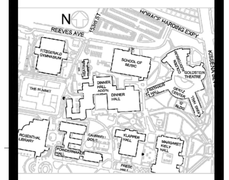
Project Key



REVISIONS

Rev No	Description	Date:
	ISSUED FOR PRICING ONLY NOT FOR CONSTRUCTION	07/09/2025
	ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION+REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client
CUNY The City University of New York — QUEENS COLLEGE THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title
STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title
PARTIAL SITE PLAN 1

Phase
100% SUBMISSION

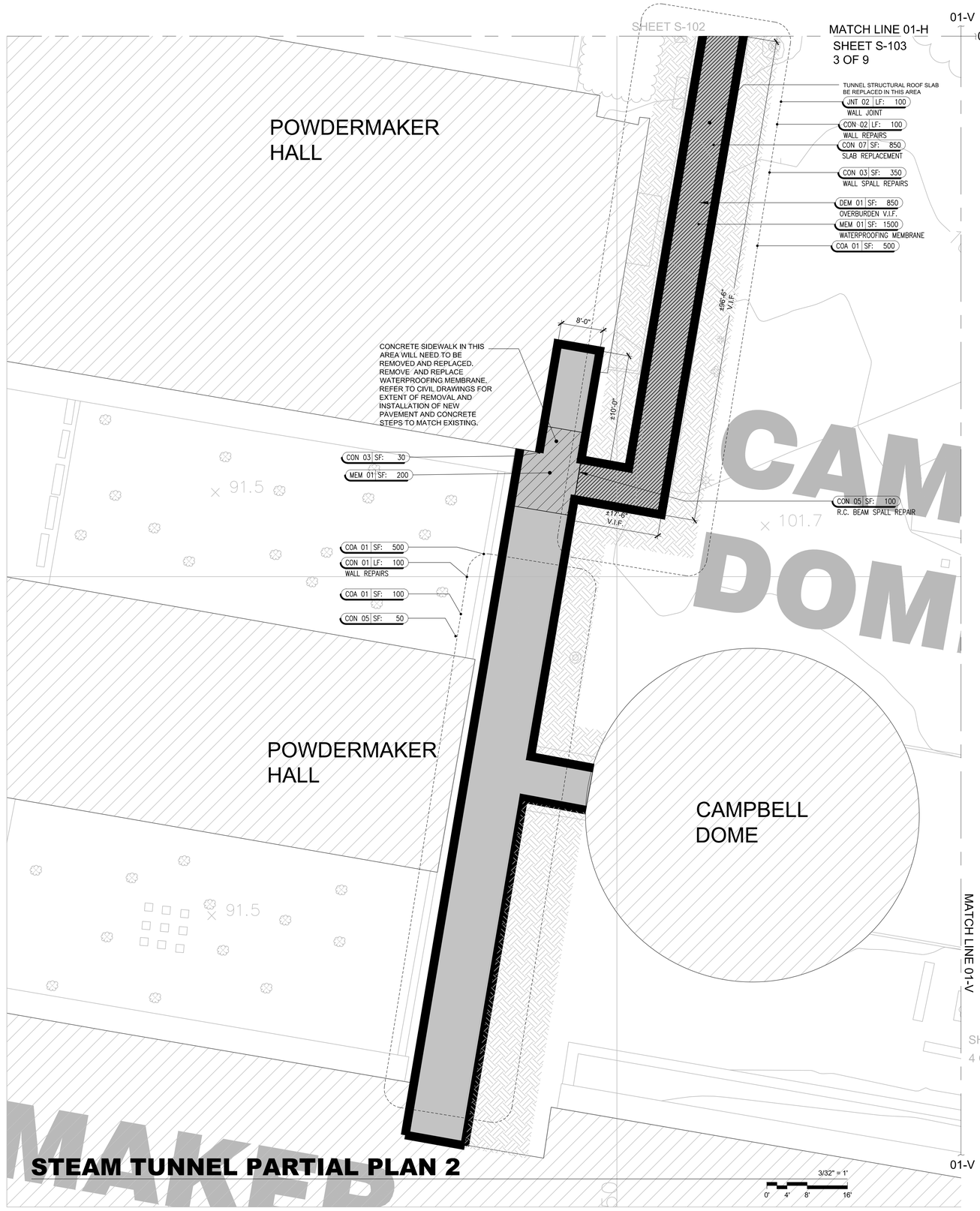
Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

DASNY Project No.
2881309999

Drawing Number
S-102

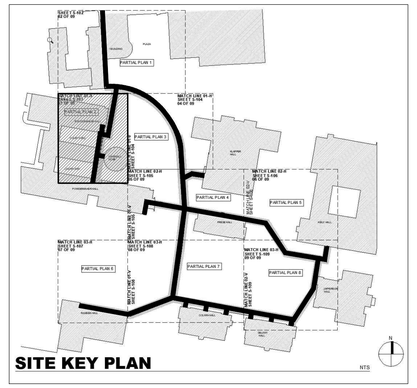
Drawing
006 of 039



STEAM TUNNEL PARTIAL PLAN 2

LEGEND

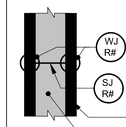
APPROXIMATE LOCATION OF EXCAVATION FOR FULL DEPTH SLAB REMOVAL AND REPLACEMENT . SEE CIVIL DRAWINGS FOR EXCAVATION WORK.



LEGEND

- WJ R# — APPROXIMATE LOCATION OF EXCAVATION FOR WALL JOINT REPAIRS FROM EXTERIOR OF THE TUNNEL PER REPAIR DETAIL **JNT 02**
- SJ R# — APPROXIMATE LOCATION OF EXCAVATION FOR SLAB JOINT REPAIRS FROM EXTERIOR OF THE TUNNEL PER REPAIR DETAIL **JNT 01**

W : WALL
J : JOINT
R: REPAIR
: LOCATION NUMBER



- WJ R# — APPROXIMATE LOCATION OF TUNNEL STRUCTURAL WALL EXPANSION JOINT
- SJ R# — APPROXIMATE LOCATION OF TUNNEL STRUCTURAL ROOF SLAB EXPANSION JOINT

SCHEMATIC PLAN

NOTES:

1. EXISTING PIPING INSULATION IS DETERMINED BY 'WATTS AE' (HAZMAT CONSULTANT) TO CONTAIN ASBESTOS. IT SHALL BE PROTECTED DURING CONSTRUCTION. CONTRACTOR IS RESPONSIBLE FOR THE REPAIR OF THE DAMAGE TO EXISTING UTILITIES PIPING AND INSULATIONS IN THE TUNNEL, DURING CONSTRUCTION DURATION.
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DOB NOW JOB NO.
Q00984460-I1

DOB APPROVAL STAMPS

NEW YORK STATE OF OPPORTUNITY | DASNY
515 Broadway, Albany, New York 12207-2964
One Penn Plaza, 52 Floor, NY, NY 10119-0098
539 Franklin Street, Buffalo, NY 14202-1109
WWW. DASNY.ORG

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NEW YORK, NY 10005
(212) 505-1133
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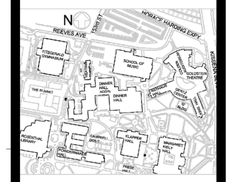
Project Key



REVISIONS

Rev No	Description	Date:
	ISSUED FOR PRICING ONLY NOT FOR CONSTRUCTION	07/09/2025
	ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION-REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client

QUEENS COLLEGE
THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title

STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title

PARTIAL SITE PLAN 2

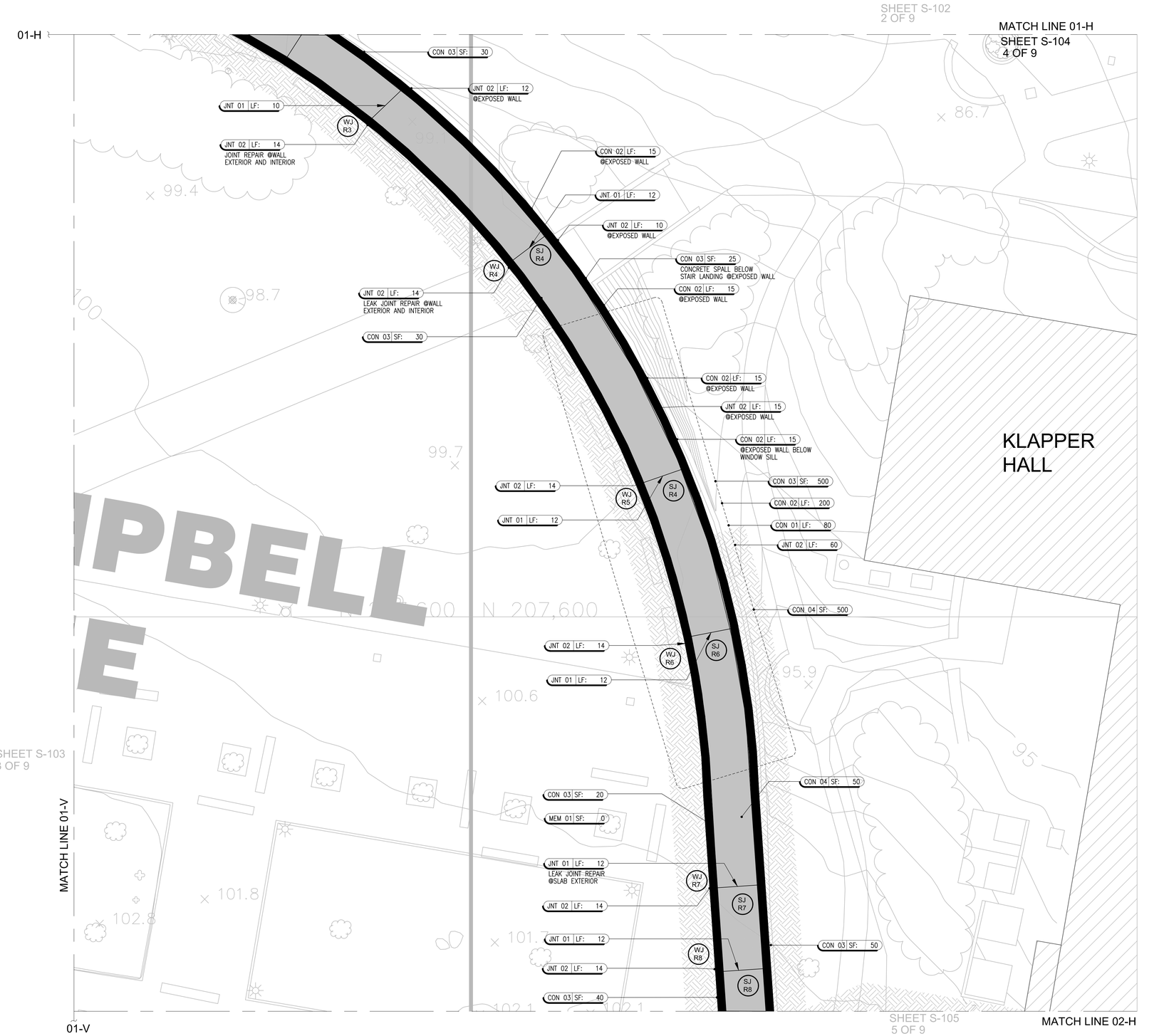
Phase

100% SUBMISSION

Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

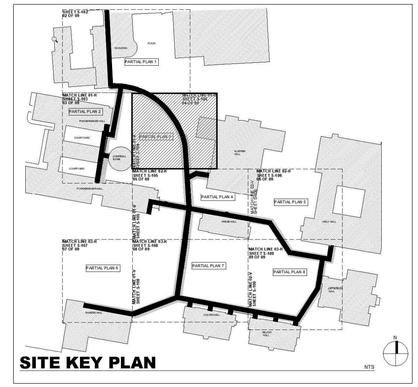
Seal & Signature

DASNY Project No: 2881309999
Drawing Number S-103
Drawing 007 of 039



STEAM TUNNEL PARTIAL PLAN 3

12" = 1'
0" 1" 2"

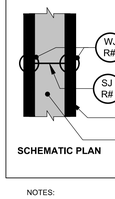


LEGEND

WJ R# — APPROXIMATE LOCATION OF EXCAVATION FOR WALL JOINT REPAIRS FROM EXTERIOR OF THE TUNNEL PER REPAIR DETAIL **JNT 02**

SJ R# — APPROXIMATE LOCATION OF EXCAVATION FOR SLAB JOINT REPAIRS FROM EXTERIOR OF THE TUNNEL PER REPAIR DETAIL **JNT 01**

W : WALL
J : JOINT
R: REPAIR
: LOCATION NUMBER



APPROXIMATE LOCATION OF TUNNEL STRUCTURAL WALL EXPANSION JOINT

APPROXIMATE LOCATION OF TUNNEL STRUCTURAL ROOF SLAB EXPANSION JOINT

SCHEMATIC PLAN

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Q00984460-I1
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NEW YORK STATE OF OPPORTUNITY | DASNY
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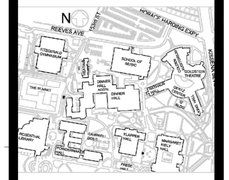
Project Key


N
REEVES AVE
KISSENA BLVD
PARKING GARAGE
CONSERVATORY GARDEN
PARKING LOT
KLAPPER HALL
DRAMA
DANCE
MUSIC
DELTA PHI
DELTA
PARKING LOT
SCIENCE
SCIENCE ANNEX
PARKING LOT
PARKING LOT
PARKING LOT

POWDERMAKER HALL

TUNNEL STRUCTURAL ROOF SLAB TO BE REPLACED IN THIS AREA

JNT 02 | LF: 14
CON 03 | SF: 12
CON 06 | SF: 500
DEM 02 | SF: 750
CON 03 | SF: 150
CON 10 | LF: 10
CON 07 | SF: 65
MEM 01 | SF: 750
JNT 01 | LF: 12
JNT 02 | LF: 14
CON 02 | LF: 12
CON 03 | SF: 50
JNT 02 | LF: 10
DEM 01 | SF: 70
CON 08 | SF: 60
MEM 01 | SF: 60
JNT 01 | LF: 60
JNT 02 | LF: 10
CON 02 | LF: 10
TUNNEL STRUCTURAL ROOF SLAB TO BE REPLACED IN THIS AREA
PNT 01 | SF: 1500
Brick Pointing

WJ R9
WJ R10
WJ R11
SJ R11
WJ R12
SJ R13
WJ R13

±22'-0"
±10'-0" V.I.F.
6'-0"
10'-0"
±5'-0" V.I.F.

CON 03 | SF: 100
CON 01 | LF: 50
CON 02 | LF: 20
JNT 02 | LF: 14
EXTERIOR AND INTERIOR
MAS 01 | SF: 25
CON 04 | SF: 6
CON 02 | LF: 6
JNT 02 | LF: 14
REPAIR AT WALL JOINT
MEM 01 | SF: 14

CON 01 | LF: 10
CON 03 | SF: 20
JNT 01 | LF: 24
JNT 02 | LF: 12
CON 01 | LF: 40
WALL CRACK
CON 01 | LF: 40
JNT 02 | LF: 8
CON 05 | SF: 10
JNT 01 | LF: 12
MAS 02 | SF: 1
CON 01 | LF: 10
SLAB CRACK

JNT 01 | LF: 12
CON 03 | SF: 16
JNT 02 | LF: 28
CON 01 | LF: 8
CON 04 | SF: 25
CON 06 | SF: 100
JNT 01 | LF: 12
SLAB EXPANSION JOINT NEW TO NEW SLAB
MEM 01 | SF: 100
DEM 01 | SF: 250
TUNNEL STRUCTURAL ROOF SLAB TO BE REPLACED IN THIS AREA. LOCATION TO BE VERIFIED IN SITE.
CON 06 | SF: 100
MEM 01 | SF: 100
JNT 01 | LF: 12
SLAB EXPANSION JOINT NEW TO NEW SLAB
DEM 01 | SF: 250
TUNNEL STRUCTURAL ROOF SLAB TO BE REPLACED IN THIS AREA. LOCATION TO BE VERIFIED IN SITE.

CONTRACTOR TO PROVIDE STEEL BEAM REINFORCEMENT DETAIL & SHOP DRAWING OF EXISTING STEEL BEAM FRAMING AT THE ELEVATED CEILING BELOW THE FRESE HALL LOBBY. DO NOT REMOVE EXISTING SHORING SUPPORT FROM EXISTING LOCATION, EOR TO REVIEW STEEL SHOP DRAWINGS AND CALCULATIONS PRIOR TO INSTALLATION OF REINFORCEMENT. ALL SHOP DRAWINGS AND CALCULATION TO BE SIGNED AND SEALED BY NYS P.E.

FRESE HALL

CON 04 | SF: 20
CON 02 | LF: 20
CON 01 | LF: 20
STL 01 | LF: 20
CON 03 | SF: 20
MAS 01 | SF: 5
PNT 01 | SF: 300
COA 01 | SF: 150
MAS 03 | EA: 4
MAS 02 | SF: 5
CON 01 | LF: 12
CON 03 | SF: 5
CON 02 | LF: 20
COA 01 | SF: 50
PNT 01 | SF: 20
MAS 02 | SF: 20
MAS 01 | SF: 50
CON 04 | SF: 15
CON 01 | LF: 13

LEGEND

WJ R# — APPROXIMATE LOCATION OF EXCAVATION FOR WALL JOINT REPAIRS FROM EXTERIOR OF THE TUNNEL PER REPAIR DETAIL **JNT 02**

SJ R# — APPROXIMATE LOCATION OF EXCAVATION FOR SLAB JOINT REPAIRS FROM EXTERIOR OF THE TUNNEL PER REPAIR DETAIL **JNT 01**

W : WALL
J : JOINT
R: REPAIR
: LOCATION NUMBER

WJ R# — APPROXIMATE LOCATION OF TUNNEL STRUCTURAL WALL EXPANSION JOINT
SJ R# — APPROXIMATE LOCATION OF TUNNEL STRUCTURAL ROOF SLAB EXPANSION JOINT
TUNNEL WALL
TUNNEL ROOF
SCHEMATIC PLAN

APPROXIMATE LOCATION OF FULL DEPTH SLAB REMOVAL AND REPLACEMENT. SEE CIVIL DRAWINGS FOR EXCAVATION WORK.

SITE KEY PLAN
NTS

NOTES:

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MATCH LINE 01-V
SHEET S-104
4 OF 9
SHEET S-106
6 OF 9
MATCH LINE 02-V
03-H
01-V
SHEET S-108
8 OF 9
MATCH LINE 03-H

STEAM TUNNEL PARTIAL PLAN 4

3/32" = 1'
0' 4' 8' 16'

DOB NOW JOB NO.
Q00984460-I1
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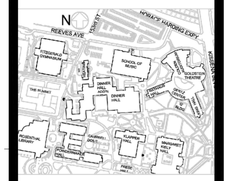
Project Key



REVISIONS

Rev No	Description	Date:
	ISSUED FOR PRICING ONLY NOT FOR CONSTRUCTION	07/09/2025
	ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION-REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client
CUNY The City University of New York
QUEENS COLLEGE
THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title
STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title
PARTIAL SITE PLAN 4

Phase
100% SUBMISSION

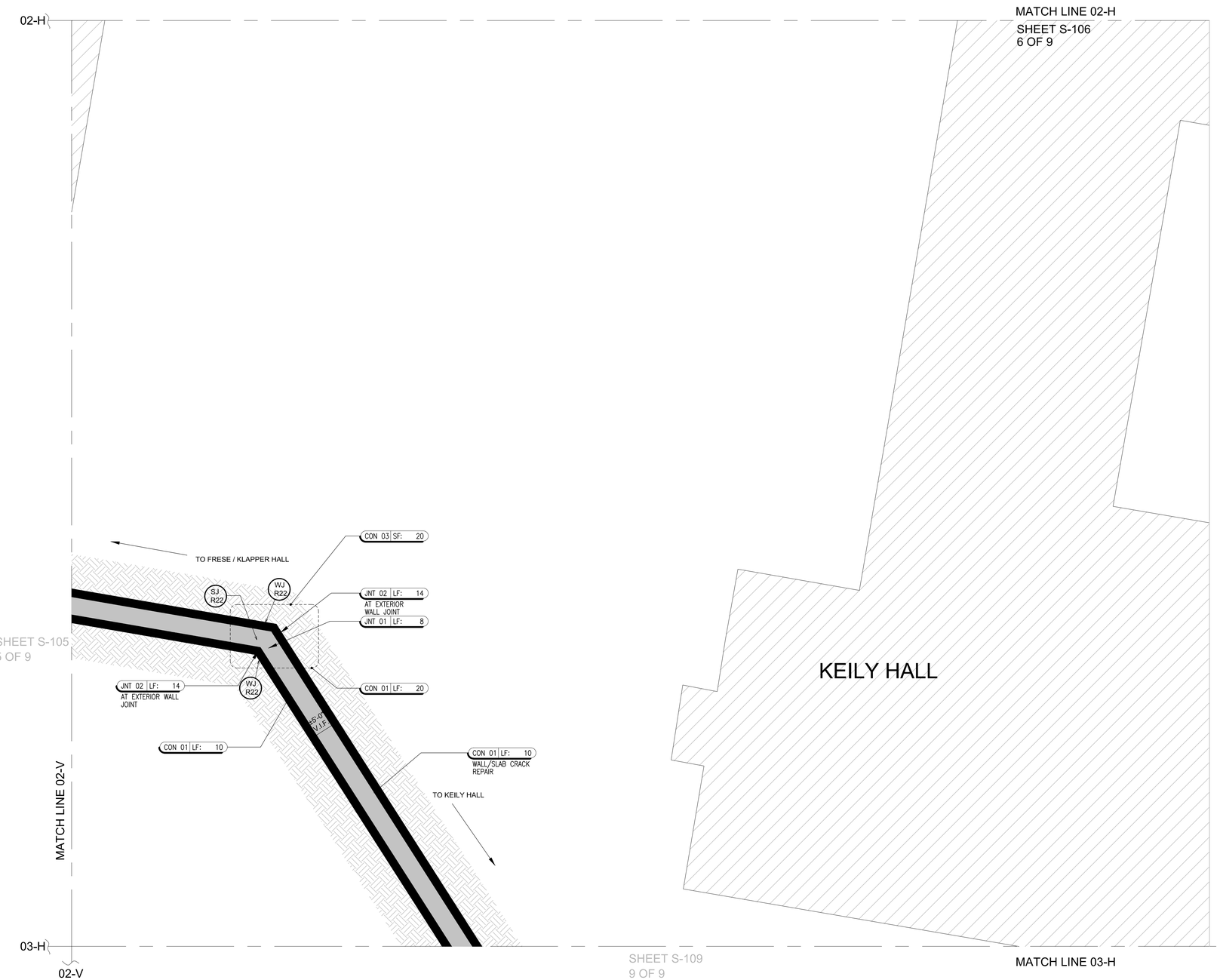
Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

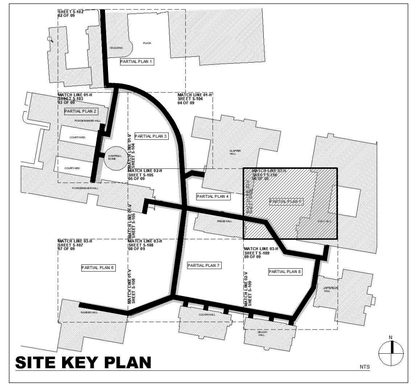
Seal & Signature

DASNY Project No:
2881309999

Drawing Number
S-105

Drawing 009 of 039





SITE KEY PLAN

LEGEND

WJ R#
APPROXIMATE LOCATION OF EXCAVATION FOR WALL JOINT REPAIRS FROM EXTERIOR OF THE TUNNEL PER REPAIR DETAIL **JNT 02**

SJ R#
APPROXIMATE LOCATION OF EXCAVATION FOR SLAB JOINT REPAIRS FROM EXTERIOR OF THE TUNNEL PER REPAIR DETAIL **JNT 01**
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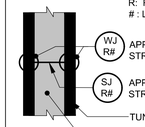

APPROXIMATE LOCATION OF TUNNEL STRUCTURAL WALL EXPANSION JOINT

APPROXIMATE LOCATION OF TUNNEL STRUCTURAL ROOF SLAB EXPANSION JOINT

SCHEMATIC PLAN

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STEAM TUNNEL PARTIAL PLAN 5

3/32" = 1'
0' 4' 8' 16'

DOB NOW JOB NO.
Q00984460-I1
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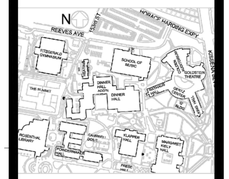
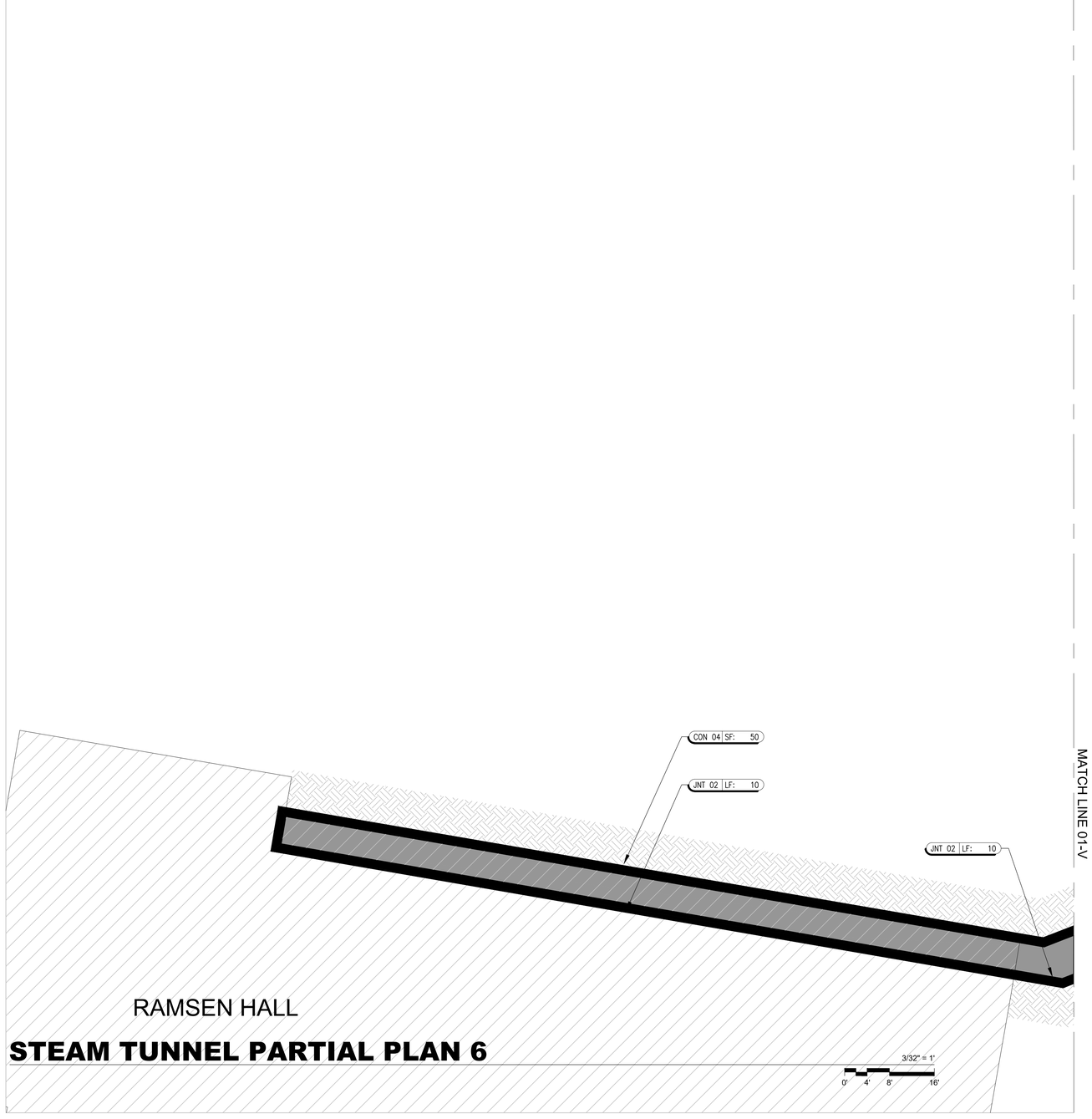

N
REEVES AVE
KISSENA BLVD
PARKING LOT
PARKING LOT
PARKING LOT

MATCH LINE 03-H

SHEET S-107
07 OF 09

01-V

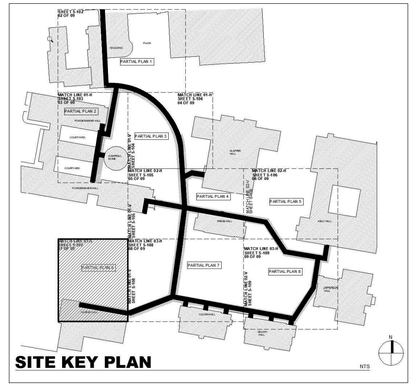
03-H



STEAM TUNNEL PARTIAL PLAN 6

SHEET S-108
08 OF 09

MATCH LINE 01-V



SITE KEY PLAN

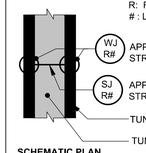
NTS

LEGEND

WJ R# — APPROXIMATE LOCATION OF EXCAVATION FOR WALL JOINT REPAIRS FROM EXTERIOR OF THE TUNNEL PER REPAIR DETAIL **JNT 02**

SJ R# — APPROXIMATE LOCATION OF EXCAVATION FOR SLAB JOINT REPAIRS FROM EXTERIOR OF THE TUNNEL PER REPAIR DETAIL **JNT 01**

W : WALL
J : JOINT
R: REPAIR
: LOCATION NUMBER



APPROXIMATE LOCATION OF TUNNEL STRUCTURAL WALL EXPANSION JOINT

APPROXIMATE LOCATION OF TUNNEL STRUCTURAL ROOF SLAB EXPANSION JOINT

SCHEMATIC PLAN

NOTES:

1. EXISTING PIPING INSULATION IS DETERMINED BY 'WATTS AE' (HAZMAT CONSULTANT) TO CONTAIN ASBESTOS. IT SHALL BE PROTECTED DURING CONSTRUCTION. CONTRACTOR IS RESPONSIBLE FOR THE REPAIR OF THE DAMAGE TO EXISTING UTILITIES PIPING AND INSULATIONS IN THE TUNNEL, DURING CONSTRUCTION DURATION.
2. PLUMBING, ELECTRICAL CONDUITS, MECHANICAL SYSTEMS TO BE TEMPORARILY ADJUSTED AND SUPPORTED TO FACILITATE THE TUNNEL REPAIRS, AND AREAS OF SLAB/WALL REMOVALS AND REPLACEMENT. EXISTING PIPE SUPPORTS CONNECTED TO WALL AND STRUCTURAL ROOF SLAB IN THE AREA OF REMOVAL AND REPLACEMENT, SHALL BE RESTORED TO MATCH EXISTING, PROVIDE NEW GALVANIZED OR STAINLESS STEEL FASTENERS AND ANCHORS AS NEEDED.
3. PROVIDE TEMPORARY SHORING AND SUPPORT SYSTEMS FOR DURATION OF CONSTRUCTION AS NEEDED. IT SHALL BE DESIGNED BY NY STATE LICENSED PROFESSIONAL ENGINEER.
4. ASSIGNED REPAIR QUANTITIES AND LOCATIONS ARE APPROXIMATE. THE CONTRACTOR IS RESPONSIBLE TO VERIFY IT IN THE FIELD, FOR COORDINATING DETAILS AND ACCURACY OF THE WORK; FOR CONFIRMING AND CORRELATING ALL QUANTITIES AND DIMENSIONS, AND CONFIRMING WITH EOR.
5. ALL REPAIRS ASSIGNED HERE ARE AT THE INTERIOR OF THE TUNNEL UNLESS OTHER WISE NOTED, THE EARTH WORK REQUIRED OR INTENDED AT THE EXTERIOR BY THE REPAIR DETAIL SHALL BE PROVIDED AND COORDINATED WITH CIVIL DRAWINGS.
6. PROVIDE AND INSTALL WATERPROOF ENCLOSURE AT WORK AREA REQUIRING SLAB AND WALL REPLACEMENTS AT TUNNEL.
7. PROTECT AREA OF WORK FROM SURFACE RUNOFF WATER ENTERING THE EXCAVATION, PROTECT AND MAINTAIN TUNNEL AND AREA OF WORK DRY AND REMOVE WATER FROM EXCAVATION REGULARLY AND KEEP IT FROM ENTERING THE TUNNEL.

DOB NOW JOB NO.
Q00984460-I1

DOB APPROVAL STAMPS

NEW YORK STATE OF OPPORTUNITY | DASNY

515 Broadway, Albany, New York 12207-2964
One Penn Plaza, 52 Floor, NY, NY 10119-0098
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Consultants:

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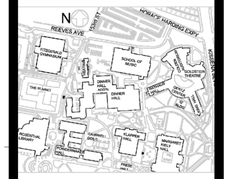
NEW YORK, NY 10005
(212) 505-1133
SUPERSTRUCTURES.COM

NOT FOR CONSTRUCTION

Project Key



REVISIONS

Rev No	Description	Date:
	ISSUED FOR PRICING ONLY NOT FOR CONSTRUCTION	07/09/2025
	ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION-REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client

CUNY The City University of New York — QUEENS COLLEGE THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title

STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title

PARTIAL SITE PLAN 6

Phase

100% SUBMISSION

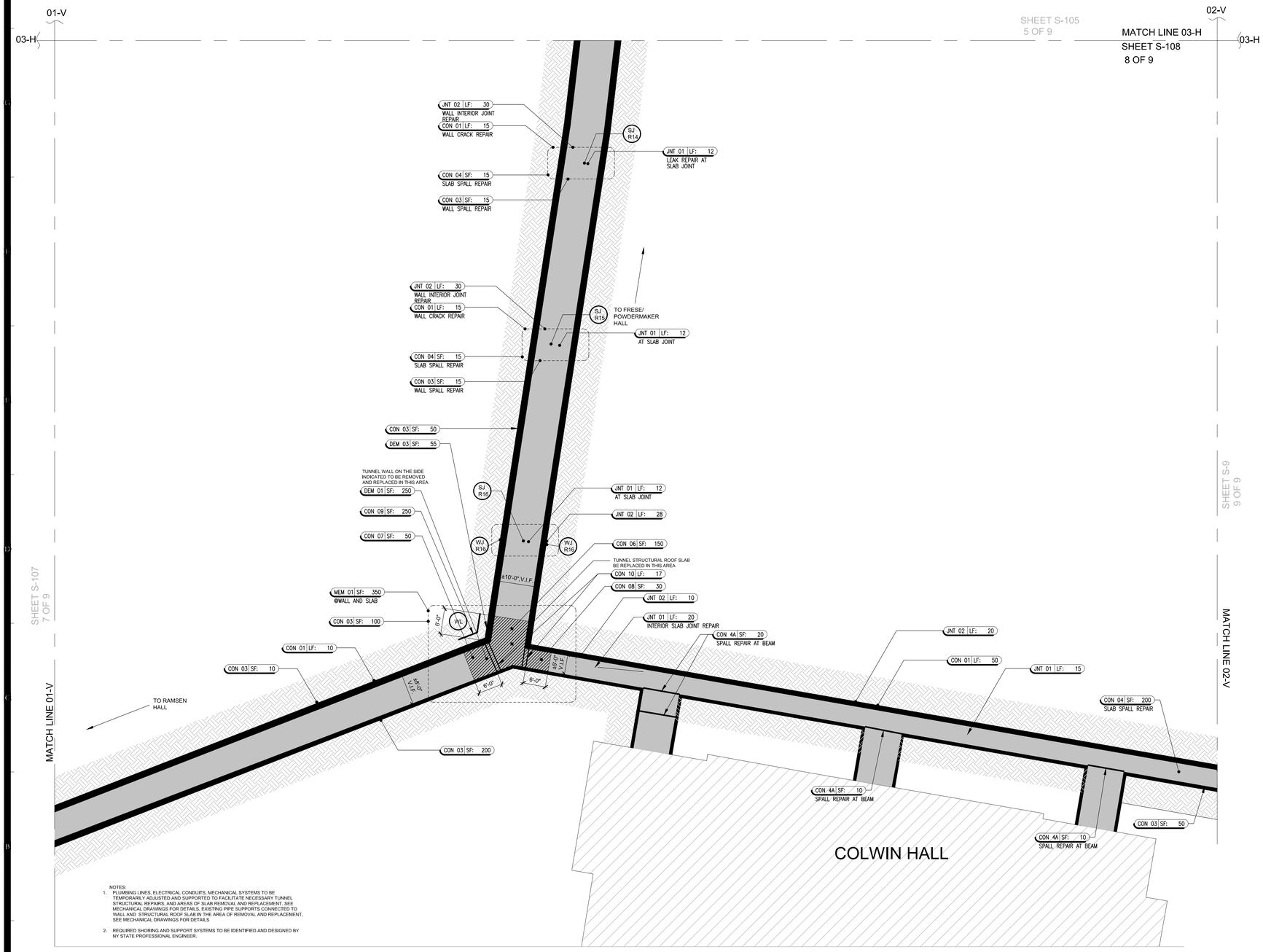
Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

DASNY Project No.
2881309999

Drawing Number
S-107

Drawing
011 of 039



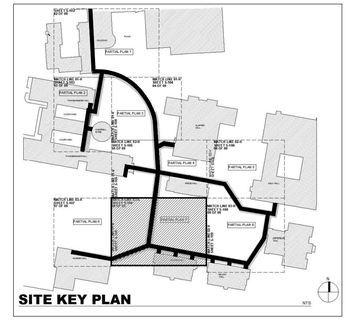
NOTES:

1. PLUMBING LINES, ELECTRICAL CONDUITS, MECHANICAL SYSTEMS TO BE TEMPORARILY ADJUSTED AND SUPPORTED TO FACILITATE NECESSARY TUNNEL STRUCTURAL REPAIRS, AND AREAS OF SLAB REMOVAL AND REPLACEMENT, SEE MECHANICAL DRAWINGS FOR DETAILS, EXISTING PIPE SUPPORTS CONNECTED TO WALL AND STRUCTURAL ROOF SLAB IN THE AREA OF REMOVAL AND REPLACEMENT, SEE MECHANICAL DRAWINGS FOR DETAILS
2. REQUIRED SHORING AND SUPPORT SYSTEMS TO BE IDENTIFIED AND DESIGNED BY NY STATE PROFESSIONAL ENGINEER.

STEAM TUNNEL PARTIAL PLAN 7

3/32" = 1'

0' 4' 8' 16'



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- SJ R# — APPROXIMATE LOCATION OF EXCAVATION FOR SLAB JOINT REPAIRS FROM EXTERIOR OF THE TUNNEL PER REPAIR DETAIL **JNT 01**

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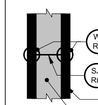

SCHEMATIC PLAN

- WJ R# — APPROXIMATE LOCATION OF TUNNEL STRUCTURAL WALL EXPANSION JOINT
- SJ R# — APPROXIMATE LOCATION OF TUNNEL STRUCTURAL SLAB EXPANSION JOINT
- APPROXIMATE LOCATION OF FULL DEPTH ROOF SLAB REMOVAL AND REPLACEMENT. SEE CIVIL DRAWINGS FOR EXCAVATION WORK.
- WL — APPROXIMATE LOCATION OF CONCRETE TUNNEL WALL TO BE REMOVED AND REPLACED. SEE S-521 FOR TUNNEL WALL REMOVAL DETAILS (DEM 03) AND SEE S-516 & S-517 FOR TUNNEL WALL REPLACEMENT DETAILS.

NOTES:

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DOB NOW JOB NO.
Q00984460-I1
DOB APPROVAL STAMPS

NEW YORK STATE OF OPPORTUNITY | DASNY

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Consultants:

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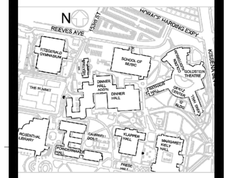
Project Key

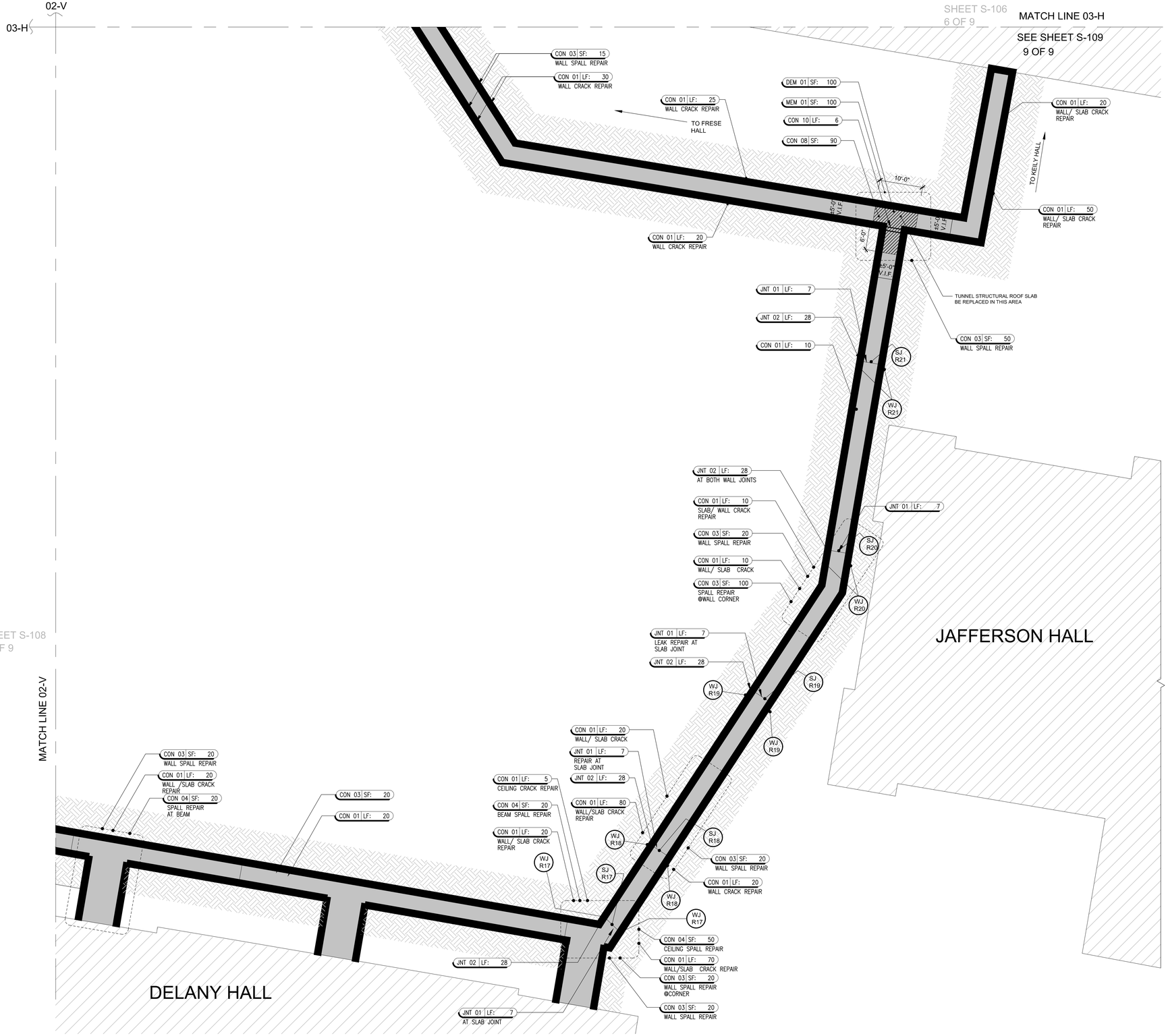

N
REEVES AVE
HENRY H. HARDING EXPY
CONSERVATORY OF MUSIC
Rosenthal Library
Music Library
Library of Music
Powdermaker Hall
Colwin Hall
Remsen Hall
Frese Hall
Science Building
Kiely Hall
Klapper Hall
Dining Commons
Student Union
Gym
Fitness Center
Athletic Fields
Parking Lot
Residence Halls
Residence Halls
Residence Halls

02-V

03-H

SHEET S-106
6 OF 9

MATCH LINE 03-H
SEE SHEET S-109
9 OF 9

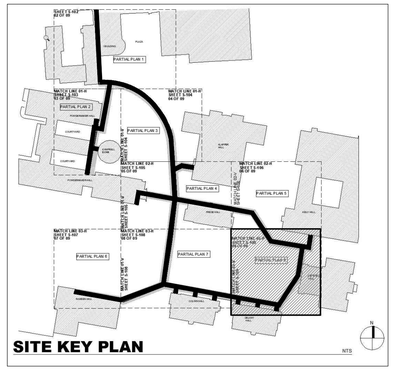


HEET S-108
OF 9

MATCH LINE 02-V

STEAM TUNNEL PARTIAL PLAN 8

3/32" = 1'
0' 4' 8' 16'



SITE KEY PLAN

NTS

LEGEND

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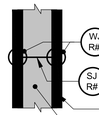

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SJ R# — APPROXIMATE LOCATION OF TUNNEL STRUCTURAL ROOF SLAB EXPANSION JOINT

TUNNEL WALL

TUNNEL ROOF

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DOB NOW JOB NO.
Q00984460-I1

DOB APPROVAL STAMPS

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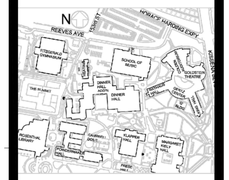
Project Key



REVISIONS

Rev No	Description	Date:
	ISSUED FOR PRICING ONLY NOT FOR CONSTRUCTION	07/09/2025
	ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION-REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client

QUEENS COLLEGE
THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title

STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title

PARTIAL SITE PLAN 8

Phase

100% SUBMISSION

Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

DASNY Project No: 2881309999

Drawing Number S-109

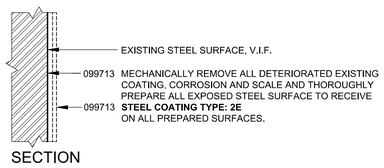
Drawing 013 *of* 039

STEEL SURFACE TO BE CLEANED, PREPARED, AND COATED WITH
099713 **STEEL COATING: 2E**

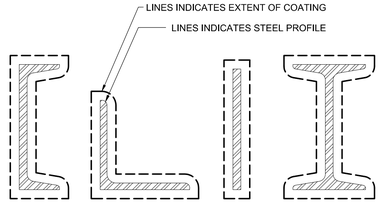
NOTE:
1. SHAPES SHOWN MAY NOT BE INDICATIVE OF ALL STEEL SHAPES TO BE ENCOUNTERED.

REFERENCE PHOTO
@ TUNNEL CEILING

REFERENCE PHOTO
@ TUNNEL CEILING



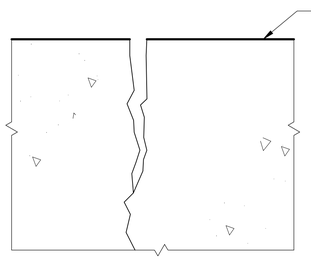
SECTION



BASIC ASSEMBLY

NTS

COA 01 STEEL COATING (SF)

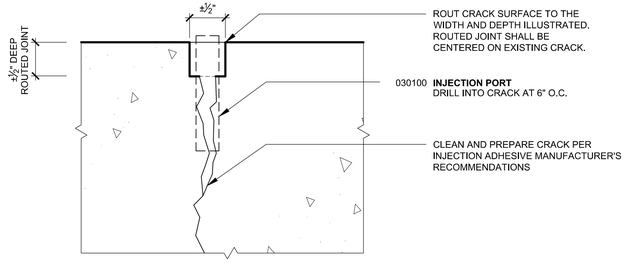


NOTES:

1. INSPECT CRACK PRIOR TO RESTORATION. IF A PORTION OF THE CRACK IS OVER 1/4" WIDE, NOTIFY A/E FOR FURTHER INSTRUCTIONS.
2. SOUND AREA AROUND CRACK PRIOR TO RESTORATION. FOR EXISTING CONCRETE THAT IS DELAMINATED, *REPAIR PER CON 03, CON 04, OR CON 05.*

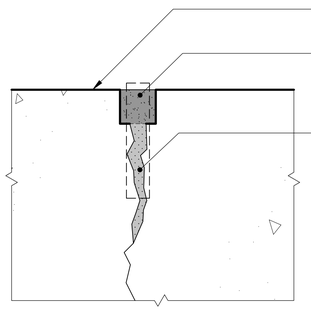
SECTION 1

STEP 1: CRACK REVIEW AND SOUNDING



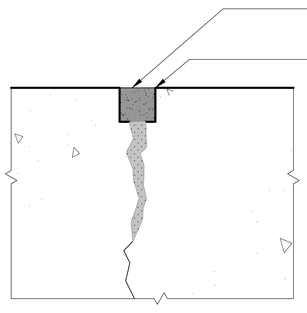
SECTION 1

STEP 2: ROUTING AND INJECTION PORTS



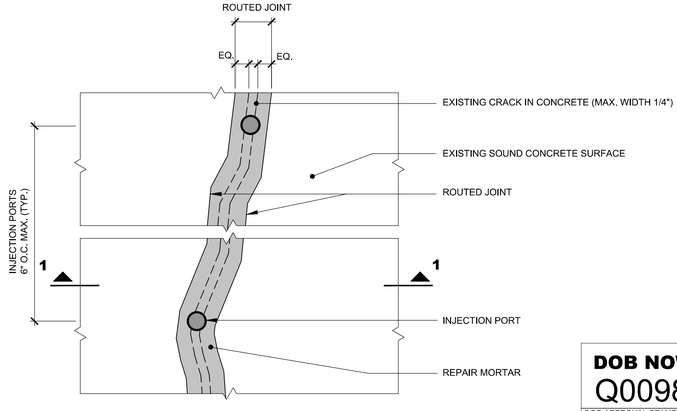
SECTION 1

STEP 3: PATCHING AND INJECTION



SECTION 1

STEP 4: REMOVE PORTS AND TOUCH UP



REFERENCE ELEVATION/ PLAN (STEPS 1 - 3 COMPOSITE)

NTS

CON 01 CONCRETE CRACK RESTORATION (LF) [CRACK WIDTH UP TO 1/4"]

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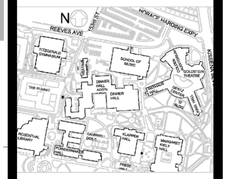

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Project Title

STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

DOB NOW JOB NO.
Q00984460-I1

DOB APPROVAL STAMPS

Drawing Title

RESTORATION DETAILS: CON 01 COA 01

Phase

100% SUBMISSION

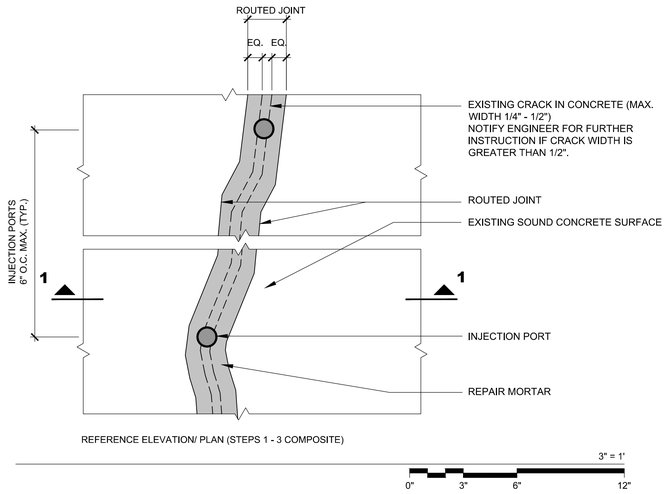
Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

DASNY Project No: 2881309999

Drawing Number S-501

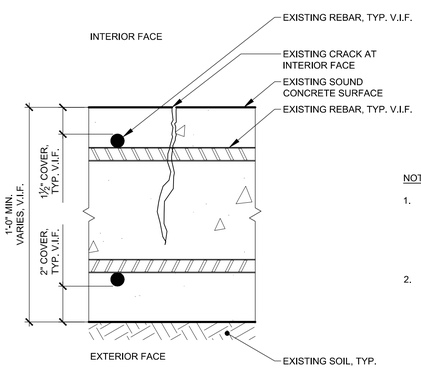
Drawing 014 of 039



REFERENCE ELEVATION/ PLAN (STEPS 1 - 3 COMPOSITE)

3" = 1'

0" 3" 6" 12"

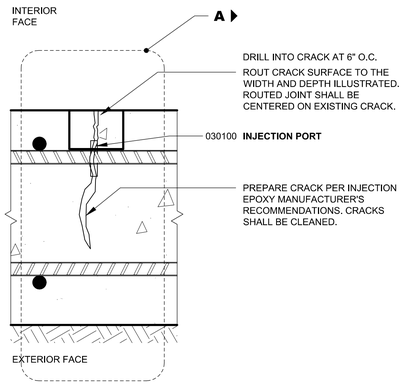


SECTION 1

STEP 1: CRACK REVIEW AND SOUNDING

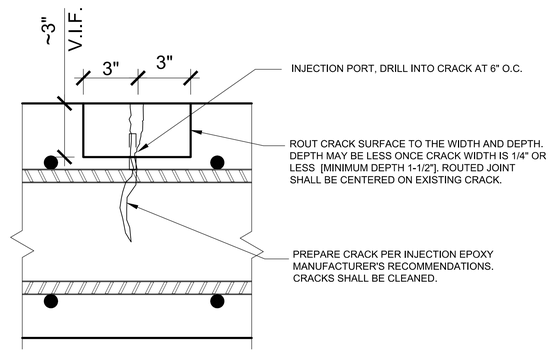
NOTES:

1. INSPECT CRACK PRIOR TO RESTORATION. IF A PORTION OF THE CRACK IS OVER 1/4" WIDE, NOTIFY A/E FOR FURTHER INSTRUCTIONS.
2. SOUND AREA AROUND CRACK PRIOR TO RESTORATION. FOR EXISTING CONCRETE THAT IS DELAMINATED, REPAIR PER CON 03, CON 04, OR CON 05.



SECTION 1

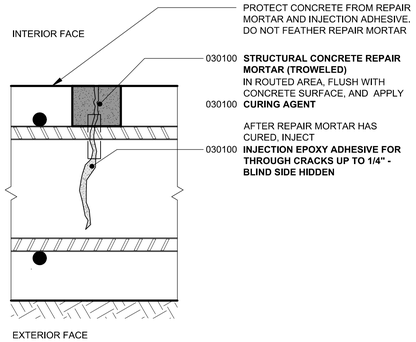
STEP 2: ROUTING AND INJECTION PORTS



A

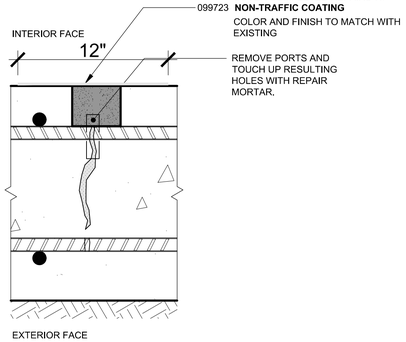
1-1/2" = 1'

0" 6" 12"



SECTION 1

STEP 3: PATCHING AND INJECTION



SECTION 1

STEP 4: REMOVE PORTS AND TOUCH UP

CON 02 CONCRETE CRACK RESTORATION WITH PATCH REPAIR (LF) [CRACK WIDTH : 1/4"-1/2"]

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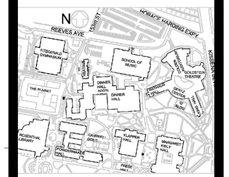
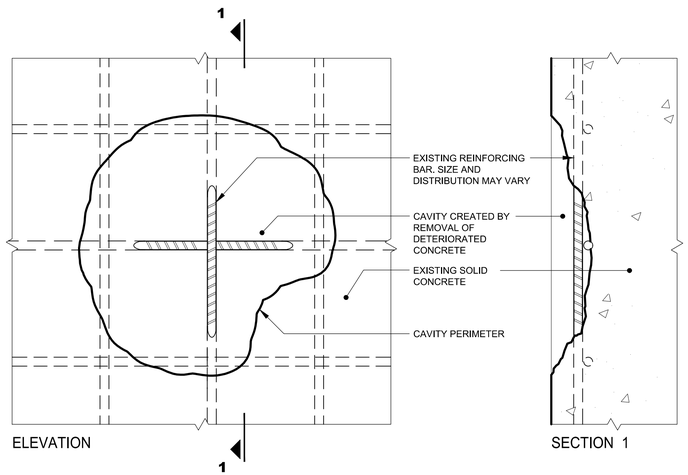
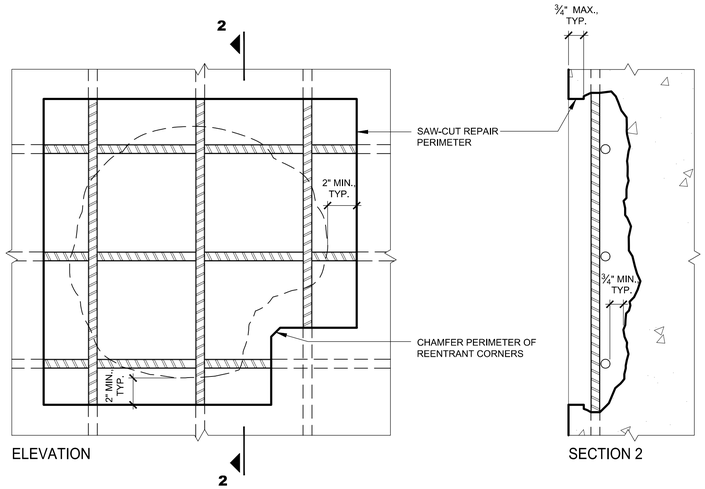

N
RIEVES AVE
KISSENA BLVD
HOWARD HANNAH WAY
CROSSING PLAZA
Rosenthal Library
Music Building
Remsen Hall
Science Building
Powdermaker Hall
Kiely Hall
Dining Commons
Colden Center for the Performing Arts
Jefferson Hall
Jefferson Gym
Fitzgerald Gym
Klapper Hall
Queens Hall
Science Addition
Powdermaker Addition
Rathaus Hall
Music Addition
Kissena Hall
Frese Hall
Music Annex
Music Annex II
Music Annex III
Temporary Classroom
Temporary Classroom
Temporary Classroom



STEP 1: SOUNDING AND REMOVAL OF DETERIORATED CONCRETE

SOUND SURFACES AT LOCATIONS APPROXIMATELY 2"-3" O.C., IN ALL DIRECTIONS, TO IDENTIFY EXTENT OF DETERIORATED/ DELAMINATED CONCRETE.

REMOVE DETERIORATED CONCRETE UNTIL NON-DETERIORATED (SOLID) SUBSTRATE IS REACHED.

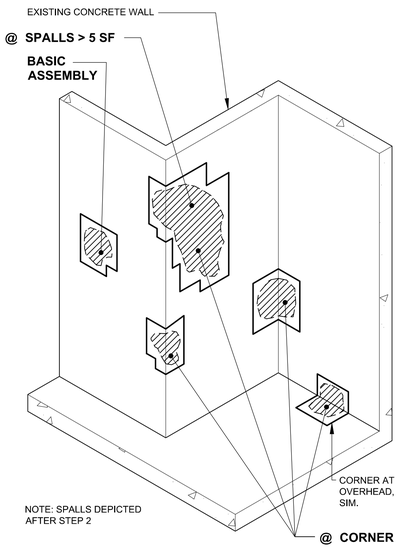


STEP 2: CONFIGURATION AND PREPARATION OF REPAIR

MARK OUT A RECTILINEAR REPAIR PERIMETER WITH MARGINS AS ILLUSTRATED IN ELEVATION ABOVE.

SAW-CUT REPAIR PERIMETER TO DEPTH ILLUSTRATED IN SECTION ABOVE.

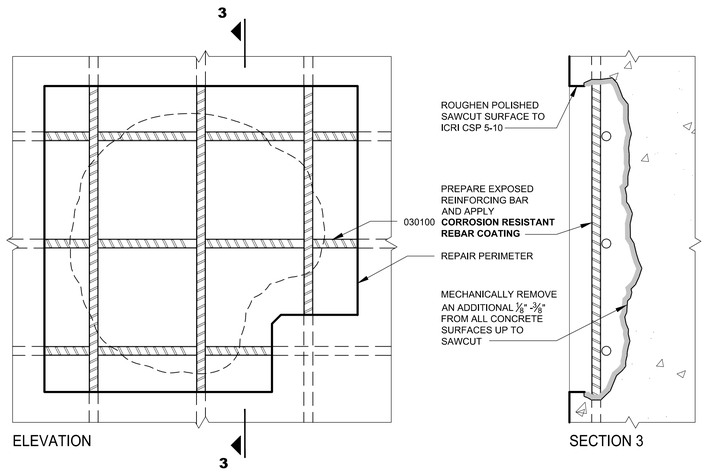
REMOVE CONCRETE TO ACHIEVE A 3/4" CLEARANCE BEYOND REINFORCING BARS, AS ILLUSTRATED IN SECTION ABOVE. FOR QUANTIFICATION PURPOSES, ASSUME AN AVERAGE DEPTH OF 4".



NOTE: SPALLS DEPICTED AFTER STEP 2

KEY

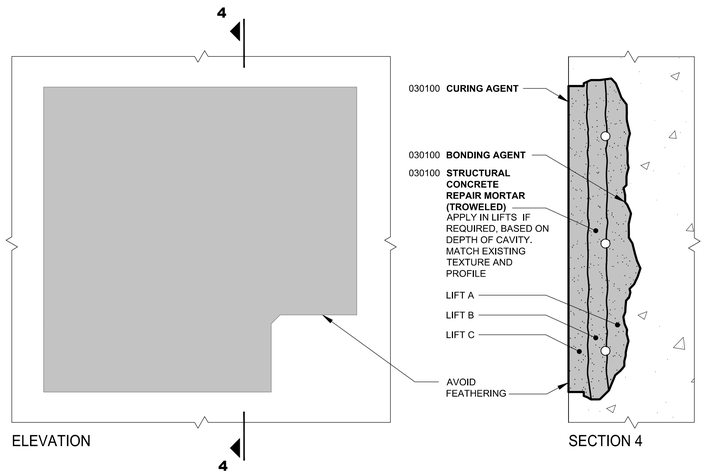
NTS



STEP 3: FINAL PREPARATION

COMPLY WITH MANUFACTURER'S RECOMMENDATIONS FOR PREPARATION AND COATING OF REINFORCING BARS.

IF CORROSION REDUCED ANY REINFORCING BAR DIAMETER BY MORE THAN 20%, SPLICE PER **@ CORRODED REBAR.**

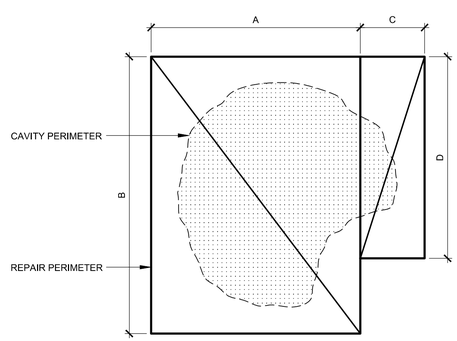


STEP 4: REPAIR MORTAR APPLICATION

COMPLY WITH MANUFACTURER'S RECOMMENDATIONS FOR PREPARATION AND APPLICATION OF BONDING AGENT, REPAIR MORTAR, AND CURING AGENT.

APPLY REPAIR MORTAR IN LIFTS AS ILLUSTRATED ABOVE. MAXIMUM THICKNESS OF EACH LIFT PER MANUFACTURER'S RECOMMENDATIONS. SCORE SURFACE OF EACH LIFT TO RECEIVE THE NEXT LIFT.

QUANTIFY CONCRETE SPALL REPAIR PER QUANTIFICATION DIAGRAM ABOVE.



THE QUANTITY OF CONCRETE SPALL REPAIR, IS EQUAL TO THE TOTAL SURFACE AREA: (A x B) + (C x D)

QUANTIFICATION DIAGRAM

BASIC ASSEMBLY

NTS

CON 03 (1 OF 3) — CONCRETE SPALL REPAIR AT VERTICAL SURFACE (SF)

DOB NOW JOB NO. Q00984460-I1

DOB APPROVAL STAMPS

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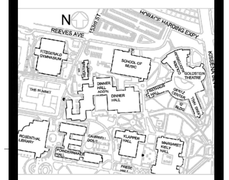


REVISIONS

Rev No	Description	Date:
	ISSUED FOR PRICING ONLY NOT FOR CONSTRUCTION	07/09/2025
	ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION-REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client
CUNY The City University of New York QUEENS COLLEGE THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title
STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title
RESTORATION DETAILS: CON 03 (1 OF 3)

Phase
100% SUBMISSION

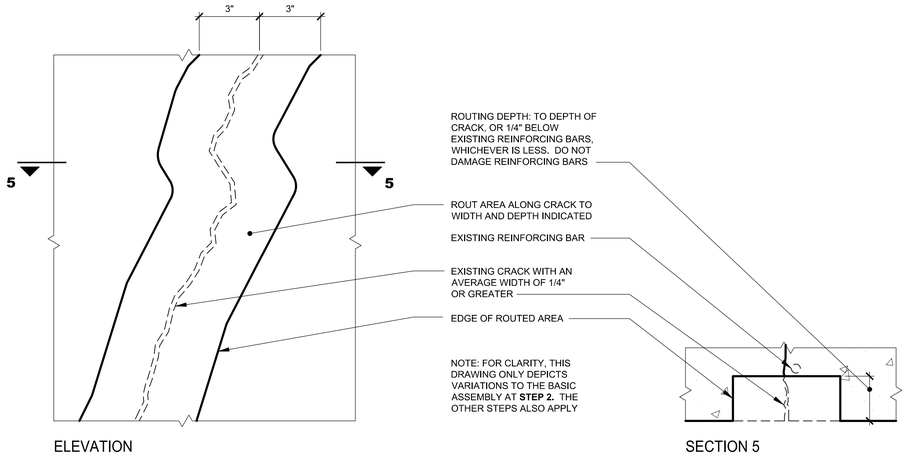
Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

DASNY Project No: 2881309999

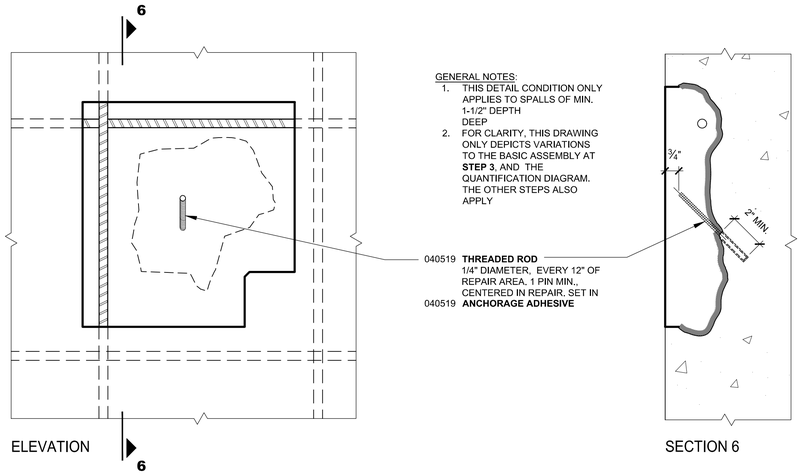
Drawing Number S-503

Drawing 016 *of* 039



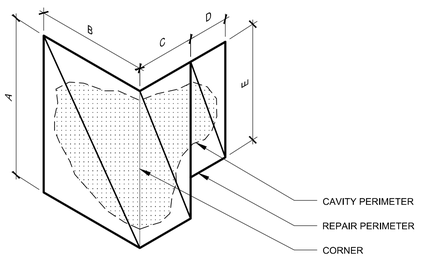
@ CRACK > 1/4" WIDE

NTS



PARTIAL/ NO REBAR @ EXPOSURE

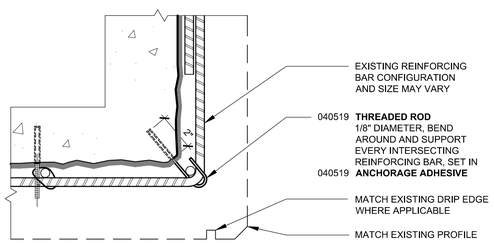
NTS

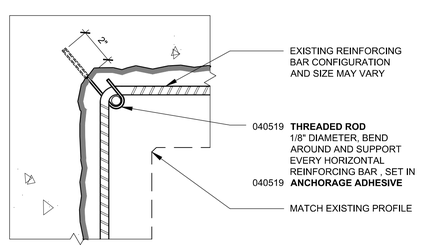


THE QUANTITY OF CONCRETE SPALL REPAIR, IS EQUAL TO THE TOTAL SURFACE AREA: (A x B) + (A x (C - d)) + (E x D), d = AVERAGE DEPTH OF REPAIR

QUANTIFICATION DIAGRAM

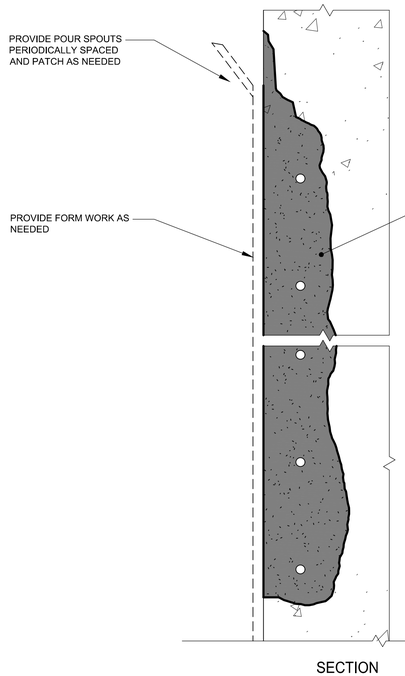
GENERAL NOTES:
1. INSIDE CORNER SIMILAR TO OUTSIDE CORNER
2. FOR CLARITY, THIS DRAWING ONLY DEPICTS VARIATIONS TO THE BASIC ASSEMBLY AT **STEP 3**, AND THE QUANTIFICATION DIAGRAM. THE OTHER STEPS ALSO APPLY





@ CORNER

NTS



@ SPALLS > 5 SF

NTS

DOB NOW JOB NO.
Q00984460-I1

DOB APPROVAL STAMPS

CON 03 (2 OF 3)

CONCRETE SPALL REPAIR AT VERTICAL SURFACE (SF)

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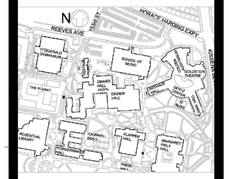

REVISIONS

Rev No	Description	Date:
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	ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION-REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client

QUEENS COLLEGE
THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title

STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title

RESTORATION DETAILS: CON 03 (2 OF 3)

Phase

100% SUBMISSION

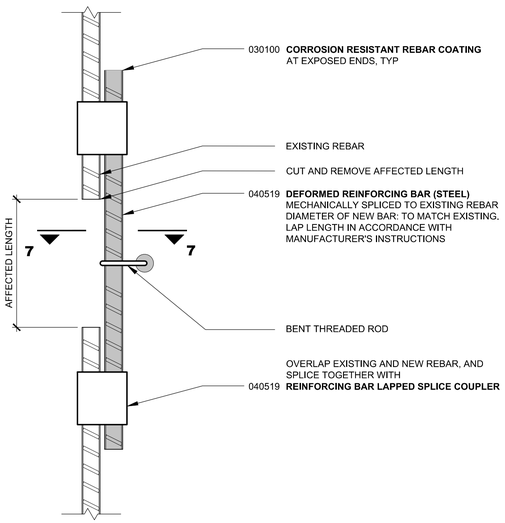
Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

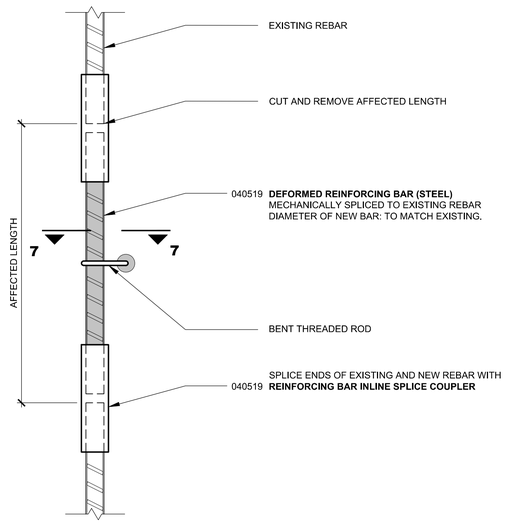
DASNY Project No: 2881309999

Drawing Number S-504

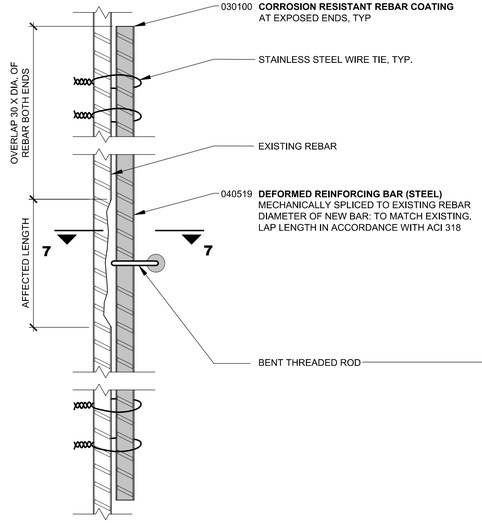
Drawing 017 of 039



ELEVATION
OPTION 1: LAPPED SPLICE

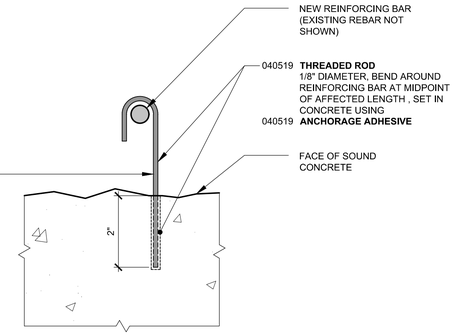


ELEVATION
OPTION 2: IN-LINE SPLICE



ELEVATION
OPTION 3: TIED OVERLAP

NOTE: FOR ANY OPTION, NEW REINFORCING BAR CONCRETE COVER SHALL BE EQUAL OR GREATER THAN EXISTING REINFORCING BAR COVER.



SECTION 7
(THREADED ROD)

@ CORRODED REBAR

NTS

CON 03
3 OF 3

CONCRETE SPALL REPAIR AT VERTICAL SURFACE (SF)

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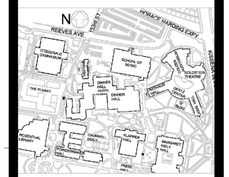
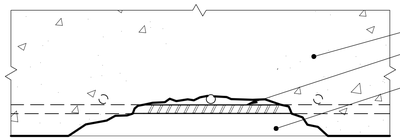
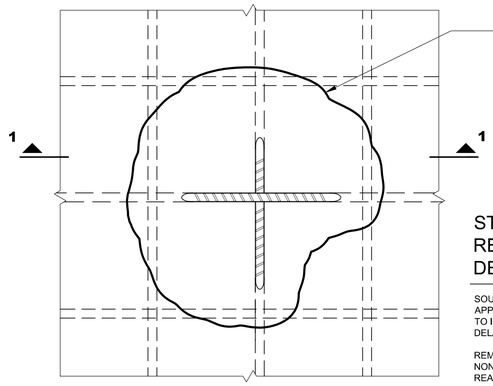

N
REEVES AVE
KISSENA BLVD
PARKING
PARKING
PARKING



SECTION 1

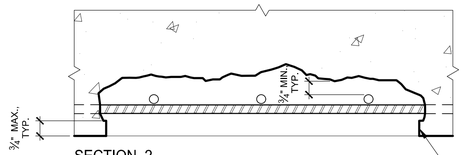


PLAN (OVERHEAD) (STEP 1)

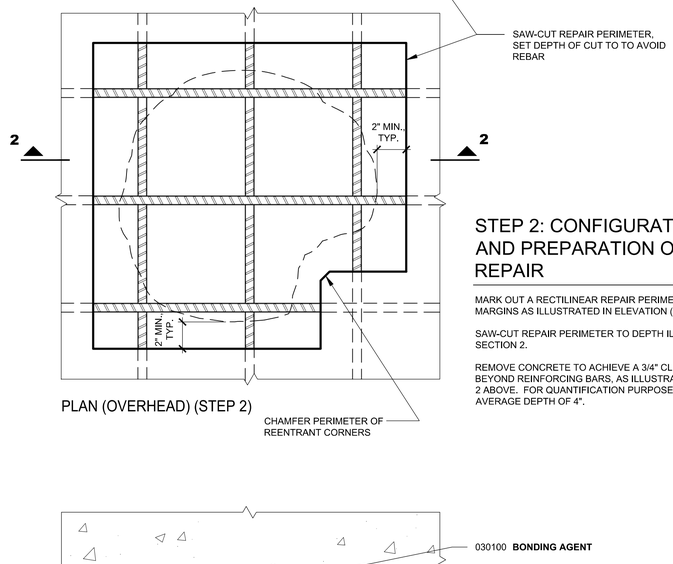
STEP 1: SOUNDING AND REMOVAL OF DETERIORATED CONCRETE

SOUND SURFACES WITH AT LOCATIONS APPROXIMATELY 2"-3" O.C., IN ALL DIRECTIONS, TO IDENTIFY EXTENT OF DETERIORATED/ DELAMINATED CONCRETE.

REMOVE DETERIORATED CONCRETE UNTIL NON-DETERIORATED (SOLID) SUBSTRATE IS REACHED.



SECTION 2



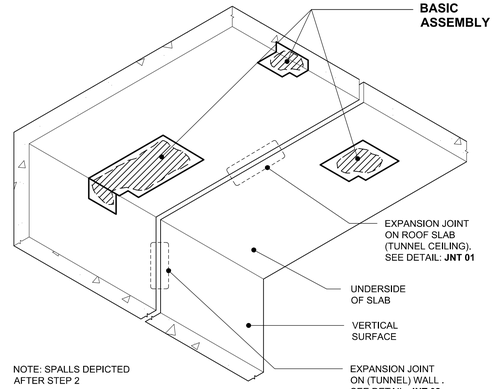
PLAN (OVERHEAD) (STEP 2)

STEP 2: CONFIGURATION AND PREPARATION OF REPAIR

MARK OUT A RECTILINEAR REPAIR PERIMETER WITH MARGINS AS ILLUSTRATED IN ELEVATION (STEP 2).

SAW-CUT REPAIR PERIMETER TO DEPTH ILLUSTRATED IN SECTION 2.

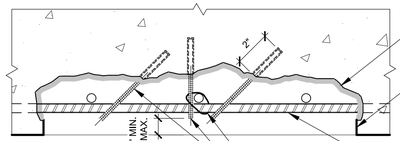
REMOVE CONCRETE TO ACHIEVE A 3/4" CLEARANCE BEYOND REINFORCING BARS, AS ILLUSTRATED IN SECTION 2 ABOVE. FOR QUANTIFICATION PURPOSES, ASSUME AN AVERAGE DEPTH OF 4".



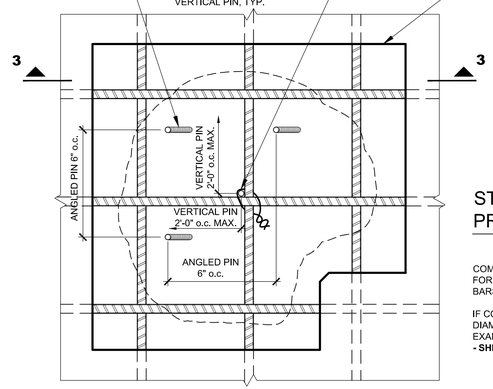
NOTE: SPALLS DEPICTED AFTER STEP 2

KEY

NTS



SECTION 3

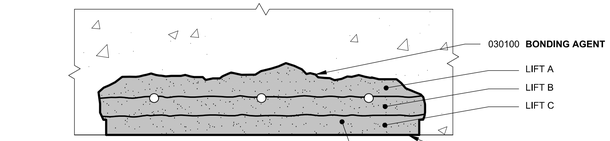


PLAN (OVERHEAD) (STEP 3)

STEP 3: FINAL PREPARATION

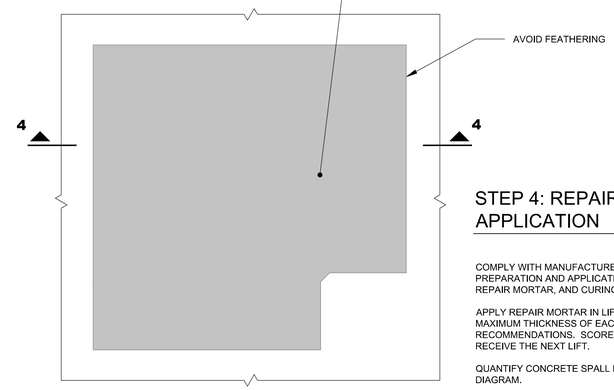
COMPLY WITH MANUFACTURER'S RECOMMENDATIONS FOR PREPARATION AND COATING OF REINFORCING BARS.

IF CORROSION REDUCED ANY REINFORCING BAR DIAMETER BY MORE THAN 20%, NOTIFY A/E FOR EXAMINATION, AND SPLICE PER **@ CORRODED REBAR - SHEET S-505**.



SECTION 4

030100 **STRUCTURAL CONCRETE REPAIR MORTAR (TROWELED)**
APPLY IN LIFTS IF REQUIRED, BASED ON DEPTH OF CAVITY. MATCH EXISTING TEXTURE AND PROFILE



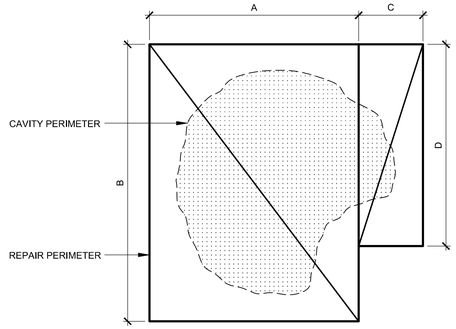
PLAN (OVERHEAD) (STEP 4)

STEP 4: REPAIR MORTAR APPLICATION

COMPLY WITH MANUFACTURER'S RECOMMENDATIONS FOR PREPARATION AND APPLICATION OF BONDING AGENT, REPAIR MORTAR, AND CURING AGENT.

APPLY REPAIR MORTAR IN LIFTS AS ILLUSTRATED. MAXIMUM THICKNESS OF EACH LIFT PER MANUFACTURER'S RECOMMENDATIONS. SCORE SURFACE OF EACH LIFT TO RECEIVE THE NEXT LIFT.

QUANTIFY CONCRETE SPALL REPAIR PER QUANTIFICATION DIAGRAM.



THE QUANTITY OF CONCRETE SPALL REPAIR, IS EQUAL TO THE TOTAL SURFACE AREA: (A x B) + (C x D)

QUANTIFICATION DIAGRAM

BASIC ASSEMBLY

NTS

CON 04 CONCRETE SPALL REPAIR AT OVERHEAD SURFACE (SF)

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One Penn Plaza, 52 Floor, NY, NY 10119-0098
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14 WALL STREET
NEW YORK, NY 10005
(212) 505-1133
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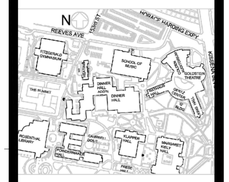
Project Key



REVISIONS

Rev.No	Description	Date:
	ISSUED FOR PRICING ONLY NOT FOR CONSTRUCTION	07/09/2025
	ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION-REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client

CUNY The City University of New York — QUEENS COLLEGE
THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title

STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title

RESTORATION DETAILS: CON 04

DOB NOW JOB NO.
Q00984460-I1
DOB APPROVAL STAMPS

Phase
100% SUBMISSION

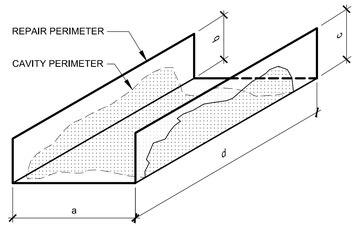
Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

DASNY Project No:
2881309999

Drawing Number
S-506

Drawing
019 of 039

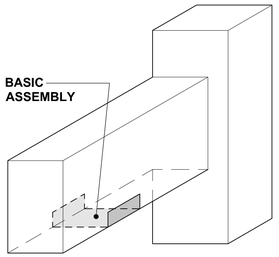


THE QUANTITY OF CONCRETE SPALL REPAIR, IS EQUAL TO THE TOTAL SURFACE AREA: (a x d) + (b x d) + (c x d), CALCULATE IN SQUARE INCHES AND DIVIDE BY 144 TO OBTAIN SQUARE FOOTAGE QUANTITY, ROUND UP TO THE NEAREST .25 SQUARE FOOT. MINIMUM QUANTITY IS .25 SQUARE FEET.

EXAMPLE:
a = 8", b = 3", c = 5", d = 10"
AREA = (8 x 10) + (3 x 10) + (5 x 10) = 80 + 30 + 50 = 160 SQUARE INCHES (SI)
160 SI DIVIDED BY 144 = 1.11 SQUARE FEET (SF)
1.11 SF ROUNDED UP TO NEAREST .25 = **1.25 SF**

QUANTIFICATION DIAGRAM

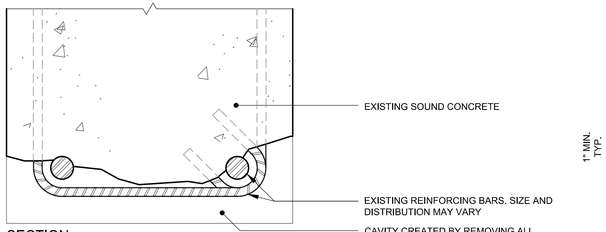
QUANTIFY THE REPAIR ACCORDING TO THIS DIAGRAM.



SEE OTHER RADS FOR CONFIGURATIONS NOT SHOWN

ISOMETRIC AT BEAM

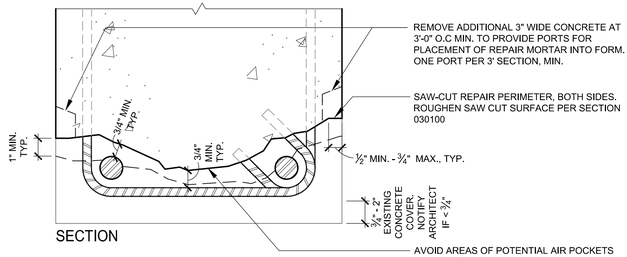
KEY DIAGRAM



SECTION

STEP 1: REMOVAL OF CONCRETE

REMOVE DETERIORATED CONCRETE USING CHIPPING HAMMER OR APPROVED TOOLS UNTIL NON-DETERIORATED (SOLID) SUBSTRATE IS REACHED.



SECTION

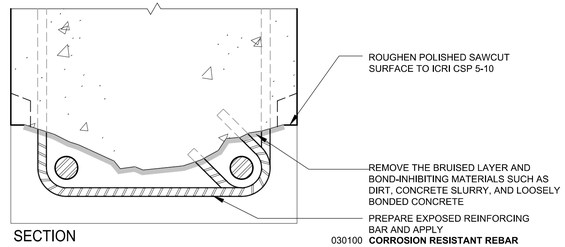
STEP 2: CONCRETE CONFIGURATION

MARK OUT A RECTILINEAR REPAIR PERIMETER WITH MARGINS AS ILLUSTRATED IN ELEVATION ABOVE. SEE QUANTIFICATION DIAGRAM FOR EXAMPLE REPAIR PERIMETER.

SAW-CUT REPAIR PERIMETER TO DEPTH ILLUSTRATED IN SECTION ABOVE.

REMOVE CONCRETE USING 15 POUND CHIPPING HAMMER TO ACHIEVE A 3/4" CLEARANCE BEYOND REINFORCING BARS, AS ILLUSTRATED IN SECTION ABOVE. FOR QUANTIFICATION PURPOSES, ASSUME AN AVERAGE REPAIR DEPTH OF 4".

NOTIFY ARCHITECT IF ACTUAL REPAIR DEPTH DOES NOT MEET MORTAR MANUFACTURER'S REQUIREMENTS.



SECTION

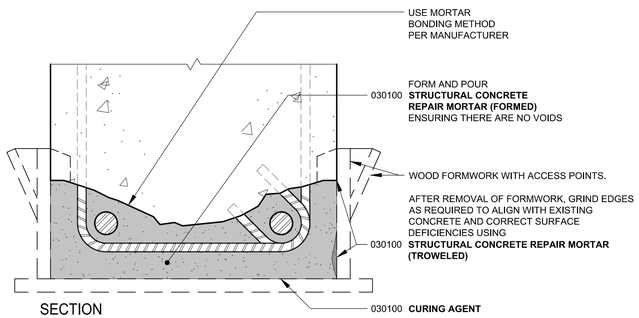
STEP 3: FINAL PREPARATION

PREPARE CONCRETE SURFACE AS DESCRIBED ABOVE.

COMPLY WITH MANUFACTURER'S RECOMMENDATIONS FOR PREPARATION AND COATING OF REINFORCING BARS.

IF CORROSION REDUCED ANY REINFORCING BAR DIAMETER BY MORE THAN 20%, SPLICE PER **@ CORRODED REBAR.**

OBTAIN ARCHITECT'S WRITTEN APPROVAL OF FINAL PREPARATION WORK PRIOR TO PROCEEDING WITH STEP 4.



SECTION

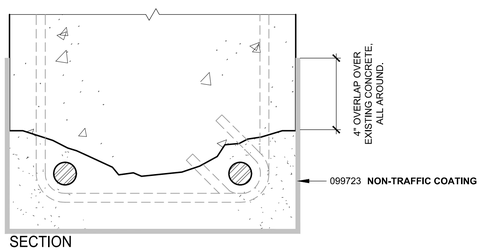
STEP 4: REPAIR MORTAR APPLICATION

PROVIDE WOOD FORMWORK IN ACCORDANCE WITH ACI 347R TO MATCH CONFIGURATION OF THE ORIGINAL CONCRETE BEAM. PROVIDE ACCESS POINTS IN FORM TO ALLOW FOR PRE-WETTING OF EXISTING CONCRETE AND TO ALLOW POURING OF FORMED REPAIR MORTAR.

COMPLY WITH MANUFACTURER'S RECOMMENDATIONS FOR PREPARATION AND APPLICATION OF REPAIR MORTAR.

ALLOW MORTAR TO CURE 72 HOURS MINIMUM PRIOR TO FORMWORK REMOVAL.

COMPLY WITH MANUFACTURER'S RECOMMENDATIONS FOR PREPARATION AND APPLICATION OF CURING AGENT.



SECTION

STEP 5: COATING APPLICATION

AFTER MORTAR APPLICATION (STEP 4) IS APPROVED BY ARCHITECT, APPLY COATING AS ILLUSTRATED.

BASIC ASSEMBLY

NTS

CON 4A CONCRETE BEAM RESTORATION: UNDERSIDE (FULL WIDTH) (SF)

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One Penn Plaza, 52 Floor, NY, NY 10119-0098
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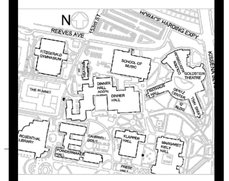

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	90% SUBMISSION-REVISION 01	02/27/2023
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Client

QUEENS COLLEGE THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title

STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

DOB NOW JOB NO.
Q00984460-I1

DOB APPROVAL STAMPS

Drawing Title

RESTORATION DETAILS: CON 04A

Phase

100% SUBMISSION

Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

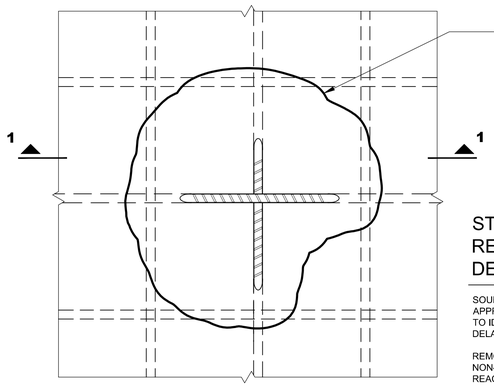
Seal & Signature

DASNY Project No: 2881309999

Drawing Number

S-507

Drawing 020 *of* 039

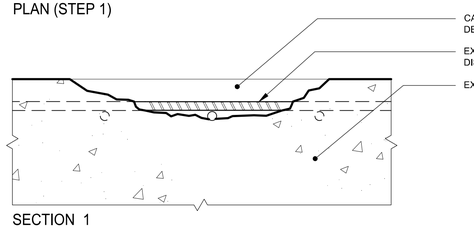


PLAN (STEP 1)

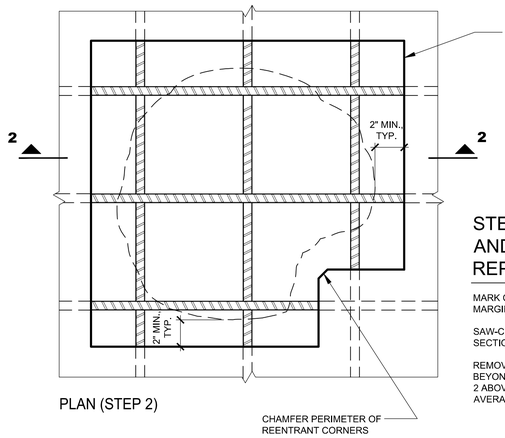
STEP 1: SOUNDING AND REMOVAL OF DETERIORATED CONCRETE

SOUND SURFACES WITH AT LOCATIONS APPROXIMATELY 2"-3" O.C., IN ALL DIRECTIONS, TO IDENTIFY EXTENT OF DETERIORATED/ DELAMINATED CONCRETE.

REMOVE DETERIORATED CONCRETE UNTIL NON-DETERIORATED (SOLID) SUBSTRATE IS REACHED.



SECTION 1



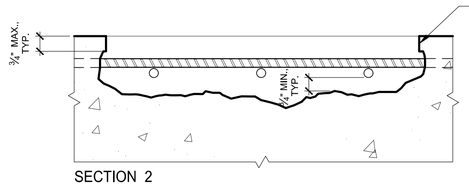
PLAN (STEP 2)

STEP 2: CONFIGURATION AND PREPARATION OF REPAIR

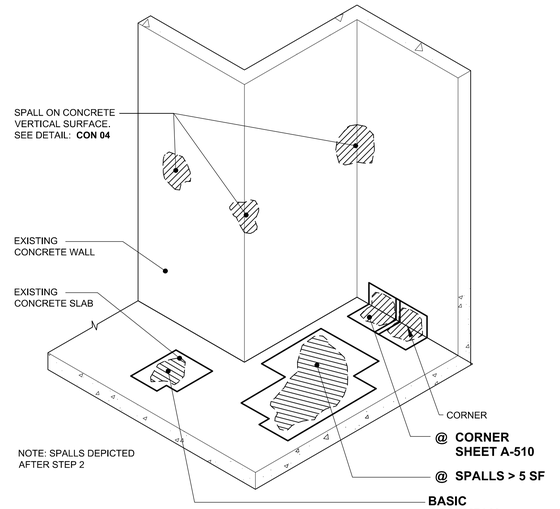
MARK OUT A RECTILINEAR REPAIR PERIMETER WITH MARGINS AS ILLUSTRATED IN ELEVATION (STEP 2).

SAW-CUT REPAIR PERIMETER TO DEPTH ILLUSTRATED IN SECTION 2.

REMOVE CONCRETE TO ACHIEVE A 3/4" CLEARANCE BEYOND REINFORCING BARS, AS ILLUSTRATED IN SECTION 2 ABOVE. FOR QUANTIFICATION PURPOSES, ASSUME AN AVERAGE DEPTH OF 4".



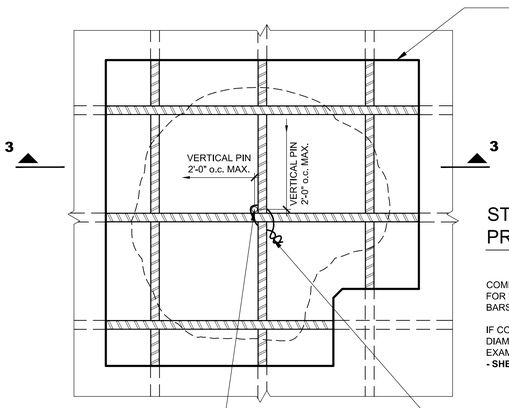
SECTION 2



NOTE: SPALLS DEPICTED AFTER STEP 2

KEY

NTS



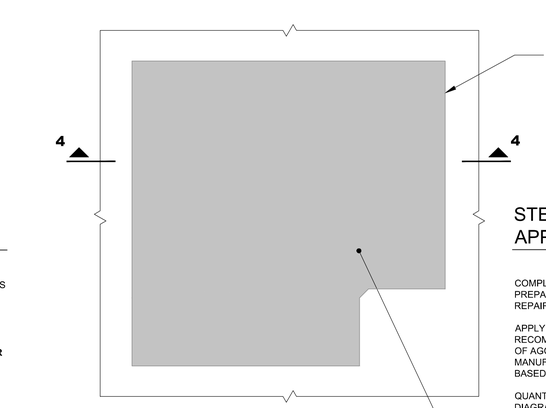
PLAN (STEP 3)

SECTION 3

STEP 3: FINAL PREPARATION

COMPLY WITH MANUFACTURER'S RECOMMENDATIONS FOR PREPARATION AND COATING OF REINFORCING BARS.

IF CORROSION REDUCED ANY REINFORCING BAR DIAMETER BY MORE THAN 20%, NOTIFY A/E FOR EXAMINATION, AND SPLICE PER **@ CORRODED REBAR - SHEET S-505**.



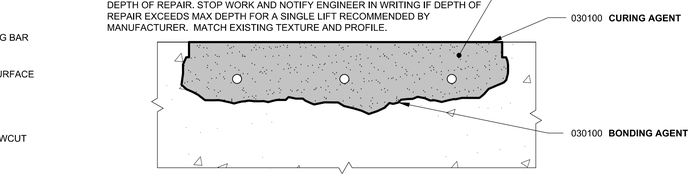
PLAN (STEP 4)

STEP 4: REPAIR MORTAR APPLICATION

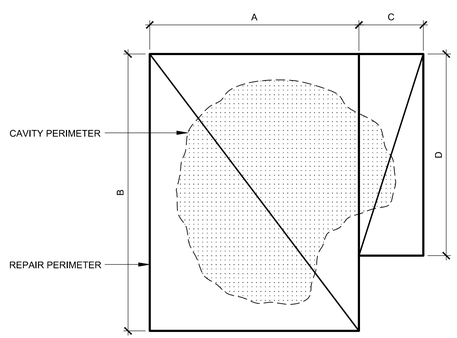
COMPLY WITH MANUFACTURER'S RECOMMENDATIONS FOR PREPARATION AND APPLICATION OF BONDING AGENT, REPAIR MORTAR, AND CURING AGENT.

APPLY REPAIR MORTAR PER MANUFACTURER'S RECOMMENDATIONS. EXTEND MORTAR BY THE ADDITION OF AGGREGATE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS IF REQUIRED BASED UPON CAVITY DEPTH.

QUANTIFY CONCRETE SPALL REPAIR PER QUANTIFICATION DIAGRAM.



SECTION 4



THE QUANTITY OF CONCRETE SPALL REPAIR, IS EQUAL TO THE TOTAL SURFACE AREA: (A x B) + (C x D)

QUANTIFICATION DIAGRAM

BASIC ASSEMBLY

NTS

CON 05 (1 OF 2)

CONCRETE SPALL RESTORATION AT HORIZONTAL SURFACE (SF)

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(212) 505-1133
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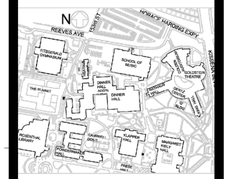
Project Key



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DOB NOW JOB NO.
Q00984460-I1

DOB APPROVAL STAMPS

Drawing Title

RESTORATION DETAILS: CON 05 (1 OF 2)

Phase

100% SUBMISSION

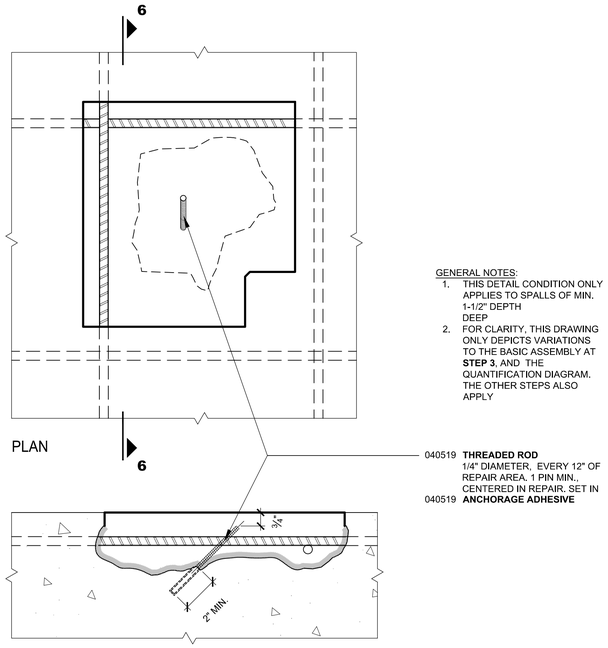
Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

DASNY Project No.
2881309999

Drawing Number
S-508

Drawing 021 of 039



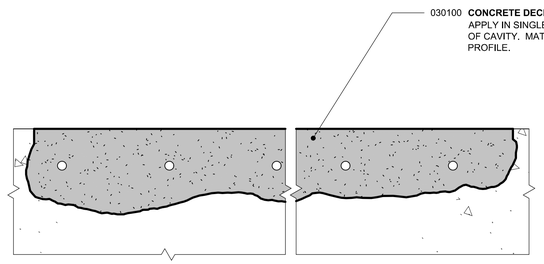
040519 **THREADED ROD**
1/4" DIAMETER, EVERY 12" OF REPAIR AREA, 1 PIN MIN.,. CENTERED IN REPAIR, SET IN
040519 **ANCHORAGE ADHESIVE**

SECTION 6

@ PARTIAL/ NO REBAR EXPOSURE

NTS

GENERAL NOTES:
1. THIS DETAIL CONDITION ONLY APPLIES TO SPALLS OF MIN. 1-1/2" DEPTH DEEP
2. FOR CLARITY, THIS DRAWING ONLY DEPICTS VARIATIONS TO THE BASIC ASSEMBLY AT **STEP 3**, AND THE QUANTIFICATION DIAGRAM. THE OTHER STEPS ALSO APPLY

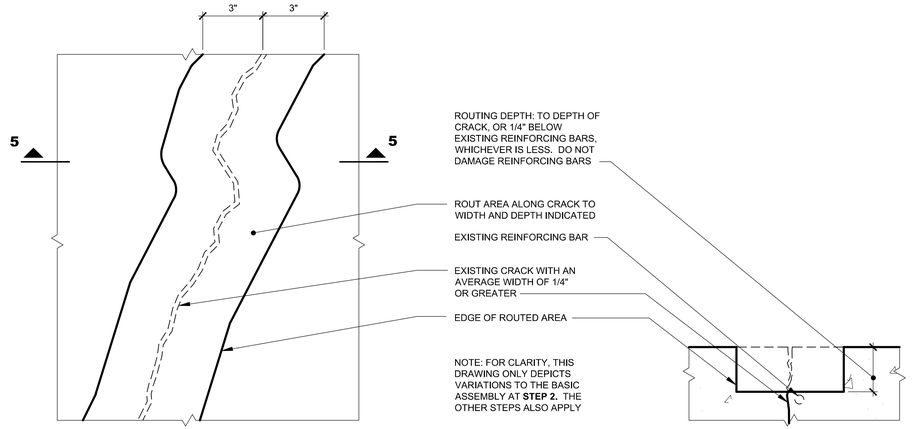


030100 **CONCRETE DECK REPAIR MORTAR**
APPLY IN SINGLE PLACEMENT TO FILL DEPTH OF CAVITY. MATCH EXISTING TEXTURE AND PROFILE.

SECTION

@ SPALLS > 5 SF

NTS

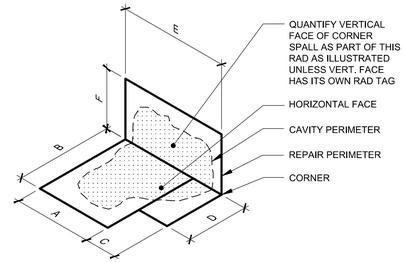


PLAN

SECTION 5

@ CRACK > 1/4" WIDE

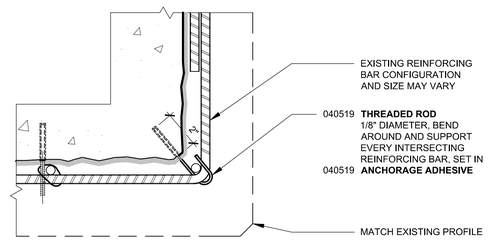
NTS



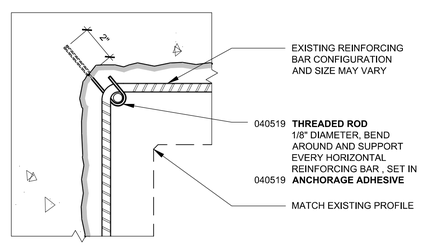
THE QUANTITY OF CONCRETE SPALL REPAIR IS EQUAL TO THE TOTAL SURFACE OF OVERHEAD AREA: (A x B) + (C x D)
ADD THE VERTICAL FACE (E x F) AS APPROPRIATE, PER THE NOTES

QUANTIFICATION DIAGRAM

GENERAL NOTES:
1. INSIDE CORNER SIMILAR TO OUTSIDE CORNER
2. FOR CLARITY, THIS DRAWING ONLY DEPICTS VARIATIONS TO THE BASIC ASSEMBLY AT **STEP 3**, AND THE QUANTIFICATION DIAGRAM. THE OTHER STEPS ALSO APPLY



OUTSIDE CORNER SECTION



INSIDE CORNER SECTION

@ CORNER

NTS

DOB NOW JOB NO.
Q00984460-I1
DOB APPROVAL STAMPS

CON 05
(2 OF 2)

CONCRETE SPALL RESTORATION AT HORIZONTAL SURFACE (SF)

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Consultants:

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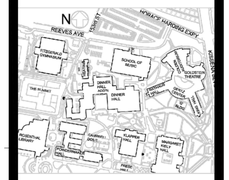
Project Key


N
REEVES AVE
HENRY E. HARDING CIRCLE
CRAMTON AUDITORIUM
KIELY HALL
PAUL KLAPPER LIBRARY
ROSENTHAL LIBRARY
DELTA PHI
KAPPA DELTA
ALPHA EPSILON PHI
KAPPA KAPPA GAMMA
ALPHA XI DELTA
ALPHA PHI
DELTA GAMMA
KAPPA ALPHA THETA
DELTA ZETA
ALPHA OMICRON PI
ALPHA CHI OMEGA
ALPHA EPSILON PHI
KAPPA ALPHA PSI
PHI SIGMA KAPPA
PHI SIGMA SIGMA
SIGMA DELTA TAU
ZETA BETA TAU
SIGMA ALPHA EPSILON
SIGMA PHI EPSILON
SIGMA CHI
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PHI DELTA THETA
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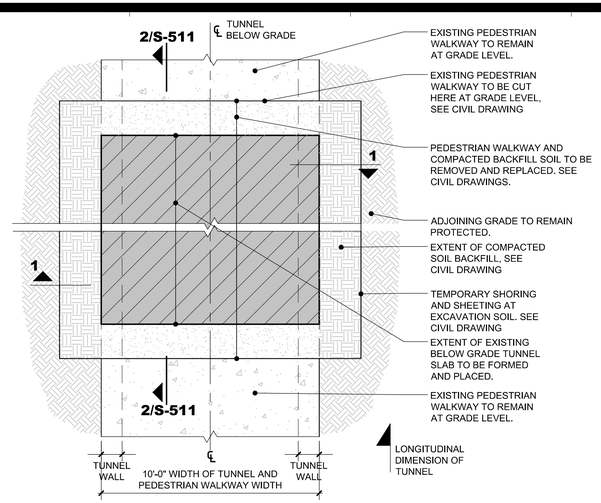
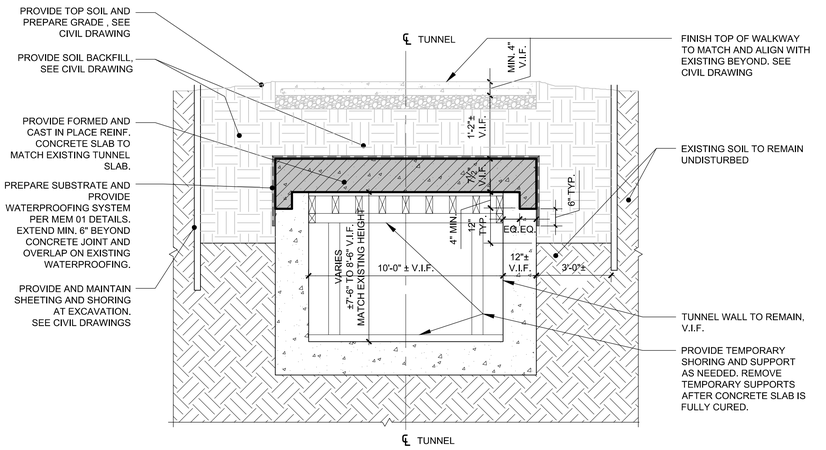
PHI BETA SIGM



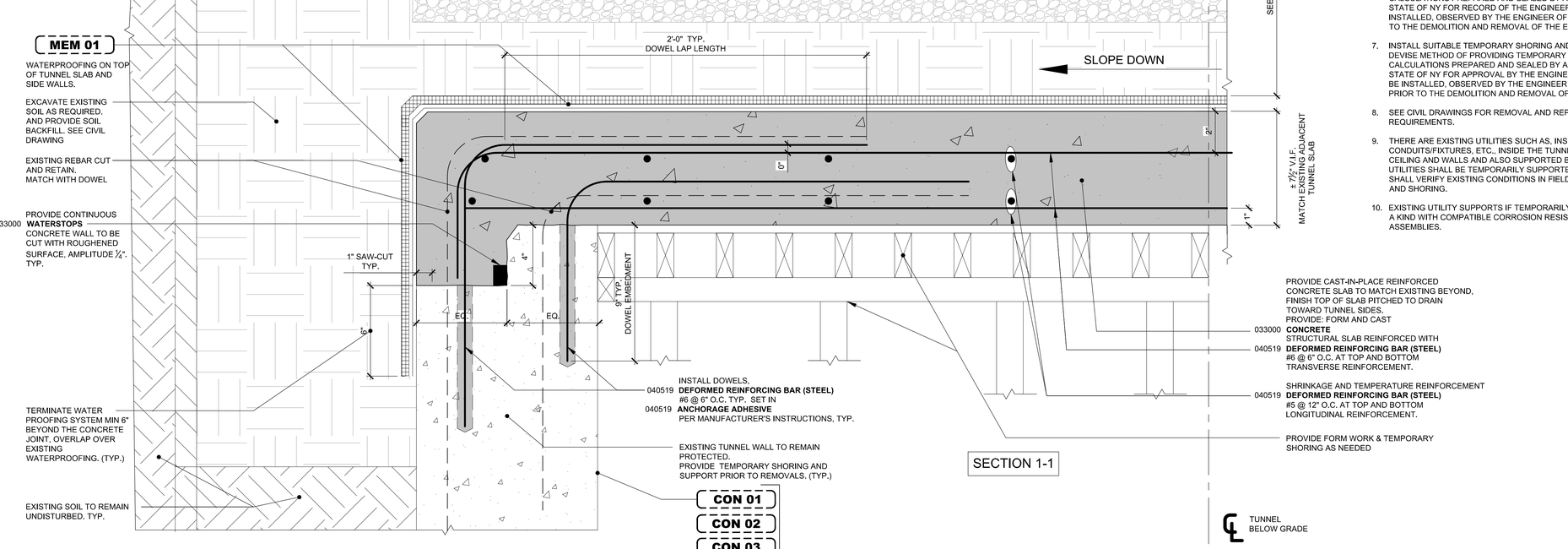
KEY PLAN: SCHEMATIC PARTIAL PLAN

NTS



KEY SECTION 1-1

NTS



BASIC ASSEMBLY

3" = 1'

0" 3" 6" 12"

NOTES:

1. UNIT OF MEASURE AND PAYMENT FOR THIS DETAIL SHALL BE THE SIZE OF TUNNEL ROOF SLAB OPENING MEASURED IN SQUARE FOOT. SEE PLANS FOR DEM 0# DETAIL.
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DOB NOW JOB NO.
Q00984460-I1
DOB APPROVAL STAMPS

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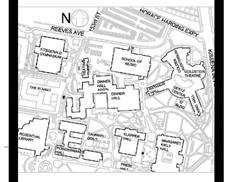
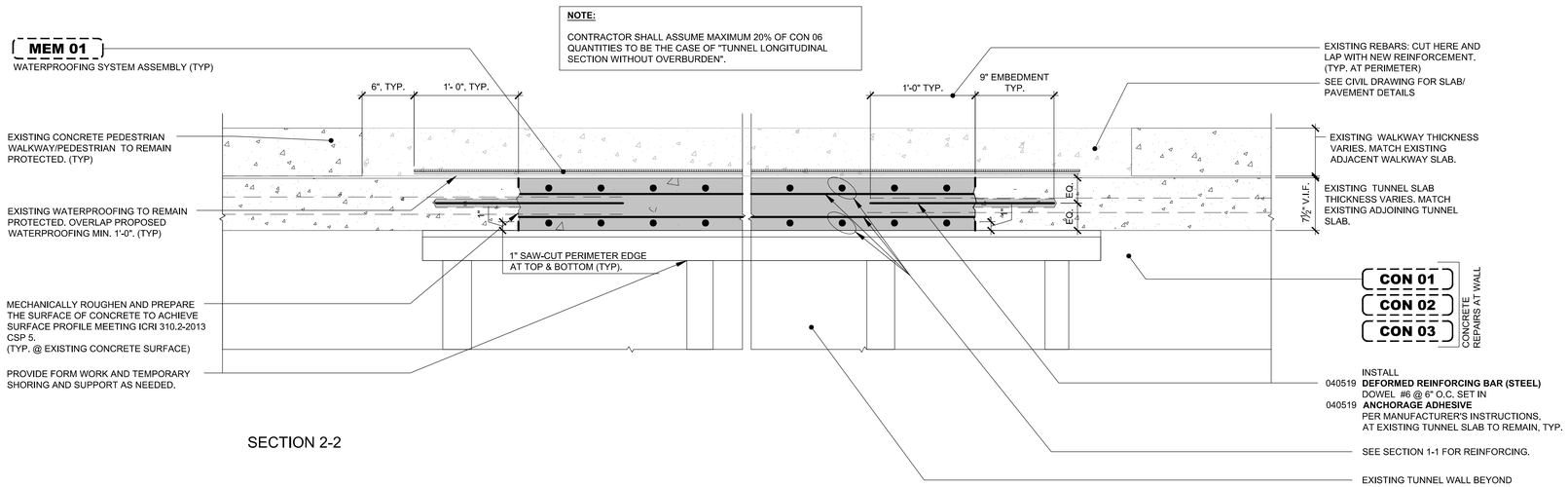
Project Key

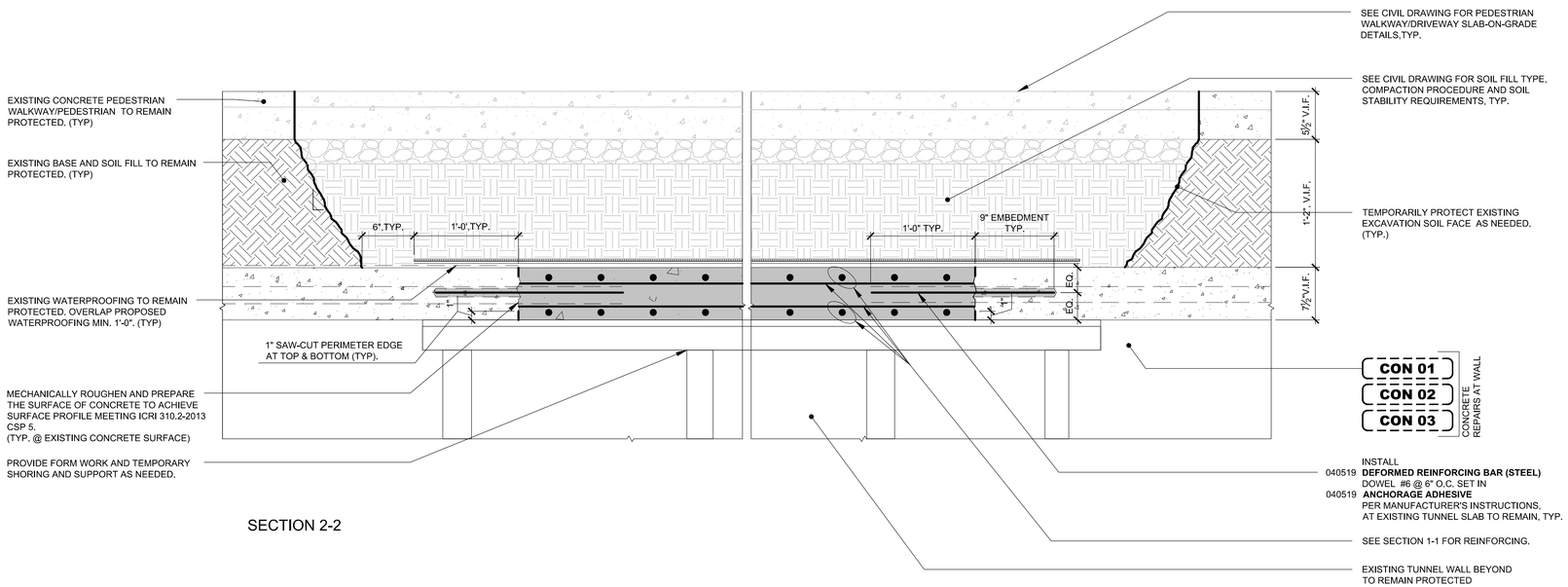

N
QUEENS BLVD
HOWARD HANLON DRIVE
KISSENA BLVD
ROOSEVELT AVE
MAIN ENTRANCE
KISSENA BLVD ENTRANCE
GOLDSTEIN COLLEGE OF NURSING
KISSENA HALL
DELTA HALL
THE QUAD
DINNER HALL
SCIENCE BUILDING
ROOSEVELT HALL
KNIGHT HALL
KLAPPER HALL
FRANCIS LEWIS HALL
ROOSEVELT AVE ENTRANCE
PARKING LOT
PARKING LOT
PARKING LOT



SECTION 2-2

TUNNEL LONGITUDINAL SECTION WITHOUT OVERBURDEN

1-1/2" = 1'
0" 6" 12"



SECTION 2-2

TUNNEL LONGITUDINAL SECTION WITH OVERBURDEN

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CON 06
(2 OF 2)

TUNNEL ROOF STRUCTURAL SLAB REPLACEMENT 10' SPAN FLAT CEILING (SF)

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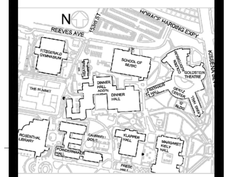
Project Key



REVISIONS

Rev No	Description	Date:
	ISSUED FOR PRICING ONLY NOT FOR CONSTRUCTION	07/09/2025
	ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION-REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client

QUEENS COLLEGE THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title

STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title

RESTORATION DETAILS: CON 06 (2 OF 2)

Phase

100% SUBMISSION

Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

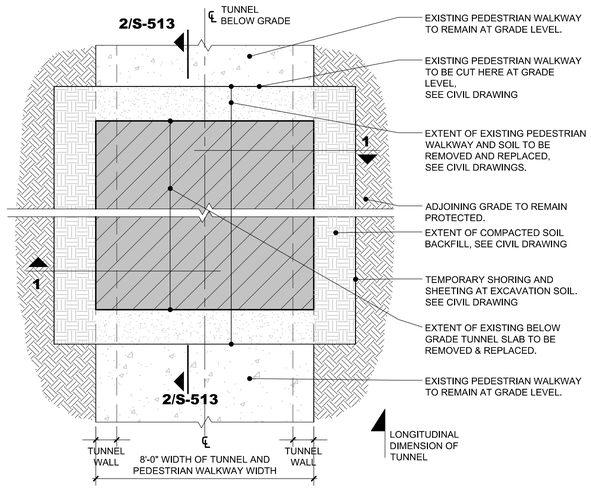
DASNY Project No: 2881309999

Drawing Number: S-511

Drawing 024 of 039

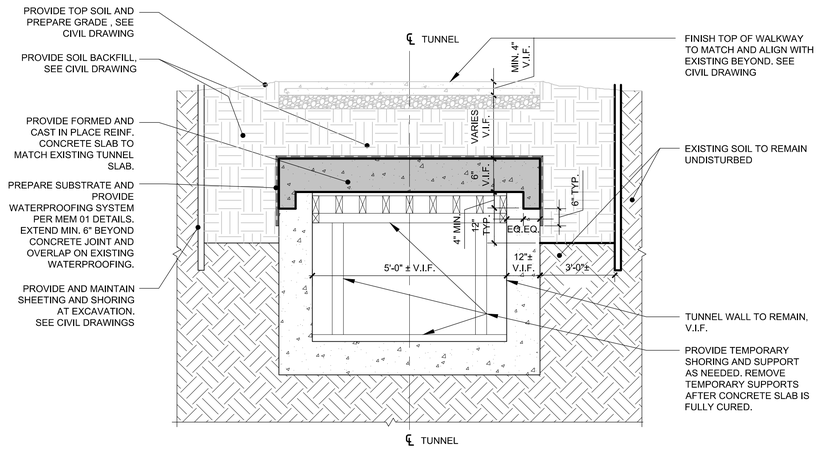
DOB NOW JOB NO.
Q00984460-I1

DOB APPROVAL STAMPS



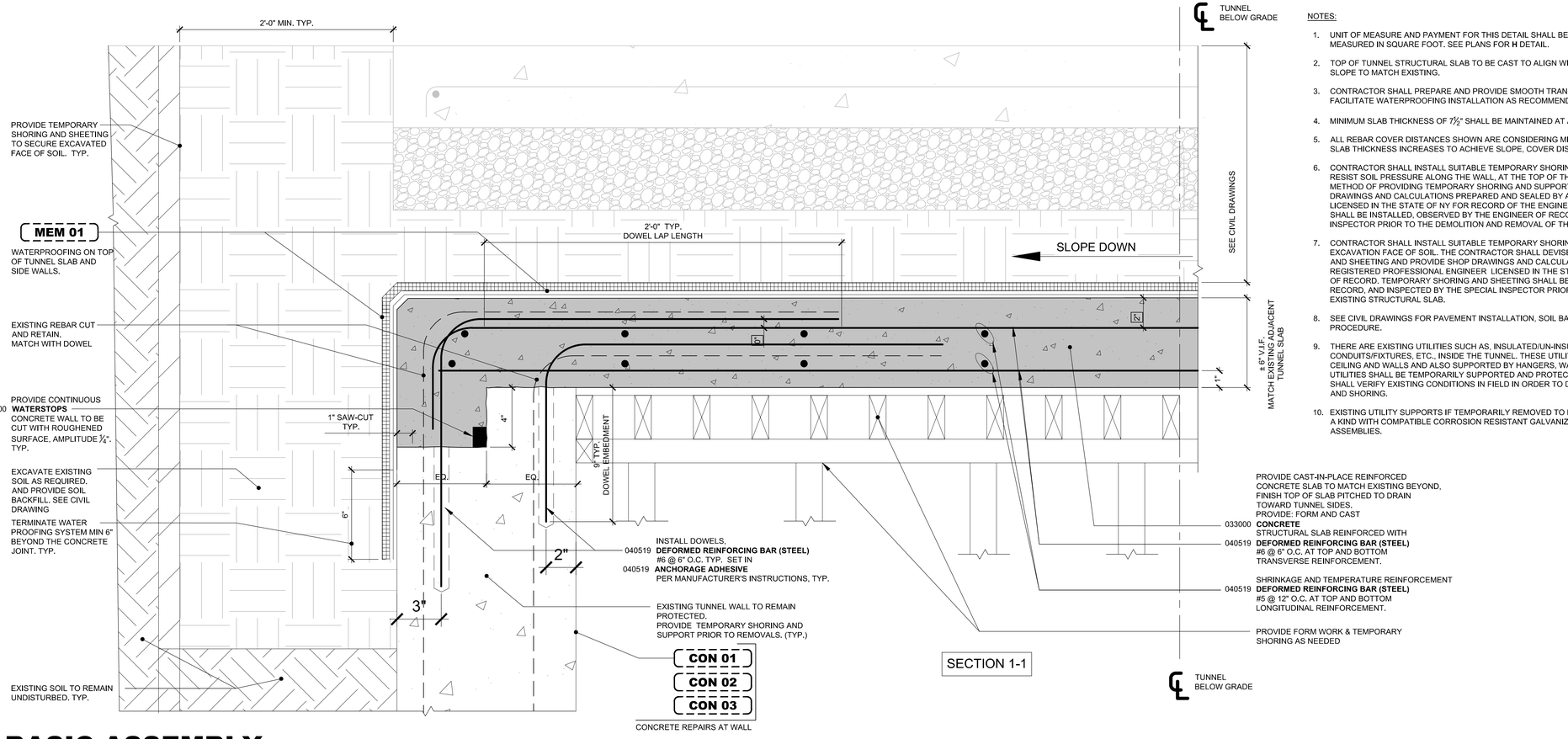
KEY PLAN: SCHEMATIC PARTIAL PLAN

NTS



KEY SECTION

NTS



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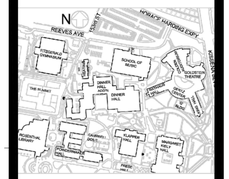
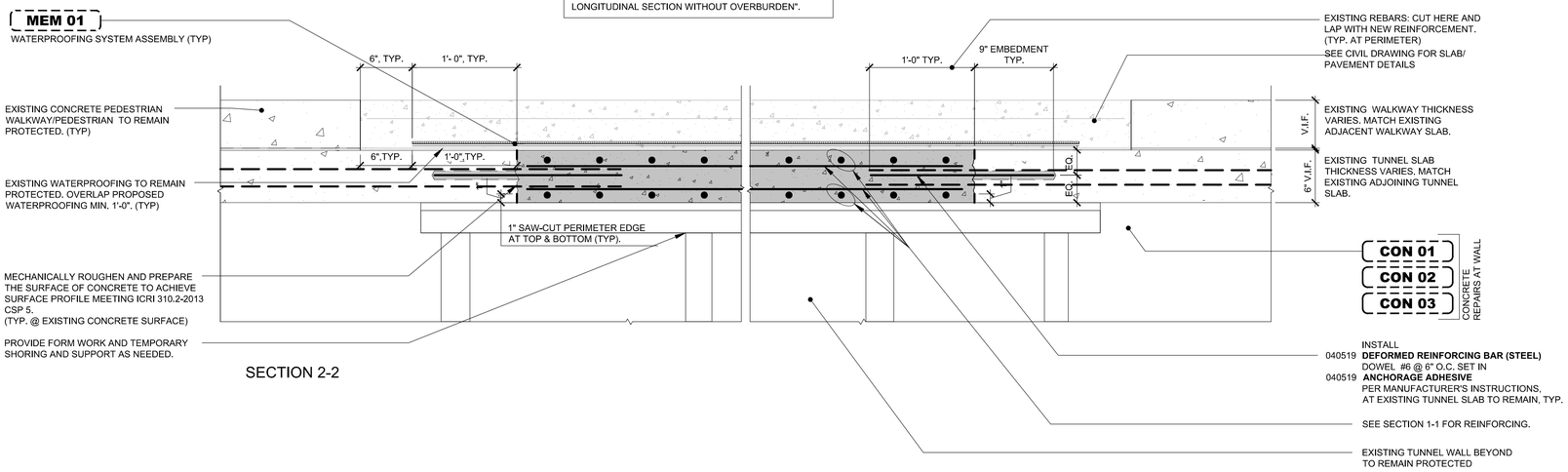
Project Key


N
REEVES AVE
KISSENA BLVD
PARKING LOT
PARKING LOT
PARKING LOT

NOTE:

CONTRACTOR SHALL ASSUME MAXIMUM 20% OF CON 07 QUANTITIES TO BE THE CASE OF "TUNNEL LONGITUDINAL SECTION WITHOUT OVERBURDEN".

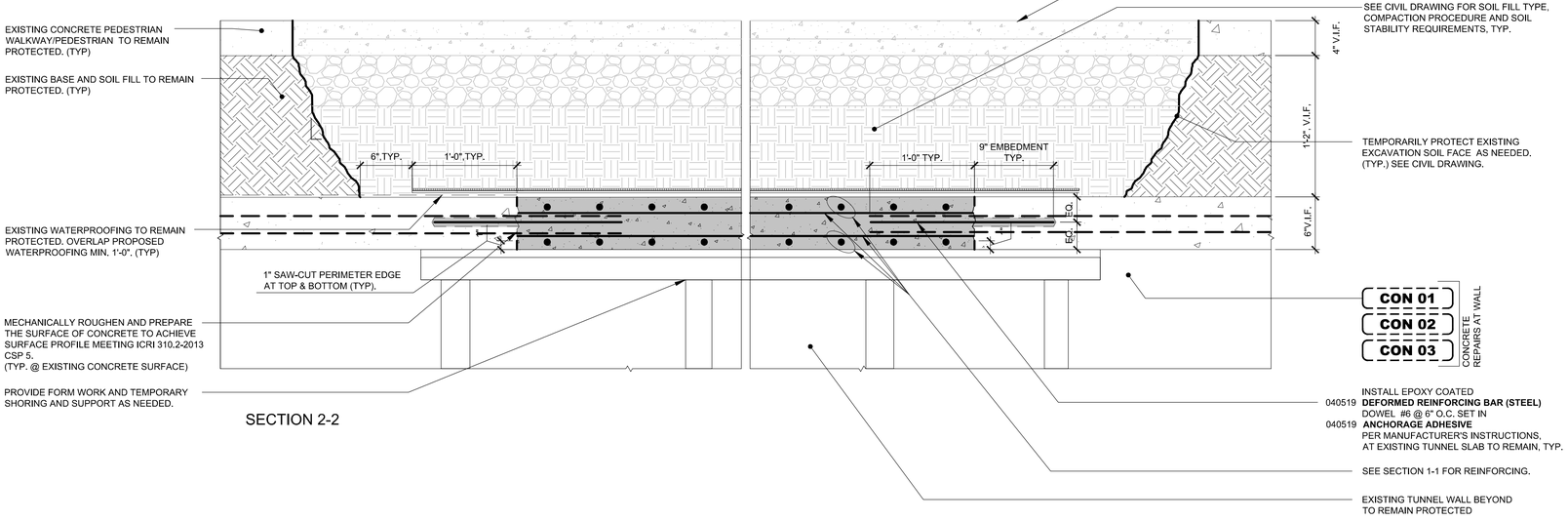


SECTION 2-2

TUNNEL LONGITUDINAL SECTION WITHOUT OVERBURDEN

1-1/2" = 1'

0" 6" 12"



SECTION 2-2

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CON 07
(2 OF 2)

TUNNEL ROOF STRUCTURAL SLAB REPLACEMENT 8' SPAN FLAT CEILING (SF)

NEW YORK STATE OF OPPORTUNITY | DASNY

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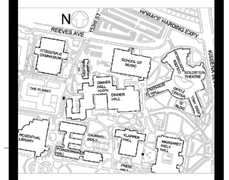

REVISIONS

Rev No	Description	Date:
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	90% SUBMISSION	01/20/2021

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The City University of New York | QUEENS COLLEGE THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title

STEAM TUNNEL RESTORATION
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FLUSHING, NY, 11367

DOB NOW JOB NO.
Q00984460-I1

DOB APPROVAL STAMPS

Drawing Title

RESTORATION DETAILS: CON 07 (2 OF 2)

Phase

100% SUBMISSION

Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

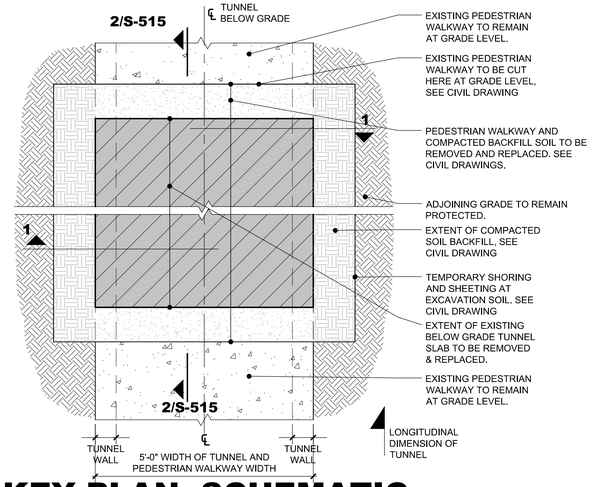
Seal & Signature

DASNY Project No: 2881309999

Drawing Number

S-513

Drawing 026 *of* 039



KEY PLAN: SCHEMATIC PARTIAL PLAN

NTS

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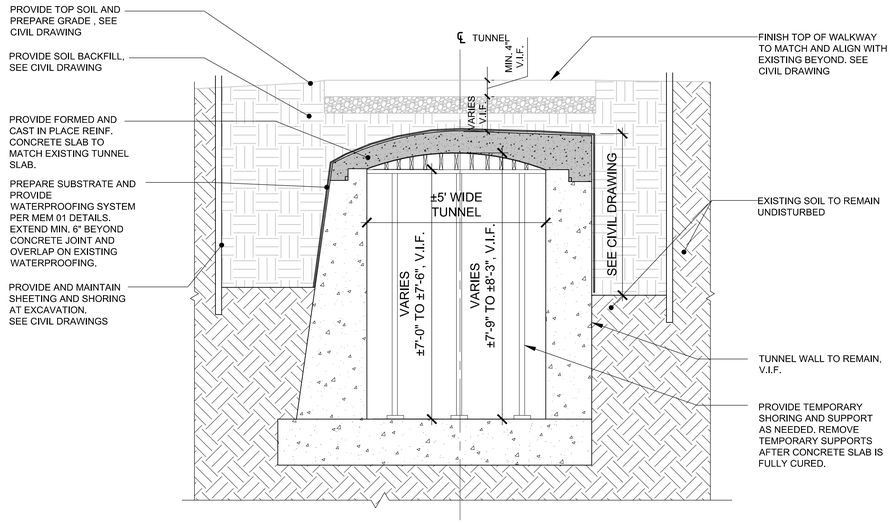
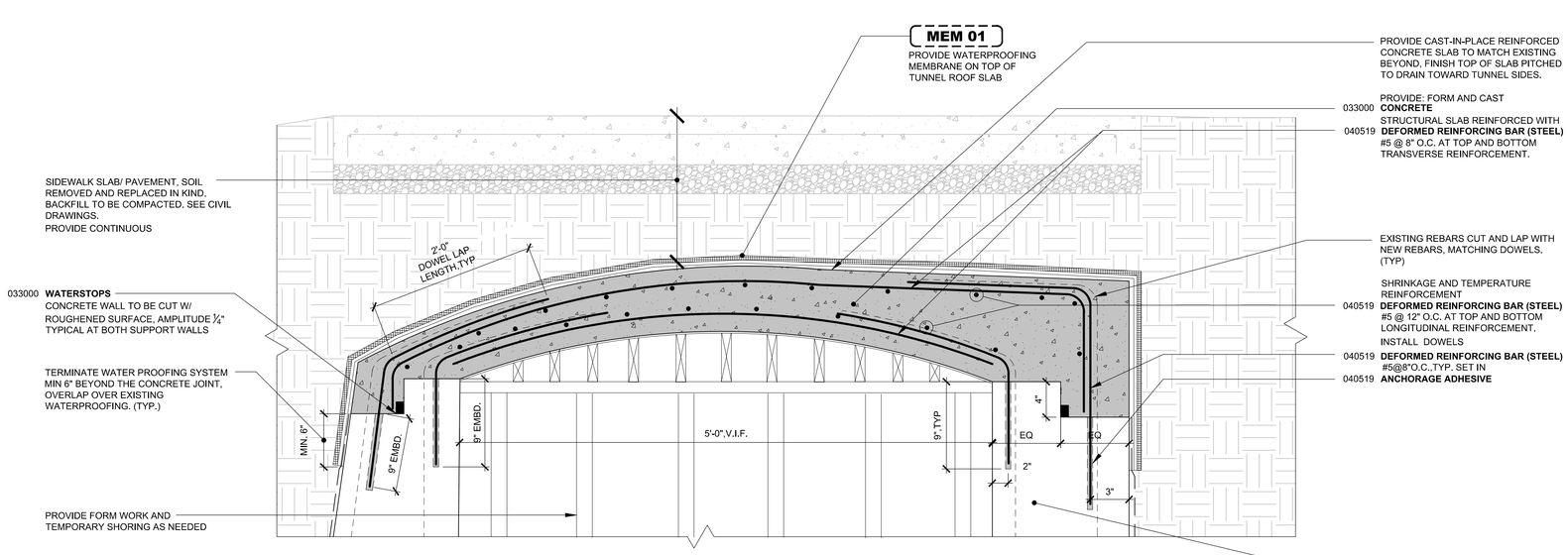
9. THERE ARE EXISTING UTILITIES SUCH AS, INSULATED/UN-INSULATED PIPING , ELECTRICAL CONDUITS/FIXTURES, ETC., INSIDE THE TUNNEL. THESE UTILITIES ARE DIRECTLY MOUNTED TO TUNNEL CEILING AND WALLS AND ALSO SUPPORTED BY HANGERS, WALL MOUNTED BRACKETS AND CLAMPS. THE UTILITIES SHALL BE TEMPORARILY SUPPORTED AND PROTECTED DURING CONSTRUCTION. CONTRACTOR SHALL VERIFY EXISTING CONDITIONS IN FIELD IN ORDER TO DESIGN AND INSTALL TEMPORARY SUPPORTS AND SHORING.
10. EXISTING UTILITY SUPPORTS IF TEMPORARILY REMOVED TO FACILITATE THE WORK, SHALL BE REPLACED IN A KIND WITH COMPATIBLE CORROSION RESISTANT GALVANIZED/STAINLESS STEEL SUPPORTS/BRACKET ASSEMBLIES.



KEY SECTION

NTS



SECTION 1-1

BASIC ASSEMBLY

1-1/2" = 1'

0" 6" 12"

CON 08
(1 OF 2)

TUNNEL ROOF STRUCTURAL SLAB REPLACEMENT 5' SPAN ARCH CEILNG (SF)

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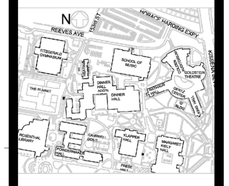
Project Key



REVISIONS

Rev.No	Description	Date:
	ISSUED FOR PRICING ONLY NOT FOR CONSTRUCTION	07/09/2025
	ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION-REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client

CUNY The City University of New York — QUEENS COLLEGE, THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title

STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

DOB NOW JOB NO.
Q00984460-I1

DOB APPROVAL STAMPS

Drawing Title

RESTORATION DETAILS: CON 08 (1 OF 2)

Phase

100% SUBMISSION

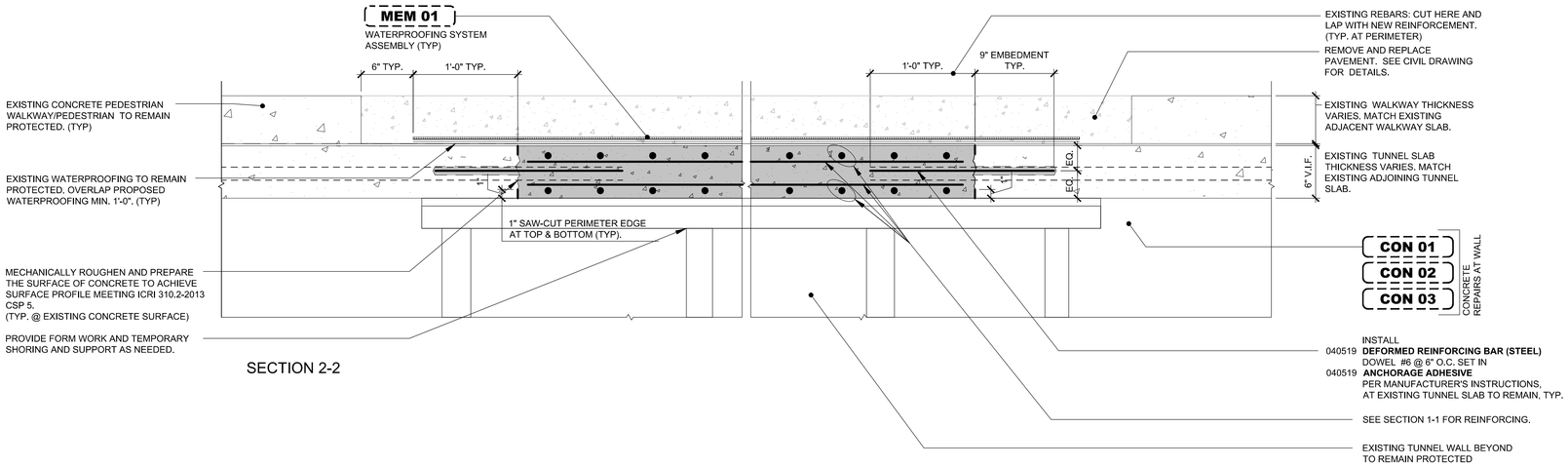
Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

DASNY Project No: 2881309999

Drawing Number S-514

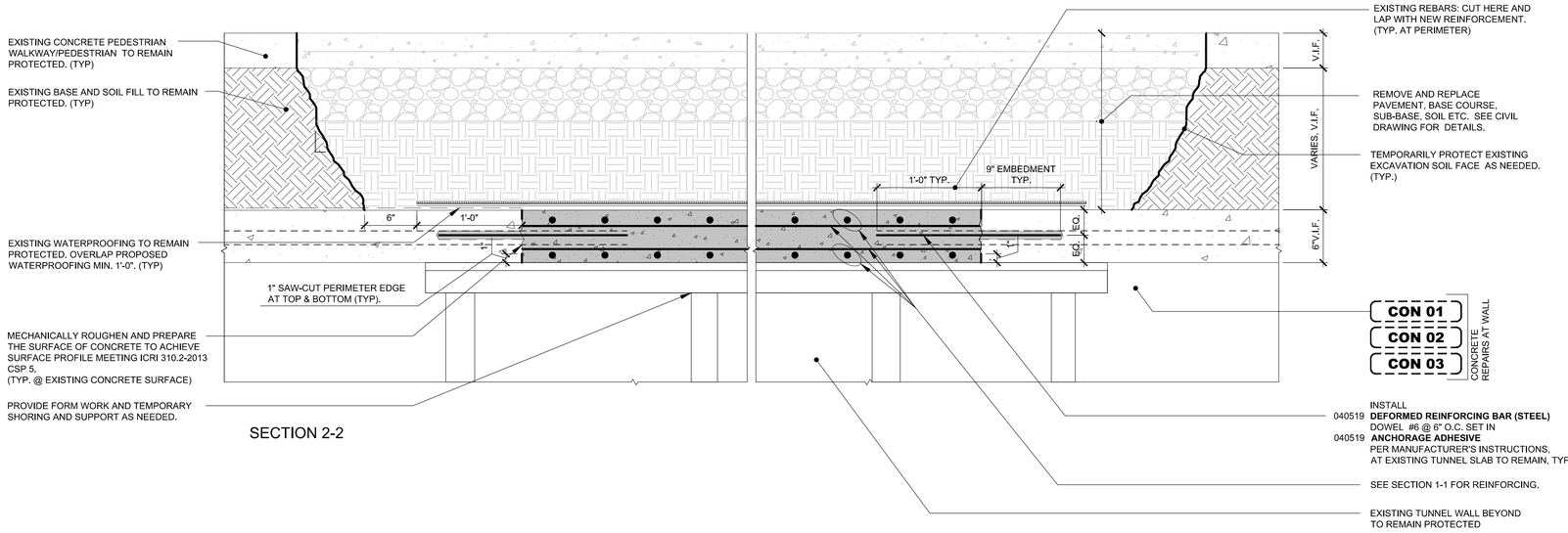
Drawing 027 of 039



SECTION 2-2

TUNNEL LONGITUDINAL SECTION WITHOUT OVERBURDEN

1-1/2" = 1'
0" 6" 12"



SECTION 2-2

TUNNEL LONGITUDINAL SECTION WITH OVERBURDEN

1-1/2" = 1'
0" 6" 12"

CON 08
(2 OF 2)

TUNNEL ROOF STRUCTURAL SLAB REPLACEMENT 5' SPAN ARCH CEILING (SF)

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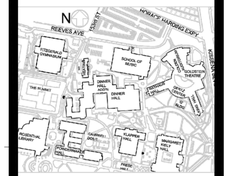

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GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

DOB NOW JOB NO.
Q00984460-I1

DOB APPROVAL STAMPS

Drawing Title

RESTORATION DETAILS: CON 08 (2 OF 2)

Phase

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AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

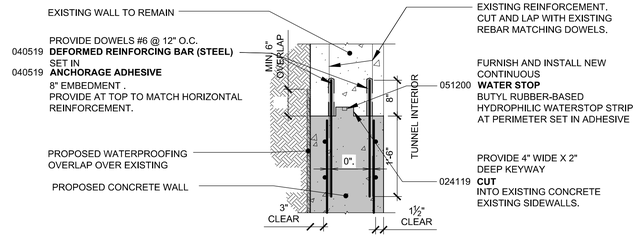
DASNY Project No: 2881309999

Drawing Number S-515

Drawing 028 *of* 039

NOTES:

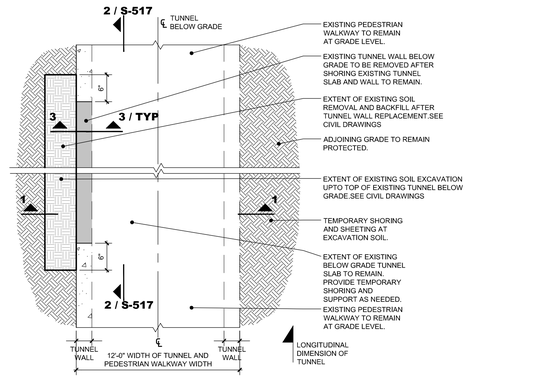
1. UNIT OF MEASURE AND PAYMENT FOR THIS DETAIL SHALL BE THE SIZE OF TUNNEL WALL FULL-HEIGHT OPENING MEASURED IN LINEAR FOOT OF WALL LENGTH. SEE PLAN FOR DEMO DETAIL.
2. TOP OF TUNNEL STRUCTURAL SLAB TO BE CAST TO ALIGN WITH TOP OF EXISTING ADJOINING AND WITH A SLOPE TO MATCH EXISTING.
3. PREPARE AND PROVIDE SMOOTH TRANSITION FROM EXISTING SLAB TO NEW SLAB TO FACILITATE WATERPROOFING INSTALLATION AS RECOMMENDED BY WATERPROOFING MANUFACTURER.
4. PROVIDE TEMPORARY LATERAL BRACING, SHORING AND SUPPORTS FOR THE EXISTING TUNNEL WALL AND TUNNEL ROOF SLAB TO REMAIN, PRIOR TO REMOVING THE TUNNEL STRUCTURAL WALL. SHORING SHALL NOT BLOCK TRAVEL AND ADEQUATE MEANS OF EGRESS SHALL BE MAINTAINED IN THE TUNNEL AT ALL TIMES, OR SUITABLE ALTERNATE MEANS OF EGRESS SHALL BE PROVIDED.
5. PROVIDE SHOP- DRAWINGS FOR THE TEMPORARY BRACING, SHORING & SUPPORTS DESIGNED TO RESIST ALL LOADS IMPOSED ON THE TUNNEL WALLS AND ROOF SLAB, WHILE THE STRUCTURAL WALL OF THE TUNNEL IS REMOVED, THE SHORING SHOP- DRAWINGS SHALL DEPICT SHORING ADEQUATELY DESIGNED TO RESIST ALL LOADS IMPOSED ON THE TUNNEL WALLS AND ROOF SLAB ONCE THE STRUCTURAL WALL IS REMOVED. THE TEMPORARY BRACING, SHORING AND SUPPORT SHOP- DRAWINGS SHALL BE SIGNED AND SEALED BY A NYS REGISTERED LICENSED PROFESSIONAL ENGINEER. TEMPORARY LATERAL BRACING SHALL BE INSTALLED, OBSERVED BY THE ENGINEER OF RECORD, AND INSPECTED BY THE SPECIAL INSPECTOR PRIOR TO THE DEMOLITION AND REMOVAL OF THE EXISTING STRUCTURAL SLAB.
6. WHERE THE TUNNEL WALL AND ROOF SLAB BOTH ARE NOTED TO BE REMOVED AT SAME LOCATION , STRUCTURAL ROOF SLAB SLAB SHALL BE COMPLETED IN AFFECTED AREAS PRIOR TO COMMENCING TUNNEL WALL DEMOLITION. ALL REMOVALS SHALL START ONLY AFTER INSTALLATION OF TEMPORARY BRACING, SHORING AND SUPPORTS.
7. INSTALL SUITABLE TEMPORARY SHORING AND SHEETING TO PROTECT THE EXCAVATION FACE OF SOIL. PROVIDE SHOP DRAWINGS AND CALCULATIONS PREPARED AND SEALED BY A REGISTERED PROFESSIONAL ENGINEER LICENSED IN THE STATE OF NY. LATERAL BRACING SHALL BE INSTALLED, OBSERVED BY THE ENGINEER OF RECORD, AND INSPECTED BY THE SPECIAL INSPECTOR PRIOR TO THE DEMOLITION AND REMOVAL OF THE EXISTING STRUCTURAL SLAB.
5. REMOVE EXISTING STRUCTURAL WALL ONLY AFTER COMPLETING ENTIRE SCOPE OF EXCAVATION IN AFFECTED AREAS.
6. CONCRETE SHALL BE FULLY CURED PRIOR TO REMOVAL OF TEMPORARY SHORING, SUPPORTS OR PLACING BACKFILL.
7. PRIOR TO REMOVALS, TEMPORARILY PROTECT AND ADJUST PIPING AND CONDUITS AND INSTALL TEMPORARY PIPING AND CONDUIT SUPPORTS AS NEEDED, AFTER REINSTALLATION OF ROOF SLAB AND/OR WALL, REINSTALL PERMANENT SUPPORTS, WITH CORROSION RESISTANT ASSEMBLY TO MATCH EXISTING.
8. SEE CIVIL DRAWINGS FOR REMOVAL AND REPLACEMENT OF PAVEMENT SOIL, BACKFILL AND COMPACTION REQUIREMENTS.



SECTION 3-3

SECTION AT WALL SIDES

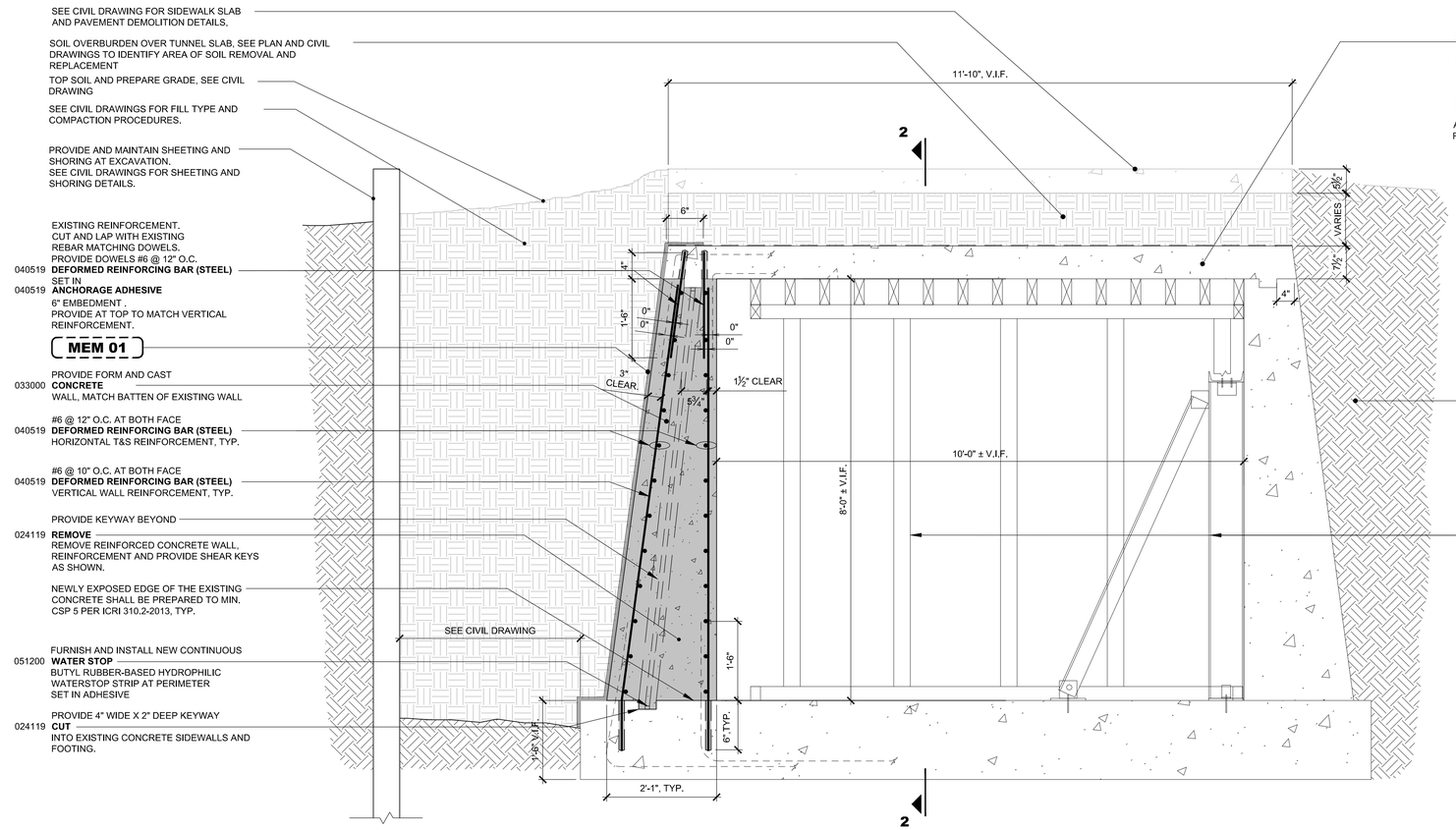
NOT TO SCALE



KEY PLAN: SCHEMATIC PARTIAL PLAN

EXISTING TUNNEL: AT AREA OF WORK

12" = 1'
0" 1" 2"



SECTION 1-1

BASIC ASSEMBLY

3/4" = 1'
0" 6" 1' 2' 3'

CON 09 (1 OF 2) TUNNEL WALL REPLACEMENT (SF)

DOB NOW JOB NO.
Q00984460-I1
DOB APPROVAL STAMPS

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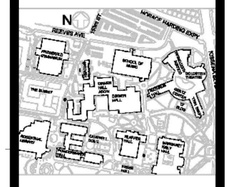

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Client
CUNY The City University of New York
QUEENS COLLEGE
THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title
STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title
RESTORATION DETAILS: CON 09 (1 OF 2)

Phase
100% SUBMISSION

Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

DASNY Project No.
2881309999

Drawing Number
S-516

Drawing
029 of 039

STEP 1: CUTTING AND REMOVAL OF DETERIORATED CONCRETE

a. PROVIDE SHORING AND SUPPORT SYSTEM FOR BEAMS TO BE REPAIRED, BEFORE REMOVING CONCRETE ENCASEMENT

b. SHORING AND SUPPORT SYSTEM SHALL BE DESIGNED BY NY REGISTERED PROFESSIONAL ENGINEER

c. REMOVE ALL LOOSE MATERIAL

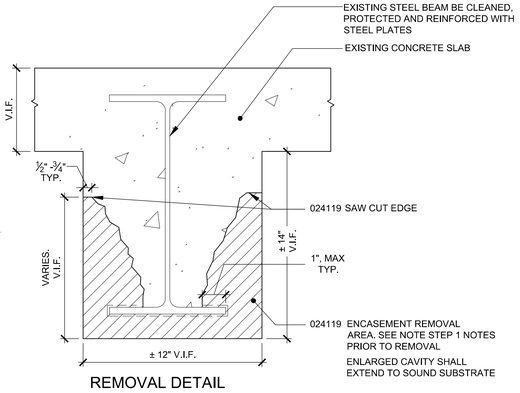
d. EXTENT OF DEMOLITION FOR CONCRETE ENCASEMENT CAN VARY BASED ON CONCRETE AND STEEL DETERIORATION AREAS. ALL EXTENT OF REMOVAL SHALL BE VERIFIED BY THE ENGINEER OF RECORD.

e. CREATE AN ENLARGED CAVITY BY PROVIDING A SAW CUT EDGE ¼" TO ½" IN DEPTH.

f. ENLARGED CAVITY TO BE RECTILINEAR, WITH EDGES PARALLEL TO EDGES OF EXISTING ADJACENT STRUCTURE.

g. REMOVE DETERIORATED CONCRETE IN ACCORDANCE WITH SPECIFICATION SECTION 024119.

h. SCRAPE AND PAINT EXPOSED STEEL SURFACES AS PER **COA 01**



REMOVAL DETAIL

STEP 2: STRUCTURAL REPAIR MORTAR INSTALLATION & FILL PATCH

a. FORM AND PUMP OR POUR STRUCTURAL REPAIR MORTAR THROUGH POUR SPOUTS.

b. LEAVE FORMS IN PLACE THE REPAIR MORTAR IS FULLY CURED (MINIMUM 72 HOURS).

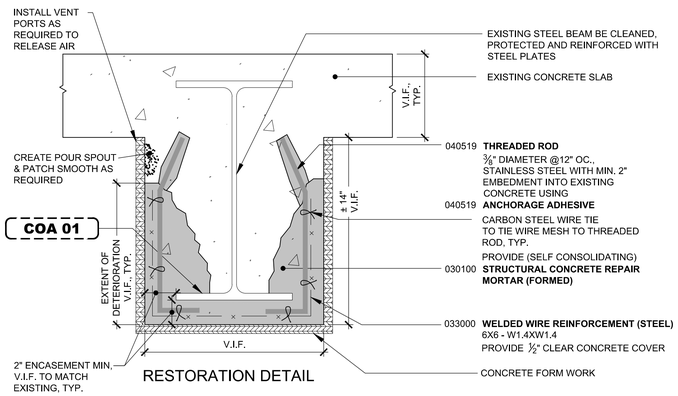
c. AFTER CONCRETE IS CURED (MIN, 72 HOURS), REMOVE FORM-WORK.

d. SATURATE CONCRETE SURFACES, APPLY BONDING AGENT, INSTALL REPAIR MORTAR IN LIFTS.

e. AT COMPLETION OF INSTALLATION, SURFACE OF REPAIR MORTAR SHALL MATCH PROFILE OF ADJACENT CONCRETE SURFACES. FINISH THE SURFACE SMOOTH. AVOID FEATHERING WITH ADJACENT SURFACE TO REMAIN.

f. CONTINUE CURING AS PER MANUFACTURERS RECOMMENDATIONS.

g. AFTER REPAIR MORTAR IS FULLY CURED PER MANUFACTURER'S RECOMMENDATIONS, APPLY FINISH COATING MATCHING WITH ADJOINING SURFACES.

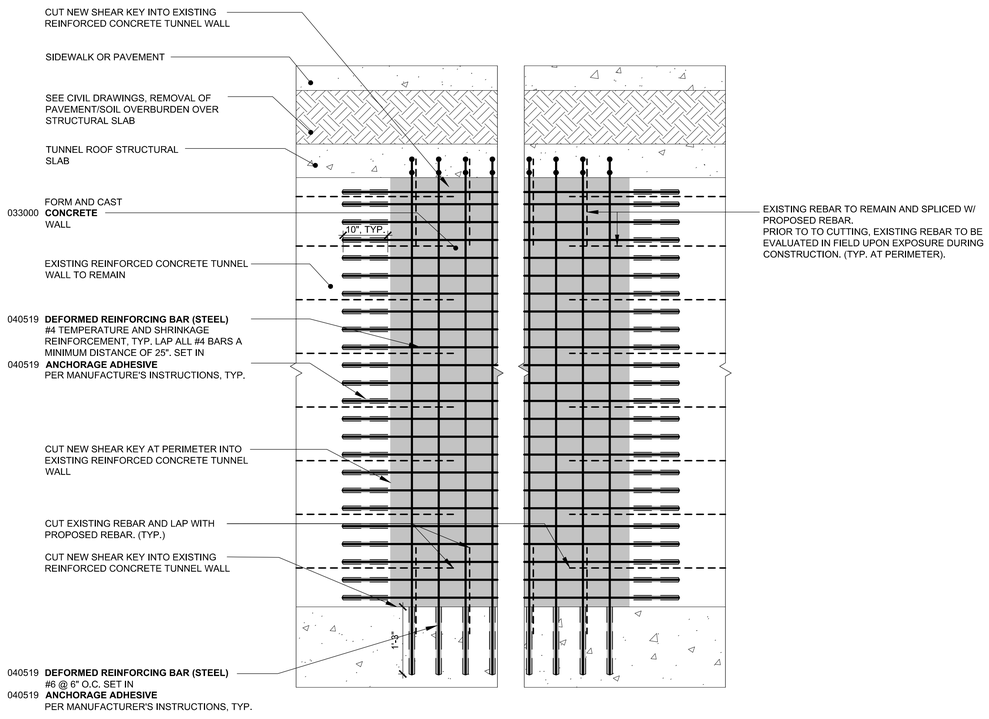


RESTORATION DETAIL

NOTE: CONTRACTOR TO USE THIS REPAIR DETAIL AS QUANTITY ALLOWANCE. ALL QUANTITY TO BE VERIFIED IN THE FIELD BY EOR.

3" = 1'
0" 3" 6" 12"

CON 11 CONCRETE ENCASEMENT REPAIR AT STEEL BEAM (LF)



SECTION 2-2

CON 09 (2 OF 2) TUNNEL WALL REPLACEMENT (SF)

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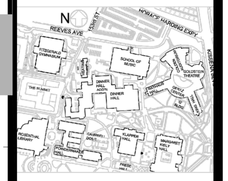

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65-30 KISSENA BLVD.
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DOB NOW JOB NO.
Q00984460-I1
DOB APPROVAL STAMPS

Drawing Title
RESTORATION DETAILS: CON 09 (2 OF 2), CON 11

Phase
100% SUBMISSION

Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

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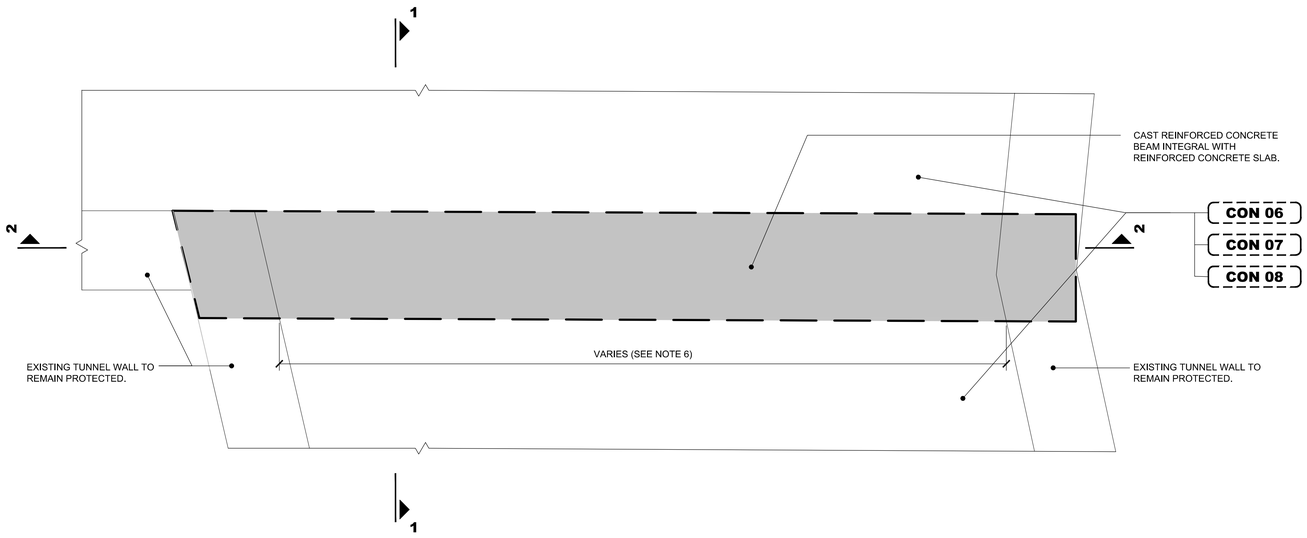
DASNY Project No:
2881309999

Drawing Number
S-517

Drawing
030 of 039



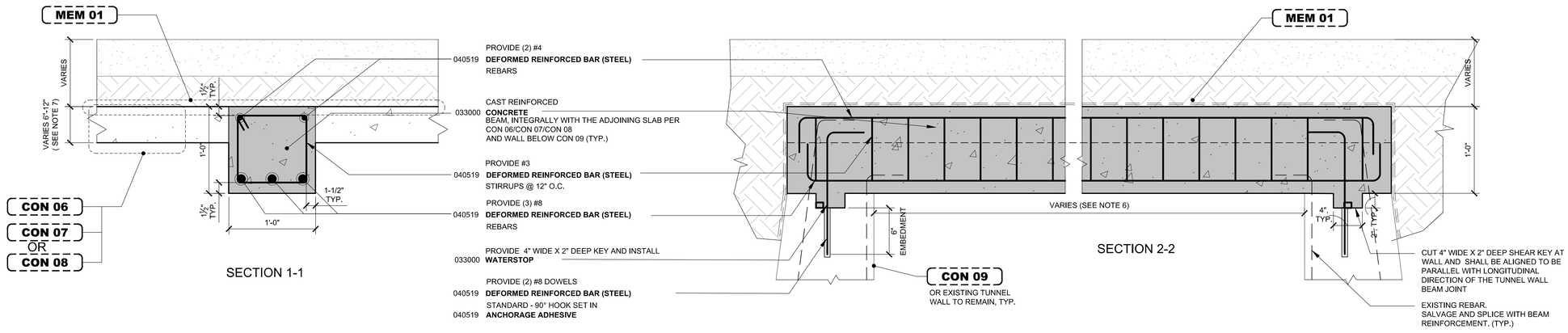
PARTIAL PLAN

1-1/2" = 1'

0" 6" 12"

NOTES:

1. CONTRACTOR SHALL NOT REMOVE EXISTING STRUCTURAL ROOF SLAB PRIOR TO THE COMPLETION OF EXCAVATION IN AFFECTED AREAS. SEE PLAN FOR DEM ## DETAIL.
2. THE CONTRACTOR SHALL INSTALL SUITABLE LATERAL BRACING FOR THE EXISTING TUNNEL WALL TO RESIST THE IMPOSED LATERAL LOADS FROM SOIL TO REMAIN PRIOR TO REMOVING THE TUNNEL STRUCTURAL ROOF SLAB. ADEQUATE MEANS OF EGRESS SHALL BE MAINTAINED IN THE TUNNEL AT ALL TIMES. SHORING SHALL NOT BLOCK TRAVEL OR SUITABLE ALTERNATE MEANS OF EGRESS SHALL BE PROVIDED.
3. THE CONTRACTOR SHALL ADJUST PIPING AND CONDUITS AND INSTALL TEMPORARY PIPING AND CONDUIT SUPPORTS AS DETAILED IN THE MECHANICAL DRAWING SET.
4. CONTRACTOR SHALL INSTALL STRUCTURAL ROOF SLAB PRIOR TO PLACING FILL.
5. THE CONTRACTOR SHALL PROVIDE LONG-TERM PIPING AND CONDUIT SUPPORTS AS INDICATED IN THE MECHANICAL DRAWING SET AFTER THE REPLACEMENT OF ROOF SLAB AND BEAM INSTALLATION.
6. BEAM SPAN LENGTH VARIES BASED ON LOCATION TO MATCH SPAN BETWEEN BEARING POINTS ON TUNNEL WALLS. BEAM CLEAR SPANS NOT TO EXCEED 8'-2" AT ANY LOCATION.
7. DEPTH SHALL BE AS INDICATED TO MATCH DETAILS CON 06, CON 07 OR CON 08 AS APPROPRIATE. SLAB DEPTH MAY VARY ON OPPOSITE SIDES OF REINFORCED CONCRETE BEAM.
8. TUNNEL WALL LAYOUT SHOWN IS NOT TYPICAL OF ALL LOCATIONS. SEE STEAM TUNNEL PARTIAL PLANS SHEETS-102 TO S-109 FOR TUNNEL WALL ORIENTATION.



BASIC ASSEMBLY

1-1/2" = 1'

0" 6" 12"

CON 10 REINFORCED CONCRETE BEAM (LF)

DOB NOW JOB NO.
Q00984460-I1
DOB APPROVAL STAMPS

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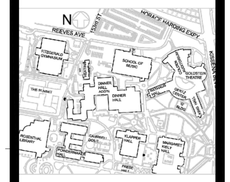

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65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title

STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title

RESTORATION DETAILS: CON 10

Phase

100% SUBMISSION

Drawn By:	Checked By:	Date:
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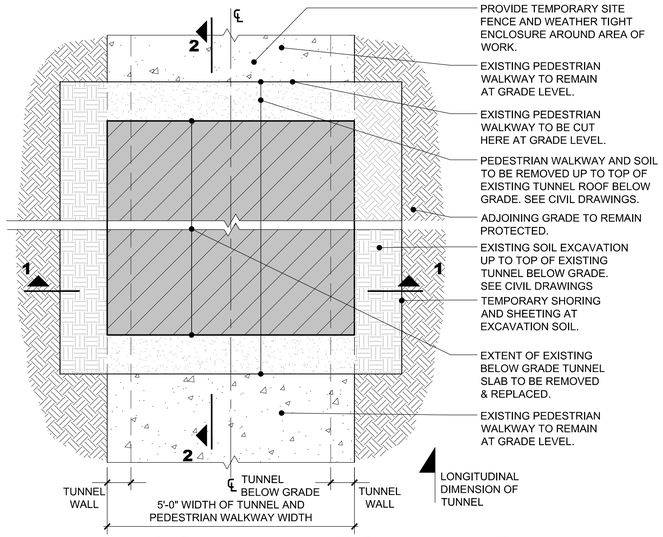
Seal & Signature

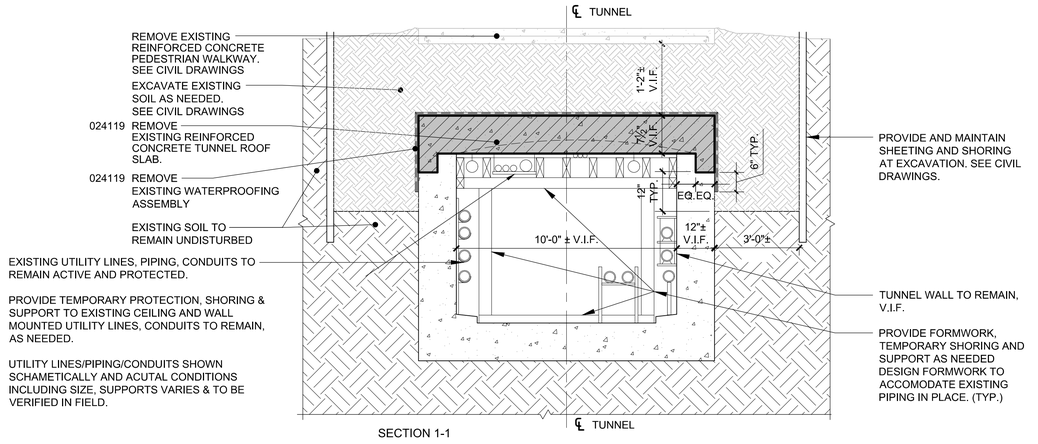
DASNY Project No: 2881309999

Drawing Number S-518

Drawing 031 *of* 039

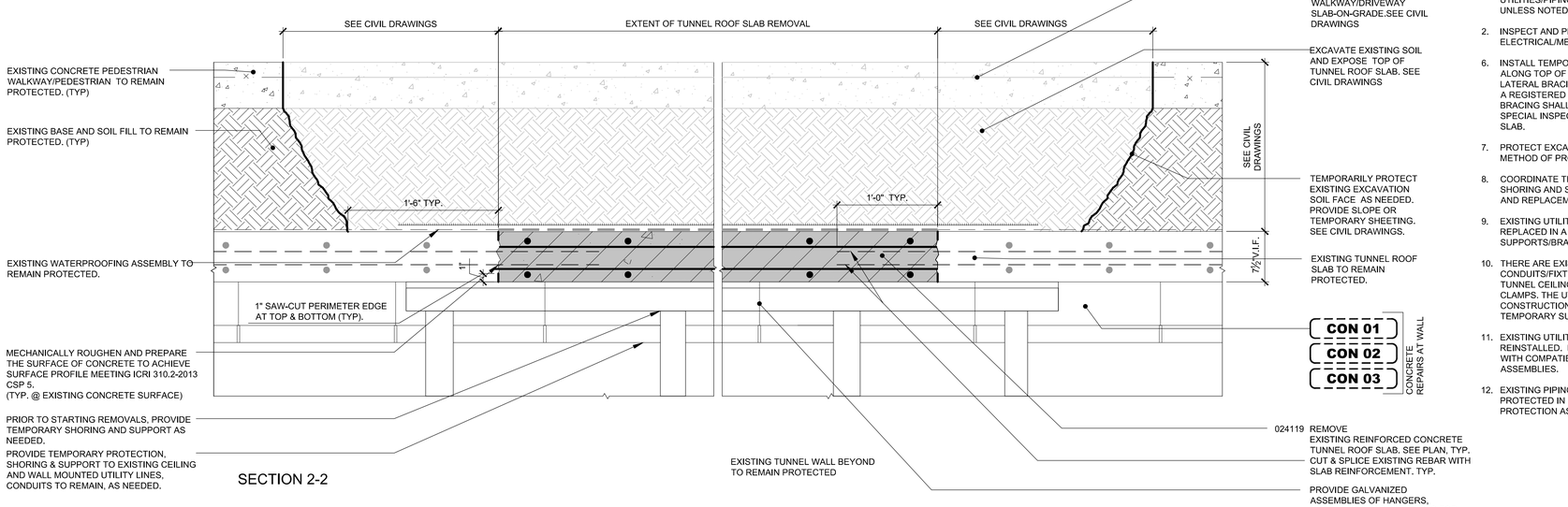


KEY PLAN: SCHEMATIC PARTIAL PLAN NTS



SECTION 1-1

KEY SECTION NTS



SECTION 2-2

TUNNEL LONGITUDINAL SECTION WITH OVERBURDEN

1-1/2" = 1'
0" 6" 12"

NOTES:

1. ACTUAL UTILITY CONDITIONS VARY AND SHOULD BE VERIFIED IN FIELD, IT IS SHOWN SCHEMATICALLY ONLY. ALL EXISTING, CEILING AND WALL MOUNTED, MEP/HVAC/STEAM UTILITIES/PIPING/CONDUITS IN TUNNEL SHALL REMAIN ACTIVE IN SERVICE DURING THE WORK, UNLESS NOTED OTHERWISE.
2. INSPECT AND PROVIDE ALL NECESSARY TEMPORARY SHORING/SUPPORTS OF UTILITIES ELECTRICAL/MECHANICAL/HVAC/PLUMBING PIPING/CONDUITS IN TUNNEL, PRIOR TO REMOVALS.
6. INSTALL TEMPORARY SHORING AND SUPPORTS WITH LATERAL BRACING TO RESIST SOIL PRESSURE ALONG TOP OF WALL. DEVISE METHOD OF PROVIDING TEMPORARY SHORING AND SUPPORT, LATERAL BRACING, AND PROVIDE SHOP DRAWINGS AND CALCULATIONS PREPARED AND SEALED BY A REGISTERED PROFESSIONAL ENGINEER LICENSED IN THE STATE OF NY. TEMPORARY LATERAL BRACING SHALL BE INSTALLED, OBSERVED BY THE ENGINEER OF RECORD, AND INSPECTED BY THE SPECIAL INSPECTOR PRIOR TO THE DEMOLITION AND REMOVAL OF THE EXISTING STRUCTURAL SLAB.
7. PROTECT EXCAVATION FACE OF SOIL, INSTALL TEMPORARY SHORING AND SHEETING, DEVISE METHOD OF PROVIDING TEMPORARY SHORING AND SHEETING NEEDED.
8. COORDINATE THE SCOPE OF WORK WITH CIVIL DRAWINGS. SEE CIVIL DRAWINGS FOR TEMPORARY SHORING AND SHEETING REQUIRED AT EXCAVATION TO PROTECT FACE OF SOIL, FOR REMOVAL AND REPLACEMENT OF PAVEMENT SOIL, BACKFILL AND COMPACTION REQUIREMENTS.
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12. EXISTING PIPING INSULATION IS AN ASBESTOS CONTAINING MATERIAL AND IT SHALL BE PROTECTED IN PLACE. IT SHALL NOT BE DAMAGED OR DISTURBED. PROVIDE TEMPORARY PROTECTION AS NEEDED.

DEM 01 REMOVAL OF EXISTING SOIL AND TUNNEL STRUCTURAL SLAB AT SOIL OVERBURDEN (SF)

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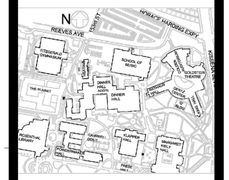
Project Key



REVISIONS

Rev No	Description	Date:
	ISSUED FOR PRICING ONLY NOT FOR CONSTRUCTION	07/09/2025
	#ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION-REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client
CUNY The City University of New York
QUEENS COLLEGE
THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title
STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

DOB NOW JOB NO.
Q00984460-I1
DOB APPROVAL STAMPS

Drawing Title
RESTORATION DETAILS: DEM 01

Phase
100% SUBMISSION

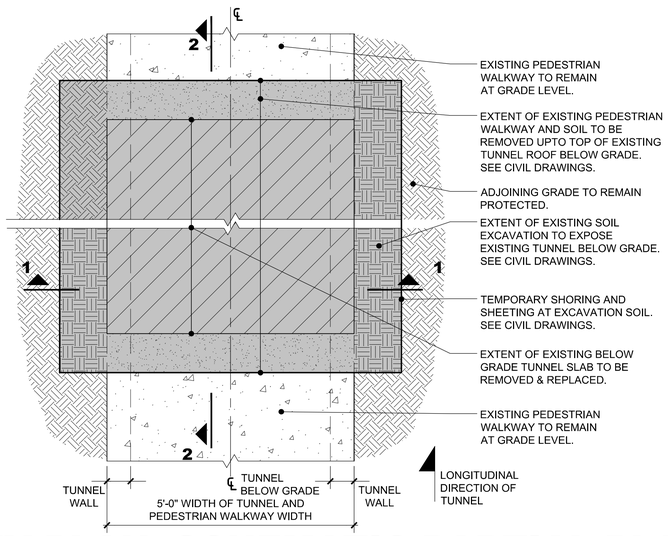
Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

DASNY Project No.
2881309999

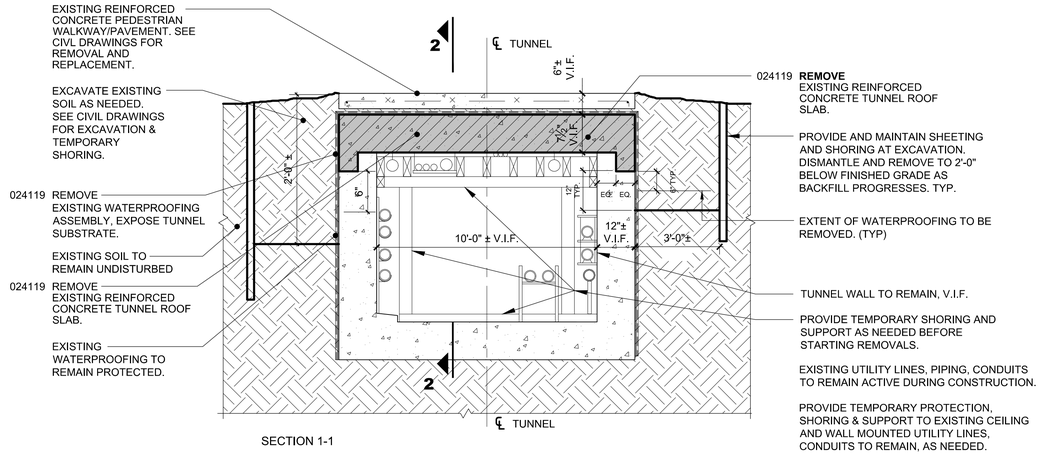
Drawing Number
S-519

Drawing 032 of 039



KEY PLAN: SCHEMATIC PARTIAL PLAN

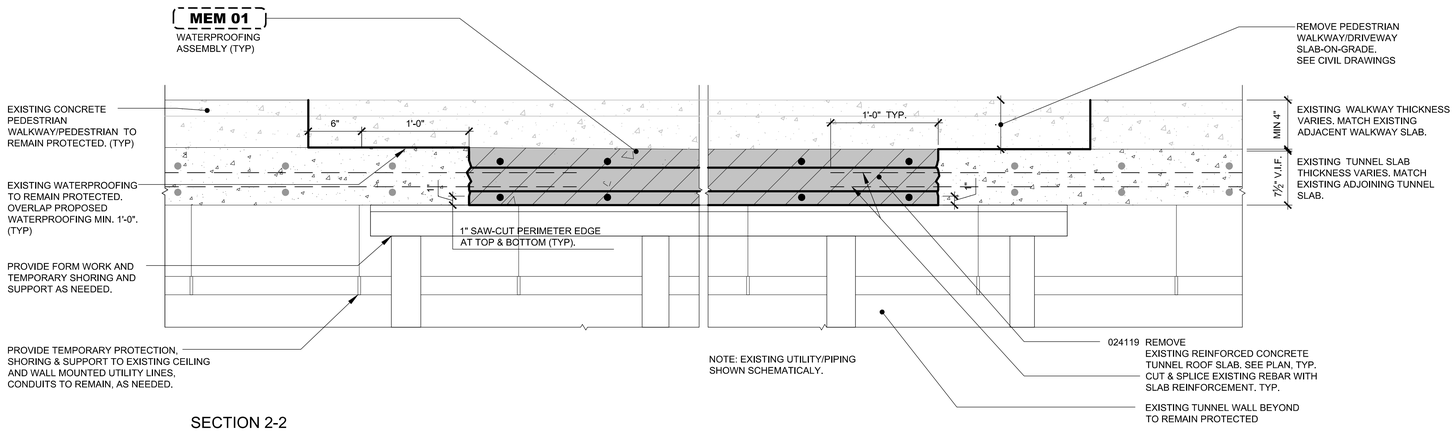
NTS



SECTION 1-1

KEY SECTION 1-1

NTS



SECTION 2-2

TUNNEL LONGITUDINAL SECTION WITHOUT OVERBURDEN

1-1/2" = 1'

0" 6" 12"

NOTES:

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DOB NOW JOB NO.
Q00984460-I1
DOB APPROVAL STAMPS

DEM 02 **REMOVAL OF EXISTING SOIL AND TUNNEL STRUCTURAL SLAB WITHOUT OBERBURDEN (SF)**

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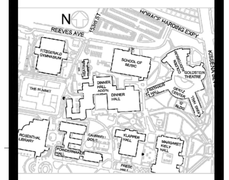
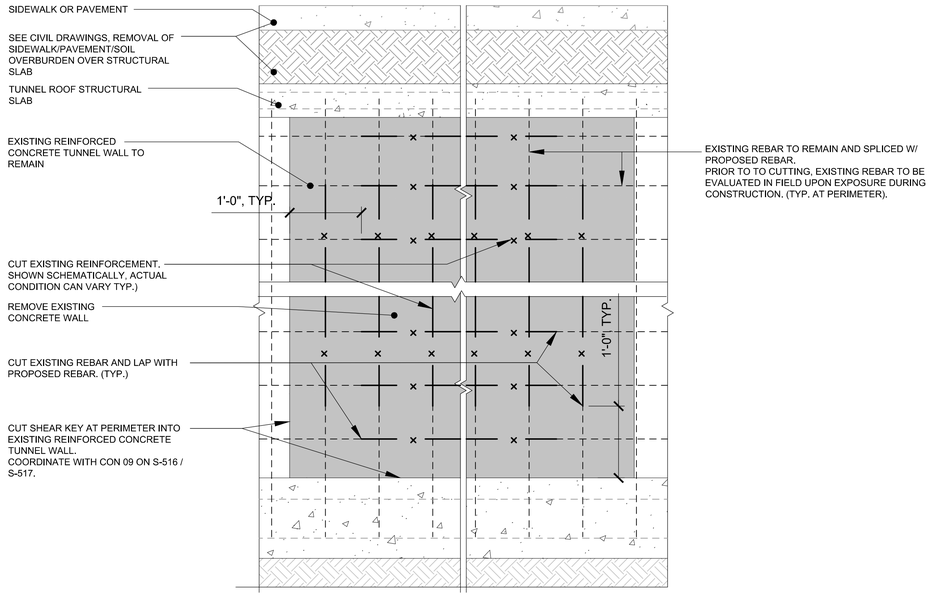
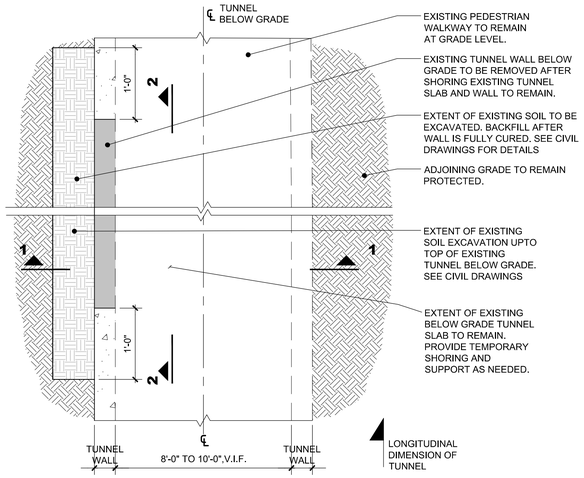
Project Key


N
REEVES AVE
KISSENA BLVD
PARKING LOT
PARKING LOT
PARKING LOT



ELEVATION SECTION 2-2



KEY PLAN: SCHEMATIC PARTIAL PLAN

12" = 1'
0" 1" 2"

SOIL OVERBURDEN OVER STRUCTURAL SLAB

DEM 02
CON 06
CON 07
OR
CON 08

024119 REMOVE EXISTING TUNNEL WALL IN THE AREAS INDICATED.

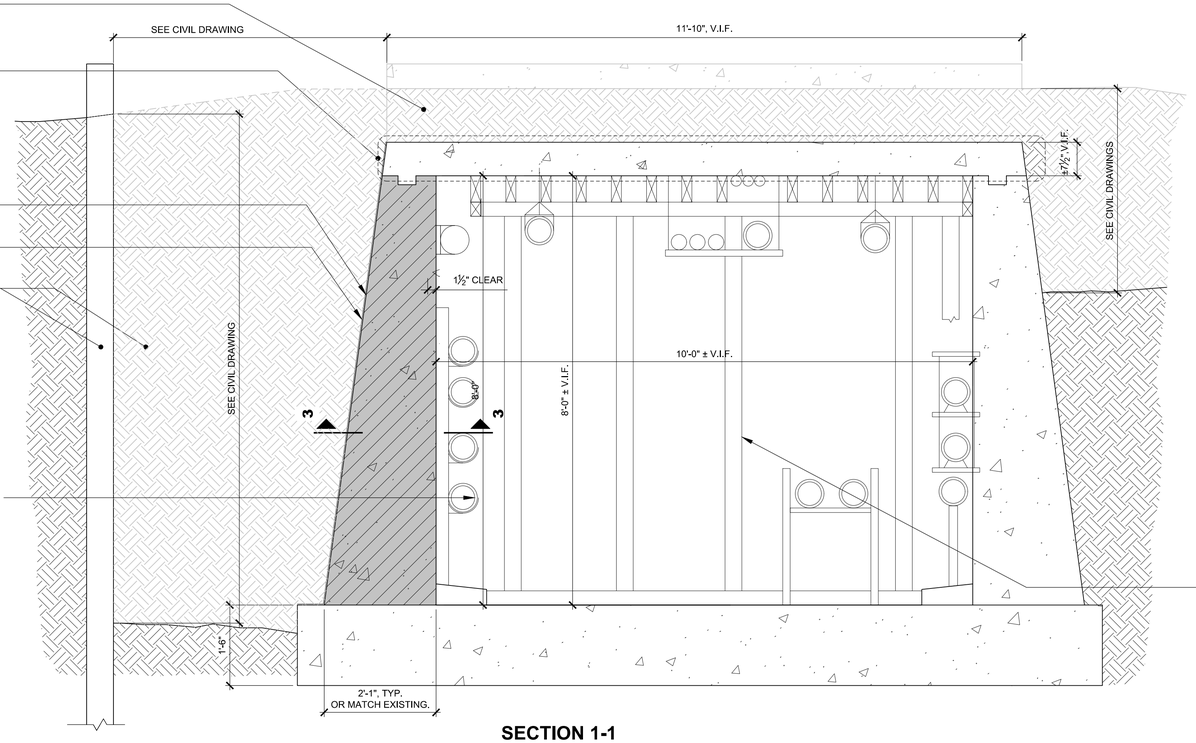
024119 REMOVE EXISTING WATERPROOFING IN THE AREAS INDICATED.

SEE CIVIL DRAWING SET FOR SOIL EXCAVATION, SHORING & SHEETING REQUIREMENTS. INSTALL SHORING PRIOR TO COMMENCING EXCAVATION OR AS EXCAVATION PROGRESSES SO THAT AT NO POINT SHALL SOIL BE EXPOSED WITHOUT AN EXCAVATION PROTECTION SYSTEM.

EXISTING UTILITY LINES, PIPING, CONDUITS TO REMAIN ACTIVE AND PROTECTED.

PROVIDE TEMPORARY PROTECTION, SHORING & SUPPORT TO EXISTING CEILING AND WALL MOUNTED UTILITY LINES, CONDUITS TO REMAIN, AS NEEDED.

UTILITY LINES/PIPING/CONDUITS SHOWN SCHAMETICALLY AND ACUTAL CONDITIONS INCLUDING SIZE, SUPPORTS VARIES & TO BE VERIFIED IN FIELD.



PROVIDE FORMWORK, TEMPORARY SHORING AND SUPPORTS AS NEEDED. IT SHALL BE DESIGNED TO ACCOMOATE EXISTING UTILITIES, PIPINIG, CONDUITS TO REMAIN IN PLACE. SEE DEM 03 SHEET S-519 FOR DETAILS AND REQUIREMENTS.

SECTION 1-1

BASIC ASSEMBLY

3/4" = 1'
0" 6" 1' 2' 3'

NOTES:

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DEM 03 REMOVAL OF EXISTING TUNNEL WALL (SF)

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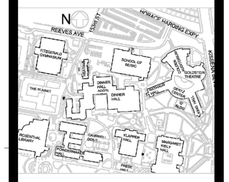
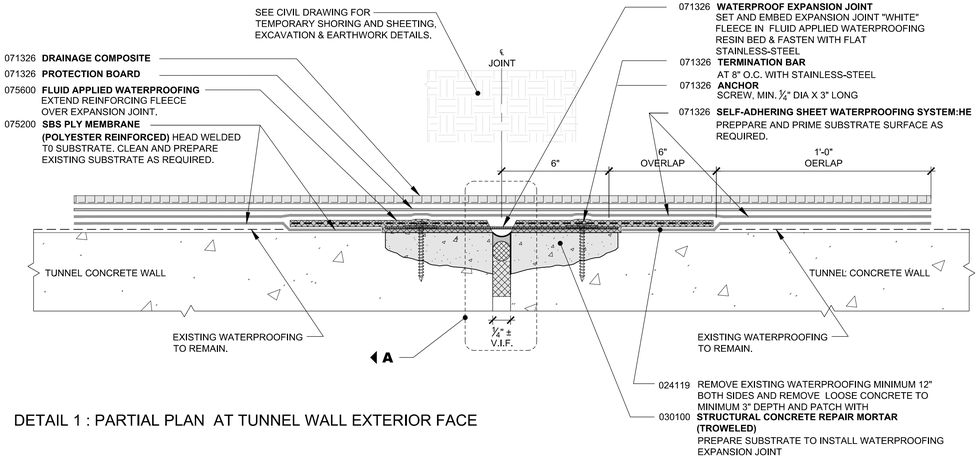
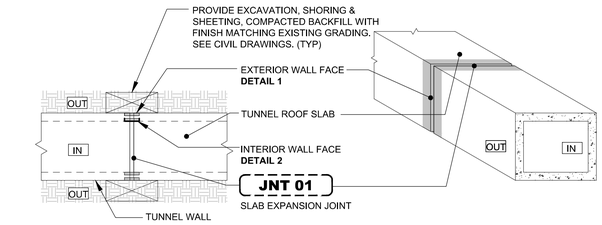

N
REVERE AVE
KISSENA BLVD
ROTC
PARKING
DINING
GYM
PARKING
PARKING
PARKING

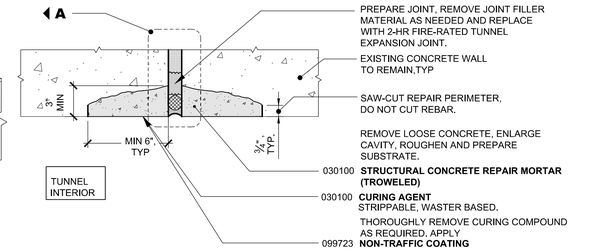


DETAIL 1 : PARTIAL PLAN AT TUNNEL WALL EXTERIOR FACE



SCHEMATIC PARTIAL PLAN OF TUNNEL, NTS.

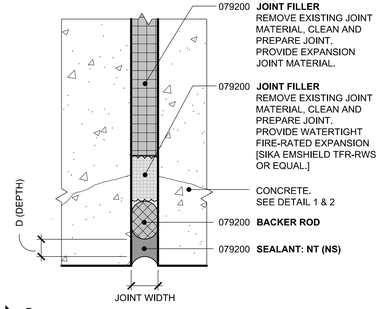
SCHEMATIC ISOMETRIC VIEW OF TUNNEL, NTS.



DETAIL 2 : PARTIAL PLAN AT WALL INTERIOR FACE

REFERENCE NOTES: APPLIES TO DETAILS JNT 01 AND JNT 02.

1. DETAIL 1 - APPLIES AT TUNNEL JOINT ON EXTERIOR.
2. DETAIL 2 - APPLIES AT TUNNEL JOINT ON INTERIOR.
3. THESE LOCATIONS REQUIRE TEMPORARY SHORING & SHEETING, EXCAVATION & BACKFILL, , REPLACEMENT OF OVERBURDEN PAVEMENT ABOVE TUNNEL ROOF AND EXPOSE TUNNEL EX
4. SEE PARTIAL PLANS 1 / S-102 THROUGH PARTIAL PLAN 8/ S-109 TO IDENTIFY APPROXIMATE L RESTORATIONS. ALL REPAIR LOCATIONS SHALL BE VERIFIED ON FILED BY THE CONTRACTOF

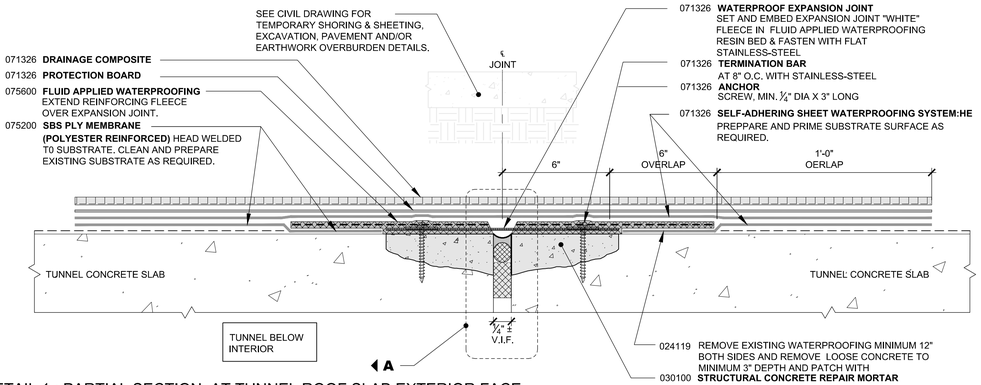


NTS

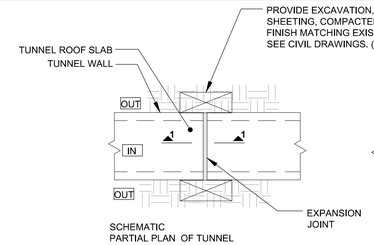
BASIC ASSEMBLY

1-1/2" = 1'
0" 6" 12"

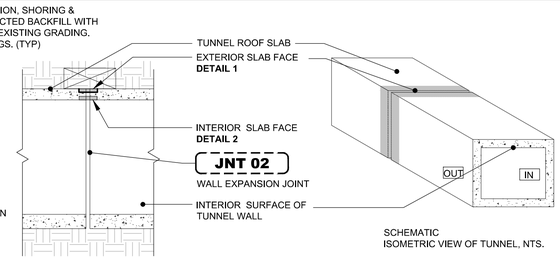
JNT 02 EXPANSION JOINT RESTORATION AT WALL (LF)



DETAIL 1 : PARTIAL SECTION AT TUNNEL ROOF SLAB EXTERIOR FACE
SEE JNT 02 FOR SUB-DETAIL A.

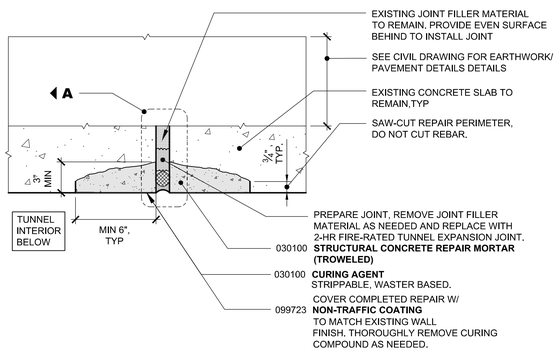


SCHEMATIC PARTIAL PLAN OF TUNNEL

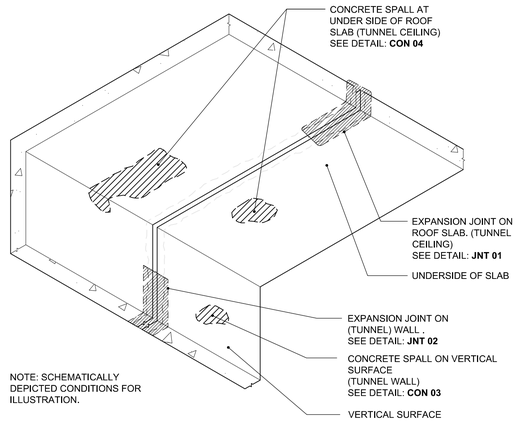


SCHEMATIC SECTION 1-1

SCHEMATIC ISOMETRIC VIEW OF TUNNEL, NTS.



DETAIL 2 : PARTIAL SECTION AT SLAB INTERIOR FACE



NOTE: SCHEMATICALLY DEPICTED CONDITIONS FOR ILLUSTRATION.

KEY

NTS

KEY FOR DETAILS JNT 01 AND JNT 02

BASIC ASSEMBLY

1-1/2" = 1'
0" 6" 12"

JNT 01 EXPANSION JOINT RESTORATION AT SLAB (LF)

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Consultants:
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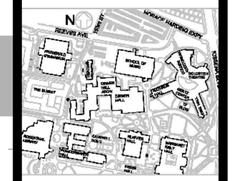
14 WALL STREET
NEW YORK, NY 10005
(212) 505-1133
SUPERSTRUCTURES.COM

NOT FOR CONSTRUCTION

Project Key



REVISIONS

Rev No	Description	Date:
	ISSUED FOR PRICING ONLY NOT FOR CONSTRUCTION	07/09/2025
	ISSUED FOR DOB FILING	02/02/2024
	90% SUBMISSION-REVISION 01	02/27/2023
	90% SUBMISSION	01/20/2021

Client
CUNY The City University of New York QUEENS COLLEGE THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title
STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

DOB NOW JOB NO.
Q00984460-I1
DOB APPROVAL STAMPS

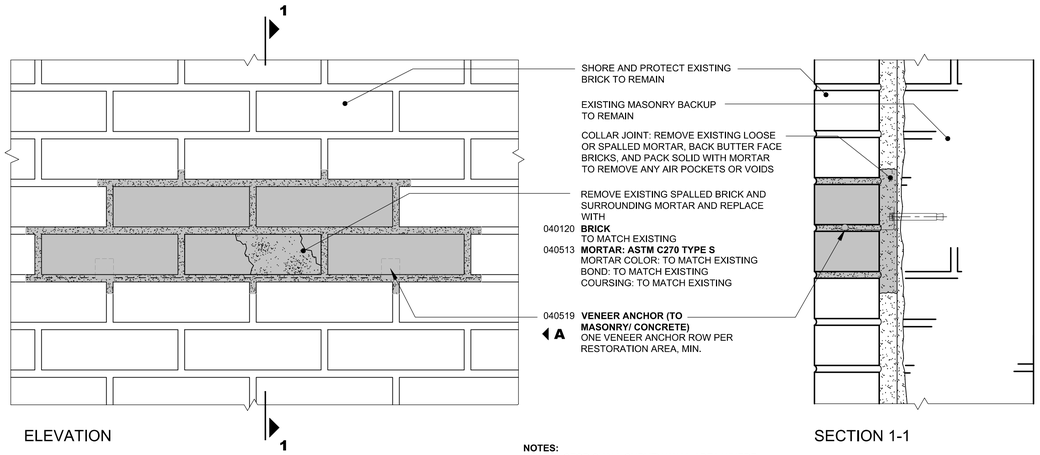
Drawing Title
RESTORATION DETAILS: JNT 01 JNT 02

Phase
100% SUBMISSION

Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

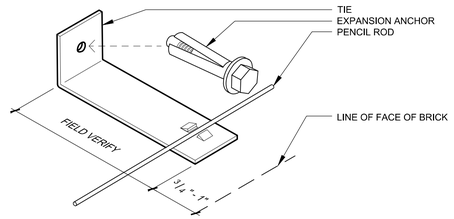
DASNY Project No: 2881309999
Drawing Number: S-522
Drawing 035 of 039



NOTES:
CONTRACTOR SHALL SURVEY WALL AREA WHERE BRICK REPLACEMENT IS NEEDED IN PRESENCE OF ENGINEER OF RECORD

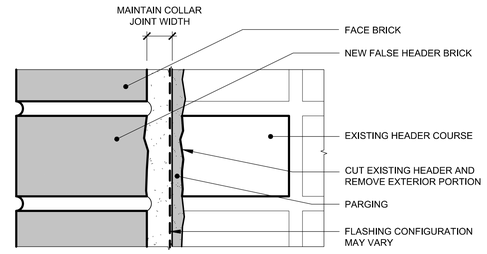
@ LOCALIZED INDIVIDUAL SPALLED BRICK

3" = 1'
0" 3" 6" 12"



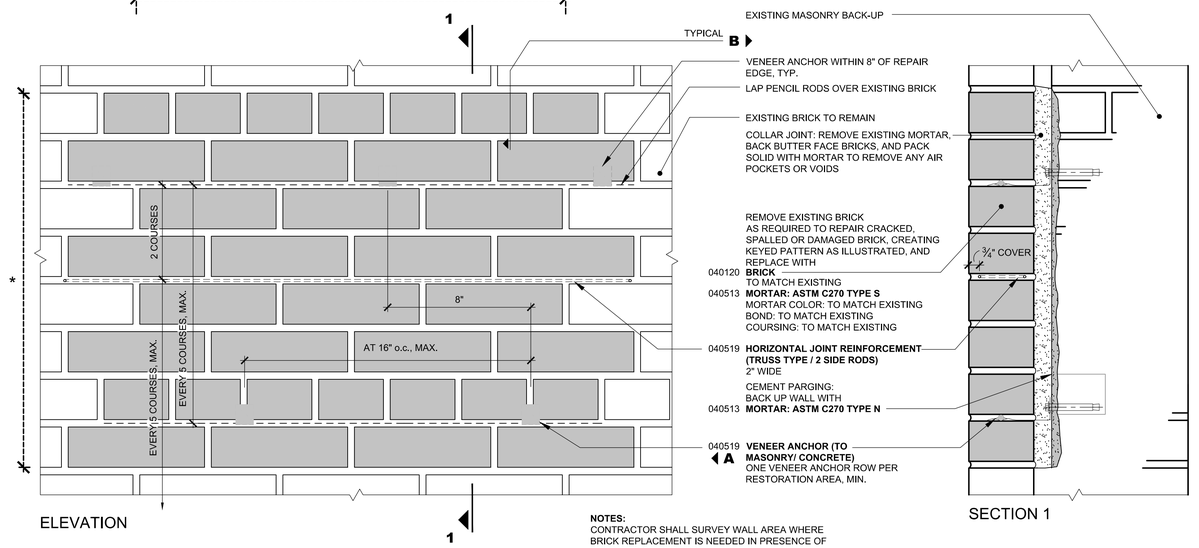
A: VENEER ANCHOR

NTS



B: CUT AT HEADER COURSE

6" = 1'
0" 2" 4"



NOTES:
CONTRACTOR SHALL SURVEY WALL AREA WHERE BRICK REPLACEMENT IS NEEDED IN PRESENCE OF ENGINEER OF RECORD

BASIC ASSEMBLY

3" = 1'
0" 3" 6" 12"

MAS 01 SPALLED BRICK MASONRY REPAIR (SF)

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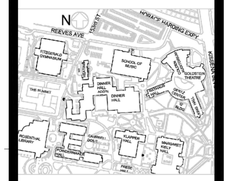

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THE CITY UNIVERSITY OF NEW YORK
65-30 KISSENA BLVD.
FLUSHING, NY, 11367

Project Title
STEAM TUNNEL RESTORATION
GATE 3 ENTRANCE RD.
FLUSHING, NY, 11367

Drawing Title
RESTORATION DETAILS: MAS 01

DOB NOW JOB NO.
Q00984460-I1
DOB APPROVAL STAMPS

Phase
100% SUBMISSION

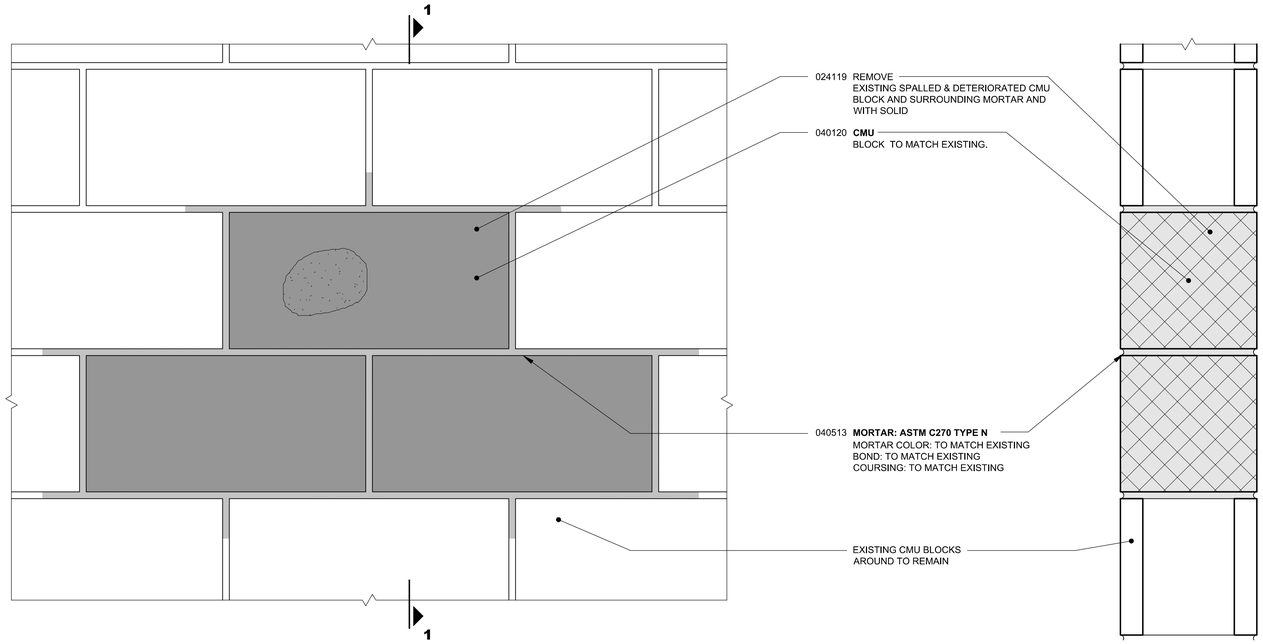
Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

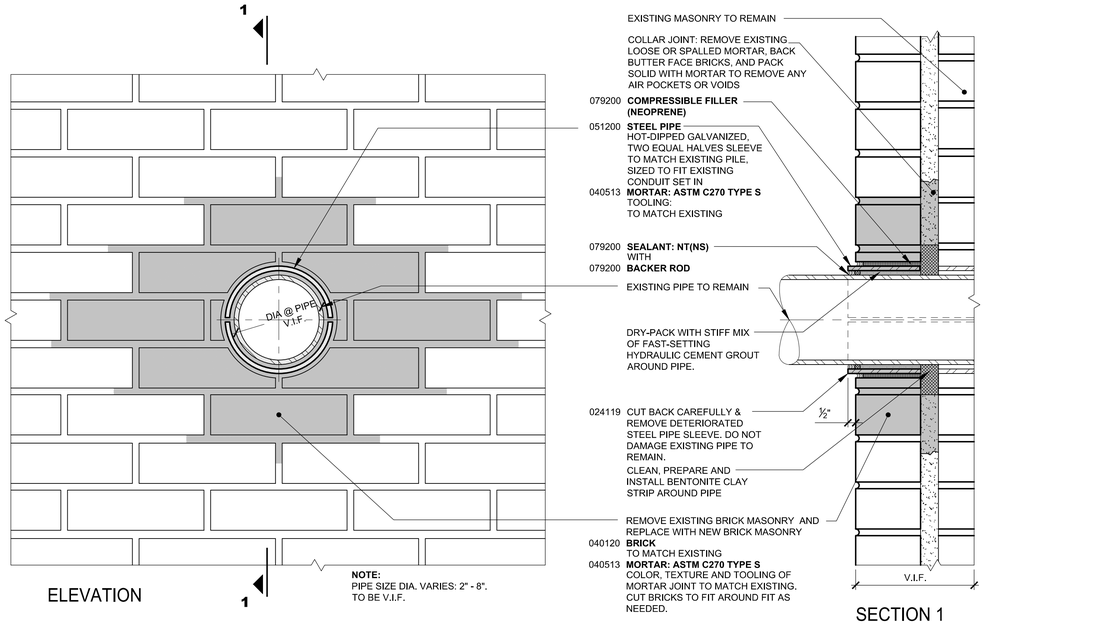
DASNY Project No:
2881309999

Drawing Number
S-523

Drawing
036 of 039



MAS 03 SPALLED CMU UNIT REPLACEMENT (EA)



NOTE:
PIPE SIZE DIA. VARIES: 2" - 8".
TO BE V.I.F.

BASIC ASSEMBLY

3" = 1'
0" 3" 6" 12"

MAS 02 MASONRY RECONSTRUCTION AROUND PIPE PENETRATION (SF)

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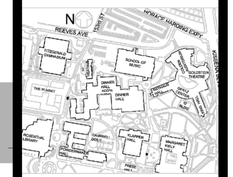
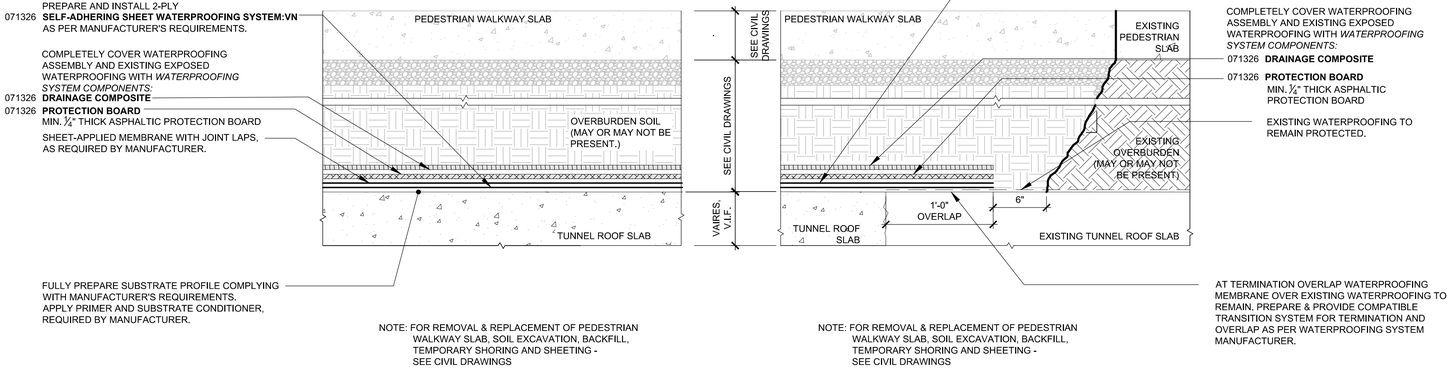
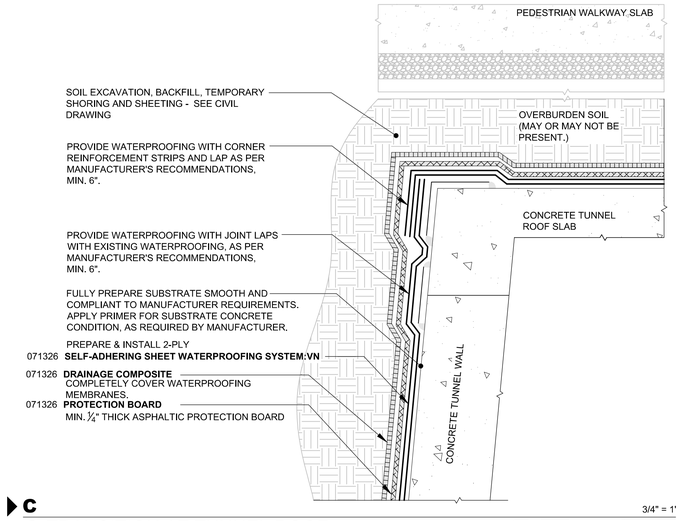

N
REEVES AVE
KISSENA BLVD
PARKING LOT
CHEMISTRY BUILDING
PARKING LOT
PARKING LOT
PARKING LOT

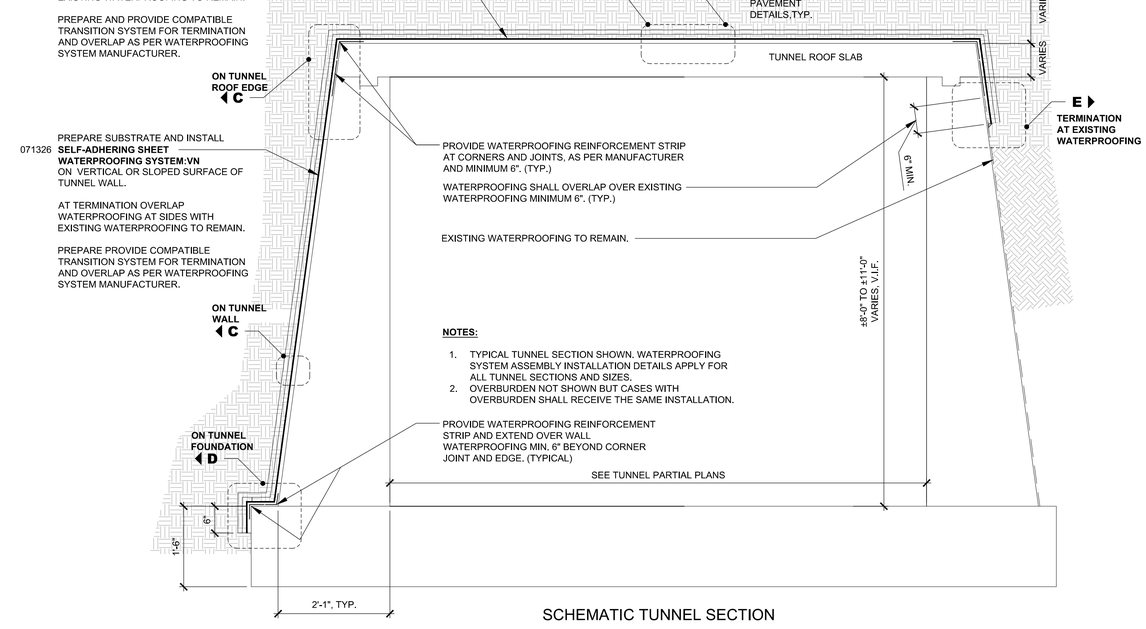


A @ ON TUNNEL ROOF — 3/4" = 1'

B @ TERMINATION BEYOND — 3/4" = 1'



C @ TRANSITION AT TUNNEL ROOF EDGE AND WALL — 3/4" = 1'

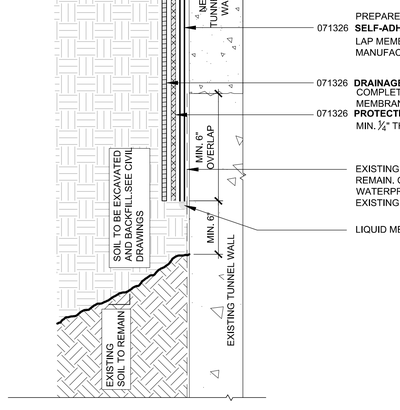


SCHEMATIC TUNNEL SECTION

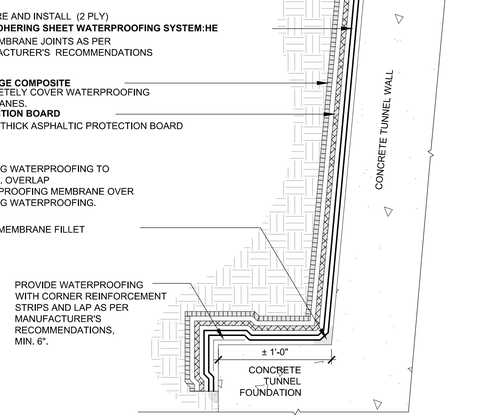
SECTION

BASIC ASSEMBLY

3/4" = 1'



E @ TERMINATION AT EXISTING WATERPROOFING — 3/4" = 1'



D @ TUNNEL FOUNDATION — 3/4" = 1'

MEM 01 WATERPROOFING MEMBRANE INSTALLATION (SF)

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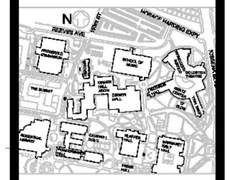
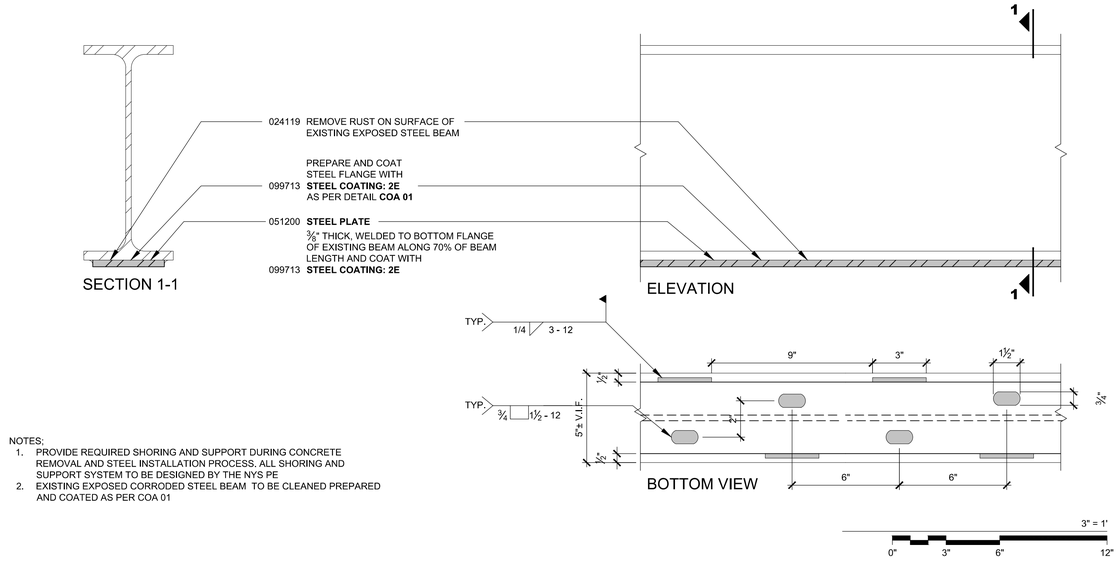
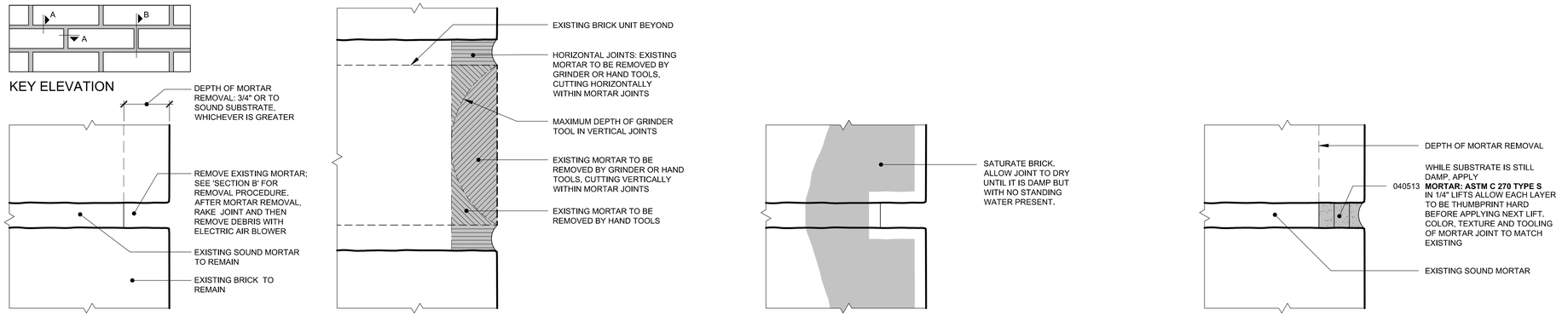

N
QUEENS COLLEGE
MEMORIAL HALL
KISSENA BLVD
ROOSEVELT AVE
MEDICAL SCIENCE
SCIENCE
KISSENA HALL
KISSENA BLVD
LAUNDRY
PARKING
PARKING
PARKING



NOTES;

1. PROVIDE REQUIRED SHORING AND SUPPORT DURING CONCRETE REMOVAL AND STEEL INSTALLATION PROCESS. ALL SHORING AND SUPPORT SYSTEM TO BE DESIGNED BY THE NYS PE
2. EXISTING EXPOSED CORRODED STEEL BEAM TO BE CLEANED PREPARED AND COATED AS PER COA 01

STL 01 STEEL BEAM REINFORCEMENT: BOTTOM FLANGE (LF)



STEP 1: MORTAR REMOVAL

NOTE: REPLACE ALL BRICKS DAMAGED BY CUTTING WORK

STEP 2: PRE-WETTING OF MASONRY UNITS

STEP 3: APPLICATION OF MORTAR

12" = 1'
0" 1" 2"

PNT 01 BRICK MASONRY POINTING (SF)

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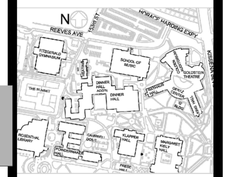

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DOB APPROVAL STAMPS

Drawing Title

RESTORATION DETAILS: PNT 01 STL 01

Phase

100% SUBMISSION

Drawn By:	Checked By:	Date:
AK/VP/AG	JMG/VP	03/15/2023

Seal & Signature

DASNY Project No.
2881309999

Drawing Number
S-526

Drawing
039 of 039