

PROPOSAL PACKAGE

**RIDGEVIEW ROAD INFRASTRUCTURE
MnANG – 148th Fighter Wing, Duluth, MN
FMKM062039B**

**City of Duluth, Minnesota
411 West 1st Street
Duluth, MN 55802**

City Project # 1491

Bid # 15-0558

Opening Date: September 16, 2015

Time: 2:00 PM

Place (Submit Bids): Room 100

CITY OF DULUTH INVITATION TO BID (ENG)

PROJECT NAME/DESCRIPTION: Ridgeview Road Infrastructure
MnANG – 148th Fighter Wing, Duluth, MN
FMKM062039B

PROJECT NUMBER: 1491

BID NUMBER: 15-0558

Sealed bids will be received by the City Purchasing Agent in and for the Corporation of the City of Duluth, Minnesota, at his office, Room 100 City Hall, Duluth, Minnesota, 55802, (218) 730-5340 until 2:00 pm local time on 16 September, 2015 for the above named project. Immediately thereafter, bids will be publicly opened and read aloud.

NOTICE TO BIDDERS: 1) Unless a Certificate of Exemption is provided, any out-of-state bidder receiving a bid award will have 8% retained from invoice payments on any contracts over \$50,000. Submit a signed copy from the State of Minnesota when submitting Payment and Performance Bonds. This form may be found at the following web address: http://taxes.state.mn.us/Forms_and_Instructions/sde.pdf

Project consists of vehicular traffic gates, fencing, active vehicle barriers, a prefabricated traffic check house, site lighting, electrical and site work associated with this work.

Questions pertaining to this project should be directed to: Colleen Dalquist, Contracting Officer, colleen.dalquist@us.army.mil, (320) 616-2751 or Colleen Moore, Contracting Specialist, colleen.m.moore.civ@mail.mil, (320) 616-2753.

Each bidder must review the 2015 Edition of the City of Duluth Public Works & Utilities Department/Engineering Division "Construction Standards" available on the city website (www.duluthmn.gov) as these Specifications are incorporated by reference and are deemed to be a part hereof this project as if fully incorporated and set forth herein.

Plans and specifications may be secured from the City Engineering office, Room 211 City Hall, 411 West 1st St., Duluth, MN 55802, upon payment of a check, draft or money order in the amount of \$20.00 made payable to the City of Duluth. (This payment will not be refunded.) Plans may be obtained at the City of Duluth website, <http://www.duluthmn.gov/purchasing/bids-requestfor-proposals/> free of charge.

Plans and specifications are on file for inspection at the City Engineering office, Duluth Builders Exchange, F.W. Dodge Plan Room, and Minneapolis Builders Exchange.

A certified check or bank draft, payable to the order of the City of Duluth, negotiable U.S. Government Bonds (at par value), or a satisfactory bid bond executed by the bidder and acceptable surety, in an amount equal to five per cent (5%) of the total bid, shall be submitted with each bid.

Attention is called to the fact that not less than the minimum salaries and prevailing wages as set forth in the contract documents must be paid on this project. The contractor must take affirmative action to ensure that the employees and applicants for employment are not discriminated against because of their race, color, creed, sex or national origin, and must meet the affirmative action goals. Contractors are encouraged to subcontract with Disadvantaged Business Enterprises, when possible.

Contractor will comply with all applicable Equal Employment Opportunity laws and regulations.

The City of Duluth is an Equal Opportunity employer.

CITY OF DULUTH
Purchasing Division

Date posted to web: 8/26/2015

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CERTIFICATION

I HEREBY CERTIFY THAT THIS plan, SPECIFICATION or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Daniel G. Shaw
Signature

Daniel Shaw
Typed or Printed Name

August 14, 2015
Date

41423
License No.

Cynthia Poirier
Signature

Cynthia Poirier
Typed or Printed Name

August 14, 2015
Date

22021
License No.

Jennifer M. Babcock
Signature

Jennifer Babcock
Typed or Printed Name

August 14, 2015
Date

40768
License No.

Michael Bilben
Signature

Michael Bilben
Typed or Printed Name

August 14, 2015
Date

51324
License No.

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Project Specifications (Divisions 01 through 33)

Appendix A Report of Geotechnical Exploration and Review prepared by American
Engineering Testing, Inc. dated January 27, 2014

Attachments:

Instructions to Bidders – Engineering 03/17/15
Data for Labor Cost Bidding
Prevailing Wage Rates: U S DOL Federal Building 7-31-15
U S DOL Federal Heavy 6-12-15
Project Insurance Requirements 2/16/11
Request for Bids form
Affadavit of Non-Collusion
EEO Affirmative Action Policy Statement and Compliance Certificate
Responsible Contractor Verification and Certification of Compliance
Bid Label
City of Duluth Purchasing Division General Specifications

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The following forms and regulations/rules/statutes and interpretations, which are incorporated by reference in this contract, are available on the World Wide Web at the sites listed below. The City of Duluth will use its best efforts to ensure that the most recent, applicable forms and regulations/rules/statutes and interpretations are included on the web sites provided; however, if you are the successful bidder, prior to signing the contract, you are responsible for comparing the versions of the forms and regulations/rules/statutes and interpretations attached to the contract which you are signing with the versions on the web to ensure conformity. Hard copies of all forms are available at the Engineering Division.

THE VERSIONS OF THE FORMS AND REGULATIONS/RULES/STATUTES and INTERPRETATION ATTACHED TO THE CONTRACT WILL BE CONTROLLING.

FORM	FUND	WEB SITE
Affidavit of Non-Collusion (required by awarded contractor only)	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/
Affirmative Action Policy Statement/Certificate - EEO (required by awarded contractor only)	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/
Bidder's Label for submitting project bids	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/
Certified Payroll Form WH347	All	www.dol.gov/whd/forms/WH347.pdf
Contractor's Haul Route	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/
Debarment/Suspension Notice (most current version)	All	www.dot.state.mn.us/pre-letting/prov/order/suspension.pdf
IC-134 form	All	http://www.revenue.state.mn.us/Forms_and_Instructions/ic134.pdf
IC-134 on-line submittal	All	https://www.mndor.state.mn.us/tp/contractoraffidavit/
MN Rules 5200.1105	All	https://www.revisor.mn.gov/rules/?id=5200.1105
MN Rules 5200.1106	All	https://www.revisor.mn.gov/rules/?id=5200.1106
MN Statutes 177.41 to 177.44	All	www.revisor.mn.gov/statutes/?id=177
Notice to Bidders - Prompt Payment to Subs – CITY (MS 471.425)	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/
One-Call Instructions	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/
Request to Sublet TP-21834	All	http://www.dot.state.mn.us/const/labor/forms.html
Request to Sublet Summary	All	http://www.dot.state.mn.us/const/labor/forms.html
Responsible Contractor Certification (MS 16C.285)	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/
Statement of Compliance Form (8-2013)	All	www.dot.state.mn.us/const/labor/forms.html
Supplemental General Conditions Part II 4/15/11	All	http://www.duluthmn.gov/engineering/standard-construction-specifications/construction-documents/

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SP-1 NOTICE TO ALL BIDDERS

The 2015 Edition of the City of Duluth Public Works & Utilities Department/Engineering Division "Construction Standards" book and any addendums or supplements is incorporated by reference and is deemed to be a part hereof as if fully incorporated and set forth herein. The 'Construction Standards' is available on the City website at: <http://www.duluthmn.gov/engineering/standard-construction-specifications/>.

SP-2 SCOPE OF WORK

Project consists of vehicular traffic gates, fencing, active vehicle barriers, a prefabricated traffic check house, site lighting, electrical and site work associated with this work.

SP-3 CONTACT INFORMATION

Questions regarding this project should be directed to: Colleen Dalquist, Contracting Officer, colleen.dalquist@us.army.mil, (320) 616-2751 and Colleen Moore, Contracting Specialist (320) 616-2753.

SP-4 NOT USED

SP-5 RESPONSIBLE CONTRACTOR VERIFICATION AND CERTIFICATION OF COMPLIANCE

A reminder to potential bidders that the Responsible Contractor Verification and Certification of Compliance is required by Minnesota Statute to be submitted with your Bid Proposal. Refer to sections S-14 and 1801 of the City's "Construction Standards" and the bid documents.

SP-6 (1504) COORDINATION OF CONTRACT DOCUMENTS

The first paragraph of MN/DOT 1504 is deleted and replaced with the following:

A requirement appearing in one of the Contract documents is as binding as though the requirement appears in all. If discrepancies exist between the Contract documents, the following order of precedence applies:

- (1) Addenda,
- (2) Special Provisions,
- (3) Project-Specific Plan Sheets,
- (4) City of Duluth Standard Construction Details,
- (5) City of Duluth Standard Construction Specifications,
- (6) MN/DOT Supplemental Specifications,
- (7) MN/DOT Standard Plan Sheets and Standard Plates,
- (8) MN/DOT Standard Specifications.

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- (A) If the Contractor chooses not to work at all on the day preceding the holiday period, no working day charges will be assessed.
- (B) If the Contractor chooses to work prior to 12:00 noon on the day preceding the holiday period or if the Contractor obtains written permission to work after 12:00 noon on the day preceding the holiday period, working day charges will be assessed only for the actual hours worked.
6. When all, or a portion, of the Contract Time is specified as a calendar completion date, the time is presumed to have been determined by considering the Proposal quantities, normal weather for the locality and season of the year, and the necessity of having the work completed by the specified date. The time may be extended by the Engineer only if the delay is considered "Excusable" in accordance with MN/DOT 1806.2 Types of Delays.

SP-11 (1807) FAILURE TO COMPLETE WORK ON TIME

The provisions of MN/DOT 1807 shall apply in full to both the Substantial Completion Date and the Final Completion Date.

SP-12 (2451) EXCAVATION, BACKFILL AND COMPACTION FOR UTILITIES – TRENCH BACKFILL

The provisions of section 2451 of the City of Duluth 'Construction Standards' are supplemented with the following:

Trench backfill above the top of encasement zone and below the top of subgrade shall be accomplished entirely with imported Granular Fill materials meeting the City's Construction Standards.

The Engineer will determine if any material is suitable for use as trench backfill.

Where acceptable material is found to be available within the site, the Engineer may direct the Contractor to utilize suitable salvaged on-site select grading materials for trench backfill to the maximum extent practical instead of imported backfill.

No adjustment will be made to the Contract unit price for increased or decreased quantities, except as provided in MN/DOT 1402.3.

All costs for placing and compacting backfill (regardless of type: select grading material, common or granular) shall be considered incidental to relevant Contract bid items.

- END -

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**SECTION 01 1000
SUMMARY**

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Ridgeview Road Infrastructure.
- B. Owner's Name: MnANG.
- C. Contracting Officer: Colleen Dalquist
- D. Contracting Officer's Representative: Maj. Ryan Kaspari
- E. The Project consists of the construction of a security gate, fencing, a prefabricated traffic check house, active vehicle barriers, site lighting and associated electrical work.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price.

1.03 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of demolition and removal work is shown on drawings and Specifications
- B. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.

1.04 WORK BY OWNER

- A. Items noted GFCl will be supplied by the Gov't and installed by the Contractor.

1.05 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the site during the entire construction period.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

1.06 CONTRACTOR USE OF SITE

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Arrange use of site to allow:
 - 1. Owner occupancy.
- C. Provide access to and from site as required by law and by Owner:
 - 1. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Utility Outages and Shutdown:
 - 1. Limit disruption of utility services to hours the site is unoccupied.
 - 2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 1005
GOVERNING SPECIFICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. The State of Minnesota Department of Transportation, "Standard Specifications for Construction", latest edition shall apply on all Divisions 30 - 35 work, except as modified or altered in the following sections: 30 0000 - 35 9999.
- B. All traffic control devices and signing shall conform to the latest Minnesota MUTCD, including the field manual dated January 2014. The Contractor is responsible for all traffic control on the Project.
- C. Brand Name or Equal: The use of a brand name item is to establish a standard of quality only and shall not be construed as limiting competition or precluding the contractor from offering an equal item(s) from another source(s). Any brand name intended to be a restriction to a sole source shall be clearly identified as "No Substitutions", and shall receive the prior approval of the Contracting Officer before it is placed in the specifications.

1.02 RELATED SECTIONS

- A. Division 1 requirements may be superseded by City Contracting Requirements. Reference the appropriate City Contract Clause for further guidance.
- B. Divisions 30 - 35 sections shall be related and referred to as shown in Governing Specifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preconstruction meeting.
- B. Progress meetings.
- C. Construction progress schedule.
- D. Consolidated list of Submittals for review, approval and acceptance.

1.02 RELATED REQUIREMENTS

- A. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.
- B. Section 01 7800 - Closeout Submittals: Project record documents.

1.03 PROJECT COORDINATION

- A. Project Coordinator: Contracting Officer's Representative.
- B. Cooperate with the Contracting Officer in allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Contracting Officer.
- D. Comply with Contracting Officer's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Make the following types of submittals to the Architect:
 - 1. Requests for interpretation.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Owner will schedule a meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect
 - 3. General Contractor.
 - 4. Major sub-contractors.
- C. Agenda:
 - 1. Submission of list of Subcontractors, schedule of values, and progress schedule.
 - 2. Designation of personnel representing the parties to Contract, MnANG Base Representatives and Architect.

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

3.02 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at maximum bi-weekly intervals.
- B. Contractor to make arrangements for meetings, prepare agenda, construction logs and schedule with copies for participants, preside at meetings.
- C. Architect will prepare and distribute meeting minutes.
- D. Attendance Required: Job superintendent, Contracting Officer's Representative, Architect, major Subcontractors and suppliers as appropriate to agenda topics for each meeting.
- E. Agenda:
 1. Review minutes of previous meetings.
 2. Review of Work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Maintenance of progress schedule.
 7. Corrective measures to regain projected schedules.
 8. Planned progress during succeeding work period.
 9. Maintenance of quality and work standards.
 10. Effect of proposed changes on progress schedule and coordination.
 11. Other business relating to Work.

3.03 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
 1. Schedule to be Contractor prepared and Contractor maintained Critical Path Method (CPM) Construction Schedule using electronic software, Microsoft Project or equal.
 2. Submit schedule following submittal procedures. Submit updated schedule with each pay application.

3.04 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Material Specification
 5. Equipment Specification
 6. Samples for verification.
 7. Certificate of conformance.
 8. Warranty
- B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed only for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.
- E. Where building components or systems require specific preventative maintenance actions to maintain their warranty those requirements shall be specifically stated by the contractor in a

letter. If no requirements exist, the contractor's letter will state that there are no owner preventive maintenance actions necessary to maintain these warranties.

- F. A Consolidated List of Submittals is attached to this Document Section.
 - 1. The attached Consolidated List of Submittals is only a summary of the requirements included within Division 2 through Division 16.
 - 2. In any instance where there is variance between the Consolidated List of Submittals and the requirements contained in Division 2 through Division 16, the requirements contained in the individual specification sections prevail.
 - 3. Division 1 requirements may be superceded by Federal Contracting Requirements.
 - a. Reference the appropriate Federal Contract Clause for further guidance.

3.05 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - 1. Design data.
 - 2. Certificates.
 - 3. Test reports.
 - 4. Inspection reports.
 - 5. Manufacturer's instructions.
 - 6. Manufacturer's field reports.
 - 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.06 SUBMITTALS FOR PROJECT CLOSEOUT

- A. When the following are specified in individual sections, submit them at project closeout:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Bonds.
 - 5. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.
- C. Provide a summary sheet of all extended warranties that differs from the government standard one year warranty

3.07 NUMBER OF COPIES OF SUBMITTALS

- A. Documents for Review, or Information:
 - 1. Submit in electronic format computer generated (pdf) one (1) copy.
 - 2. Where electronic format is not possible, submit in hard copy, the number of copies the contractor requires plus (2) total to be retained by the Contracting Officer and Architect.
- B. Documents for Project Closeout: Submit per Section 01 7800.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. Retained samples will not be returned to Contractor unless specifically so stated.

3.08 SUBMITTAL PROCEDURES

- A. Transmit each submittal with a copy of approved submittal form.
- B. Transmit each submittal with MnANG approved Form F3000.
- C. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- D. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

- E. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- F. Deliver submittals to Architect at business address.
- G. Schedule submittals to expedite the Project, and coordinate submission of related items.
- H. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
- I. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- J. Provide space for Contractor and Architect review stamps.
- K. When revised for resubmission, identify all changes made since previous submission.
- L. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- M. Submittals not requested will not be recognized or processed.

END OF SECTION

**SECTION 01 3260
ENVIRONMENTAL REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hazardous material usage and storage requirements.

1.02 SUBMITTALS

- A. Contractor Hazardous Material Identification Form - Part I
 - 1. Complete prior to the construction start date, maintain on the job site throughout construction.
- B. Contractor Hazardous Material Form Close-Out Procedure - Part II

PART 3 EXECUTION

2.01 HAZARDOUS MATERIAL STORAGE AND DISTRIBUTION SYSTEM REQUIREMENTS

- A. The contractor shall establish a Hazardous Material (HM) storage and distribution system when HM is to be used. All HM required to support the contract shall be reported to the Hazardous Material Pharmacy (HMP) using the Contractor HM Identification Form. The Contractor HM Identification Form will be provided to the Contractor at or prior to the Pre-Construction meeting. Additional HM needed by the contractor shall be identified to the Contracting Officer's Representative (COR) for approval by the HMP.
- B. The contractor planning to use HM for work shall register with the base HMP prior to the start of work in order to support the installations compliance with Executive Order 12856. Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements.
- C. The contractor shall maintain Contractor HM Identification Form for HM on the job site for inspection and verification.
- D. The COR will verify that the HM identified to HMP is the only HM in use on the job site.
- E. The Contractor shall be responsible for the following items:
- F. Provide a list of each material and quantity of material for all proposed Hazardous Material (HM). HM shall be construed to mean any item that is:
 - 1. A health hazard or physical hazard as defined in 29 CFR, 1910.1200(c).
 - 2. Regulated in its disposal by EPA under 40 CFR.
 - 3. Hazardous as defined by DOT regulations under 40 CFR.
 - 4. Hazardous as defined by the Dangerous Goods Regulations of the International Air Transport Association.
- G. Provide a material safety data sheet (MSDS) for each item on the HM list.
- H. Contractor shall establish a construction specific HM storage and issue location that fully complies with Federal, State and Local environmental regulations. Materials issued shall be tracked for quantities used. Unused materials shall be inventoried and removed from the ANG installation prior to close out of the contract or expiration date of the HM. Reports of materials delivered, used and removed from the installation shall be submitted to the COR monthly and prior to the contract close-out.
- I. The Contractor shall comply with all Federal, State and Local environmental standards.
- J. The Contractor shall accompany the Bio-environmental Engineering Representative (BEE) and the (COR) on project close-out inspection to ensure all used/unused HM is removed from the installation. This requirement shall not be a punch list item and must be accomplished prior to the Government accepting beneficial occupancy of the facility or construction item.

END OF SECTION

SECTION 01 4533
CODE-REQUIRED SPECIAL INSPECTIONS

PART 1 GENERAL - NOT USED

1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.

1.02 RELATED REQUIREMENTS

- A. Document 00 3100 - Available Project Information: Soil investigation data.
- B. Section 01 3000 - ADMINISTRATIVE REQUIREMENTS: Submittal procedures.

1.03 DEFINITIONS

- A. Code or Building Code: 2012 Edition of the International Building Code and, more specifically, Chapter 17 - Structural Tests and Inspections, of same.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. Special Inspection:
 - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
 - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.04 SUBMITTALS

- A. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency shall:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
- B. Testing Agency Qualifications: Prior to the start of work, the Testing Agency shall:
 - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Testing Agency is acceptable to AHJ.
- C. Special Inspection Reports: After each special inspection, Special Inspector shall promptly submit two copies of report; one to Architect and one to the AHJ.
- D. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
 - 1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

1.05 SPECIAL INSPECTION AGENCY

- A. Contractor shall employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.06 TESTING AND INSPECTION AGENCIES

- A. Contractor shall employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

PART 3 EXECUTION

2.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
 - 1. Continuous Special Inspection: Special Inspection Agency shall be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspection: Special Inspection Agency shall be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

2.02 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

- A. Reinforcing Steel, Including Prestressing of Tendons and Placement: Verify compliance with approved contract documents and ACI 318, 3.5 and 7.1 through 7.7; periodic.
- B. Anchors Installed in Hardened Concrete: Verify compliance with ACI 318, 3.8.6, 8.1.3 and 21.2.8; periodic.
- C. Design Mix: Verify plastic concrete complies with the design mix in approved contract documents and with ACI 318, Chapter 4 and 5.2; periodic.
- D. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172, ASTM C31 and ACI 318, 5.6 and 5.8 and record the following, continuous:
 - 1. Slump.
 - 2. Air content.
 - 3. Temperature of concrete.
- E. Concrete and Shotcrete Placement: Verify application techniques comply with approved contract documents and ACI 318, 5.9 and 5.10; continuous.
- F. Specified Curing Temperature and Techniques: Verify compliance with approved contract documents and ACI 318, 5.11 through 5.13; periodic.
- G. Concrete Strength in Situ: Verify concrete strength complies with approved contract documents and ACI 318, 6.2, for the following.
- H. Formwork Shape, Location and Dimensions: Verify compliance with approved contract documents and ACI 318, 6.1.1; periodic.

2.03 SPECIAL INSPECTIONS FOR SOILS

- A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
 - 1. Design bearing capacity of material below shallow foundations; periodic.
 - 2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
 - 3. Subgrade, prior to placement of compacted fill; periodic.

- B. Testing: Classify and test excavated material; periodic.

2.04 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified reference standards.
 - 3. Ascertain compliance of materials and products with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests or inspections specified.
- B. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
- C. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

2.05 TESTING AGENCY DUTIES AND RESPONSIBILITIES

- A. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests or inspections specified.
- B. Limits on Testing or Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the work.
- C. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
- D. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

2.06 CONTRACTOR DUTIES AND RESPONSIBILITIES

- A. Contractor Responsibilities, General:
 - 1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
 - 2. Cooperate with agency and laboratory personnel; provide access to the work, to manufacturers' facilities, and to fabricators' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to work to be tested or inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
 - c. To facilitate tests or inspections.
 - d. To provide storage and curing of test samples.

4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

END OF SECTION

Minnesota Department of Labor and Industry
 Construction Codes and Licensing Division
 Building Plan Review/Inspections
 443 Lafayette Road North
 St. Paul, MN 55155-4341
 Phone: (651) 284-5068 Fax: (651) 284-5749
 www.dli.mn.gov



MINNESOTA DEPARTMENT OF
LABOR & INDUSTRY

**Special Structural Testing and Inspection Program
 Summary Schedule**

PRINT IN INK or TYPE your responses.

PROJECT NAME RIDGEVIEW ROAD INFRASTRUCTURE	PROJECT NO.
LOCATION	PERMIT NO.

Technical (2)		Description (3)	Type of Inspector (4)	Specific Report Frequency (5)	Assigned Firm (6)
Section	Article				
1705.3	(1)	CONC. REINFORCING	SI-T	PERIODIC	
1705.3	(3) (4)	CONC. ANCHORS	SI-T	PERIODIC	
1705.3	(5)	CONC. MIX DESIGNS	SI-T	PERIODIC	
1705.3	(6) (7)	CONC. PLACEMENT	SI-T	CONTINUOUS	
1705.3	(12)	CONC. FORMWORK	SI-T	PERIODIC	
1705.6	(1)	VERIFY SUB-SOIL	SI-T	PERIODIC	
1705.6	(2)	EXCAVATION VERIFY	SI-T	PERIODIC	
1705.6	(3)	COMPACTION TESTING	SI-T	PERIODIC	

Note: This schedule shall be filled out and included in a Special Structural Testing and Inspection Program.
 (If not otherwise specified, assumed program will be "Guidelines for Special Inspection & Testing" as contained in the State Building Code and as modified by the state adopted IBC.)

A complete specification-ready program can be downloaded directly by visiting CASE/MN at www.cecm.org

- (1) Permit No. to be provided by the Building Official
- (2) Referenced to the specific technical scope section in the program.
- (3) Use descriptions per IBC Chapter 17, as adopted by Minnesota State Building Code.
- (4) Special Inspector – Technical (SIT); Special Inspector – Structural (SIS)
- (5) Weekly, monthly, per test/inspection, per floor, etc.
- (6) Name of Firm contracted to perform services.

ACKNOWLEDGEMENTS
 (Each appropriate representative shall sign below)

Owner: _____	Firm: _____	Date: _____
Contractor: _____	Firm: _____	Date: _____
Architect: _____	Firm: _____	Date: _____
SER: <u>Jennifer M. Balcock</u>	Firm: <u>LHB, INC.</u>	Date: <u>8-13-15</u>
SI-T: _____	Firm: _____	Date: _____
SI-S: _____	Firm: _____	Date: _____
TA: _____	Firm: _____	Date: _____
F: _____	Firm: _____	Date: _____

If requested by engineer/architect of record or building official, the individual names of all prospective special inspectors and the work they intend to observe shall be identified as an attachment.

Legend: SER = Structural Engineer of Record SI-T = Special Inspector - Technical TA = Testing Agency
 SI-S = Special Inspector - Structural F = Fabricator

Accepted for the Building Department By _____ Date _____
 This material can be made available in different forms, such as large print, Braille or on a tape. To request, call 1-800-342-5354 (DIAL-DLI) Voice or TDD (651) 297-4198.

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.

1.02 RELATED REQUIREMENTS

- A. Section 26 0500 - Basic Electrical Requirements

1.03 TEMPORARY UTILITIES

- A. Contractor to pay for temporary utilities.
 - 1. Electrical power, may connect to existing Owner's electrical system with meter or provide temporary generator.
 - 2. Water supply, consisting of connection to existing facilities with temperature meter.

1.04 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications service to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software, laser printer, and internet connection.
 - 2. Telephone Lines: One line, minimum; cellular phone for Site Superintendent.
 - 3. Facsimile Service: Fax-to-email software on personal computer.

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 SECURITY

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

1.08 VEHICULAR ACCESS AND PARKING

- A. Coordinate access and haul routes with governing authorities and Owner.
- B. Contractor Officer's Representative will provide temporary parking areas to accommodate construction personnel.
- C. Contractor must comply with Foreign Object Damage (FOD) procedures.

1.09 WASTE REMOVAL

- A. See Section 01 7419 - Waste Management, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.

1.10 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations and procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 4000 - Quality Requirements: Product quality monitoring.

1.03 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns unless noted otherwise in the technical sections.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. Do not use products having any of the following characteristics:
 - 1. Made outside the United States, its territories, Canada, or Mexico without Government approval.
 - 2. Made using or containing CFC's or HCFC's.
 - 3. Made of wood from newly cut old growth timber.
- C. Where all other criteria are met, Contractor shall give preference to products that:
 - 1. Are extracted, harvested, and/or manufactured closer to the location of the project.
 - 2. Have longer documented life span under normal use.
 - 3. Result in less construction waste.

2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: The use of brand name items is to establish a standard of quality only and shall not be construed as limiting competition or precluding the contractor from offering an equal item(s) from another source(s). Any brand name intended to be a restriction to a sole source shall be clearly identified as "No substitutions".

2.03 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

- A. Product substitution pre-approvals will not be given during bidding. Follow substitution procedures during submittal process.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- C. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Will provide the same warranty for the substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- D. Substitution Submittal Procedure:
 - 1. Submit one electronic copy of request for substitution for consideration. Limit each request to one proposed substitution.
 - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
 - 3. The Architect will notify Contractor in writing of decision to accept or reject request.

3.02 TRANSPORTATION AND HANDLING

- A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- B. Transport and handle products in accordance with manufacturer's instructions.
- C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
- F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. Prevent contact with material that may cause corrosion, discoloration, or staining.
- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

- I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Cleaning and protection.
- C. Starting of systems and equipment.
- D. Demonstration and instruction of Owner personnel.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary:
- B. Section 01 3000 - ADMINISTRATIVE REQUIREMENTS: Submittals procedures.
- C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.
- E. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- F. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 PROJECT CONDITIONS

- A. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- B. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.05 COORDINATION

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Examine and verify specific conditions described in individual specification sections.
- C. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- D. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate, leveling compound, primer, sealer, or conditioner prior to applying any new material or substance in contact or bond. Coordinate to align with adjacent finished surfaces.

3.03 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, and ground floor elevations.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

3.04 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

3.05 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

3.06 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.

- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.07 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- B. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

3.08 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.09 FINAL CLEANING

- A. Execute final cleaning .
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces,
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean site; sweep paved areas, rake clean landscaped surfaces.
- F. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.10 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
- B. Notify Architect when work is considered ready for Substantial Completion.
- C. Project Closeout Meeting;
 - 1. COR when Work is to be 70% complete or 60 days prior to Substantial Completion.
 - 2. COR will Schedule Project Closeout meeting. Attendance required;
 - a. Contractor's Project Manager and Site Superintendent.
 - b. Major Sub-Contractors and suppliers
 - c. COR
 - d. Architect's Project Manager
 - 3. Contractor shall use Project Closeout Checklist, attached to this Section, to ensure the timely completion of all required project closeout milestones. Contractor shall brief the Government on the completion status at each Progress Meeting and shall advise the COR in writing when each of the milestone have been completed.
- D. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.
- E. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.
- F. Notify Architect when work is considered finally complete.
- G. Complete items of work determined by Architect's final inspection.
- H. Make submittals that are required by governing or other authorities.
- I. Notify Architect when work is considered finally complete.

J. Complete items of work determined by Architect's final inspection.

END OF SECTION

SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- C. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Clean dimensional wood: May be used as blocking or furring.
 - 5. Land clearing debris, including brush, branches, logs, and stumps: See Section 31 1000 for use options.
 - 6. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
 - 7. Asphalt paving.
 - 8. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
- D. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- E. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - ADMINISTRATIVE REQUIREMENTS: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.
- E. Section 31 1000 - Site Clearing: Handling and disposal of land clearing debris.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 01 7000 for trash/waste prevention procedures installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing Waste Management.
- B. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- C. Meetings: Discuss trash/waste management goals and issues at project meetings, particularly at:
 - 1. Pre-bid meeting.
 - 2. Pre-construction meeting.
 - 3. Regular job-site meetings.
 - 4. Job safety meetings.
- D. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. As a minimum, provide:

- a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
 - b. Separate dumpsters for each category of recyclable.
 - c. Recycling bins at worker lunch area.
 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- E. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- F. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- G. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- H. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

**SECTION 01 7800
CLOSEOUT SUBMITTALS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittals, shop drawings, product data, samples and similar documents.
- B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Government prior to final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 2. Submit one (1) copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 3. Submit two (2) sets hard copy and one (1) digital, of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
- D. ANG Worksheet for form 1354 completed.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.

- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Upon completion of construction, the Contractor shall be required to furnish a copy of the construction drawings showing in red any changes from the original design that occurred during the construction period.
 - 2. The copy of the construction drawings so marked shall be marked and certified "AS BUILT."

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

3.04 WORKSHEET FOR FORM 1354

- A. A copy of the Works Sheet for DD Form 1354 is included with this document (5 pages.)
- B. Contact Contracting Officer for further instructions on completing form.
- C. Submit completed form to Contracting Officer for review and approval prior to submitting Final Pay Application.

END OF SECTION

SECTION 03 1000
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

1.02 RELATED REQUIREMENTS

- A. Section 03 2000 - Concrete Reinforcing.
- B. Section 03 3000 - Cast-in-Place Concrete.
- C. Section 03 3900 - Concrete Curing.
- D. Section 04 2001 - Masonry Veneer: Spacing for veneer anchor reglets recessed in concrete, recessed anchor slots.
- E. Section 05 1200 - Structural Steel: Placement of embedded steel anchors and plates in cast-in-place concrete.

1.03 REFERENCE STANDARDS

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.
- B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute; 2010.
- C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2005.
- D. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute; 2004.
- E. PS 1 - Structural Plywood; 2009.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store products under cover to protect from oil, dirt, and sunlight.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.
- C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.
- D. Comply with relevant portions of ACI 347, ACI 301, and ACI 318.

2.02 WOOD FORM MATERIALS

- A. Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I.

2.03 REMOVABLE PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Preformed Plastic Forms: Thermoplastic polystyrene form liner, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

- C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

2.04 FORMWORK ACCESSORIES

- A. Form Ties: Snap-off type, plastic, adjustable length, cone type, 1 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.
- B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
 - 1. Composition: Colorless mineral oil-based compound.
- C. Flashing Reglets: Galvanized steel, 22 gage thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- E. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 1200.
- F. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A153/A153M, Class B-2 finish.
 - 1. Wire ties: triangular shape, 0.1875 inch thick.
 - 2. Vertical adjustment: Not less than 2 inches.
 - 3. Spacing: One anchor for every 2 square feet of wall surface.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

- A. Earth forms are not permitted.

3.03 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members that are not indicated on drawings.
- F. Coordinate this section with other sections of work that require attachment of components to formwork.
- G. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.04 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.
- D. At concrete scheduled to receive waterproofing, use only form release agent with prior approval from waterproofing manufacturer.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
 - 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
 - 2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

3.08 FIELD QUALITY CONTROL

- A. An independent testing agency will inspect installed forms, as specified in Section 01400.

3.09 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

**SECTION 03 2000
CONCRETE REINFORCING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

- A. Section 03 1000 - Concrete Forming and Accessories.
- B. Section 03 3000 - Cast-in-Place Concrete.
- C. Section 04 2001 - Masonry Veneer: Spacing for veneer anchor reglets recessed in concrete.

1.03 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
- B. ACI 318 - Building Code Requirements For Structural Concrete and Commentary; American Concrete Institute International; 2005.
- C. ACI SP-66 - ACI Detailing Manual; American Concrete Institute International; 2004.
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2013.
- E. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a.
- F. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement; 2006 (Reapproved 2011).
- G. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement; 2013.
- H. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2013.
- I. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute; 28th Edition.
- J. CRSI (P1) - Placing Reinforcing Bars; Concrete Reinforcing Steel Institute; 2011.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
- C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301, ACI SP-66, and CRSI Manual of Standard Practice.

PART 2 PRODUCTS

2.01 REINFORCEMENT

- A. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420) or ASTM A 706/A 706M Grade 60 (weldable).
 - 1. Deformed billet-steel bars.
 - 2. Unfinished, except as noted.
- B. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, plain type.

1. Flat Sheets.
 2. Mesh Size and Wire Gage: As indicated on Drawings.
- C. Reinforcement Accessories:
1. Tie Wire: Annealed, minimum 16 gage.
 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - a. Precast concrete blocks of strength equal to or greater than specified strength of concrete or Class 3 supports equipped with sand plates, where concrete will be cast against earth. Concrete masonry units will not be acceptable.

2.02 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Welding of reinforcement is not permitted, unless specifically noted on the Drawings.
- C. Locate reinforcing splices not indicated on drawings at point of minimum stress.

PART 3 EXECUTION

3.01 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor retarder.
- C. Accommodate placement of formed openings.
- D. Conform to ACI 318 code for concrete cover over reinforcement.

3.02 FIELD QUALITY CONTROL

- A. An independent testing agency, as specified in Section 01 4000, will inspect installed reinforcement for conformance to contract documents before concrete placement.

END OF SECTION

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Floors and slabs on grade.
- B. Concrete footings and foundation walls.
- C. Joint devices associated with concrete work.
- D. Miscellaneous concrete elements, including equipment pads and light pole bases.
- E. Installation of embedments and bearing plates in concrete.

1.02 RELATED REQUIREMENTS

- A. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.
- B. Section 03 2000 - Concrete Reinforcing.
- C. Section 07 9200 - Joint Sealants: Products and installation for sealants for saw cut joints and isolation joints in slabs.
- D. Section 03 3513 - Concrete Floor Finishing.
- E. Section 03 3900 - Concrete Curing.
- F. Section 07 2620 - Under-Slab Vapor Retarder.
- G. Section 07 9005 - Joint Sealers: Sealants for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
- B. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International; 2010.
- C. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (errata 2007).
- D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- E. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.
- F. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.
- G. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).
- H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2005.
- I. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute International; 2004.
- J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Billet-Steel Bars for Concrete Reinforcement; 2015.
- K. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2013.
- L. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- M. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2012a.
- N. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2013.
- O. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.

- P. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.
- Q. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.
- R. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2007.
- S. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.
- T. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- U. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.
- V. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.
- W. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2012.
- X. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2011.
- Y. ASTM C 989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars; 2004.
- Z. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2013.
- AA. ASTM D994/D994M - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type); 2011.
- AB. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.
- C. Mix Design: Submit proposed concrete mix design.
- D. Samples: Submit samples of underslab vapor retarder to be used.
- E. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
 - 1. Maintain one copy of each document on site.
- B. Acquire cement from same source and aggregate from same source for entire project.
- C. Follow recommendations of ACI 305R when concreting during hot weather.
- D. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Comply with requirements of Section 03 1000.

2.02 REINFORCEMENT

- A. Comply with requirements of Section 03 2000.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal Portland type.
 - 1. Acquire all cement for entire project from same source.

- B. Fine and Coarse Aggregates: ASTM C 33.
 1. Acquire all aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or 120.
- E. Water: Clean and not detrimental to concrete.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. Accelerating Admixture: ASTM C494/C494M Type C.
- D. Retarding Admixture: ASTM C494/C494M Type B.
- E. Water Reducing Admixture: ASTM C 494/C 494M Type A and/or Type F.

2.05 ACCESSORY MATERIALS

- A. Under-Slab Vapor Retarder: Comply with the requirements of Section 07 2620.
- B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 1. ASTM C1107/C1107M; Grade A, B, or C.
 2. Minimum Compressive Strength at 48 Hours: 2,000 psi.
 3. Minimum Compressive Strength at 28 Days: 7,000 psi.

2.06 BONDING AND JOINTING PRODUCTS

- A. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
- B. Joint Filler: Nonextruding, resilient asphalt impregnated fiberboard or felt, 1/4 inch thick and full depth of slab less 1/2 inch; tongue and groove profile.
- C. Construction Joint Devices: As detailed on the drawings.
- D. Sealant and Primer: As specified in Section 07 9005.

2.07 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures for normal weight concrete, as specified in ACI 301.
 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
 2. Where trial mixtures are used, they shall be completed, tested and approved by the Architect/Engineer prior to use on the site. In addition, the trial mixtures shall include all admixtures that will be used in the field. Additional trial mixtures shall be required for all variations of mix components and admixtures.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1, as appropriate for environmental conditions, and at rates recommended by manufacturer.
- D. Normal Weight Concrete:
 1. Compressive Strength, Slump, Aggregate and Air: As noted on the Drawings.
 2. Admixtures: Add acceptable admixtures as recommended in ACI 211.1, as appropriate for environmental conditions, and at rates recommended by manufacturer.
 3. Fly Ash Content: Maximum 25 percent of cementitious materials by weight, except maximum 15 percent in floor slabs.
 4. Total Air Content: 6 percent, per ASTM C 173 (exterior concrete only).
 5. Maximum Slump: 4 inches.

6. Granulated Blast Furnace Slag: Maximum 50 percent of cementitious materials by weight, except maximum 15 percent in floor slabs.
7. Total of Fly Ash and Granulated Blast Furnace Slag Combined: Maximum 50 percent of cementitious materials by weight, except maximum 15 percent in floor slabs.

2.08 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Verify that forms are clean and free of rust before applying release agent.
- B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- C. Install vapor retarder in accordance with Section 07 2620 under interior slabs on grade. Place as noted on the Drawings.
- D. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify Architect not less than 24 hours prior to commencement of placement operations.
- D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- E. Ensure reinforcement, inserts, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.04 SLAB JOINTING

- A. Locate joints as indicated on the drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 8 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.
- E. FLOOR FLATNESS AND LEVELNESS TOLERANCES
- F. Maximum Variation of Surface Flatness:
 1. Exposed Concrete Floors: 1/8 inch in 10 ft.
- G. Correct the slab surface if tolerances are less than specified.

- H. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.05 CONCRETE FINISHING

- A. Repair surface defects, immediately after removing formwork.
- B. Concrete slabs: Finish to requirements of Section 03 3513.

3.06 CURING AND PROTECTION

- A. Comply with requirements of Section 03 3900.
- B. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.07 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- E. Periodically verify proper concrete placement technique.
- F. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 50 cu yd or less of each class of concrete placed per day.
- G. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- H. Perform one slump test and check temperature for each set of test cylinders taken, following procedures of ASTM C 143/C 143M.
- I. Perform one air test for each set of cylinders taken for air-entrained concrete.

3.08 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

END OF SECTION

**SECTION 03 3513
CONCRETE FLOOR FINISHING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finishing slabs on grade.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Prepared concrete floors ready to receive finish.
- B. Section 03 3000 - Cast-in-Place Concrete: Control and formed expansion and contraction joints and joint devices.
- C. Section 03 3900 - Concrete Curing.
- D. Section 07 9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2005.
- B. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (errata 2007) .

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.07 PROJECT CONDITIONS

- A. Coordinate the work with concrete floor placement and concrete floor curing.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section.

3.02 FLOOR FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1R.
- B. Magnesium float (not steel trowelled) finish on interior slabs-on-grade (due to air entrainment).
- C. Light broom finish perpendicular to traffic direction for exterior slab surfaces.

3.03 SEALER (BASE BID)

- A. Install concrete sealer according to manufacturer's recommendations.

3.04 TOLERANCES

- A. Measure flatness of slabs in accordance with ACI 302.1R.
 - 1. Maximum Variation of Surface Flatness For Exposed Concrete Floors: 1/8 inch in 10 ft.
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

END OF SECTION

**SECTION 03 3900
CONCRETE CURING**

ACI 301 - SPECIFICATION FOR STRUCTURAL CONCRETE FOR BUILDINGS; AMERICAN CONCRETE INSTITUTE INTERNATIONAL.

1.01 SECTION INCLUDES

- A. Initial and final curing of horizontal and vertical concrete surfaces.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.
- B. Section 03 3513 - Concrete Floor Finishing.

1.03 REFERENCE STANDARDS

- A. ACI 301 - Specification for Structural Concrete for Buildings; American Concrete Institute International.
- B. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (errata 2007) .
- C. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).
- D. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2007.
- E. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2007.
- F. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting; 2008.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 and ACI 302.1R.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver curing materials in manufacturer's sealed packaging, including application instructions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Membrane Curing Compound: ASTM C 309 Type 1 - Clear or translucent, Class A.
 - 1. Water-Based Acrylic type.
 - 2. Provide Kure-N-Seal (TM) W manufactured by BASF Sonneborn.
- B. Membrane Curing, Hardening, Sealing, and Dustproofing Compound
 - 1. Alkali-silicate hardener.
 - 2. Provide Kure-N-Harden (TM) manufactured by BASF Sonneborn.
- C. Moisture-Retaining Sheet: ASTM C171.
 - 1. White-burlap-polyethylene sheet, weighing not less than 10 oz/per linear yd, 40 inches wide.
- D. Polyethylene Film: ASTM D2103, 4 mil thick, clear.
- E. Water: Potable, not detrimental to concrete.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to be cured.

3.02 EXECUTION - HORIZONTAL SURFACES

- A. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 3 days.
- B. Spraying: Spray water over floor slab areas and maintain wet for 3 days.

- C. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges; maintain in place for not less than 3 days.
- D. Absorptive Moisture-Retaining Sheet: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place for 3 days.
- E. Membrane Curing Compound: Apply curing compound in accordance with manufacturer's instructions in two coats, with second coat applied at right angles to first.
- F. Membrane Curing, Hardening, Sealing, and Dustproofing Compound: Apply in accordance with manufacturer's instructions.

3.03 EXECUTION - VERTICAL SURFACES

- A. Cure surfaces in accordance with ACI 308R.
- B. Spraying: Spray water over surfaces and maintain wet for 5 days.
- C. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions in two coats, with second coat applied at right angles to first.

3.04 PROTECTION

- A. Do not permit traffic over unprotected floor surface.

3.05 FIELD QUALITY CONTROL

- A. Owner's representative will check maintenance of curing procedures in accordance with Section 01 4000.

3.06 SCHEDULES

- A. Floors to receive floor coverings, coatings or other products that may react adversely to membrane curing compounds: Wet or moist cure method: ponding, spraying, moisture-retaining sheet or absorptive moisture-retaining sheet.
- B. All Other Floor Areas: Membrane curing compound.

END OF SECTION

SECTION 04 2616
ADHERED MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Thin Brick.
- B. Mortar and Grout.
- C. Adhesives.
- D. Accessories.

1.02 REFERENCE STANDARDS

- A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; American Concrete Institute International; 2011.
- B. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile - Version; 2013.1.
- C. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive; 2013.1.
- D. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.
- E. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.
- F. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2012.
- H. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring; 2003 (Reapproved 2013).
- I. ASTM C847 - Standard Specification for Metal Lath; 2012.
- J. ASTM C1088 - Standard Specification for Thin Veneer Brick Units Made From Clay or Shale; 2014.
- K. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation - Version; 2013.1.

1.03 SUBMITTALS

- A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
- B. Product Data: Provide data for thin brick units, mortar, grout, and adhesive.
- C. Samples: Submit four samples of thin brick units to illustrate color, texture, and extremes of color range.

1.04 QUALITY ASSURANCE

- A. Maintain one copy of the ANSI A108/A118/A136.1 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 5 years of documented experience.
- C. Installer Qualifications: Company specializing in performing tile installation, with minimum of 5 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.
- B. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.06 FIELD CONDITIONS

- A. Do not install adhesives in an unventilated environment.

- B. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 THIN BRICK

- A. Manufacturers:
 - 1. Endicott Clay Products Co: www.endicott.com.
 - 2. Ochs Brick Co.: www.ochsbrick.com
 - 3. Sioux City Brick & Tile Co., www.siouxcitybrick.com
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Thin Brick: ASTM C1088.
 - 1. Type: TBX.
 - 2. Size: Manufacturer's standard Modular.
 - 3. Thickness: 5/8 inch.
 - 4. Tolerances: 1/16 inch.
 - 5. Color, Texture, Range: to match Base Standard, Building 212.
 - 6. Protective Coating: Wax.

2.02 ADHESIVE MATERIALS

- A. Epoxy Adhesive: ANSI A118.3, _____, thinset bond type.
- B. Thin Brick Setting Adhesive: Elastomeric, waterproof, liquid applied, _____.

2.03 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C91/C91M Type N.
- B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Water: Clean and potable.

2.04 MORTAR AND GROUT MIXES

- A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.
 - 1. Exterior, non-loadbearing masonry: Type N.
- B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

2.05 FLASHINGS

- A. Copper/Kraft Paper Flashings: 1 oz/sq ft sheet copper bonded to fiber reinforced asphalt treated Kraft paper. Provide _____ manufactured by _____.
- B. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane, or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

2.06 LATH

- A. Diamond Mesh Metal Lath: ASTM C847, galvanized; self-furring.
 - 1. Weight: To suit application and as specified in ASTM C841 for framing spacing.
 - 2. Weight: 2.5 lb/sq yd, minimum.
- B. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, maximum possible lengths.

2.07 ACCESSORIES

- A. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive thin brick veneer.

3.02 INSTALLATION

- A. Exterior Applications: Comply with TCNA (HB) Method W201, W202, or W244E.
- B. Lath Installation:
 - 1. Apply metal lath taut, with long dimension perpendicular to supports.
 - 2. Lap ends minimum 1 inch. Secure end laps with tie wire where they occur between supports.
 - 3. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.
 - 4. Place corner bead at external wall corners; fasten at outer edges of lath only.
 - 5. Place 4 inch wide strips of metal lath centered over junctions of dissimilar backing materials. Secure rigidly in place.
 - 6. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.
 - 7. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

3.03 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Brick Units:
 - 1. Bond: Running.
 - 2. Coursing: Three units and three mortar joints to equal 8 inches.
 - 3. Mortar Joints: Concave.

3.04 PLACING AND BONDING

- A. Remove excess mortar as work progresses.
- B. Interlock intersections and external corners, except for units laid in stack bond.
- C. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove and replace.
- D. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.05 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

3.06 TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- B. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
- C. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

3.07 CLEANING

- A. Remove excess mortar and mortar smears as work progresses.

B. Clean soiled surfaces with cleaning solution.

END OF SECTION

**SECTION 04 7200
CAST STONE MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural cast stone.

1.02 SUBMITTALS

- A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
- B. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
- C. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. A firm with a minimum of 5 years experience producing cast stone of types required for project.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
- B. Store cast stone components and installation materials in accordance with manufacturer's instructions.
- C. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

PART 2 PRODUCTS

2.01 ARCHITECTURAL CAST STONE

- A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural granite, complying with ASTM C1364.
 - 1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
 - 2. Freeze-Thaw Resistance: Demonstrated by field experience.
 - 3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
 - 4. Color: Match Base standard, "Buff".
- B. Shapes: Provide shapes indicated on drawings.
 - 1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
 - 2. Unless otherwise indicated on drawings, provide:
 - a. Wash or slope of 1:12 on exterior horizontal surfaces.
 - b. Drips on projecting components, wherever possible.
 - c. Raised fillets at back of sills and at ends to be built in.
- C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.02 MATERIALS

- A. Portland Cement: ASTM C150.
 - 1. For Mortar: Type I or II, except Type III may be used in cold weather.
- B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

- C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.
- D. Admixtures: ASTM C494/C494M.
- E. Water: Potable.
- F. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized.
 - 1. Galvanized in accordance with ASTM A767/A767M, Class I.
- G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.
- H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
- I. Mortar: Portland cement-lime, ASTM C270, Type N; do not use masonry cement.
- J. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Mechanically anchor each cast stone unit.
- B. Setting:
 - 1. Drench cast stone components with clear, running water immediately before installation.
 - 2. Set units in a full bed of mortar unless otherwise indicated.
 - 3. Fill vertical joints with mortar.
 - 4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
- C. Joints: Make all joints 3/8 inch, except as otherwise detailed.
 - 1. Rake mortar joints 3/4 inch for pointing.
 - 2. Remove excess mortar from face of stone before pointing joints.
 - 3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
- D. Installation Tolerances:
 - 1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
 - 2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.
 - 3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
- E. Repairs: Repair chips and other surface damage noticeable when viewed in direct daylight at 10 feet.
 - 1. Repair with matching touchup material provided by the manufacturer and in accordance with manufacturer's instructions.
 - 2. Repair methods and results subject to Architect 's approval.

3.02 CLEANING

- A. Keep cast stone components clean as work progresses.

3.03 PROTECTION

- A. Protect completed work from damage.
- B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 07 1400
FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fluid applied membrane waterproofing.

1.02 RELATED REQUIREMENTS

- A. Section 31 2323 - Fill.
- B. Section 03 3000 - Cast-in-place Concrete
- C. Section 07 9005 - Joint Sealers: Sealant for joints in substrates.

1.03 REFERENCE STANDARDS

- A. ASTM D-5329 - Standard Test Methods for Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements. 2009-JUN-01
- B. ASTM E96/E96M - Standard Test Methods For Water Vapor Transmission of Materials; 2013.
- C. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for membrane.
- C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacture of fluid-applied waterproofing membranes with three years experience.
- B. Installer Qualifications: Company specializing in installation of fluid-applied waterproofing approved by manufacturer.

1.06 PRE-INSTALLATION MEETING:

- A. Membrane waterproofing applicator shall meet with the Manufacturer's representative, Contractor, Architect and Owner or Owner's Representative at the project site to review the membrane water proofing procedures, acceptance of surfaces and coordination of other trades.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures above 0 degrees F for 24 hours before and during application and until cured or as recommended by mfgr.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no cost to Owner.
- C. Total System Warranty: Provide five year manufacturer warranty for waterproofing failing to resist penetration of water .

1.09 DELIVERY, STORAGE AND HANDLING

- A. Store all materials for membrane waterproofing work in accordance with the manufacturer's recommendations, as approved, and in accordance with the requirements herein specified.

- B. Deliver materials in Manufacturer's unopened containers fully identified with brand, type, class, grade and all other qualifying and product information.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hot-Applied Rubberized Asphalt Waterproofing Manufacturers:
 - 1. American Hydrotech, Inc; Product MM6125: www.hydrotechusa.com.
 - 2. Carlisle Coatings & Waterproofing, Inc; Product CCW-500R: www.carlisle-ccw.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SYSTEM DESCRIPTION

- A. Furnish and install a complete waterproofing assembly including surface conditioner, a monolithic, rubberized asphalt membrane, and flashings. All products to be from a single-source manufacturer.

2.03 WATERPROOFING APPLICATIONS

- A. Hot-Applied Rubberized Asphalt Waterproofing: Use at all concrete surfaces to be below grade..

2.04 MEMBRANE AND FLASHING MATERIALS

- A. Hot-Applied Rubberized Asphalt Waterproofing: Elasticized rubberized asphaltic compound, hot-applied and quick setting.
 - 1. Cured Thickness: 0.03 inches, minimum.
 - 2. Suitable for installation over concrete, gypsum board, and plywood substrates.
 - 3. Tensile Strength: 15 psi, measured in accordance with ASTM D412.
 - 4. Ultimate Elongation: 500 percent, minimum, measured in accordance with ASTM D412.
 - 5. Hardness: 60, measured in accordance with ASTM D2240, using Type A durometer.
 - 6. Tear Strength: 150 lbf/inch, measured in accordance with ASTM D624.
 - 7. Water Vapor Permeance: 0.2 perms, maximum, measured in accordance with ASTM E96/E96M.
 - 8. Adhesion: Greater than 150 psi, measured in accordance with ASTM D4541.

2.05 ACCESSORIES

- A. Surface Conditioner: asphaltic type, compatible with membrane compound; as recommended by membrane manufacturer.
- B. Sealant for Substrate Surfaces: As recommended by membrane manufacturer.
- C. Counterflashings: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.
- C. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

- A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.
- B. Do not apply waterproofing to surfaces unacceptable to manufacturer.
- C. Seal cracks and joints with sealant using methods recommended by sealant manufacturer and waterproofing manufacturer.

3.03 INSTALLATION

- A. Apply primer or surface conditioner at a rate recommended by manufacturer. Protect conditioner from rain or frost until dry. Allow sufficient time for surface conditioner to dry prior to membrane application.
- B. Apply waterproofing in accordance with manufacturer's instructions to specified minimum thickness.
- C. At joints and cracks less than 1/2 inch in width including joints between horizontal and vertical surfaces, apply 12 inch wide strip of joint cover sheet.
- D. Install flexible flashings and seal into waterproofing material. Seal items penetrating through membrane with flexible flashings. All detailing and flashing shall be done in accordance with manufacturer's recommended details.
- E. Seal membrane and flashings to adjoining surfaces. Install counterflashing over all exposed edges.

3.04 FIELD QUALITY CONTROL

- A. Contractor to provide testing services of Waterproofing installation in accordance with Section 01 4000 - Quality Requirements. Contractor shall provide temporary construction and materials as required for testing.
- B. Testing to be by means of electronic testing or ponding water. For ponding water test;
 - 1. On completion of horizontal membrane installation, dam installation area in preparation for flood testing.
 - 2. Flood to minimum depth of 2 inch with clean water. After 48 hours, inspect for leaks.
- C. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test. Repair damage to building.
- D. When area is proven watertight, drain water and remove dam.

3.05 PROTECTION

- A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

**SECTION 07 2100
THERMAL INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation and integral vapor retarder at perimeter foundation wall and underside of floor slabs.

1.02 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2013.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2013a.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation Under Concrete Slabs: Extruded polystyrene board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene board.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene Board Insulation: ASTM C578, Type VII; Extruded polystyrene board with either natural skin or cut cell surfaces; with the following characteristics:
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Board Size: 48 x 96 inch.
 - 4. Board Thickness: 2 inches.
 - 5. Board Edges: Square.
 - 6. Compressive Resistance: 60 psi.
 - 7. Water Absorption, maximum: 0.3 percent, volume.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.
- B. Verify substrate surfaces are flat, free of irregularities.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER AND SLABS ON GRADE

- A. Install boards horizontally on foundation perimeter and beneath slabs on grade.
 - 1. Place insulation under footings and slabs on grade after subgrade compaction and by providing a shallow compacted sand leveling bed.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and to protrusions.
 - 4. Stagger joints between adjacent layers.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2620
UNDER-SLAB VAPOR RETARDER

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reinforced vapor retarders.
- B. Tape to seal joints and repair vapor retarder.
- C. Pipe boots for sealing penetrations.

1.02 RELATED SECTIONS

- A. Section 03 3000 - Cast-In-Place Concrete: Slabs on grade.

1.03 REFERENCES

- A. ACI 302.1R - Guide for Concrete and Slab Construction; 1996.
- B. ASTM E 96 - Water Vapor Transmission of Materials; 2000.
- C. ASTM E 1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 1998.
- D. ASTM E 1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 1997.
- E. ASTM F 1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor; 2006.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Independent laboratory test results showing compliance with ASTM & ACI Standards.
- C. Selection Samples: Submit manufacturer's samples of reinforced vapor retarders.

1.05 QUALITY ASSURANCE

- A. Preinstallation Meeting: Convene a preinstallation meeting two weeks before start of installation of reinforced vapor retarders. Require attendance of parties directly affecting work of this section, including Contractor, Architect and installer. Review installation, protection, and coordination with other work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage:
 - 1. Store products in manufacturer's unopened packaging until ready for installation.
 - 2. Store materials in a clean, dry area in accordance with manufacturer's instructions.
- C. Handling: Protect materials during handling and installation to prevent damage.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Stego Wrap (15 mil, Class A) by Stego Industries, San Juan Capistrano, CA: (877) 464-7834.
- B. Griffolyn (15 mil, Class A) by Reef Industries, Inc., PO Box 750250, Houston, Texas 77275-0250/9209 Almeda Genoa Rd Houston, TX 77075. Tel: (800) 231-6074 or (713) 507-4200. Fax (713) 507-4295. E-Mail ri@reefindustries.com. www.reefindustries.com

- C. Barrier-Bac VB-350 (16 mil, Class A) by Barrier-Bac, Inc., Calhoun, GA: (973) 994-8035.
- D. VaporBlock VB 15 (15 mil, Class A) or VB Plus 20 (20 mil, Class A) by Raven Industries: (800) 635-3456.
- E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REINFORCED VAPOR RETARDERS

- A. Maximum Permeance: 0.03 Perms, ASTM E-96 or F 1249.
- B. Water Vapor Retarder: ASTM E 1745, meet or exceed Class A.
- C. Thickness of Retarder: ACI 302.1R, not less than 15 mils.
- D. Made for use in below-grade applications.

2.03 ACCESSORIES

- A. General: Ensure accessories are from same manufacturer as reinforced vapor retarders.
- B. Seam Tape: High Density Polyethylene Tape with pressure-sensitive adhesive. Minimum width 4 inches.
- C. Pipe Boots: Construct pipe boots from vapor retarder material and pressure-sensitive tape per manufacturer's instructions.
- D. Mastic: Vapor retarder manufacturer's recommended mastic.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces and areas to receive reinforced vapor retarders. Notify Architect in writing defects of work and other unsatisfactory site conditions that would cause defective installation of vapor retarders. Do not begin installation until unacceptable conditions have been corrected.
- B. Verify site dimensions.
- C. Commencement of work will imply acceptance of substrate.

3.02 INSTALLATION

- A. Install reinforced vapor retarders in accordance with manufacturer's instructions and ASTM E 1643 at concrete slabs.
- B. Install vapor retarders continuously at locations as indicated on the drawings. Ensure there are no discontinuities in vapor retarder at seams and penetrations.
- C. Install vapor retarders in largest practical widths.
- D. Ensure surface beneath vapor retarder is smooth with no sharp projections.
- E. Lap vapor retarder over footings and seal to foundation walls.
- F. Lap vapor retarder 6 inches and seal with manufacturer's tape. Ensure vapor retarder surfaces to receive mastic tape are clean and dry.
- G. Immediately repair holes in vapor retarder with manufacturer's self-adhesive repair tape or mastic.
- H. Seal around pipes and other penetrations in vapor retarder with pipe boots or manufacturer's mastic in accordance with manufacturer's instructions.

3.03 FIELD QUALITY CONTROL

- A. Notify Architect/Engineer for inspection of vapor retarder installation prior to covering. Provide 48 hour notice.

END OF SECTION

**SECTION 07 9005
JOINT SEALERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sealants and joint backing.

1.02 REFERENCE STANDARDS

- A. ASTM C834 - Standard Specification for Latex Sealants; 2010.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with other sections referencing this section.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics.
- C. Samples: Submit two samples, 1 x 2 inch in size illustrating sealant colors for selection.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANTS

- A. General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single component.
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Applications: Use for:
 - a. Control, expansion, and soft joints in masonry.
 - b. Joints between concrete and other materials.
 - c. Joints between metal frames and other materials.
 - d. Other exterior joints for which no other sealant is indicated.
 - 3. Polyurethane Products:
 - a. Bostik Inc: www.bostik-us.com.
 - b. Pecora Corporation; DynaTrol I-XL General Purpose One Part Polyurethane Sealant: www.pecora.com.
 - c. Pecora Corporation; DynaTrol II General Purpose One Part Polyurethane Sealant: www.pecora.com.
 - d. Pecora Corporation; DynaTrol II General Purpose Two Part Polyurethane Sealant: www.pecora.com.
 - e. The QUIKRETE Companies; QUIKRETE® Polyurethane Non-Sag Sealant: www.quikrete.com.

- f. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - g. Sherwin-Williams Company; Stampede-1/-TX Polyurethane Sealant: www.sherwin-williams.com.
 - h. Sherwin-Williams Company; Stampede 1H Hybrid Sealant: www.sherwin-williams.com.
 - i. Sherwin-Williams Company; Stampede 100 Low-Modulus Hybrid Sealant: www.sherwin-williams.com.
 - j. Sherwin-Williams Company; Stampede 2NS Polyurethane Sealant: www.sherwin-williams.com.
 - k. Substitutions: See Section 01 6000 - Product Requirements.
- B. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
- 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Applications: Use for:
 - a. Interior wall and ceiling control joints.
 - b. Joints between door and window frames and wall surfaces.
 - c. Other interior joints for which no other type of sealant is indicated.
 - 3. Products:
 - a. Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com.
 - b. Red Devil; Siliconized Acrylic Construction Grade (35 Year) Sealant: www.reddevil.com.
 - c. Sherwin-Williams Company; 850A Acrylic Latex Caulk: www.sherwin-williams.com.
 - d. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.
 - e. Sherwin-Williams Company; Bolt Quickdry Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.
 - f. Sherwin-Williams Company; Powerhouse Siliconized Acrylic Latex Sealant: www.sherwin-williams.com.
 - g. Substitutions: See Section 01 6000 - Product Requirements.
- C. Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.
- 1. Color: Gray.
 - 2. Applications: Use for:
 - a. Joints in sidewalks and vehicular paving.
 - 3. Products:
 - a. Pecora Corporation; NR-201 Self-Leveling Traffic and Loop Sealant: www.pecora.com.
 - b. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - c. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: www.sherwin-williams.com.
 - d. Sherwin-Williams Company; Stampede 2SL Polyurethane Sealant: www.sherwin-williams.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Install bond breaker where joint backing is not used.
- D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Tool joints concave.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect sealants until cured.

END OF SECTION

SECTION 13 3419
PREFABRICATED BUILDING STRUCTURE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Provide prefabricated guard booth.

1.02 RELATED REQUIREMENTS

- A. Concrete foundation and slab work as specified in Division 03 - Concrete
B. Electrical service supply and connections as specified in Division 26 - Electrical.
C. Communications service and connections as specified in Division 27 - Communications.
D. Electronic safety connections or devices as specified in Division 28 - Electronic Safety.

1.03 DESIGN REQUIREMENTS

- A. Structure:
1. Prefabricated steel building shall be single unit welded steel construction. Building to be shipped completely assembled. All welded joints ground smooth.
 2. Frame to be minimum of A-500 3"x3"x.083 structural steel tubing, formed for accuracy.
 3. Walls to be minimum of A-527, 16ga. cold rolled galvanized steel interior walls with U.L. Level 5 armor plate exterior walls MIG welded between frame and mullions for self unitized system.
 4. Floor structure to be 2" steel tube frame and joists with 1/4" steel anchor plates welded to the floor frame with pre-drilled holes for anchoring to the foundation. Provide 2" rigid insulation (R-10) between floor joist space and 11ga stainless steel A-569 steel plate floor finish with cut outs for anchoring the unit and for electrical, data and communication stub-ups. Underside of floor to be fully coated with bituminous undercoating sealant.
 5. Doors to be U.L. Level 5 bullet resistant commercial steel framed insulated doors with steel panels and window. Doors to be top hung by a minimum of eight 3" steel ball bearing rollers in a upper steel track, with lower stainless steel guide, stainless steel pull welded to the frame, and mortise hook bolt lock.
 6. Windows to be 16ga. galvanized window frame system (painted to match booth) with flush mounted corners and welded fastening. Fixed windows on all sides.
 - a. All glazing to be U.L. Level 5 tinted glass clad polycarbonate.
 7. Roof to be custom curved style roof designed for exterior use and constructed of internal steel framing that is covered with 3/4" exterior grade plywood, roofing paper and 24ga. pre-finished steel standing seam roofing and custom crown molding around the the booth. Roof and crown molding to have Kynar 500 painted finish.
 8. Counter to be 20" deep shelf at front wall, mounted at 34" above the floor with 1 1/2" downturned and rounded edge. Counter to be 16ga type 304 stainless steel.
 9. Finish of building to have high epoxy primer and two part polyurethane finish coat. Paint to have minimum 3500 hour salt spray test. One color to be selected for the body of the booth inside and out and separate roof and crown molding color.
 10. Weather-tightness to be insured for exterior use with all seams and joints pressure bonderized. Doors to be fully weatherstripped, roof to have heat protective membrane coating and floor underside to have bituminous coating.
- B. Installed Thermal Resistance of Wall System: R value of 17.
C. Installed Thermal Resistance of Roof System: R value of 19.
D. Installed Thermal Resistance of Floor System: R value of (10).
E. Design members to withstand dead load, applicable snow load, and design loads due to pressure and suction of wind calculated in accordance with applicable code.

- F. Heating and Air Conditioning: Provide packaged unit for heating and air conditioning with 11,800 BTU cooling, 11,200 BTU heating capacities and 208/1/60 voltage. Unit to be protected with a U.L. Level 5 bullet resistant shroud.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, installation ; framing anchor bolt settings, sizes, and locations from datum, electrical rough-in locations; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.

1.05 QUALITY ASSURANCE

- A. Structure shall be the product of a manufacturer with a minimum of 10 years documented experience in the design and fabrication of portable prefabricated building structures.
- B. Prefabricated buildings by manufacturers other than the "basis of design" shall submit sufficient data to enable approval to be given. As a minimum: design drawings and/or calculations, applicable certifications, catalog information, and color samples showing equal range to the product specified.
- C. Electrical devices factory installed within the prefabricated building shall be UL Listed. Factory installed wiring system shall be in full compliance with current National Electrical Code.
- D. Adherence to applicable portions of state and local building codes is the responsibility of the installing contractor. Building manufacturer shall be responsible for providing professionally engineered and stamped drawings and calculations to assist in permit processes related to the building structure. Engineer shall be licensed in the State of Minnesota.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: B.I.G. Enterprizes, Inc. South El Monte CA. (800-669-1449) Model #DC68OB. This design has been selected because of it's design that compliments the design of the primary base entrance gate house. Alternate manufacturers shall be capable of providing a reasonably similar design that meets all of the specified design criteria.
- B. Additional approved manufacturers:
 - 1. Ameristar Booth & Building Structures: www.ameristarbooths.com
 - 2. Austin Mohawk Engineered Buildings: www.austinmohawk.com
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ELECTRICAL

- A. Refer to Architect Electrical Drawings for locations of electrical and communications components.
- B. Conduit for circuits operating at greater than 50 volts: Electrical Metallic Tubing (EMT), minimum size 3/4 inch, unless indicated otherwise.
- C. Grounding and Bonding:
 - 1. Provide physical accessible space at electrical stub area inside cabinet for Main Building Ground (MBG). Ground bar provided by Contractor.
 - 2. Bond to structural steel by Contractor.
 - 3. Grounding electrode system provided by Contractor.
- D. Boxes:
 - 1. Wiring Devices and Lighting Control Devices: Single-gang or multi-gang as suitable for devices, 2-1/8 inch deep.
 - 2. Hatchet Gate Control Station: Two-gang as suitable for devices, 2-1/8 inch deep.

3. Pop-Up Barrier Remote Control Station: 16.75" wide x 3.88" high x 1.5" deep for control station componets furnished by others.
- E. Lighting Control Devices:
1. Interior Lighting: Vacancy sensor, Wattstopper CS-50.
 2. Exterior Building Lighting: Integral with exterior light fixture.
 3. Exterior Site Lighting: In-wall interval timer, Wattstopper TS-400-24.
 - a. Provide power pack in accessible box with cover plate beneath device, with 3/4 inch galvanized rigid metallic conduit (RMC) conduit to floor space for threaded fitting attachment and continuation by Contractor.
 4. Wall plates: Stainless steel type 302 decorator style with label fields above and below each device location.
 - a. Manufacturer: Semtron, Inc; www.semtron.com
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- F. Load Center:
1. Description: Circuit breaker type load centers listed and labeled as complying with UL 67; ratings, configurations, and features as indicated on the drawings.
 2. Bus Material: Copper; for phase, neutral and ground.
 3. Provide circuit directory label on inside of door or individual circuit labels adjacent to circuit breakers.
 4. Circuit Breakers: Thermal magnetic plug-in type.

LOAD CENTER SCHEDULE

LOCATION: Casework	VOLTAGE: 208Y/120 V. 3 Phase 4 Wire
MOUNTING: Recessed NEMA 1	A.I.C. RATING: 10,000 Amps Symmetrical
MAIN DEVICE: 60A MCB Branch Mounted	SPECIAL: No main bonding jumper
BUS AMPS: 125 Amperes	

LOAD DESCRIPTION	BKR	P	CKT	CKT	P	BKR	LOAD DESCRIPTION
Main Disconnect	60 A	3	1	2	2	20 A	HVAC Unit
---	--	--	3	4	--	--	---
---	--	--	5	6	1	20 A	Rcpt (1) Convenience
Lights	20 A	1	7	8	1	20 A	SS Rcpt (2) Comp
Spare	20 A	1	9	10	1	20 A	WP Rcpt Exterior
Spare	20 A	1	11	12	1	--	Space & Bus
Spare	20 A	1	13	14	1	--	Space & Bus
Spare	20 A	1	15	16	1	--	Space & Bus
Spare	20 A	1	17	18	1	--	Space & Bus
Comm UPS	30 A	1	19	20	1	--	Space & Bus

- G. Wiring Devices:
1. (5) Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings, white color.
 - a. Two double duplex (fourplex) work station receptacles in (2) two-gang boxes at work table.
 - b. One single duplex convenience receptacle above work table near south door.
 2. (1) Weather Resistant GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant

type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

3. (2) Specific Purpose Receptacles:
 - a. (1) Industrial specification grade, ampacity, voltage, and NEMA configuration to match equipment plug; single for HVAC unit, white color.
 - b. (1) Industrial specification grade, 30 ampere 120 volt twist-lock, NEMA L5-30R; single telecommunications UPS unit, white color.
 - 1) Receptacle packaged loose for installation by Contractor inside communications cabinet in the field. Provide conduit from load center to stub up from floor at communications cabinet location, coordinate actual location with Contractor. Final conduit extension and device installation by Contractor.
4. Wall plates: Stainless steel type 302.
 - a. Manufacturers:
 - 1) Semtron, Inc: www.semtron.com
 - 2) Hubbell: www.hubbell.com
 - 3) Pass & Seymour: www.legrand.us/passandseymour.aspx
 - b. Substitutions: See Section 01 6000 - Product Requirements.
5. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected. Large capacity, vertical, Hubbell WP26M.

H. Lighting Fixtures:

1. Interior: (4) LED downlights, 4100K, 2200 lumens, clear aperture, L70 = 50,000 hours. Gotham EVO R 41K 22 6AR MVOLT.
2. Exterior: (2) LED wall packs, 4000K, 3343 lumens, L70 = 150,000 hours, dark sky compliant, with integral photocell. Cree/BetaLED SEC-EDG -M-WM-04-D-12-BZ-350-P.

I. Communications:

1. Telecommunications service entrance: Two pipe sleeves through floor, suitable for 103 mm (4 inch) schedule 80 PVC conduit. Refer to Architect Electrical Drawings for location.
2. Telecommunications Ground Bar (TGB): By Contractor.
 - a. Provide 1-1/4" PVC conduit from communications cabinet to electrical cabinet location for telecommunications grounding conductor by Contractor. Metal conduit is not permitted.
3. Communications Cabinet: Provided by Division 27.
4. Horizontal pathways and boxes for telecommunications:
 - a. (4) back boxes for telecommunications voice and data devices.
 - 1) Box Size: 4-11/16 inch square x 2-1/8 inches deep.
 - b. Pathways - EMT conduit:
 - 1) First box to second box 27 mm (1 inch)
 - 2) Second box to communications cabinet: 35 mm (1-1/4 inch).
 - 3) No more than three 90 degree bends in continuous pathways.
5. Telecommunications cabling, devices, and mounting plates by Owner.
6. Public Address:
 - a. Ceiling Speaker: Quam C 10X/BU/W with back box ERD-8U, and 21 mm (3/4 inch) conduit to communications cabinet.
 - b. Exterior Horn Speaker: Quam QH-16T with 21 mm (3/4 inch) conduit to communications cabinet.
7. Electrical Identification:
 - a. Nameplates: Provide plastic laminated nameplate at load center, with naming convention as indicated in Section 26 0553 and on Drawings.
 - b. Labels:
 - 1) Provide adhesive labels at receptacles, indicating panel and circuit connection.
 - 2) Provide adhesive labels at switches, indicating:
 - (a) Panel and circuit connection.

(b) Description of load controlled; i.e. "EXTERIOR AREA LIGHTING".
END OF SECTION

SECTION 26 0500
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF WORK

- A. Drawings, Bidding Requirements, Contract Forms, Conditions of the Contract and Division 1 General Requirements apply to work of this section.
- B. The work to be done under this specification and the accompanying drawings include the furnishing of all labor, materials, equipment and services necessary for the completion of all electrical work.
- C. The omission of express reference to any parts necessary for or reasonably incidental to a complete installation shall not be construed as releasing the contractor from furnishing such parts.

1.02 DIVISION 26, 27, AND 28 SECTIONS

- A. Requirements of this in this section apply to all work performed for Divisions 26, 27, and 28.
- B. Requirements of this section apply to Division 33 sections:
 - 1. Section 33 7119 - Electrical Underground Ducts and Manholes.

1.03 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.
- B. Section 01 5000 - Temporary Facilities and Controls.
- C. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- D. Section 01 7000 - Execution and Closeout Requirements: Examination, preparation, and general installation procedures; preinstallation meetings; cutting and patching; cleaning and protection; starting of systems; demonstration and instruction; closeout procedures except payment procedures; requirements for alterations work.
- E. Section 01 7419 - Construction Waste Management and Disposal.
- F. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.
- G. Section 13 3419 - Prefabricated Building Structure: Electrical and communications components, boxes, and conduit in prefabricated structure.

1.04 SYMBOLS, AND ABBREVIATIONS, AND ACRONYMS

- A. Refer to symbols and abbreviations listed on the drawings. Other symbols are in common usage but if uncertainty exists regarding any plan symbols or abbreviations they shall be brought to the attention of the Architect and he shall clarify same.
- B. GFGI: Owner Furnished, Owner Installed.
- C. GFCI: Owner Furnished, Contractor Installed.

1.05 DEFINITIONS

- A. Where the phrase starts "Provide _____", "provide" shall be construed to mean the same as "Furnish and install _____".
- B. Where the phrase "Division 21", "Division 22" or "Division 23" is used on the drawings or in Divisions 26, 27, or 28 of this specification, it shall be the responsibility of this Contractor to determine which Contractor doing work under a Division 21, 22, or 23 specification section is the Contractor being referred to (i.e., plumbing, HVAC, temperature controls, etc.).

1.06 REFERENCE STANDARDS

- A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

1.07 ADMINISTRATIVE REQUIREMENTS

- A. Site Mobilization Meeting: Attend meeting at the Project site prior to Contractor occupancy.
- B. Preconstruction Meeting: Attend preconstruction meeting prior to the start of the work of this section.

1.08 INSPECTION OF SITE

- A. Before submitting a proposal on the work contemplated in this specification and accompanying drawings, each bidder shall examine the site and check as to the means of making connections to services and shall familiarize himself with all the existing conditions and limitations.
- B. No extras will be allowed because of the contractor's misunderstanding as to the amount of work involved or the contractor's lack of knowledge of any site conditions which may affect their work.
- C. Any apparent variance of the plan or specification from the existing conditions at the site shall be called to the attention of the Architect.

1.09 DRAWINGS

- A. The drawings are to scale as noted. The Contractor shall refer to architectural and structural drawings for exact location of partitions, walls, beams, shafts, equipment, etc.
- B. The Contractor, before rough-in facilities or installation of any equipment shall consult all drawings, general, structural, mechanical, finishes, locations of ceiling, structural members, pipes, ducts, recessed lighting fixtures, conduits, etc., which may affect the installation.
- C. Discrepancies discovered before or after work has started shall be brought to the attention of Owner: Architect. Owner reserves the right to require minor changes in the work of any Contractor to eliminate such discrepancies with no change in contract cost.
- D. The plans and specifications are complementary and what is called for in either one shall be as binding as if called for in both.
- E. Where a disagreement exists between the plans and specifications, the item or arrangement of better quality, greater quantity or higher cost shall be used.
- F. Where a disagreement exists between an item on the drawings and another item on the drawings, the item or arrangement of better quality, greater quantity or higher cost shall be used.
- G. Where drawings contain revision clouds, only the work encircled by the revision cloud is included in the contractor's scope of the work for this project.

1.10 COORDINATION

- A. This Contractor shall review drawings and specifications from all divisions for conflicts in work for locations of ducts, piping, sprinkler heads, door hardware schedule for devices, ceiling plans, wall elevations, etc. Discrepancies shall be brought to the attention of the Architect prior to beginning the work.
- B. Coordinate with all sub-contractors for locations of all conduit, cable-tray, lighting, devices, door hardware, occupancy sensors.
- C. Coordinate with prefabricated building structure manufacturer for electrical installation and rough-in requirements for all electrical and communications components.
 - 1. Determine which components will be provided by manufacturer, and which components will be provided by this Contractor.
 - 2. Coordinate rough-in requirements for components provided with equipment specified in other sections and installed by this Contractor.
 - 3. Coordinate conduit routing, pipe sleeves in floor, and other requirements necessary for interface to electrical and communications components located elsewhere on this site.

4. See section 13 3419 for prefabricated building structure requirements.
- D. Attend Preinstallation and Coordination meetings, if required by individual Section.

1.11 MATERIALS AND WORKMANSHIP

- A. All material and workmanship must be of the best throughout. All material and equipment must be new and must be adequately protected from damage and dirt at all times. The Architect reserves the right to reject any material or workmanship not in accordance with the specifications, either before or after installation.
1. Refer to National Electrical Code 110.12 and NECA-1 for execution of work.
- B. The Contractor will be held responsible for any and all defects in material and workmanship which may appear during guarantee period after the building has been accepted. All such defects must be repaired or defective material replaced by the Contractor at no expense to the Owner.

1.12 GUARANTEE

- A. All electrical work specified in Division 26, 27, 28, or 33 sections shall be guaranteed to be free from defects in materials and installation for a minimum period of one year from the Date of Substantial Completion. See Division 1 requirements and General Conditions for additional requirements. The Contractor shall repair and/or replace defective work, including materials and labor, discovered during the guarantee period.
- B. See individual specification sections for additional guarantees, which include guarantees that extend beyond one year.
- C. Product Warrantees:
1. Product warranty periods begin at Date of Substantial Completion.
 - a. Product manufacturer "Terms and Conditions" statement for warranty period that begins at "Date of Shipment" will not be accepted.
 - b. This Contractor shall make arrangements with product manufacturers for warranty that periods begin at Date of Substantial Completion.

1.13 CODES

- A. This Contractor shall comply with all ordinances, laws, regulations and codes applicable to the work involved. This does not relieve the contractor from furnishing and installing work shown or specified which may be beyond the requirements of such ordinances, laws, regulations and codes.
- B. Regular inspections shall be requested by the Contractor as required by any and all regulations. All charges for the inspections by regulating agencies of installations or plans and specifications shall be paid by the Contractor.

1.14 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. See Section 01 6000 - Product Requirements for substitutions procedures.
- C. Definitions:
1. Prerequisite Submittals: Submittals that shall be submitted prior to commencement of design, calculations, or study; subsequent submittals, tests, or inspections.
 2. Action Submittals: Product data, shop drawings, samples, and similar items for components that are purchased or fabricated.
 3. Information Submittals: Contractor and installer qualifications, test agency qualifications, field quality reports, prefunctional checklists, test plans, test reports, and similar items that require review for quality control.
 4. Closeout Submittals: Operation and maintenance manuals, as-built drawings, documentation of training, certificates of completion, certificates of compliance by Authority Having Jurisdiction, and similar items required for project documentation.
- D. Submittals for Review:

1. Identify Section Number and Section Title for each submittal.
 2. Submit items identified in individual sections.
 3. Submit each Section Number independently from other Sections.
 - a. Submittals containing multiple Sections in the same submittal may result in the submittal(s) returned to the Contractor for correction and resubmission.
 4. Where an individual Section requires more than one identified item for review (i.e. "Shop Drawings", "Product Data", and "Samples"), submit all items concurrently.
 - a. Provide tabbed divider separating each item for review included in the submittal (i.e. "Product Data", "Shop Drawings", and "Warranty").
 5. Mark catalog sheets and drawings to indicate specific items submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.
 - a. Failure to properly identify items included in a submittal may result in the submittal(s) returned to the Contractor for correction and resubmission.
 6. Failure to follow submittal instructions does not relieve the Contractor from the requirements of meeting the project schedule.
- E. Prerequisite Submittals:
1. Submit manufacturer qualifications and installer qualifications prior to or in conjunction with action submittals for review.
 2. Submit delegated design company and personnel qualifications, where indicated in individual sections, prior to commencement of design, calculations, or study.
 3. Submit testing agency qualifications, where indicated in individual Sections, prior to preparation of test plans.
 4. Submit Field Quality Control reports, where indicated in individual Sections, 10 Days prior to Notice of Substantial Completion.
 5. Failure to submit prerequisite submittals does not relieve the Contractor from the requirements of meeting the project schedule.

1.15 MAINTENANCE AND OPERATING INSTRUCTIONS

- A. The Contractor shall furnish, without additional expense to the Owner, the services of competent instructors, who will give instruction in the care, adjustment and operation and maintenance of parts of the electrical equipment to the Owner's permanent employees who are to have charge of the equipment.
- B. The amount of instruction to be given will be specified in the respective section.
- C. Instruction shall be given during the regular work week and at a time just prior to the time the equipment is accepted and turned over to the Owner for regular operation.

1.16 OPERATION AND MAINTENANCE MANUAL

- A. See Section 01 3000 - Administrative Requirements for requirements and submittal procedures.
- B. This Contractor shall prepare and submit maintenance and operating manuals for all equipment and systems provided by this Contractor.
- C. Submit required information in a three ring binder.
 1. Submit one (1) binder for review prior to final submittal.
 2. Submit three (3) binders for final submittal.
 3. Provide tabbed divider for each Specification Section.
 4. Provide index with Consolidated Maintenance Schedule and each Specification Section identified.
 5. Include Consolidated Maintenance Schedule with tabbed divider after index, before tabbed individual sections.
- D. Provide optical disk (CD or DVD) with information required in individual specification sections.
- E. Maintenance Schedule:

1. Provide a consolidated maintenance schedule. Indicate item or equipment, maintenance or testing requirement and frequency of maintenance or test. Provide in a table format, refer to sample Consolidated Maintenance Schedule at the end of this Section.
- F. Provide the following for each specification section, where indicated:
1. Product Data.
 2. Approved shop drawings.
 3. Maintenance Instructions.
 4. Operating Instructions.
 5. Training Outline.
 6. Test Reports.
 7. Inspector's reports.
 8. Certificates of completion.
 9. Warranty information.

1.17 RECORD DRAWINGS

- A. The Contractor shall keep a complete set of all drawings in his job site office for the purposes of showing "As-Built" installation of electrical systems and equipment. This set of drawings shall be used for no other purpose.
- B. Where any material, equipment, or system components are installed differently from that shown on the Architect's drawings, such differences shall be clearly and neatly shown on this set of drawings using ink or indelible pencil.
- C. The change notations shall be kept up-to-date on a daily basis. When requested, this set of drawings shall be transmitted to the Architect, and after the Architect has examined the drawings, the set will be returned to the contractor for further use.
- D. At the completion of the project, the "As-Built" set of drawings shall be turned over to the for review and then shall become the property of the Owner.

1.18 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 1. The testing organization shall be an independent, third party entity which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers.
 2. Three years documented experience testing products specified in Divisions 26, 27 and 28.
 3. Where indicated in individual Sections:
 - a. InterNational Electrical Testing Association "NETA Accredited Company".
 - b. Personnel certified in accordance with ANSI/NETA ETT-2000, Standard for Certification of Electrical Testing Personnel, level III or higher.

1.19 TEMPORARY CONSTRUCTION LIGHTING AND POWER

- A. Temporary Electricity:
 1. Cost: By Contractor.
- B. Temporary Power Source: Provide temporary power for construction by means of one of the two following methods:
 1. Provide temporary generator for on-site construction requirements; or
 2. Connect to Owner's existing power service.
 - a. Do not disrupt Owner's need for continuous service.
 - b. Coordinate and schedule all necessary shutdowns with Owner. Schedule all necessary shutdowns 14 days in advance.
 - 1) Include actual time and duration of necessary shutdown in scheduled shutdown request.
 - c. Exercise measures to conserve energy.
 - d. Provide separate metering and reimburse Owner for cost of energy used.

- e. Provide temporary electric feeder from existing on-site electrical service at location as directed.
- C. Temporary Power for Construction Purposes:
- 1. Power Service Characteristics: 208Y/120 volt, 100 ampere, three phase, four wire.
 - 2. Complement existing power service capacity and characteristics as required.
 - 3. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.
 - 4. Provide feeder switch at source distribution equipment .
 - 5. Permanent convenience receptacles may be utilized during construction.
 - 6. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.
 - a. Provide 20 ampere duplex outlets, single phase circuits for power tools for every 500 sq ft of active work area.
 - b. Provide 20 ampere, single phase branch circuits for lighting.
- D. Temporary Lighting For Construction Purposes:
- 1. Provide and maintain lighting for construction operations to achieve a minimum lighting level of 10 footcandles.
 - 2. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
 - 3. Maintain lighting and provide routine repairs.
 - 4. Permanent building lighting may be utilized during construction.
 - a. Replace lamps in permanent fixtures used for construction purposes upon Owner occupancy.
- E. Telecommunications Services:
- 1. Provide, and maintain telephone service to field office at time of project mobilization.
 - 2. Telecommunications services shall include:
 - a. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - b. Telephone Land Lines: One line, minimum; one handset per line.
 - c. Email: Account/address reserved for project use.
- F. Refer to Division 1 section for work to be provided by this contractor.

1.20 HOLES THROUGH MASONRY

- A. The Contractor shall provide all holes and openings required for electrical work unless such openings are shown on the architectural and/or structural drawings. The notes on structural drawings are particularly significant when precast and prestressed members are used.
- B. Holes made in existing masonry for raceways or other electrical equipment shall be core drilled.
- C. The Contractor shall be responsible for grouting air-tight any openings adjacent to raceways, etc. to seal against passage of air, smoke or vapors.
- D. The Contractor shall be responsible for providing and disposing of water used in the core drilling operation. Work shall be scheduled and other trades coordinated so that damage will not result from the use of water.

1.21 CLEANING

- A. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.
- B. Contractor shall clear away all debris, surplus materials, etc., resulting from his work or operations, leaving the job and the equipment furnished under any or all contracts in a clean condition.

1.22 SCHEDULES

- A. Sample Consolidated Maintenance Schedule for Operations and Maintenance Manual:
1. Table below is a sample representing some typical maintenance items, not representative of actual items included in this project.
- B. Include National Fire Alarm and Signaling Code; 2010 Edition; Tables 14.3.1, 14.4.2.2, and 14.5.5 for fire alarm inspection and testing.

CONSOLIDATED MAINTENANCE SCHEDULE		
EQUIP ITEM	REQUIRED ACTION	FREQUENCY
GROUNDING CONNECTIONS	INSPECT FOR INTEGRITY	12 MONTHS
PANELBOARD CIRCUIT BREAKERS	EXERCISE: CYCLE OFF/ON 5 TIMES.	12 MONTHS
SWITCHBOARD & PANELBOARD FUSIBLE SWITCHES	INSPECT, CLEAN, LUBRICATE	12 MONTHS
ENCLOSED SWITCHES	INSPECT, CLEAN, LUBRICATE	12 MONTHS
LUMINAIRES IN HANGAR	CLEAN LENS WITH MILD DETERGENT, RINSE, DRY.	24 MONTHS
LENSED LUMINAIRES	CLEAN LENS WITH MILD DETERGENT, RINSE, DRY.	36 MONTHS
EMERGENCY LIGHT UNIT EQUIPMENT	OPERATION AND BATTERY TEST.	12 MONTHS
FIRE ALARM COMPONENTS	INSPECT AND TEST PER NFPA 72 TABLES 14.3.1, 14.4.2.2, AND 14.4.5 ON FOLLOWING PAGES.	PER NFPA 72

PART 2 PRODUCTS

2.01 NOT APPLICABLE.

PART 3 EXECUTION

3.01 NOT APPLICABLE.

END OF SECTION

SECTION 26 0519

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wire and cable for 600 volts and less.
- B. Single conductor building wire.
- C. Wiring connectors.
- D. Electrical tape.
- E. Oxide inhibiting compound.
- F. Wire pulling lubricant.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.
- F. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- G. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; National Electrical Manufacturers Association; 2009 (ANSI/NEMA WC 70/ICEA S-95-658).
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).
- I. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- K. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- L. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- M. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- N. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- O. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
- B. Submit all product data and samples concurrently
- C. Action Submittals:
 1. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- D. Information Submittals:
- E. Closeout Submittals:
 1. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.
 2. Project Record Documents: Record actual locations of components and circuits #6 AWG and larger.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

1.08 SEQUENCING AND SCHEDULING

- A. Coordination: Coordinate layout and installation of cable with other installations.
 1. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Contracting Officer.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Concealed Dry Interior Locations: Use only building wire in raceway.
- D. Exposed Dry Interior Locations: Use only building wire in raceway.
- E. Wet or Damp Interior Locations: Use only building wire with Type THWN insulation in raceway.
- F. Exterior Above Grade Locations: Use only building wire with Type THWN insulation in raceway.
- G. Underground Installations: Use only building wire with Type THWN insulation in raceway.
- H. Nonmetallic-sheathed cable is not permitted.
- I. Underground feeder and branch-circuit cable is not permitted.
- J. Service entrance cable is not permitted.

- K. Armored cable is not permitted.
- L. Metal-clad cable is not permitted.

2.02 CONDUCTOR AND CABLE MANUFACTURERS

- A. Cerro Wire LLC: www.cerrowire.com.
- B. Encore Wire Corporation: www.encorewire.com.
- C. Southwire Company: www.southwire.com.
- D. Houston Wire and Cable: www.houwire.com.
- E. General Cable: www.generalcable.com.
- F. Substitutions: See Section 01 6000 - Product Requirements.

2.03 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B 787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
- H. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits greater than 60 feet and less than 100 feet: 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits greater than 100 feet and less than 150 feet: 8 AWG, for voltage drop.
 - 3) 20 A, 120 V circuits greater than 150 feet: 6 AWG, for voltage drop.
- I. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 - 3. Color Code:
 - a. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Shared Neutral/Grounded: White.
 - 5) Dedicated Neutral/Grounded: White with colored tracer in braid, same color as phase conductor.
 - 6) Switch Leg: Pink.
 - b. Equipment Ground, All Systems: Green.

- c. Travelers for 3-Way and 4-Way Switching: Pink.

2.04 SINGLE CONDUCTOR BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Stranded.
 - b. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 Volts.
- D. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.

2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 - 2. Copper Conductors Size 6 AWG to Size 4 AWG: Use mechanical connectors or compression connectors.
 - 3. Copper Conductors Size 3 AWG and Larger: Use Power Distribution Blocks:
 - a. Copper Conductors Power Distribution Blocks secured inside enclosure:
 - b. Withstand rating: Not less than fault current ampere interrupting capacity of upstream overcurrent protective device.
 - c. Manufacturers:
 - 1) Bussmann.
 - 2) Ferraz Shawmut.
 - 3) Ilco.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- C. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
 - 3. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
- D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- G. Mechanical Connectors: Provide bolted type or set-screw type.
- H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.06 WIRING ACCESSORIES

- A. Electrical Tape:
 - 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.

2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
- B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
 - C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as shown on the drawings.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 2. When circuit destination is indicated and routing is not shown, determine exact routing required.
 3. Arrange circuiting to minimize splices.
 4. Include circuit lengths required to install connected devices within 10 ft of location shown.
 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is not permitted.
- B. The use of multi-wire branch circuits serving multiple loads with a common neutral is permitted only for individual utilization equipment that is provided with a disconnecting means that simultaneously disconnects all ungrounded conductors.
- C. Install products in accordance with manufacturer's instructions.
- D. Use fish tape with marked 12 inch increments to provide conduit length data. Install minimum conductor size adjusted for voltage drop.
- E. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.
- F. Installation in Raceway:
 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

- H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
 - 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
- I. Install conductors with a minimum of 8 inches of slack at each outlet.
- J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- L. Make wiring connections using specified wiring connectors.
 - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 - 3. Do not remove conductor strands to facilitate insertion into connector.
 - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
 - 5. Terminations for Fine-Strand Conductors: Terminate with tin-plated aluminum-bodied compression connectors only.
 - 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- N. Insulate ends of spare conductors using vinyl insulating electrical tape.
- O. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is only required for conductors larger than #2 AWG. The resistance test for parallel conductors listed as optional is not required.
 - 1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

- A. Section 26 0519 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Additional requirements for conductors for grounding and bonding, including conductor color coding.
 - 1. Includes oxide inhibiting compound.
- B. Section 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS: Identification products and requirements.
- C. Section 26 4300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

- A. IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System; 1983.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; National Electrical Manufacturers Association; 2007.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).
- E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 2. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Submit all product data, samples, manufacturer's instructions, installer qualifications, and testing agency qualifications concurrently.
- C. Prerequisite Submittals:
 - 1. Submit testing agency qualifications 14 prior to performing field quality control tests.
- D. Action Submittals:

1. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
 - a. Include each component specified in this section.
 - b. Include exothermic weld kits.
- E. Information Submittals:
 1. Construction Documentation:
 - a. Inform Architect of completion of below grade connections 7 days prior to cover.
 - b. Submit digital photographs of each below grade connections prior to cover.
 2. Testing Agency Qualifications and personnel certifications.
 3. Field quality control test reports.
 - a. Indicate overall resistance to ground and resistance of each electrode.
 - b. Indicate compliance with the performance requirements.
- F. Closeout Submittals:
 1. Project Record Documents: Record actual locations of grounding electrode system components and connections.
 2. Operation and Maintenance Manual:
 - a. Test Reports: Include field quality control test reports.
 - b. Maintenance Schedule: Include equipment maintenance or testing requirement and frequency of maintenance or test in consolidated maintenance schedule table.
 - 1) Inspection frequency for accessible connections: 12 months.
 - c. Maintenance Data:
 - 1) Include recommended maintenance procedures.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Testing Agency Qualifications:
 1. The testing organization shall be an independent, third party entity which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers.
 2. Three years documented experience testing products specified in this section .
 3. InterNational Electrical Testing Association "NETA Accredited Company".
 4. Personnel certified in accordance with ANSI/NETA ETT-2000, Standard for Certification of Electrical Testing Personnel, level III or higher.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding System Resistance:
 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested according to IEEE 81 using "point-to-point" methods.
- E. Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 2. Metal Building or Structure Frame:
 - a. Provide connection to metal building or structure frame effectively grounded in accordance with NFPA 70 at nearest accessible location.
 3. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
 4. Ground Ring:
 - a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
 - b. Locate ground ring conductor 3'-0" to 8'-0" from structure.
 - c. Provide connection from ground ring conductor to:
 - 1) Ground rod electrodes located as indicated.
 5. Ground Rod Electrode(s):
 - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
 - b. Space electrodes not less than 6.0 M (20 feet) from each other and any other ground electrode.
 6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
- F. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- G. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
1. Provide grounding electrode system for each separate building or structure.
 2. Provide equipment grounding conductor routed with supply conductors.
 3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
 4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.
- H. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.

4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for metal building frame where not used as a grounding electrode.
8. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in addition to requirements of Section 26 0519:
 1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
 2. Grounding Electrode Conductor Size: As indicated on Drawings, not less than #6 AWG.
- C. Connectors for Grounding and Bonding:
 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
 4. Mechanical and Compression Connector Material: Bronze.
 5. Exothermic Connections:
 - a. Provide in kit form and selected per manufacturer's written instructions for specific types, sizes and combinations of conductors and connected items.
 - b. Use metal alloy weld material as recommended by manufacturer for use on material to be exothermically connected.
 - c. Manufacturers - Exothermic Welded Connections:
 - 1) Cadweld, a brand of Erico International Corporation: www.erico.com.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.
- D. Ground Bars:
 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.
 3. Holes for Connections: As indicated or as required for connections to be made.
 4. Manufacturers:
 - a. Erico International Corporation: www.erico.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ELECTRODES

- A. Ground Rod Electrodes:
 1. Comply with NEMA GR 1.
 2. Material: Copper-bonded (copper-clad) steel.
 3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

4. Manufacturers:
 - a. Erico International Corporation: www.erico.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

- A. Grounding Lugs: All lugs used on grounding of manholes and transformers, including medium/high voltage cable shields, are to be compression type.
- B. Oxide Inhibiting Compound: Comply with Section 26 0519.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as shown on the drawings.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
- D. Install ground electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- E. Make grounding and bonding connections using specified connectors.
 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- F. Identify grounding and bonding system components in accordance with Section 26 0553.
- G. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.
- H. Bond metal piping systems to ground.
 1. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.
- I. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

3.03 CONNECTIONS

- A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

- B. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.04 FIELD QUALITY CONTROL

- A. Perform inspection, testing, and adjusting in accordance with Section 01 4000.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.
- F. Test ground resistance at each rod, plate, and pipe electrode (before interconnection to other electrodes), the entire ground rod-ground cable counterpoise system before it is bonded to concrete encased electrode or building steel.
- G. Test ground resistance at electrical equipment as follows:
 - 1. Power and Lighting Equipment or Systems.
- H. Test Procedures:
 - 1. Test with a D.C. three-point earth ground resistance tester in accordance with IEEE 81.
 - 2. Measure ground resistance without the soil being moistened by any means other than natural precipitation.
 - 3. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 26 0529

HANGARS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2013.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

1.03 SUBMITTALS

- A. See Section 01 3000 - ADMINISTRATIVE REQUIREMENTS, for submittal procedures.
- B. Action Submittals:
 - 1. Product Data: Submit for Metal Channel (Strut) Framing Systems.

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 PRODUCTS

2.01 COMPLY WITH APPLICABLE BUILDING CODE.

2.02 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
- B. Anchors and Fasteners:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 - 2. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the static design load to be supported plus 200 pounds. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
 - 5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 6. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
 - 7. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
 - 8. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.

9. Wood Elements: Use wood screws.
 - a. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- C. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 2. Conduit Clamps: Bolted type unless otherwise indicated.
- D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
- E. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 1. Comply with MFMA-4.
- F. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
- B. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- C. Miscellaneous Supports: Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other except where components are mounted directly to structural features of adequate strength.
- D. Anchors and Fasteners:
 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 4. Hollow Masonry: Use toggle bolts.
 5. Hollow Stud Walls: Use toggle bolts.
 6. Sheet Metal: Use sheet metal screws.
 7. Plastic and lead anchors are not permitted.
 8. Powder-actuated fasteners are not permitted.
 9. Hammer-driven anchors and fasteners are not permitted.
 10. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
 11. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
 12. Manufacturers - Mechanical Anchors:
 - a. Hilti, Inc: www.us.hilti.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

3.02 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 0534
CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. PVC-coated galvanized steel rigid metal conduit (RMC).
- C. Flexible metal conduit (FMC).
- D. Liquidtight flexible metal conduit (LFMC).
- E. Electrical metallic tubing (EMT).
- F. Rigid polyvinyl chloride (PVC) conduit.
- G. Conduit fittings.
- H. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- B. Section 26 0529 - HANGARS AND SUPPORTS FOR ELECTRICAL SYSTEMS.
- C. Section 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS: Identification products and requirements.
- D. Section 31 2316 - Excavation.
- E. Section 31 2323 - Fill: Bedding and backfilling.

1.03 DEFINITIONS

- A. Wet Location: A location in which water or other liquid can drip, splash, or flow on or against electrical equipment.
- B. Damp Location: An exterior or interior location that is normally or periodically subject to condensation of moisture in, on, or adjacent to, electrical equipment, and includes partially protected locations.
- C. Inaccessible Spaces: Inside permanent walls and ceilings, completely enclosed without access.
- D. Accessible Spaces: Spaces above accessible ceiling tile, spaces with access panels, accessible void spaces, accessible attic spaces.
- E. Finished Spaces: Rooms or spaces with painted or otherwise finished surfaces, intended for regular use by occupants.
 - 1. Spaces are considered finished spaces unless defined as unfinished.
- F. Unfinished Spaces: Mechanical rooms, shop spaces, bulk storage, shell space for future construction.

1.04 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); National Electrical Contractors Association; 2006.
- E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); National Electrical Contractors Association; 2003.

- F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).
- G. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association; 2005.
- H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; National Electrical Manufacturers Association; 2003.
- I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004.
- J. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- L. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- M. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- N. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- O. UL 651 - Schedule 40 and 80 Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- P. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
 - 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
 - 5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Action Submittals:
 - 1. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Closeout Submittals:
 - 1. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.07 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit or rigid PVC conduit.
 - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit or rigid PVC conduit.
 - a. Within 5 Feet from Foundation Wall: Use galvanized rigid steel metal conduit or intermediate metal conduit (IMC).
 - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit or rigid PVC conduit.
 - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
 - 5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
 - 6. Where rigid polyvinyl (PVC) conduit is provided under vehicle driving areas: Use Schedule 80.
 - 7. Where steel conduit is installed in direct contact with earth, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
 - 8. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
- D. Embedded Within Concrete:
 - 1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit or rigid PVC conduit.
 - 2. Within Slab Above Ground: Not permitted.
 - 3. Maximum Size Conduit Within Slab: 3/4 inch; 1/2 inch for conduits crossing each other.
 - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.
- E. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).
- F. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 - 3. Maximum Length: 6 feet unless otherwise indicated.
 - 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.

2.02 CONDUIT REQUIREMENTS

- A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
- C. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Power Branch Circuits: 3/4 inch (21 mm) trade size.
 - 2. Power Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.

3. Control Circuits: 3/4 inch (21 mm) trade size.
 4. Access Control and Intrusion Detection Systems: 3/4 inch (21 mm) trade size.
 5. Underground, Interior: 3/4 inch (21 mm) trade size.
 6. Underground, Exterior: 1 inch (27 mm) trade size.
- D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com.
 2. Republic Conduit: www.republic-conduit.com.
 3. Wheatland Tube Company: www.wheatland.com.
 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
 - a. Hazardous Location Boundaries: Use conduit seal fittings.
 3. Material: Use steel or malleable iron.
 4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
1. Thomas & Betts Corporation: www.tnb.com.
 2. Robroy Industries: www.robroy.com.
 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.
- D. PVC-Coated Fittings:
1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.
- E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.05 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- B. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.

2.07 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied Tube & Conduit: www.alliedeg.com.
 - 2. Republic Conduit: www.republic-conduit.com.
 - 3. Wheatland Tube Company: www.wheatland.com.
- B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
 - 1. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify routing and termination locations of conduit prior to rough-in.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

- D. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- F. Install liquidtight flexible metallic conduit (LFMC) in accordance with NECA 111.
- G. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated and routing is not shown, determine exact routing required.
 - 3. Conceal all conduits unless specifically indicated to be exposed.
 - 4. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 5. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
 - 6. Arrange conduit to provide no more than 150 feet between pull points.
 - 7. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
- H. Conduit Support:
 - 1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 - 3. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
 - 4. Use of spring steel conduit clips for support of conduits is not permitted.
 - 5. Use of wire for support of conduits is not permitted.
 - 6. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.
- I. Connections and Terminations:
 - 1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 - 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 - 3. Use suitable adapters where required to transition from one type of conduit to another.
 - 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 - 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 - 6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 - 7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- J. Penetrations:
 - 1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 - 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 - 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 - 4. Conceal bends for conduit risers emerging above ground.
 - 5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.

6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
- K. Underground Installation:
 1. Provide trenching and backfilling in accordance with Sections 31 2316 and 31 2316.
 2. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 24 inches.
 - b. Under Slab on Grade: 12 inches to bottom of slab.
 3. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.
- L. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
 1. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
 2. Secure conduits to prevent floating or movement during pouring of concrete.
- M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where conduits are subject to earth movement by settlement or frost.
- N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
 1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- O. Provide grounding and bonding in accordance with Section 26 0526.
- P. Identify conduits in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 0537
BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Underground pull box enclosures.

1.02 RELATED REQUIREMENTS

- A. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- B. Section 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- C. Section 26 0529 - HANGARS AND SUPPORTS FOR ELECTRICAL SYSTEMS.
- D. Section 26 0534 - Conduit:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- E. Section 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS: Identification products and requirements.
- F. Section 26 2716 - Electrical Cabinets and Enclosures.
- G. Section 26 2726 - WIRING DEVICES:
 - 1. Wall plates.
 - 2. Additional requirements for locating boxes for wiring devices.
- H. Section 33 7119 - Electrical Underground Ducts and Manholes: Concrete handholes and manholes for electrical systems.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2008 (Revised 2010) (ANSI/NEMA OS 1).
- E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. SCTE 77 - Specification for Underground Enclosure Integrity; Society of Cable Telecommunications Engineers; 2013 (ANSI/SCTE 77).
- G. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Submittals, for submittal procedures.
- B. Submit all product data, samples, and manufacturer's instructions concurrently.
- C. Action Submittals:
 1. Product Data: Provide manufacturer's standard catalog pages and data sheets for underground boxes/enclosures.
 - a. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.
 2. Shop Drawings:
 - a. Submit manufacturer's dimensioned drawings for underground handholes, in-ground pull and junction boxes. Include product information for weight ratings.
- D. Closeout Submittals:
 1. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.
- D. Source limitations:
 1. Obtain multi-source wall boxes from a single manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
 4. Use suitable concrete type boxes where flush-mounted in concrete.
 5. Use suitable masonry type boxes where flush-mounted in masonry walls.
 6. Use raised covers suitable for the type of wall construction and device configuration where required.
 7. Use shallow boxes where required by the type of wall construction.
 8. Do not use "through-wall" boxes designed for access from both sides of wall.
 9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 11. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 12. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
 13. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
 - b. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
 14. Wall Plates: Comply with Section 26 2726.
 15. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Hubbell Incorporated; Bell Products: www.hubbell-bell.com.
 - c. Hubbell Incorporated; RACO Products: www.hubbell-raco.com.
 - d. Thomas & Betts Corporation: www.tnb.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- C. Cabinets and Enclosures: See Section 26 2716.
- D. Underground Pull Box Enclosures:
1. Description: In-ground, stackable open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
 2. Cover Legends:
 - a. LV ELECTRIC for low voltage electrical systems, 600 volts and less.
 - b. COMMUNICATIONS for telecommunications systems.
 3. Size: As indicated on drawings.
 4. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
 5. Applications:
 - a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 8 load rating.
 - b. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.

6. Polymer Concrete Underground Pull Box Enclosures: Comply with SCTE 77.
 - a. Manufacturers:
 - 1) Hubbell Incorporated; Quazite Products: www.hubbellpowersystems.com.
 - 2) Oldcastle Precast, Inc: www.oldcastleprecast.com.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
- E. Manholes and Handholes: See Section 33 7119 - Electrical Underground Ducts, Handholes, and Manholes.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- G. Box Locations:
 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
 2. Unless dimensioned, box locations indicated are approximate.
 3. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
 4. Locate boxes so that wall plates do not span different building finishes.
 5. Locate boxes so that wall plates do not cross masonry joints.
 6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
 9. Fire-Resistance-Rated Walls: Install flush-mounted boxes such that the required fire-resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
 - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
 10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0534.

11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.
 - b. Within joists in areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
- H. Box Supports:
 1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
 4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- I. Install boxes plumb and level.
- J. Flush-Mounted Boxes:
 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- K. Install boxes as required to preserve insulation integrity.
- L. Underground Pull Box Enclosures:
 1. Install enclosure on gravel base, minimum 6 inches deep.
 2. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
 3. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.
- M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- N. Close unused box openings.
- O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- P. Provide grounding and bonding in accordance with Section 26 0526.
- Q. Identify boxes in accordance with Section 26 0553.

3.03 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Warning signs and labels.

1.02 RELATED REQUIREMENTS

- A. Section 09 9000 - Painting and Coating.
- B. Section 26 0519 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- C. Section 26 0573 - Overcurrent Protective Device Coordination Study and Arc Flash Assessment.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Submit all product data and samples concurrently.
- C. Action Submittals:
 - 1. Product Data: Provide manufacturer's standard catalog pages and data sheets for:
 - a. Identification Labels, indicate label text height.
 - b. Cable and Wire Markers.
 - c. Voltage Markers, indicate size and text height.
 - d. Warning Signs and Labels, indicate size and text height.
 - 2. Samples:
 - a. Identification Nameplates: One of each type and color specified.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Panelboards:
 - 1) Equipment identification nameplate:
 - (a) Include equipment identification name.
 - (b) Include voltage and phase.
 - (c) Include ampere interrupting capacity (AIC) or short circuit current rating (SCCR).
 - (d) Include power source and circuit number. Include location when not within sight of equipment.
 - 2) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.

- 3) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces.
- 4) For power distribution panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
- b. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Equipment identification nameplate:
 - (a) Include equipment identification name. Match identification for load(s) served. Include location when not within sight of equipment.
(1) Example: EF-1 EXHAUST FAN - PENTHOUSE EXTERIOR
 - (b) Include voltage and phase.
 - (c) Include power source and circuit number. Include location.
 - (d) Include ampere interrupting capacity (AIC) or short circuit current rating (SCCR).
 - c. Time Switches:
 - 1) Identify load(s) served and associated circuits controlled. Include location.
 - d. Enclosed Contactors:
 - 1) Equipment identification nameplate:
 - (a) Include equipment identification name.
2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - b. Use identification nameplate at each piece of service equipment to identify the available fault current and the date calculations were performed.
3. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
4. Use identification label on inside of door at each fused switch to identify required NEMA fuse class and size.
5. Arc Flash Hazard Warning Labels: Comply with Section 26 0573.
6. Use warning signs to identify electrical hazards for temporary connections to portable generators with the word message "WARNING: FOR CONNECTION OF A NONSEPARATELY DERIVED (FLOATING NEUTRAL) SYSTEM ONLY".
- B. Identification for Conductors and Cables:
 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
 2. Use identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment.
 3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
 - a. At each source and load connection.
 - b. Within boxes.
 4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
- C. Identification for Conduit:
 1. Definitions:
 - a. Accessible spaces: Spaces above accessible ceiling tile, spaces with access panels, accessible void spaces, accessible attic spaces.
 - b. Finished spaces: Normally occupied spaces that are not defined as unfinished spaces.
 - c. Unfinished spaces: Mechanical rooms, shop spaces, bulk storage, shell space for future construction.
 - d. Concealed: Not visible from within a finished space.
 - e. Exposed: Surface installed, visible.
 2. Use color-coded bands to identify specified systems.
 - a. Concealed accessible spaces: Identify conduit using colored band.

- b. Exposed unpainted, unfinished spaces: Identify conduit using Include colored band.
 - c. Exposed painted, unfinished spaces: Identify using conduit markers.
 - d. Painted finished spaces:
 - 1) Conduit on ceiling: No markers.
 - 2) Conduit on walls: Not permitted, unmarked surface raceway used where indicated.
 - 3) Locate colored band on each conduit longer than 6 feet.
 - e. Unfinished open spaces less than 20 feet across and above accessible ceilings: Locate bands at changes in direction, within 0.5 m (18 inches) of each penetration of walls and floors, at 10 feet on intervals in all areas.
 - f. Unfinished open spaces greater than 20 feet across: Locate bands at changes in direction, within 0.5 m (18 inches) of each penetration of walls and floors, at 20 feet on intervals in all areas.
 - g. Color-Coded Bands: Use vinyl color marking tape to mark bands 2 inch(es) wide.
 - 1) Color Code:
 - (a) 120/208 Volt System: Black.
 - (b) Telecommunications System: Green and Yellow.
 - (c) Security System: Blue and Yellow.
 - (d) Control System: Black and Yellow.
 - h. Vinyl Color Marking Tape: 2 inch wide, www.tapebrothers.com.
 - 1) Wrap tape a minimum of 3 times around each individual conduit.
3. Use red dye on top surface of concrete duct banks.
- D. Identification for Boxes:
- 1. Use identification labels to identify circuits enclosed.
- E. Identification for Devices:
- 1. Use identification label to identify serving branch circuit for receptacles.
 - 2. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.
 - 3. Use identification label to identify individual wall switches where indicated.
- F. Identification for Luminaires:

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
- 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 - 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 - 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
 - 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
 - 5. Text height: 3/16 inches minimum.
 - 6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
- 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

- C. Format for Equipment Identification:
 - 1. Minimum Size: 1 inch by 2.5 inches.
 - 2. Legend:
 - a. Equipment designation or other approved description.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height:
 - a. Equipment Designation: 1/2 inch.
 - 5. Color:
 - a. Normal Power System: Black text on white background.
- D. Format for Receptacle Identification:
 - 1. Minimum Size: 1/4 inch by 1.5 inches.
 - 2. Legend: Power source and circuit number or other designation indicated.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 3/16 inch.
 - 5. Color: White text on black background.

2.03 WIRE AND CABLE MARKERS

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- E. Minimum Text Height: 1/8 inch.
- F. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

- A. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- B. Minimum Size:
 - 1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
- C. Legend:
 - 1. Markers for Voltage Identification: Highest voltage present.
- D. Color: Black text on orange background unless otherwise indicated.

2.05 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
 - 1. Materials:
 - a. Outdoor Locations: Use factory pre-printed rigid plastic signs.
 - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
 - 3. Minimum Size: 7 by 10 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 - 1. Surface-Mounted Equipment: Enclosure front.
 - 2. Flush-Mounted Equipment: Inside of equipment door.
 - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 - 4. Elevated Equipment: Legible from the floor or working platform.
 - 5. Branch Devices: Adjacent to device.
 - 6. Interior Components: Legible from the point of access.
 - 7. Boxes: Outside face of cover.
 - 8. Conductors and Cables: Legible from the point of access.
 - 9. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using stainless steel screws.
 - 1. Do not use adhesives except where substrate can not be penetrated.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install arc flash hazard warning labels on electrical equipment.
 - 1. Panelboards with a door: Install on inside surface of door.
 - 2. Power distribution panels with a door: Install inside panel near mains, visible with door open.
- G. Secure rigid signs using stainless steel screws.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 0573
OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY
AND ARC FLASH ASSESSMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance requirements for overcurrent protective devices.
- B. Short circuit study.
- C. Coordination study and analysis.
- D. Arc flash hazard analysis.

1.02 SCOPE

- A. The electrical contractor shall retain qualified services to perform a short circuit/coordination study and arch flash hazard assessment.
- B. The study shall be performed, stamped and signed by a registered professional engineer licensed in the State in which the Project is located. Credentials of the individual(s) performing the study and background of the firm shall be submitted to the Engineer for approval prior to start of the work.
- C. The firm performing the study should demonstrate capability and experience to provide assistance during start up as required.
- D. The studies shall be submitted to the Design Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacture.
- E. Include existing electrical equipment in the study.
- F. No less than two scenarios shall be included in the study:
 - 1. High level short circuit conditions than may occur during connection to the utility source.
 - 2. Other short circuit conditions than may occur during connection to an alternate utility source.
 - 3. Low level short circuit conditions that may occur during connection to the alternate/emergency source.
- G. Short Circuit Study: Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study. The studies shall include:
 - 1. All portions of the electrical distribution system from the normal power source or sources down to and including each bus in the distribution system.
 - 2. All devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.
 - 3. All multimotor and combination-load refrigeration equipment that has a protective device rated greater than 60 amperes.
 - 4. All motor controllers; except those rated less than 2 horsepower at 300 volts or less.
- H. Coordination study and Analysis shall include normal and emergency/alternate systems. The studies shall include:
 - 1. All devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.
 - a. Include enclosed circuit breakers and enclosed switches that function as overcurrent protective devices for panelboard mains.
 - 2. All portions of the normal system components on the line side of emergency/alternate source transfer switches.
 - 3. All portions of the electrical distribution system that serves elevators.
 - 4. All portions of the emergency/alternate source systems.
 - 5. All ground fault protection of equipment.

- I. Arc Flash Assessment: Normal and emergency/alternate system connections; and those that result in maximum arc flash conditions. The studies shall include:
 1. All portions of the normal electrical distribution system from the electrical service equipment devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.
 - a. Include enclosed circuit breakers and enclosed switches that function as overcurrent protective devices for panelboard mains.
 2. All portions of the electrical distribution system from the emergency/alternate power source or sources down to and including the smallest adjustable trip circuit breaker in the distribution system.
 3. All devices that provide overcurrent protection for multimotor and combination load refrigeration equipment that has a protective device rated greater than 60 amperes.

1.03 RELATED REQUIREMENTS

- A. Section 26 2416 - PANELBOARDS: Overcurrent protective devices in panelboards.
- B. Section 26 2813 - FUSES.

1.04 REFERENCE STANDARDS

- A. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001.
- B. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2009.
- E. IEEE 1584a - Guide for Arc Flash Hazard Calculations; 2004.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Failure to follow submittal instructions does not relieve the Contractor from the requirements of meeting the project schedule.
- C. Evaluation of electrical equipment product data submittals by Architect will not commence until acceptable preliminary studies in sufficient detail to ensure that device selection will be adequate have been submitted.
- D. Prerequisite Submittals:
 1. Qualifications of firm performing the study.
 2. Personnel Qualifications: Submit qualifications of individual(s) who will perform the work for approval prior to commencement of the studies. Submit within 30 days of award of contract.
- E. Action Submittals:
 1. Study Report - General: Submit protective device studies as specified, prior to submission of product data submittals or ordering or fabrication of protective devices.
 - a. Evaluation of product data submittals by Architect will not commence until acceptable preliminary studies in sufficient detail to ensure that device selection will be adequate have been submitted.
 - b. Equipment submittals received prior to submittal of acceptable studies will be rejected without review.
 - c. Include stamp or seal and signature of preparing engineer.
 2. Draft Report: Submit a draft of the study to Engineer for review prior to delivery of the study to the Owner. Submit draft report in conjunction with equipment submittals. The report shall include:
 - a. Descriptions, purpose, and scope of the study.

- b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties, and commentary regarding same.
 - c. Fault current calculations including a definition of terms and guide for interpretation of computer printout.
 - d. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same
 - e. Complete one-line diagram with fault current trip setting shall be included with submittal.
 - f. Arc flash hazard tabulations indicating hazard class and personnel protective equipment.
 - g. Include color printouts of arc flash hazard warning labels; paper hard copy or PDF electronic file format.
 - h. Include all files prepared using software packages, on optical disk (CD-ROM or DVD), with file name cross-references to specific pieces of equipment and systems. Include all libraries necessary for the reviewer to open and review settings.
3. Final Report: Provide studies in conjunction with Record Documents submittals to verify equipment ratings required. The results of the power system study shall be summarized in a final report. Six (6) bound copies of the final report shall be submitted. The report shall include the following sections:
- a. All items included in draft report, with all additions or changes as required by the reviewer.
 - 1) Include updated files prepared using software packages, on optical disk (CD-ROM or DVD).
 - b. Field study findings.
 - c. Include stamp or seal and signature of preparing engineer.
- F. Closeout Submittals:
- 1. Project Record Documents: Revise protective device study as required to show as-built conditions.
 - a. Submit not less than 60 days prior to final inspection of electrical system.
 - b. Include hard copies in operation and maintenance data submittals.
 - c. Include all files prepared using software packages, on optical disk (CD-ROM or DVD), with file name cross-references to specific pieces of equipment and systems.

1.06 DATA COLLECTION FOR THE STUDY

- A. Contractor Responsibility: Provide all project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, and actual circuit lengths, and provide to study preparer.
 - 1. Obtain information on existing power distribution equipment.
 - 2. Obtain information from utility company.
 - 3. Obtain information on relevant Owner provided power distribution equipment.
- B. Owner's Responsibility: Provide data on relevant Owner power distribution equipment to Contractor.

1.07 PROTECTIVE DEVICE STUDY

- A. Analyze the specific electrical and utilization equipment (according to NEC definition), the actual protective devices to be used, and the actual feeder lengths to be installed.
 - 1. Primary Source, for Purposes of Studies: Utility company primary protective devices.
 - 2. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.
 - 3. Report: State the methodology, assumptions, base per unit quantities selected, and rationale employed in making each type of calculation; identify computer software package(s) used.

- B. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with all electrical equipment and wiring to be protected by the protective devices; identify nodes on the diagrams for reference on report that includes:
1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at the main switchboard bus and all downstream devices containing protective devices.
 2. Breaker and fuse ratings.
 3. Generator kW and voltage ratings, percent impedance, X/R ratios, and wiring connections.
 4. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
 5. Identification of each bus, with voltage.
 6. Conduit materials, feeder sizes, actual lengths, and X/R ratios.
- C. Short Circuit Study: Calculate the fault impedance to determine available 3-phase short circuit and ground fault currents at each bus and piece of equipment during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum fault conditions.
1. Include fault currents at supply switchgear lineup, unit substation primary and secondary terminals, low voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the system.
 2. Show fault currents available at key points in the system down to a fault current of 7,000 A at 480 V and 208 V.
 3. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit KVA, and symmetrical and asymmetrical fault currents.
 4. Show transformer full load and 150, 400, or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical and asymmetrical fault current to which the device is exposed.
 5. Include source combinations for present and future supply circuits, large motors, or generators.
 6. Include motor contributions in determining the momentary and interrupting ratings of the protective devices.
 - a. Utilize equipment load data for the study obtained by the Contractor from the contract documents.
 7. Primary Fault Level Assumptions at utility primary connection:
 - a. Analyze for assumed infinite bus at utility connection.
 - b. Obtain source impedance data and power company system characteristics from utility company.
 8. Report: Include all pertinent data used in calculations and for each device include:
 - a. Device identification.
 - b. Operating voltage.
 - c. Protective device.
 - d. Device rating.
 - e. Calculated short circuit current, asymmetrical and symmetrical, and ground fault current.
- D. Coordination Study: Perform an organized time-current analysis of each protective device in series from the individual device back to the primary source, under normal conditions, alternate operations, and emergency power conditions.

1. Include phase and ground coordination of the generator protective devices. Show the generator decrement curve and damage curve along with the operating characteristics of the protective devices.
 2. For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current to ensure protective devices will not trip major or group operation.
 3. Graphically illustrate that adequate time separation exists between series devices, including upstream primary device.
 4. Plot the specific time-current characteristics of each protective device graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms.
 - a. Organize plots so that all upstream devices are clearly depicted on one sheet.
 5. Also show the following on curve plot sheets:
 - a. Device identification: Type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
 - b. Voltage and current transformer ratios for curves.
 - c. 3-phase and 1-phase ANSI damage curves for each transformer.
 - d. No-damage, melting, and clearing curves for fuses. Include manufacturing tolerance and damage bands in plotted fuse characteristics.
 - e. Cable damage curves.
 - f. Transformer inrush points.
 - g. Maximum short circuit cutoff point.
 - h. Simple one-line diagram with title for the portion of the system that each curve plot illustrates.
 - i. Software report for each curve plot, labeled for identification.
- E. Analysis: Determine ratings and settings of protective devices to minimize damage caused by a fault and so that the protective device closest to the fault will open first.
1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
 2. Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.
 3. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.
 4. Provide settings for chiller motor starters or obtain from the mechanical contractor, include in the study package, and comment.
 5. Identify any equipment that is underrated as specified.
 - a. Notify the Engineer in writing of circuit protective devices not properly rated for fault conditions
 6. Identify existing protective devices that will not achieve required coordination and cannot be field adjusted to do so.
 7. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve a change to the contract sum.
 8. In all cases where adequate protection or coordination cannot be achieved at no extra cost to Owner, provide a discussion of alternatives and logical compromises for best achievable coordination.
- F. Protective Device Rating and Setting Chart: Summarize in tabular format the required characteristics for each protective device based on the analysis; include:
1. Device identification.
 2. Relay CT ratios, tap, time dial, and instantaneous pickup.

3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
4. Fuse rating and type.
5. Ground fault pickup and time delay.
 - a. Include all adjustable settings for ground fault protective devices.
6. Input level and expected response time at two test points that are compatible with commonly available test equipment and the ratings of the protective device.
7. Highlight all devices that as furnished by Contractor will not achieve required protection.

1.08 ARC FLASH HAZARD ASSESSMENT

- A. As part of the short circuit and coordination study, arc flash hazard study shall be included.
- B. Determine and document all possible utility and generator/emergency sources that are capable of being connected to each piece of electrical gear. Calculations shall be based on highest possible source connection.
- C. Calculations to conform to IEEE 1584a 2004 - Guide for Arc Flash Hazard Calculations standards. All incident energy units shall be calculated in calories per square centimeter.
- D. Provide recommended boundary zones and personal protective equipment (PPE) based on the calculated incident energy and requirements of NFPA 70E-2003 for each piece of electrical gear.

1.09 QUALITY ASSURANCE

- A. Study Preparer Qualifications:
 1. Company Qualifications: The firm performing the study should be currently involved in high- and low-voltage power system evaluation, regularly engaged in short circuit and coordination studies, with at least 5 years experience in power system analysis.
 2. Study Preparer Qualifications: Qualified engineer of switchgear manufacturer; or approved professional engineer.
 - a. Professional electrical engineer licensed in the State in which the Project is located.
 - b. Minimum 5 years experience in preparation of studies of similar type and magnitude.
 - c. Familiar with the software analysis products specified.
- B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
 1. Acceptable Software Products:
 - a. SKM Systems Analysis, Inc; Power Tools for Windows: www.skm.com.
- C. Contractor Responsibilities:
 1. Provide all project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, and actual circuit lengths.
 2. Obtain all project-related data needed by study preparer from utility company, other Contractors and subcontractors, and Owner. Typical data includes but is not limited to:
 - a. Utility primary voltage, transformer kVA and impedance, and X/R ratios.
 - b. Motors and other utilization equipment connected to the electrical distribution system, including existing components.
 - c. Motor controllers, including variable-frequency controllers.
 - d. Generator(s): New, existing, or Owner provided.
- D. Owner's Responsibility: Provide data on relevant Owner power distribution equipment.

PART 2 PRODUCTS

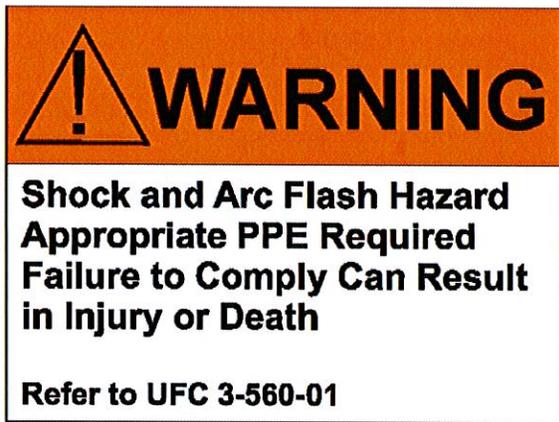
2.01 PROTECTIVE DEVICES

- A. Provide protective devices of ratings and settings as required so that the protective device closest to the fault will open first.
- B. Replace existing protective devices to achieve specified performance.

- C. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of this analysis.

2.02 LABELS

- A. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
1. Description: self-adhesive vinyl label to affix to electrical equipment to warn of arc flash hazards, suitable for outdoor use.
 2. Minimum Size: 4 by 6 inches.
 3. Size:
 - a. Indoor equipment: 2 inches high x 3 inches wide.
 - b. Outdoor equipment: 4 inches high x 6 inches high.
 4. Legend: Include orange header that reads "WARNING", followed by the word message "Shock and Arc Flash Hazard. Appropriate PPE Required. Failure to Comply Can Result in Injury or Death. Refer to UFC 3-560-01".
 5. Sample Labels:



- a. Downloadable Windows Metafile is available on the Whole Building Design Guide website www.WDBG.org for use in a label making machine.
 - 1) The file is located on the "NAVFAC CADD DETAILS" page. Navigate to location: HOME > DOCUMENTS AND REFERENCES > ccb > CADD LIBRARY > NAVFAC CADD RESOURCES > NAVFAC CADD DETAILS.

END OF SECTION

SECTION 26 0914
ELECTRICAL POWER MONITORING

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. IEEE C12.1 - American National Standard Code for Electricity Metering; Institute of Electrical and Electronic Engineers; 1988.
- B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; Institute of Electrical and Electronic Engineers; 2008.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Action Submittals:
 - 1. Shop drawings:
 - a. Include drawings with enclosure type, outline dimensions, mounting dimensions, terminal connection information, and weights.
 - 2. Product Data: Provide complete manufacturer's product data with options and accessories identified. Provide electrical ratings and adjustment ranges. Indicate complete model numbers with accessories, and software.
- C. Information Submittals:
 - 1. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- D. Closeout Submittals:
 - 1. Operation and Maintenance Manual:
 - a. Operation Data: Operating instructions.
 - b. Product Information: Include approved shop drawings and product data.
 - c. Warranty: Include manufacturer warranty and ensure that forms have been completed in Owner 's name and registered with manufacturer.
 - d. Documentation of Training: Indicate date of training. Include attendance roster and training outline.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 150 miles of Project.
- C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

1.06 WARRANTY

- A. The meter manufacturer shall warrant the meter against defects in materials and workmanship for 5 years after initial start-up.

PART 2 PRODUCTS

2.01 MICROPROCESSOR METERING EQUIPMENT

- A. Provide energy measurement, monitoring, and data storage of electrical usage at the facility:

1. Actual electric kW consumed by the facility in real-time.
 2. Total electric kWh consumed for previous week, month, and year.
 3. Peak electric kW demand for previous week, month, and year; with time/date of occurrence.
- B. Communications using ModBus protocol ASCII/RTU and DNP 3.0.
1. Remote command through communications port.
 2. Communicate all outputs with Building Management System.
- C. Manufacturers:
1. Digital Power Quality Meter & Analyzer for electrical service entrance(s): Square D PowerLogic.
 - a. Square D Ion 7330 meter.
 2. Substitutions: Not Permitted.
- D. Provide meters with appropriate multiplier tags.

2.02 METERING TRANSFORMERS

- A. Current Transformers: IEEE C57.13; 5 ampere secondary, wound type, with single secondary winding and secondary shorting device, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.

PART 3 EXECUTION

3.01 PRE-INSTALLATION

- A. Verify meter is compatible with energy management control system.
- B. Provide recommended fuses for meter.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install branch circuit power monitoring in gutters of panelboards.
 1. Manufactured assembly with panelboards from panelboard manufacturer is permitted.
 2. Install in existing panelboards.
- C. Connect all meters to building energy management control system.
- D. Configure building energy management control system to display and report data.

3.03 TRAINING

- A. Provide 2 hours training to the Owner explaining the operation use and of Power and Quality Analyzer.

END OF SECTION

SECTION 26 0916
ELECTRIC CONTROLS AND RELAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pushbutton and selector switches.
- B. Control stations and panels.
- C. Digital time switches.
- D. Clock Timers.
- E. Sensors.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. NEMA ICS 1 - Industrial Control and Systems: General Requirements; National Electrical Manufacturers Association; 2005 (R2008).
- B. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2008).
- C. NEMA ICS 6 - Industrial Control and Systems: Enclosures; National Electrical Manufacturers Association; 1993 (R2006).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Action Submittals:
 - 1. Shop Drawings:
 - a. Include NEMA ICS 1 indicating control panel layouts.
 - b. Include wiring connections and diagrams.
 - c. Include dimensions and support points.
 - 2. Product Data: Provide for each component showing electrical characteristics and connection requirements.
- C. Information Submittals:
 - 1. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- D. Closeout Submittals:
 - 1. Project Record Documents: Record actual locations of devices.
 - 2. Operation and Maintenance Manual:
 - a. Include Operation Data: Instructions on how to make field adjustments.
 - b. Include Maintenance Data: Maintenance and repair procedures.
 - c. Include Warrantee Information.

PART 2 PRODUCTS

2.01 COMPONENTS

- A. Control Switches and Stations:
 - 1. Contacts: NEMA ICS 2, Form Z.
 - 2. Contact Ratings: NEMA ICS 2, A150.
 - 3. Selector Switch Operators: Two position rotary selector switch.
 - 4. Pushbutton Operator: Unguarded type.
 - 5. Mushroom Switch: Covered type.
 - a. Twist to release push pull, maintained contact, 40 mm red mushroom.
 - b. Configuration: DPDT.

- c. Enclosure shall be stainless steel.
 - d. Clear plexiglass cover.
6. Control Stations: Standard duty oiltight type pushbutton station.

2.02 ENCLOSURES

- A. Control Station Enclosures: NEMA ICS 6; Type 1.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install individual relays and time-delay relays in enclosures.
- C. Make electrical wiring interconnections as indicated.

END OF SECTION

SECTION 26 0919
ENCLOSED CONTACTORS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 26 0529 - HANGARS AND SUPPORTS FOR ELECTRICAL SYSTEMS.
- B. Section 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS: Identification products and requirements.

1.02 REFERENCE STANDARDS

- A. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2008).
- B. NEMA ICS 6 - Industrial Control and Systems: Enclosures; National Electrical Manufacturers Association; 1993 (R2006).
- C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Action Submittals:
 - 1. Product Data: Provide dimensions, size, voltage ratings and current ratings.
- C. Closeout Submittals:
 - 1. Project Record Documents: Record actual installed locations of contactors
 - 2. Operation and Maintenance Manual:
 - a. Include approved shop drawings and product data.
 - b. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
- B. Schneider Electric; Square D Products: www.schneider-electric.us.
- C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LIGHTING CONTACTORS

- A. Description: NEMA ICS 2, magnetic lighting contactor.
- B. Configuration: Electrically held.
- C. Coil operating voltage: 120 volts, 60 Hertz.
- D. Poles: As required to match circuit configuration and control function. Refer to Schedules on Drawings.
- E. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.

- F. Enclosure: NEMA ICS 6, Type 1.
- G. Accessories:
 - 1. Auxiliary Contacts: One, normally open.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install enclosed contactors where indicated, in accordance with manufacturer's instructions.
- B. Install enclosed contactors plumb. Provide supports in accordance with Section 26 0529.
- C. Identify enclosed contactors in accordance with Section 26 0553.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform applicable inspections and tests listed in NETA ATS, Section 7.16.1.

END OF SECTION

SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Occupancy/Vacancy sensors.
- B. Outdoor photo sensors.

1.02 RELATED REQUIREMENTS

- A. Section 26 0537 - Boxes.
- B. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, fan speed controllers, and wall plates.
- C. Section 26 5110 - Luminaires.

1.03 REFERENCE STANDARDS

- A. ASHRAE 90.1-2007 - Energy Standard for Buildings Except Low-Rise Residential Buildings: Lighting.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.
- C. Underwriters Laboratories (UL)
 - 1. UL 508 – Industrial Control Equipment
- D. ABBREVIATIONS:
 - 1. BAS: Building Automation System.
 - 2. AV: Audio Visual.
 - 3. RF: Radio Frequency.
 - 4. CT: Current Transformer.
- E. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.
- F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 773 - Plug-in Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.
- I. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.
- J. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
 - 3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
 - 4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
- B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Submit all product data, shop drawings, and manufacturer's instructions concurrently.
- C. Action Submittals:
 1. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
 - a. Occupancy/Vacancy Sensors: Include detailed motion detection coverage range diagrams.
- D. Information Submittals:
 1. Field Quality Control Reports.
- E. Closeout Submittals:
 1. Operation and Maintenance Manual:
 - a. Operation and Maintenance Data: Include detailed information on device programming and setup.
 - b. Include approved Shop Drawings and Product Data.
 - c. Include Sequence of Operation, identifying operation for each room or space.
 - d. Include manufacturer's maintenance information.
 - e. Include startup and test reports.
 - f. Include Documentation of Training:
 - 1) Date, attendance roster, and outline of training.
 2. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide three year manufacturer warranty for all occupancy sensors.
- C. Provide three year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.
- D. Manufacturer's "Terms and Conditions" stating that warranty period begins at date of shipment is prohibited. Provide extended warranty for time period indicated that begins at date of Substantial Completion.

PART 2 PRODUCTS

2.01 ALL LIGHTING CONTROL DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.
- C. Products for Switching of Electronic Fluorescent Ballasts: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.02 OCCUPANCY/VACANCY SENSORS

- A. Manufacturers:
 1. WattStopper: www.wattstopper.com.
 2. Steinel: www.steinell.net.
 3. Substitutions: See Section 01 6000 - Product Requirements.

4. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- B. All Occupancy/Vacancy Sensors:
1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
 2. Sensor Technology:
 - a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
 3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
 4. Vacancy (Manual On) Operation: Unless otherwise indicated, vacancy sensor to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval. Manual switch operation required to turn load on.
 5. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
 6. Compatibility:
 - a. Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, LED lighting with electronic drivers, and fractional motor loads, with no minimum load requirements.
 7. Load Rating for Line Voltage Occupancy Sensors:
 - a. Incandescent Load: Not less than 800 W.
 - b. Fluorescent or LED Load: Not less than 800 W at 120 V ac and 1,200 W at 277 V ac.
 - c. Motor Load: Not less than 1/6 HP.
 8. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
- C. Wall Switch Occupancy/Vacancy Sensors:
1. All Wall Switch Occupancy/Vacancy Sensors:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
 - b. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.
 - c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
 - d. Operation: Operates only as vacancy sensor (manual-on/automatic-off) in accordance with California Title 24 requirements.
 - 1) Vacancy Sensor: Manual on, automatic off.
 - e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
 - f. Finish: White with stainless steel cover plate.
 - g. Products:
 - 1) Wattstopper CS-50-W.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.

2.03 IN-WALL INTERVAL TIMERS

- A. Manufacturers:
1. Wattstopper.
 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Digital Electronic In-Wall Interval Timers:

1. Description: Factory-assembled solid state programmable controller with LCD display, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.
2. Program Capability: Designed to turn load off at end of preset time interval.
3. Time Interval: Field selectable range of presets available from 2 minutes up to 60 minutes.
4. Provide field selectable audible and visual indication to warn that end of interval operation is about to turn off load.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of both turning load off and resetting timer to original preset time interval.
7. Switch Configuration: Suitable for use in either SPST or 3-way application.
8. Load Rating for Line Voltage Occupancy Sensors:
 - a. Incandescent Load: Not less than 800 W.
 - b. Fluorescent Load: Not less than 800 W at 120 V ac and 1,200 W at 277 V ac.
 - c. Motor Load: Not less than 1/6 HP.
9. Finish: White with stainless steel cover plate.
10. Products:
 - a. Wattstopper TS-400 (120 or 277 V line voltage).
 - b. Wattstopper TS-400-24 (24 volt with power pack).
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.04 OUTDOOR PHOTO CONTROLS

- A. Manufacturers:
 1. Intermatic, Inc: www.intermatic.com.
 2. Paragon, a brand of Invensys Controls: www.invensyscontrols.com.
 3. Tork, a division of NSI Industries LLC: www.tork.com.
 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Locking Receptacle-Mounted Outdoor Photo Controls
 1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on a compatible receptacle, listed and labeled as complying with UL 773.
 2. Housing: Weatherproof, impact resistant UV stabilized polypropylene.
 3. Photo Sensor: Cadmium sulfide.
 4. Light Level Activation: 1 to 3 footcandles turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
 5. Voltage: As required to control the load indicated on the drawings.
 6. Failure Mode: Fails to the on position.
 7. Load Rating: As required to control the load indicated on the drawings.
 8. Surge Protection: 160 joule metal oxide varistor.
 9. Provide the following accessories where indicated or as required to complete installation:
 - a. Receptacle: Complying with ANSI C136.10.
 - b. Mounting Bracket.
 - c. Shorting Cap: Suitable for replacing locking photo control to complete circuit.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.

- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of lighting control devices provided under this section.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.
- F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.
- G. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- H. Outdoor Photo Control Locations:
 - 1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
 - 2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
- I. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.
- J. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.
- K. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Section 01 9113 for further details.
- C. Inspect each lighting control device for damage and defects.
- D. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- E. Test outdoor photo controls to verify proper operation, including time delays where applicable.
- F. Provide a report in table format including each room or space that has occupancy sensors and/or light level sensors installed. Indicate the following for each space:
 - 1. Date of test or inspection.
 - 2. Room Number and Room Name.
 - 3. Sensor Types.

4. Sequence of Operation for the control of each space.
 5. Verification that the control of each space complies with the Sequence of Operation.
 6. Quantity and Type of each device installed.
 7. Test Reports for each device.
 8. Occupancy Sensors, indicate the following:
 - a. Verification that sensors are adjusted for complete coverage of space.
 - b. Time delay settings.
- G. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.04 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.
- C. Adjust time switch settings to achieve desired operation schedule as indicated in Lighting Controls Sequence of Operations on Drawings. Record settings in written report to be included with submittals.
- D. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 2. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
 3. Location: At project site.

END OF SECTION

SECTION 26 2416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Lighting and appliance panelboards.
- B. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- B. Section 26 0529 - HANGARS AND SUPPORTS FOR ELECTRICAL SYSTEMS.
- C. Section 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS: Identification products and requirements.
- D. Section 26 4300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; National Electrical Contractors Association; 2009.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.
- E. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).
- H. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 67 - Panelboards; Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- M. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Action Submittals:
 1. Submit Product Data and Shop Drawings in conjunction with Overcurrent Protective Device Coordination Study and Arc Flash Assessment to verify equipment ratings required. Submittals received without concurrent submittal of Section 26 0573 may be rejected without review.
 2. Submit all product data and shop drawings concurrently.
 3. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
 4. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - a. Circuit arrangement has been designed by the engineer for optimum phase balance; rearrangement by equipment provider is prohibited.
 - b. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
- C. Information Submittals:
 1. Field Quality Control Test Reports.
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Closeout Submittals:
 1. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
 2. Operation and Maintenance Manual:
 - a. Include approved shop drawings and product data.
 - b. Test Reports: Include field quality control test reports.
 - c. Maintenance Schedule: Include equipment maintenance or testing requirement and frequency of maintenance or test in consolidated maintenance schedule table. Refer to Section 26 0500 - Basic Electrical Requirements for maintenance schedule table requirements.
 - 1) Include exercise requirements for circuit breakers.
 - d. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
 - e. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - f. Time-current coordination curves for each type and rating of main overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.
 - 1) Include coordination curves for each feeder overcurrent protective device for panelboards with main lugs only.
 - g. Documentation of Training:
 - 1) Include date, attendance roster, and outline of training session.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Panelboard Keys: Two of each different key.
3. Circuit Breaker Padlock Keys: Six of each different key.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 1.1 and trained in electrical safety as required by NFPA 70E.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
- B. Substitutions: See Section 01 6000 - Product Requirements.
- C. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ALL PANELBOARDS

- A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 1. Altitude: Less than 6,600 feet.
 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
 2. Listed series ratings are not acceptable.
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - b. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.

- b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
- c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
- 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- J. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- K. Provide the following features and accessories where indicated or where required to complete installation:
 - 1. Feed-through lugs.
 - 2. Sub-feed lugs.

2.03 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Copper.
 - 3. Ground Bus Material: Copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 - 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
 - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - 5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
 - 6. Provide the following circuit breaker types where indicated:

- a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
 - c. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
7. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
 8. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
 9. Do not use tandem circuit breakers.
 10. Do not use handle ties in lieu of multi-pole circuit breakers.
 11. Provide the following features and accessories where indicated or where required to complete installation:
 - a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - b. Handle Pad-Lock Provision: For locking circuit breaker handle in ON or OFF position.
 - c. Padlocks, all keyed alike, provide keys.

2.05 SURGE PROTECTIVE DEVICES

- A. Surge Protective Devices: Surge protected devices inside the panel or bus mounted are prohibited. Where surge protection is required, provide remote surge protective device immediately adjacent to the panelboard.
 1. Provide circuit breaker in panelboard for surge protective device connection.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Verify that field measurements are as indicated on shop drawings.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26 0529.
- E. Install panelboards plumb.
- F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- G. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

- J. Provide grounding and bonding in accordance with Section 26 0526.
- K. Install all field-installed branch devices, components, and accessories.
- L. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- M. Provide filler plates to cover unused spaces in panelboards.
- N. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
 - 1. Emergency and night lighting circuits.
 - 2. Fire detection and alarm circuits.
- O. Identify panelboards in accordance with Section 26 0553.
- P. Provide arc flash hazard labels under the provisions of Section 26 0553.

3.04 FIELD QUALITY CONTROL

- A. Perform Tests and Inspections:
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Perform inspection, testing, and adjusting in accordance with Section 01 4000.
 - 2. Inspect and test in accordance with NETA ATS, except Section 4.
 - 3. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 100 amperes. Tests listed as optional are not required.
 - 4. Test GFCI circuit breakers to verify proper operation.
 - 5. Test shunt trips to verify proper operation.
 - 6. Correct deficiencies and replace damaged or defective panelboards or associated components.
- C. Prepare Test and Inspection Reports:
 - 1. Provide a cover sheet listing all deficient items. Correct deficiencies and repeat tests for deficient items. Provide new test report for each panelboard containing a deficient item.
 - 2. Provide certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
 - 3. Provide test reports for each panelboard feeder indicating balance of phase loads. Indicate the following:
 - a. Date of test or inspection.
 - b. Deficiency and corrective action taken.
 - c. Repeat test/verification for each panelboard containing a deficient item.

3.05 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Adjust alignment of panelboard fronts.
- C. Adjust circuit breaker trip and time delay settings to values indicated in Overcurrent Protective Device Coordination Study. Refer to Section 26 0573.
- D. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes:
 - 1. Measure as directed during period of normal system loading.
 - 2. Tolerance: Difference exceeding 20 percent between phase loads within a panelboard is not acceptable.

3. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disruption of critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
4. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

3.06 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. Demonstration and Training: Train Owners's personnel to adjust, operate, and maintain panelboards, overcurrent protective devices, and accessories.
 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 2. Location: At project site.

END OF SECTION

SECTION 26 2716
ELECTRICAL CABINETS AND ENCLOSURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cabinets.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Pads for enclosure support.
- B. Section 26 0537 - Boxes.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Action Submittals:
 - 1. Product Data: Provide manufacturer's standard data for enclosures and cabinets.
 - 2. Shop Drawings: Indicate dimensions, weight, and mounting points.
 - a. Include dimensioned plan and elevation views of equipment and conduit layout of all components mounted in cabinet.
- C. Cabinet Keys: Deliver to Owner in accordance with Section 01 6000 for maintenance materials.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 ENCLOSURE MANUFACTURERS

- A. Hoffman, a division of Pentair: <http://www.hoffmanonline.com>.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CABINETS

- A. Type: NEMA 12.
- B. Box Size: 72 inches wide x 72 inches high x 12 inches deep.
- C. Doors: Gasketed overlapping doors with no centerpost, 3-point latch mechanism operated by oil-tight key-lock handle, latch rod rollers for easy door closing.
 - 1. Oil-resistant gasket.
- D. Knockouts: None.
- E. Finish: Inside, ANSI 61 Gray. Outside, Match Base Standard Brown.
- F. Accessories:
 - 1. Provide 12 inch accessory feet for free-standing equipment, welded to enclosure.
 - 2. Heavy duty lifting eyes.
 - 3. Data Pocket, high-impact thermoplastic.
 - 4. Panel Support rails.
 - 5. Bonding provision on door.

- G. Keys: Provide two of each different key.

PART 3 EXECUTION

3.01 PREPARATION

- A. Provide concrete housekeeping pad under the provisions of Section 03 3000.
- B. Verify that field measurements are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install cabinet fronts plumb.

3.03 CLEANING

- A. Remove dirt and debris from enclosure.
- B. Clean finishes and touch up damage.

END OF SECTION

**SECTION 26 2717
EQUIPMENT WIRING**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 26 0534 - CONDUIT.
- B. Section 26 0537 - BOXES.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 2719 - Cord Reels.
- E. Section 26 2726 - WIRING DEVICES.
- F. Section 26 2818 - Enclosed Switches.
- G. Section 26 2913 - Enclosed Controllers.

1.02 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2010).
- B. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
 - 2. Determine connection locations and requirements.
- B. Sequencing:
 - 1. Obtain coordination requirements prior to rough-in for equipment.
 - 2. Install rough-in of electrical connections before installation of equipment is required.
 - 3. Make electrical connections before required start-up of equipment.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Action Submittals:
 - 1. Consolidated Table: Provide information in table format indicating each Equipment Designation and Name; Cord Type/Size; Device Configuration.
 - 2. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Closeout Submittals:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Consolidated Table.
 - b. Include approved Product Data.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
 - 1. Colors: Conform to NEMA WD 1.
 - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
 - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- B. Portable Generator Connection:
 - 1. Description: Designed to supply power to portable or fixed electrical equipment such as motor generator units, welders, pumps, compressors, cellular relay stations, and similar apparatus.
 - a. Suitable for use in locations where a weatherproof enclosure is
 - b. Rough usage construction.
 - 2. Rating: 200 amperes.
 - 3. Features:
 - a. Neoprene bushing compressed by cable collar prevents entrance of water. Bushing is highly resistant to hydrocarbon deterioration and is self-extinguishing.
 - b. Locking screw and slot prevents plug cable collar from "backing off."
 - c. Contacts exert constant pressure along entire contact surface.
 - d. Suitable for use from -40 °F/-40 °C to 225 °F/107 °C.
 - e. Positive polarization: only plugs and receptacles of same style, number of poles and ampere rating can be used together.
 - f. Arcing created as line and load terminals disengage is safely confined within terminal cavities. Plugs may be withdrawn in an emergency under full rated loads without separate disconnect.
 - g. Controlled length contacts ensure that ground makes first and breaks last for added safety.
 - 4. Construction:
 - a. Plug, receptacle, connector and mounting box housings: copperfree (4/10 of 1% max.) aluminum.
 - b. Insulating blocks: glass filled polyester.
 - c. Enclosure: NEMA 4X.
 - 5. Finish: Aluminum plug, receptacle, connector and mounting box housings: Gray epoxy powder coat.
 - 6. Product: Appleton AJA20044-250.
 - 7. Substitutions: Not permitted.
- C. Disconnect Switches: As specified in Section 26 2818 and in individual equipment sections.
- D. Wiring Devices: As specified in Section 26 2726.
- E. Flexible Conduit: As specified in Section 26 0534.
- F. Wire and Cable: As specified in Section 26 0519.
- G. Boxes: As specified in Section 26 0537.

2.02 EQUIPMENT CONNECTIONS

- A. Direct-wired connections:
 - 1. Electrical Connection: Flexible conduit.
 - a. Provide flexible metallic conduit or liquid-tight flexible metal conduit suitable for environment of intended use.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- J. Identify portable generator connections with warning signs in accordance with Section 26 0553.

END OF SECTION

SECTION 26 2726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Wall plates.

1.02 RELATED REQUIREMENTS

- A. Section 26 0537 - BOXES.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- D. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2010).
- E. NEMA WD 6 - Wiring Device -- Dimensional Specifications; National Electrical Manufacturers Association; 2002 (R2008).
- F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- H. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- I. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- J. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hubbell Incorporated: www.hubbell-wiring.com.
- B. Leviton Manufacturing Company, Inc: www.leviton.com.
- C. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
- D. Semtron Incorporated; www.semtron.com; for wall plates.
- E. Substitutions: See Section 01 6000 - Product Requirements.
- F. Source Limitations:
 - 1. Where possible, for each type of wiring device furnish products produced by a single manufacturer and obtained from a single supplier.
 - 2. Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer and material indicated in this section.

2.02 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.
- D. Unless noted otherwise, do not use combination switch/receptacle devices.

2.03 ALL WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Finishes:
 - 1. Wiring Devices Installed in Finished Spaces: White with white stainless steel wall plate unless otherwise indicated.
 - 2. Wiring Devices Installed in Unfinished Spaces: Brown with stainless steel wall plate unless otherwise indicated.
 - 3. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover unless otherwise indicated.
 - 4. Isolated Ground Convenience Receptacles: Gray with isolated ground triangle mark on device face.
 - 5. Electronic Grade Convenience Receptacles: Gray.

2.04 WALL SWITCHES

- A. All Wall Switches: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- C. Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.

2.05 RECEPTACLES

- A. Manufacturers:
 - 1. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:
 - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
- D. GFI Receptacles:
 - 1. All GFI Receptacles: Provide with feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
 - 2. Weather Resistant GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.06 WALL PLATES

- A. Manufacturers:
 - 1. Semtron, Inc.; www.semtron.com
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
 - 3. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. All Wall Plates: Comply with UL 514D.
 - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 - 2. Size: Standard.
 - a. Jumbo wall plates are not permitted.
 - 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.
 - 1. Product: Large capacity, vertical, Hubbell WP26M.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of wiring devices provided under this section.
 - 1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

- H. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- I. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- J. Install wall switches with OFF position down.
- K. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on left.
- L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting in accordance with Section 01 4000.
- B. Test Equipment: Digital wiring analyzer with the following features:
 - 1. LCD display.
 - 2. Tests and indicates voltage drop under load, user selectable 10, 15, and 20 ampere loads.
 - 3. Detects faulty wiring in need of repair without removing cover plates or panel covers:
 - a. Faulty splices and connectors.
 - b. Incorrect wiring.
 - c. Undersized wiring.
 - d. Faulty GFCI devices.
 - e. Faulty or incorrectly wired AFCI devices.
 - f. Incorrect line voltage.
 - g. Poor ground quality.
 - 4. Incorrect wiring or voltage drop is indicated by flashing screen.
 - 5. Will not trip overcurrent protective devices during tests.
 - 6. Tests GFCI and AFCI devices for proper operation.
 - 7. Checks ground quality for safety and ability to support electronic equipment.
 - 8. Measures available fault current at test location.
 - 9. Product:
 - a. Amprobe INSP-3.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- C. Inspect each wiring device for damage and defects.
- D. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- E. Convenience Receptacles:
 - 1. Test with digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
 - 2. Test each receptacle to verify operation and proper polarity.
 - 3. Test for line voltage: Acceptable range is 110 to 132 V.
 - 4. Test for voltage drop from measured line voltage, with 15 Ampere load: A value of greater than 5 percent is not acceptable.
 - 5. Test for ground impedance: Values of up to 2 ohms are acceptable.
 - 6. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
 - 7. Tests shall be diagnostic; indicating damaged conductors, high resistance at the circuit breaker source, poor connections, inadequate fault current path, defective devices, or similar problems.

- F. Correct wiring deficiencies and replace damaged or defective wiring devices.
 - 1. Replace branch circuit conductors for devices at locations that tests indicate are not within acceptable range.
 - 2. Repeat tests at devices found defective and replaced.

3.04 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.05 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 2813

FUSES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 26 2818 - Enclosed Switches: Fusible switches.

1.02 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2002 (R2007).
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.
- D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
 - a. Fusible Enclosed Switches: See Section 26 2818.
 - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
 - 3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Action Submittals:
 - 1. Product Data:
 - a. Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
- C. Closeout Submittals:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cooper Bussmann, a division of Cooper Industries: www.cooperindustries.com.
- B. Mersen (formerly Ferraz Shawmut): ferrazshawmut.mersen.com.
- C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 APPLICATIONS

- A. Service Entrance:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
- B. Individual Motor Branch Circuits: Class RK1, time-delay.

2.03 FUSES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
- H. Provide the following accessories where indicated or where required to complete installation:
 - 1. Fuseholders: Compatible with indicated fuses.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify fuse types and ratings are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

**SECTION 26 2818
ENCLOSED SWITCHES**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- B. Section 26 0529 - HANGARS AND SUPPORTS FOR ELECTRICAL SYSTEMS.
- C. Section 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS: Identification products and requirements.
- D. Section 26 0573 - Overcurrent Protective Device Coordination Study.
- E. Section 26 2813 - FUSES.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.
- C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
- H. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Action Submittals:
 - 1. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
 - 2. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- C. Closeout Submittals:

- D. Project Record Documents: Record actual locations of enclosed switches.
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Shop Drawings.
 - b. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Siemens Industry, Inc: www.usa.siemens.com.
- B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
- C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break, enclosed safety switches complying with NEMA KS 1, type HD (heavy duty), and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
 - 2. Minimum Ratings:
 - a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
 - b. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
- G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- H. Provide with switch blade contact position that is visible when the cover is open.
- I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
 - 1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- J. Conductor Terminations: Suitable for use with the conductors to be installed.
- K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- M. Enclosures: Comply with NEMA KS 1 and NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
- N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- O. Heavy Duty Switches:
1. Products:
 - a. 200 A 4-Pole Switches, Type 3R: Siemens HNF464J.
 - 1) Finish: Base Standard Brown.
 - b. 200 A Double Throw Fusible Switches, Type 1: Cutler-Hammer DT324FGK.
 - 1) Suitable for use as service equipment.
 - 2) Solid Neutral.
 - 3) Class R fuse clips, for rating indicated in Enclosed Switch Schedule on Drawings.
 - 4) Finish: Manufacturer's gray enamel.
 - c. Switches for Equipment Wiring: Refer to Electrical Equipment Schedule on Drawings.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
 2. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
 - a. Provide means for locking handle in the ON position where indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install enclosed switches in accordance with manufacturer's instructions.
- B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26 0529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 0526.
- H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- I. Identify enclosed switches in accordance with Section 26 0553.

3.02 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.03 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 4300
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surge protective devices for branch panelboard locations.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Devices.
- B. Section 26 2416 - Panelboards.

1.03 ABBREVIATIONS AND ACRONYMS

- A. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.
- C. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.
- F. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to ordering equipment.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Action Submittals:
 - 1. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, service condition requirements, and installed features.
 - 2. Shop Drawings: Include enclosure ratings, outline and support point dimensions, weight, wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.
- C. Information Submittals:
 - 1. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
 - a. UL 1449.
 - b. UL 1283 (for Type 2 SPDs).
 - 2. Manufacturer's Certified Test Reports:
 - a. Indicate the following:
 - 1) Surge Current Capacity:
 - (a) Single Pulse Surge Current: In compliance with ANSI/IEEE C62.41, using IEEE Category B3 bi-wave
 - (b) Repetitive Surge Current: Per ANSI/IEEE C62.41 and ANSI/IEEE C62.45-1992, using Category B3 bi-wave.

- 2) Clamping Voltage: In compliance with NEMA LS 1-1992. Indicate for all modes of protection.
 - (a) Category B3/C1 bi-wave.
- 3) EMI/RFI Noise Attenuation: Indicate attenuation in dB for single unit installation at 100 KHz., 1 MHz., 10 MHz., and 100 MHz.
- 3. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Closeout Submittals:
 - 1. Operation and Maintenance Manual:
 - a. Include approved shop drawings, product data, and installation instructions.
 - b. Include information on status indicators and recommended maintenance procedures and intervals.
 - c. Include field quality control test reports.
 - d. Include Warranty: Manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.
- C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Field-installed, Externally Mounted Surge Protective Devices:
 - 1. Square D SurgeLogic.
 - 2. Eaton Cutler-Hammer.
 - 3. Liebert.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.02 ALL SURGE PROTECTIVE DEVICES FOR ELECTRICAL EQUIPMENT

- A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service, listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated; system voltage as indicated on the drawings.
- B. Protected Modes:
 - 1. Wye Systems: L-N, L-G, N-G, L-L.
- C. UL 1449 Voltage Protection Ratings (VPRs):
 - 1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
- D. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 125% of nominal system voltage.

- E. Fusing: Individually fuse suppression components. Single fuses that protect multiple suppression devices are prohibited. The suppression device must not become inoperative because of a failure of a fuse or suppression component.
- F. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 1. Indoor clean, dry locations: Type 1.
 - 2. Outdoor locations: Type 4.
- G. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
 - 1. Provide surface-mounted SPD where mounted in non-public areas or on exterior.
- H. Equipment Containing Factory-installed, Internally Mounted SPDs: Not permitted.

2.03 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

- A. Unless otherwise indicated, provide field-installed, externally mounted SPDs.
- B. List and label as complying with UL 1449, Type 1 or Type 2.
- C. List and label complete unit as complying with UL 1283 and UL 1449, Type 1 or Type 2.
- D. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.
- E. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.
- F. Repetitive Surge Current Capacity: Not less than 4,500 impulses of repetitive sequential IEEE C62.41 Category B3 waveforms with less than 10% degradation of measured limiting voltage.
- G. UL 1449 Nominal Discharge Current (I-n): 20 kA.
- H. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
- I. Diagnostics:
 - 1. Protection Status Monitoring: Provide indicator lights to report the protection status.
 - 2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
 - 3. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
- C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of the drawings and manufacturer's instructions.
- D. Verify system grounding and bonding is in accordance with Section 26 0526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1.
- B. Install SPD in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

- D. Provide conductors with minimum ampacity as required by NFPA 70 and not less than manufacturer's recommended minimum conductor size.
- E. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length and bend radius. Twist conductors together to reduce inductance.
 - 1. Maximum conductor length shall not exceed 24 inches.
- F. Connect to overcurrent protective device at protected equipment.
- G. Connect surge protective device to grounding electrode system with conductor per manufacturer's instructions.
- H. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 0526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.
- I. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.03 FIELD QUALITY CONTROL

- A. Perform inspection, testing, and adjusting in accordance with Section 01 4000.
- B. Inspect for physical damage and compare nameplate data with drawings and specifications.
- C. Verify that the surge protector rating is appropriate for the voltage.
- D. Check the ground lead on each device for individual attachment to the ground
- E. For surge protectors with visual indications of proper operation (indicating lights), verify that the surge protector displays normal operating characteristics.
- F. Record the date of installation.

3.04 CLEANING

- A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 5110
LUMINAIRES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Luminaires.
- B. Light emitting diode (LED) luminaires (fixtures).
- C. Lamps.
- D. Luminaire accessories.

1.02 DEFINITIONS

- A. Emergency Lighting Unit: A fixture with integral emergency battery power supply and the means for controlling and charging the battery.
- B. Fixture: A complete lighting unit, exit sign. Fixtures include lamps and parts required to distribute the light, position and protect the lamps, and connect lamps to the power supply.
- C. Luminaire: Fixture.
- D. Average Life: The time after which 50 percent will have failed and 50 percent will have survived under normal conditions.
- E. LED Lumen Maintenance: The time of operation at which the lumen output is a percentage of the initial lumen output, as tested per IESNA LM-79-2008.
 - 1. Examples: L70 = 70% of initial lumens, L80 = 80% of initial lumens, etc.

1.03 RELATED REQUIREMENTS

- A. Section 26 0923 - Lighting Control Devices: Occupancy sensors, photoelectric sensors, remote keypad controls.
- B. Section 26 0944 - Network Lighting Controls.

1.04 REFERENCE STANDARDS

- A. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.
- B. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.
- C. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2011.
- E. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2006.
- F. UL 924 - Emergency Lighting and Power Equipment.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of lighting fixtures with HVAC diffusers, sprinklers, smoke detectors, lighting sensors, etc. installed under other sections or by others.
 - 2. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Action Submittals:
 - 1. Shop Drawings:

- a. Indicate dimensions, weights, support points, and accessory components for each luminaire.
- b. Submit Product Data for each luminaire:
- 2. Product Data:
 - a. LED Luminaires; include luminaire product data: Manufacturer, model number, start temperature, input current, ANSI input watts, total harmonic distortion, power factor, and efficiency (output lumens/watt).
 - b. Include emergency power supply where indicated.
 - c. Include components, mounting accessories, ratings, and photometric performance data.
- C. Closout Submittals:
 - 1. Operation and Maintenance Manual:
 - a. Include Shop Drawings and Product Data.
 - b. Include spare parts listing.
 - 2. Project Record Documents: Record actual installed locations of lighting fixture and actual installed circuiting and control arrangements.

1.07 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70 and NFPA 101.
- B. Coordination of Fixtures With Ceiling: Coordinate fixtures mounting hardware and trim with the ceiling system.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.08 WARRANTY

- A. Manufacturer's warranty in which manufacturer agrees to repair or replace components of luminaires (fixtures) that fail in materials or workmanship within the specified warranty period following substantial completion.
 - 1. Warranty Period, LED Luminaires: 5 years minimum.
 - a. Warranty shall include components, transportation, removal, installation of new products, and all costs incidental to on-site replacement.
 - b. Provide 10 year extended warranty as indicated for specific lighting fixtures as indicated on Lighting Fixture Schedule on Drawings.
 - 1) After first 5 years, remainder of 10 year warranty shall include components and shipping. Labor not included.
- B. Manufacturer's "Terms and Conditions" stating that warranty period begins at date of shipment is prohibited. Provide extended warranty for time period indicated that begins at date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Complete Fixtures: Per lighting fixture schedule on the drawings.
 - 2. Lamps, except where limited to indicated manufacturers and models for specific lamp types:
 - a. Integrated LED Lamps:
 - 1) Cree.

2.02 FIXTURES

- A. Furnish products as indicated in Schedule included on the Drawings.

- B. Specification Grade: Where indicated "Specification Grade", paint after fabrication.
- C. Fixture Components:
 - 1. Doors and Frames: Smooth operating and free from light leakage under operating conditions.
 - 2. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic except as indicated.
 - a. Plastic: Highly resistant to yellowing and other changes due to aging, exposure to heat and UV radiation.
- D. Substitutions: See Section 01 6000 - Product Requirements.
 - 1. Include point-by-point lighting calculations for each space where a product substitution is proposed.
 - 2. Include electronic Photometric.ies file for each proposed substitution.

2.03 LAMPS

- A. Conform to ANSI Standards, C78 series applicable to each type of lamp.
- B. Lamp Types: As specified for each luminaire in schedule on Drawings..
- C. Integrated Light Emitting Diode (LED) Lamps:
 - 1. Description: Omni-directional A19 size LED lamp with integrated driver.
 - 2. Rated Life: L70 25,000 hours, minimum.
 - 3. Luminous intensity - Initial lumens: 800 lumens.
 - 4. ANSI Input Watts: 9.5 watts.
 - 5. Power Factor: Not less than 0.70.
 - 6. Color Temperature: 2700 Kelvin.
 - 7. Voltage: 120 volts.
 - 8. Base: E26 Screw.
 - 9. Product:
 - a. Cree A196027K
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 LIGHT EMITTING DIODE (LED) FIXTURES:

- A. Color Rendering Index (CRI): Minimum 83.
- B. Rated Lumens: Total fixture delivered light output, comply with LM79.
- C. Lumen Maintenance: Operation time to percentage of initial rated lumens, comply with IESNA LM-79-2008.
 - 1. Not less than indicated in Lighting Fixture Schedule on Drawings.
- D. Correlated Color Temperature: 4000 Kelvin, unless indicated otherwise.
- E. Efficacy: 90 delivered lumens per watt, minimum.
- F. Driver: Engine providing required power source characteristics to LEDs.
- G. Dimming Capability: 13 to 100 percent, 0-10 V.
- H. Power Factor: 0.90 minimum.
- I. Total Harmonic Distortion: Less than 10 percent THD.
- J. Surge Protection: Meet "C Low" waveforms as defined in ANSI/IEEE C62.41.2, Scenario 1 Location Category C.

2.05 ACCESSORIES

- A. Provide Lighting Control Devices integral with fixtures where indicated.
 - 1. Outdoor Motion Sensors:
 - a. Manufacturers:
 - 1) Same as fixture manufacturer.
 - 2) Pole Mount: Sensor Switch SBOR 6 ODP.

- 3) Substitutions: See Section 01 6000 - Product Requirements.
- 4) Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- b. Description: Factory-assembled wet location listed device suitable for integral lighting fixture mounting, with integral field adjustment of coverage, capable of detecting motion for automatic control of load indicated.
- c. Sensor Technology: Passive Infrared (PIR) designed to detect occupancy by sensing movement of thermal energy between zones.
- d. Operation: Unless otherwise indicated, motion sensor to turn load on when motion is detected and to turn load off when no motion is detected during an adjustable turn-off delay time interval.
 - 1) Capable of ramp up/down dimming by 0-10 VDC signal to LED driver in light fixtures.
 - 2) Field adjustable for 8 settings for each of the following categories: Ambient, Time Delay, High Dimming and Low Dimming.
- e. Turn-Off Delay: Field adjustable, with time delay settings available up to 30 minutes.
- f. Load Rating: 1,000 W incandescent, fluorescent, or LED load at 277 V AC.
- g. Coverage: Capable of detecting motion within a distance of 60 feet at a mounting height of 30 feet, with a field of view of 360 degrees.
- h. Finish: Black.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 and 502.
- B. Locate recessed ceiling luminaires as indicated on reflected ceiling plan (if available), or as indicated on the electrical drawings.
- C. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- D. Install recessed luminaires to permit removal from below.
- E. Install wall mounted luminaires at height as indicated on Drawings.
- F. Install accessories furnished with each luminaire.
- G. Connect luminaires to branch circuit outlets provided under Section 26 0537 as indicated.
- H. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- I. Bond products and metal accessories to branch circuit equipment grounding conductor.
- J. Install specified lamps in each luminaire.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting in accordance with Section 01 4000.
- B. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- C. Operate each luminaire after installation and connection. Inspect for proper connection and operation.
- D. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

3.03 ADJUSTING

- A. Aim and adjust directional luminaires as directed, in the field, by the Engineer.
- B. Position exit sign directional arrows as indicated.

3.04 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosures.
- C. Clean finishes and touch up damage.

3.05 CLOSEOUT ACTIVITIES

- A. Demonstrate luminaire operation for minimum of two hours.

3.06 PROTECTION

- A. Relamp luminaires that have failed lamps at Substantial Completion.

3.07 SCHEDULES - SEE DRAWINGS

- A. Lighting Fixture Schedule: See Drawings.

LUMINAIRES				
	LUMINAIRE	LAMP	BALLAST	ANSI
TYPE	MANUFACTURER AND CATALOG NUMBER	MANUFACTURER AND MODEL NUMBER	MANUFACTURER AND MODEL NUMBER	INPUT WATTS
A2	LITHONIA 2SP8-G-232-FW-A12125-MVOLT	PHILLIPS (2)-F32T8/ADV835/ALTO	ADVANCE IOP-2S32-SC	56
H4	SIMKAR ADJUST-454-S12-UNV/AWG4/CAB472	PHILLIPS (4)-F54T5/ADV841HOEA49W/ALTO	ADVANCE IOP-4PSP542-LSG	208

END OF SECTION

SECTION 27 0534
COMMUNICATIONS SERVICE AND PATHWAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Telephone service entrance raceway.
- B. Communications Equipment cabinets.
- C. Telecommunications ground system.
- D. Telephone/data system pathways.

1.02 RELATED SECTIONS

- A. Section 26 0534 - Conduit.
- B. Section 26 0537 - Boxes.
- C. Section 33 7119 - Electrical Underground Ducts, Handholes, and Manholes.

1.03 REFERENCES

- A. ANSI/TIA/EIA-568-B - Commercial Building Telecommunications Cabling Standard; Telecommunications Industry Association; B, 2001.
- B. ANSI/TIA/EIA-607-A - Commercial Building Grounding/Bonding Requirements
- C. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide for cable management equipment.
- C. Project Record Documents: Record actual locations and sizes of equipment, pathways, and outlets.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 70.
- B. Products: Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.01 TELECOMMUNICATIONS SERVICE AND PATHWAYS

- A. Telecommunications Service Entrance Pathway: Nonmetallic conduit, PVC, Type EPC-40 from communications distribution outside plant (campus backbone) connection at handhole to building service communications equipment cabinet.

2.02 COMMUNICATIONS EQUIPMENT CABINET

- A. Equipment Management Cabinet: Secure wall mount cabinet, 597 mm (23.50 inch) wide, 581 mm (22.86 inch) deep, 880 mm (34.63") high.
 - 1. Usable interior space: 18 RMU.
 - 2. Cable lacing points on the side of equipment mounting rails.
 - 3. Load capacity: 113.4 kg (250 pounds).
 - 4. Doorframe embedded into the chassis.
 - 5. Smoke grey scratch resistant door window.
 - 6. Fully vented.
 - 7. Finish: Black.
 - 8. Product: Kendall Howard 18U - 3140-3-001-18.
 - 9. Substitutions: Not permitted.
- B. Accessories:
 - 1. Rack shall have vertical rail kit EIA-310 compliant.

2. Product: Kendall Howard 18U Wall Mount Vertical Rail Kit.

2.03 COMPONENTS

- A. Telecommunications Ground System
 1. Provide ground bus bars at the main electrical service and at the Communications Cabinet. The ground cable shall be sized as shown on the drawing. All bonding of the main ground riser to the bus bars shall be done with exothermic type bonds.
 2. Bus bars shall be sized as shown on the drawings.
 - a. Product: Panduit GB2B0316TPI-1.
 - b. Substitutions: See Section 01600 - Product Requirements.
 3. Equipment cabinet shall be grounded to the bus bar with # 6 copper ground cable. All connections of the # 6 copper ground wire to the bus bar shall be with cable clamps screwed to the bus bar.
 4. Conduit for Information Outlets (IO's) and IO outlet boxes shall be grounded.
- B. Conduit: Refer to Section 26 0534 - Conduit.

2.04 TELEPHONE WIRE AND CABLE

- A. Premises Wiring: By Owner.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install equipment cabinets plumb.
- B. Support raceways under the provisions of Section 26 0529.
- C. Install pullwire in each empty telephone conduit over 10 feet in length or containing a bend.
- D. Test telecommunication ground system for resistance to ground and turnover results to Contracting Officer.

END OF SECTION

**SECTION 27 5117
PUBLIC ADDRESS SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reproducer equipment.
- B. Sound system cable.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SYSTEM DESCRIPTION

- A. Public address system for voice.
- B. System Components: System shall consist of amplifier, speakers, back boxes and accessories, horns, microphones, and cable. Amplifier is existing.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data showing electrical characteristics and connection requirements for each component.
- C. Test Reports: Indicate satisfactory completion of each test recommended by the manufacturer.
- D. Project Record Documents: Record actual locations of speakers, control equipment, and outlets for input/output connectors.
- E. Operation Data:
 - 1. Include Shop Drawings and Product Data.
 - 2. Include Test Reports.
 - 3. Operation Data: Include instructions for adjusting, operating, and extending the system.
 - 4. Maintenance Data: Include repair procedures and spare parts documentation.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70 and Federal Communications Commission.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.
- C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.
- D. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.01 AMPLIFICATION AND CONTROL EQUIPMENT

- A. Amplifiers will be provided by Owner.

2.02 COMPONENTS

- A. Speakers: 8 inch coaxial speaker with integral crossover circuit.
 - 1. Power Rating: 20 watts.
 - 2. Frequency Range: 45 to 18,000 Hz.

3. Sound Pressure Level: 95 dB at 3 feet with 1 watt input.
 4. Magnet: Ceramic; 10 ounces low frequency unit; 3 ounces high frequency unit.
 5. Dispersion: Minus 3 dB at 90 degrees, minus 5 dB at 110 degrees.
 6. Product:
 - a. Quam # C10X/BU/W, match MnANG Base standard.
 - b. Substitutions: Not permitted.
- B. Speaker Baffles and Enclosure: Square, painted steel, with uniform perforations.
1. Size: 12 inch.
 2. Finish: White.
 3. Speaker Backbox: Insulated with sound-deadening material.
 4. Product:
 - a. Speaker Backbox: Quam # ERD-8U.
 - b. Substitutions: Not permitted.
- C. Tile Bridge Supports: Quam # SSB2.
- D. Horns: Wide dispersion indoor/outdoor horn with driver.
1. Power Rating: 60 watts.
 2. Low Frequency Cutoff: 250 Hz.
 3. Sound Distribution: 20 x 50 degrees.
 4. Sound Pressure Level: 120 dB at 4 feet with full range input.
 5. Material: Cast aluminum.
 6. Product:
 - a. Manufacturer: Quam # QH-16Tor QH-32T.
- E. Matching Transformers: Dual rated 25/70 volt, tapped from 0.5 to 4 watts in 1 watt steps, with primary/secondary ratio to match amplifier to speaker impedances.

2.03 WIRE AND CABLE

- A. Plenum Cable for Speaker Circuits: 18 AWG tinned copper conductor, 300 volt S-R PVC insulation, rated 200 degrees C, paired conductors twisted together shielded with aluminum-polyester shield cabled with a 20 AWG stranded tinned copper drain wire, covered with a nonmetallic jacket; suitable for use for Class 2 circuits in air handling ducts, hollow spaces used as ducts, and plenums.
1. Manufacturers:
 - a. West Penn Wire.
 - b. Belden Company.
 - c. Signal Wire.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in conduit.
- C. Splice cable only in accessible junction boxes or at terminal block units.
- D. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at amplifier.
- E. Install input circuits in separate cables and raceways from output circuits.
- F. Leave 18 inches excess cable at each termination at microphone, volume pad, speaker, and other system outlet.
- G. Leave 6 feet excess cable at each termination at system cabinet
- H. Use suitable cable fittings and connectors.
- I. Connect reproducers to amplifier with matching transformers.
- J. Ground and bond equipment and circuits in accordance with Section 26 0526.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.
- B. Measure and record sound power levels at designated locations.

3.03 ADJUSTING

- A. Adjust transformer taps for appropriate sound level.
- B. Adjust devices and wall plates to be flush and level.

END OF SECTION

SECTION 28 1800
ACCESS CONTROL AND INTRUSION DETECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Security access devices.

1.02 RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).

1.03 REFERENCES

- A. Air Force Instruction AFI 31-101.

1.04 SYSTEM DESCRIPTION

- A. Security Access: Control access to selected areas using encoded cards:
 - 1. Secure Gated Areas: Control access into secure area.
- B. Equipment shall be compatible with AFI 31-101 and the existing Base Security Force's Vindicator security system.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Installer Qualifications: Provide documentation of company experience and installer experience.
- C. Shop Drawings:
 - 1. Include Product Data.
 - 2. Provide system wiring diagram showing each device and wiring connection required.
 - 3. Provide dimensions of control panel and controller enclosures.
- D. Product Data: Provide electrical characteristics and connection requirements.
- E. Project Record Documents: Record actual locations of access authorization equipment.
- F. Operation and Maintenance Manual:
 - 1. Test Reports: Include completed test reports and inspections.
 - 2. Product Information: Include approved shop drawings and product data.
 - 3. Operation Data: Operating instructions.
 - 4. Maintenance Data: Maintenance and repair procedures.
 - 5. Include Documentation of Training and attendance roster.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Company specializing in installing the products specified in this section with minimum three years documented experience.
 - 2. Installers: Workers specializing in installation of Products specified in this section with minimum three years documented experience.
- B. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

1.07 MAINTENANCE SERVICE

- A. Furnish service and maintenance of security access system for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Security Access Control and Intrusion Detection System:
 - 1. Vindicator .

2. Substitutions: Not Permitted.

2.02 CONTROL PANEL

- A. The Security Access Control and Intrusion Detection System shall be manufactured by Vindicator and consist of a V5 ACS Server(s), keypads, readers, door hardware, and other I/O.
 1. Portal Control Module (PCM) for direct interface to two card readers.
 2. Sensor Input Module (SIM) for direct interface to ballanced magnetic switch.
 3. NEMA 4X enclosure.
 4. Strip heater.
- B. The system shall have backup batteries capable of operating the system for 24 hours without normal AC power.
- C. Data Transponders shall be an 8-input unit, Vindicator #6842.
- D. System shall include all components as required to support the following Sequence of Operations:
 1. Security System in "Armed" status:
 - a. Alarm inputs from ballanced magnetic switches are on. System will transmit alarm signal after a pre-determined number of seconds.
 - b. Card Readers with integral keypad will release magnetic lock.
 - c. Duress pushbutton initiates alarm.
 2. Security System in "Dis-Armed" status:
 - a. This feature is not available at this location. System is armed at all times.
 3. Controlled Entry of Secure Area:
 - a. Use Card Reader and keypad to release magnetic lock, then enter or exit area.
 - b. Secure area shall require access control at all times.

2.03 DEVICES

- A. Card Readers: As scheduled on Drawings.
- B. Ballanced Magnetic Switch: As scheduled on Drawings.
- C. Magnetic Locks: As scheduled on Drawings.
- D. Duress Pushbuttons: As scheduled on Drawings.

2.04 SEQUENCE OF OPERATOINS

- A. Controlled Entry of Secure Space:
 1. Use Card Reader with keypad to release strike/lock and enter secure area.
 - a. Secure space shall require access control at all times.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use 16 AWG minimum size conductors for 12 volt power circuit conductors. Install wiring in conduit.
- C. Use 18 AWG minimum size conductors for detection and signal circuit conductors. Install wiring in conduit.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.
- B. In the presence of representative from Base Security, test entire system for proper operation. Correct all defects.
- C. Provide written certification system was installed according to manufacturer's instructions and operated properly during final acceptance test. Include certification as part of O&M manual.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Provide the services of the manufacturer's technical representative to prepare and start systems.
- B. Include services of technician to supervise installation, adjustments, final connections, system testing, and to train Owner personnel.
- C. Include travel and living expenses for manufacturer's technical representative.

3.04 DEMONSTRATION AND TRAINING

- A. Demonstrate normal and abnormal modes of operation, and required response to each.
- B. Provide 1 hours of instruction each for two persons.
 - 1. Conduct instruction at project site with manufacturer's representative.

END OF SECTION

SECTION 30 1000
BASIC CIVIL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Governing Specification - Reference specification for civil work.
- B. Utility Property and Service - Identifying and working around existing utilities.
- C. Construction Surveying - Surveying necessary to perform the work.

1.02 RELATED SECTIONS

- A. Section 01 7000 Execution and Closeout Requirements - Laying out the work.
- B. Division 31 - 35 All Sections - Site and Infrastructure.
- C. Division 01 General Requirements may be superceded by Federal Contracting Requirements. Reference the appropriate Federal Contract Clause for further guidance.

1.03 GOVERNING SPECIFICATION

- A. The State of Minnesota Department of Transportation, Standard Specifications for Construction, latest edition shall apply on all Division 30 through 35 work, except as modified or altered in the following sections: 30 0000 through 35 9999.
- B. All traffic control devices and signing shall conform to the latest Minnesota MUTCD, including the field manual dated current to the year the project is bid. The Contractor is responsible for all traffic control on the Project.
- C. All references to "Engineer" in the Standard Specifications shall be replaced with "Contracting Officer".
- D. Brand Name or Equal: The use of a brand name item is to establish a standard of quality only and shall not be construed as limiting competition or precluding the contractor from offering an equal item(s) from another source(s). Any brand name intended to be a restriction to a sole source shall be clearly identified as "No Substitutions", and shall receive the prior approval of the Contracting Officer before it is placed in the specifications.

1.04 UTILITY PROPERTY AND SERVICE

- A. Construction operations in proximity of utility properties shall be performed in accordance with the provisions of MnDOT 1507, except as modified below:
 - 1. Interference of Underground Structures
 - a. When any underground structure interferes with the planned placement of the pipeline or appurtenances to such an extent that alterations in the work are necessary to eliminate the conflict or avoid endangering effects on either the existing or proposed facilities, the Contractor shall immediately notify the Contracting Officer of the affected structure. When any existing facilities are endangered by the Contractor's operations, the Contractor shall cease work associated with the interference and take such precautions as may be necessary to protect the in-place structures until a decision is made as to how the conflict will be resolved.
 - b. Without specific authorization from the Contracting Officer, no essential utility service shall be disrupted, nor shall any change be made in either the existing structures or the planned installations to overcome the interference. Alterations in existing facilities will be allowed only to the extent that service will not be curtailed unavoidably and then only when the encroachment or relocation will satisfy all applicable regulations and conditions.
 - c. Whenever alterations are required as a result of unforeseen underground interferences not due to any fault or negligence of the Contractor, the Contracting Officer will issue a written order covering any additional or extra work involved and specifying the revised basis of payment, if any. Any alterations made strictly for the

convenience of the Contractor shall be subject to prior approval and shall be at the Contractor's expense.

1.05 CONSTRUCTION SURVEYING

A. GENERAL SURVEY SPECIFICATIONS

1. This Contract provides for the Contractor to accomplish the Construction Surveying for this project. Furthermore, the Contractor is advised that the Contract may not fully describe every detail or make specific allowances for all probable exceptions and contingencies related to the Construction Surveying requirements for this Project.
2. The building layout shall be established from the Architectural and Structural Plans. The electronic data may be used to set the building location. The Contractor shall verify the building location with site interfaces including but not limited to utilities, sidewalks, existing grades, and proposed grades. The Contractor shall field verify all dimensions prior to executing the work. Notify the Contracting Officer if field conditions vary from the plan.
3. **SURVEYING TO BE PERFORMED BY OWNER**
 - a. The Contracting Officer will set the initial horizontal and vertical control points in the field for the Project as indicated in the Plans. Upon request by the Contractor, the Contracting Officer will also provide electronic data in the format that was used in the accomplishment of the surveys for the Construction Plan, and in Construction Plan development itself. However, due to the many different processes that the design survey data goes through and the large variety of sources of input in the final production of the Plan itself, no warrantee is made as to the value or adaptability of the electronic data to the Surveyor. No warrantee is made that the data systems used by the government, or any consultants employed by the government for Surveying or Construction Plan preparation, will be compatible with the systems used by the Contractor's surveyor. Information shown on the printed "Plan" shall always govern over any electronic "Plan" data.
 - b. At the discretion of the Contracting Officer, spot checks may be performed upon the Contractor's surveying calculations, records, field procedures, and actual staking. If the Contracting Officer determines that the work is not being performed in a manner that will assure proper controls and accuracy, the Contracting Officer will order the Contractor to redo such work, to the standards specified in the Contract, at no additional cost to the government.

B. CONSTRUCTION SURVEYING BY THE CONTRACTOR

1. Contractor Construction Surveying Requirements are as follows:
 - a. Construction Surveying is defined as accurately providing all necessary computations, stakes and marks to establish lines, slopes, elevations, points, continuous profile grades and the requirements shown in the Plan for Construction Staking; so that the Contractor's forces are able to construct all the required work for the project in accordance with the Contract requirements; and so that the Contracting Officer is able to complete all necessary inspection and Contract Administration duties. The staking shall include, but not be limited to clearing, grubbing, removals, grading, culverts, embankments, borrow, aggregate base course, pavements, buildings, utilities, signs, parking, erosion control, fencing and turf establishment items to complete the Project as represented in the Plans. The surveying must be done in a way that is timely, and that is reflective of the continuing and ongoing nature of construction and inspection activities which will generally require frequent, separate Project visits by the Contractor's survey crew to the Project to accommodate the various stages of construction and inspection activities that will occur.
 - b. The Contractor's Surveyor shall be prepared to make all necessary surveying checks for field verification of actual conditions and shall make the necessary minor surveying and staking adjustments to fit the construction to actual field conditions. In addition, some Plan details may be dependent upon actual field conditions at the

time of construction. It may be necessary to perform some field surveying or office computations in order to stake these components. All work referred in this paragraph is considered part of the work of Contractor Construction Surveying and no additional payment will be made for this work.

- c. The Contractor shall:
- 1) Be responsible for the preservation of all reference points, monuments, government land corners, horizontal and vertical control points, stakes, and marks that are established by the Contracting Officer or others within the Project limits. If the Contractor or its surveyor fails to preserve these items and if they must be re-established by the Contracting Officer, the Contracting Officer will deduct a charge from monies due or becoming due the Contractor according to the government's costs.
 - 2) Start and end all level runs, traverses, or GPS control surveys from known control.
 - 3) Perform all Construction Surveying.
 - 4) Provide As-built Survey Data. The as-built survey data shall include the following:
 - (a) Changes from the Plan:
 - (1) Manhole and catch basin inverts and top of castings
 - (2) Entrance floor elevations
 - (3) Valve box covers locations and elevations
 - (4) Fence and gate locations
 - (5) Contours of constructed stormwater ponds and swales
 - (6) Storm Water Control Structure inverts, overflows, and orifice elevations
 - (7) Culvert inlet and outlet locations and elevations
 - (8) Locations of utilities relocated or replaced as part of the Project.
 - (9) Identify any alignment, property, or control monumentation destroyed during the Project.
 - (10) The information shall include the X, Y and if applicable, the Z coordinates in the Project datum. If the original item had no coordinate reference, then show the revised centerline station and offset.
 - (11) The information shall be provided in both electronic AutoCADD and hard copy format.
 - (b) Furnish survey documentation and as-built survey data to the Contracting Officer within the time limits indicated in the surveying work schedule and prior to application for final payment.
- d. Contractor Construction Surveying Activities:
- 1) The Contractor shall give the Contracting Officer a 14-calendar day written notice before the Contractor needs the Contracting Officer to establish any horizontal and vertical control points in the Plan for Construction Surveying.
 - 2) At the preconstruction conference, the Contractor shall submit to the Contracting Officer for approval, a written Construction Surveying Work Plan and Schedule, detailing the following:
 - (a) Pertinent information as to how the requirements in these specifications are being met by the Contractor's Surveyor.
 - (b) A proposed method of communications between the Contractor, Surveyor, and the Contracting Officer.
 - (c) How and when the Contractor's Surveyor will make delivery of the as-built survey data to the Contracting Officer.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 31 1000
SITE CLEARING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clearing and protection of vegetation.
- B. Removal of bituminous pavements.
- C. Removal of sod.
- D. Temporary erosion control during construction.

1.02 RELATED REQUIREMENTS

- A. Section 01 7419 - Construction Waste Management and Disposal: waste removal.
- B. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.
- C. Section 30 1000 - Basic Civil Requirements
- D. Section 31 2200 - Grading: Topsoil removal.
- E. Section 31 2323 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

1.03 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for dust control and air quality regulations.
- B. Obtain required permits from authorities having jurisdiction.
- C. Do not close or obstruct public easements or private driveway access.
- D. Along with the government, the Contractor will be co-permittee for the MPCA NPDES Storm Water Construction Permit for this project.
- E. Contractor's signature on the Permit is required upon receiving Notification of Award.
- F. The Contractor shall designate a responsible and competent person to:
 - 1. Conduct inspections required in the NPDES permit.
 - 2. Maintain a weekly inspection log.
 - 3. Ensure that erosion control measures are incorporated into the work in a timely manner and that disturbed areas are stabilized with mulch/seed or vegetative cover.
 - 4. Ensure that erosion control devices are maintained during the construction period and removed when they are no longer necessary.

1.04 SEQUENCING

- A. Sequence work under the provisions of Section 01 1000.
- B. Sequence clearing operations to minimize exposure of soils in unused portions of the site.

1.05 QUALITY ASSURANCE

- A. Perform clearing and grubbing work in accordance with Minnesota Department of Transportation "Standard Specifications for Construction, Section 2101". Conform to the requirements of Mn/DOT Section 2573 for erosion control practices.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Material: As specified in Section 31 2323 - Fill
- B. Siltation Fencing: Conform to detail shown on plans.
- C. Stabilized Construction Entrance: Conform to detail shown on plans.

PART 3 EXECUTION

3.01 PREPARATION

- A. Locate and identify utilities to remain.
- B. Contractor shall contact Gopher 1-Call and obtain a Base Digging Permit prior to any excavation on the project site.
- C. Erect and maintain construction fencing, siltation fencing, and inlet sediment protection.
- D. Provide traffic control barriers and warning signs. Coordinate road closures and traffic routing plans with Contracting Officer.

3.02 SITE CLEARING

- A. Comply with other requirements specified in Section 01 5713.
 - 1. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
 - a. All topsoil shall be salvaged and stockpiled on site in locations designated by Contracting Officer.
 - b. Remove portions of existing bituminous paving as indicated. Neatly sawcut edges at right angles to surface.
 - c. Remove portions of existing concrete pavement as indicated.
 - d. Existing surfacing damaged by the Contractor shall be replaced or repaired by the Contractor as directed by the Contracting Officer and at no additional cost to the government.
 - e. Remove debris from the site.

3.03 EXISTING UTILITIES AND BUILT ELEMENTS

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Protect existing structures and other elements that are not to be removed.

3.04 VEGETATION

- A. Do not remove or damage vegetation beyond limits indicated on drawings.
- B. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to government.

3.05 DEBRIS

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 31 2200

GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal and storage of topsoil.
- B. Rough grading and preparing the site for site structures, building pads, and landscaped areas.
- C. Finish grading .

1.02 RELATED REQUIREMENTS

- A. Section 00 3100 - Available Project Information.
- B. Section 30 1000 - Basic Civil Requirements.
- C. Section 31 1000 - Site Clearing.
- D. Section 31 2316 - Excavation.
- E. Section 31 2323 - Fill: Filling and compaction.
- F. Section 32 9219 - Seeding: Finish ground cover.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with the provisions of Mn/DOT 2112.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil: See Section 31 2323.
- B. Other Fill Materials: See Section 31 2323.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.
- C. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.
- D. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.
- E. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

3.03 ROUGH GRADING

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Do not remove topsoil when wet.
- C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
- E. When excavating through roots, perform work by hand and cut roots with sharp axe.
- F. See Section 31 2323 for filling procedures.

- G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.
- H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.
- I. Stockpile topsoil to be re-used on site; remove remainder from site.
- J. Stockpile subsoil to be re-used on site; remove remainder from site.
- K. Stockpiles: Use areas designated on site by Contracting Officer; pile depth not to exceed 8 feet; protect from erosion.

3.04 FINISH GRADING

- A. Before Finish Grading:
 - 1. Verify building and trench backfilling have been inspected.
 - 2. Verify subgrade has been contoured and compacted.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.
- C. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 8 inches.
- D. Place topsoil during dry weather.
- E. Remove roots, weeds, rocks, and foreign material while spreading.
- F. Near plants spread topsoil manually to prevent damage.
- G. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
- H. Lightly compact placed topsoil.

3.05 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.
- B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

3.06 FIELD QUALITY CONTROL

- A. See Section 31 2323 for compaction density testing in pavement areas.

3.07 CLEANING

- A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

**SECTION 31 2316
EXCAVATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavating for footings, slabs-on-grade, paving, site structures, and utilities within the building.

1.02 RELATED REQUIREMENTS

- A. Document 00 3100: Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 31 1000 - Basic Civil Requirements.
- C. Section 31 2200 - Grading: Soil removal from surface of site.
- D. Section 31 2200 - Grading: Grading.
- E. Section 31 2323 - Fill: Fill materials, filling, and compacting.
- F. Section 33 7900 - Site Grounding.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Contractor shall contact Gopher 1-Call and obtain a Base Digging Permit prior to any excavation on the project site.
- C. See Section 31 2200 for additional requirements.

3.03 EXCAVATING

- A. Excavate to accommodate new structures and construction operations.
 - 1. Excavate to remove all previously disturbed (fill) soils from planned building footprint area.
 - 2. Excavate to remove all previously disturbed (fill) soils from the lift gate foundation areas.
 - 3. Excavate to remove all previously disturbed (fill) soils from the vehicle barriers foundation areas.
 - 4. Over-size all foundation excavations laterally at 1:1 ratio beyond the planned outside edges of all foundations.
- B. Underpin adjacent structures that could be damaged by excavating work
- C. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- D. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- E. Do not interfere with 45 degree bearing splay of foundations.
- F. Hand trim excavations. Remove loose matter.
- G. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 2323.
- H. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- I. Remove excavated material that is unsuitable for re-use from site.
- J. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 2200.
- K. Remove excess excavated material from site.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.
- B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations, or placement of sub-base materials.

3.05 PROTECTION

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- C. Keep excavations free of water. Provide dewatering by approved means. Water pumped or otherwise discharged from the site during construction shall be directed towards sediment containing devices prior to discharge.

END OF SECTION

SECTION 31 2316.13

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 REFERENCES

- A. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- C. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- D. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- E. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Samples: 10 lb sample of each type of fill; submit in air-tight containers to testing laboratory.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. See Section 31 2323

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 2200 for additional requirements.

3.03 TRENCHING

- A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 3 feet to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Cut trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
- G. Remove excavated material that is unsuitable for re-use from site.
- H. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 2200.

- I. Remove or dispose of excess excavated material in accordance with Section 31 2316.

3.04 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Granular Fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.05 BACKFILLING

- A. Conform to the detail on the plans.
- B. Backfill to contours and elevations indicated using unfrozen materials.
- C. Fill up to subgrade elevations unless otherwise indicated.
- D. Employ a placement method that does not disturb or damage other work.
- E. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- F. Maintain optimum moisture content of fill materials to attain required compaction density.
- G. Granular Fill: Place and compact materials in equal continuous layers not exceeding 12 inches compacted depth.
- H. General Fill: Place and compact material in equal continuous layers not exceeding 12 inches compacted depth.
- I. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- J. Correct areas that are over-excavated.
 - 1. Thrust bearing surfaces: Fill with concrete.
 - 2. Other areas: Use Granular Fill, flush to required elevation, compacted to minimum 100 percent of maximum dry density.
- K. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 100 percent of maximum dry density within the upper 3ft and 95 percent of maximum dry density below 3ft.
 - 2. At other locations: 95 percent of maximum dry density.
- L. Reshape and re-compact fills subjected to vehicular traffic.

3.06 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Utility Piping, Conduits, and any other buried utilities :
 - 1. Conform to the detail on the plans.
 - 2. Bedding: Use Fill Type Aggregate Bedding.
 - 3. Cover with Fill Type Granular Fill.
 - 4. Compact in maximum 12 inch lifts to the following density requirements.
 - a. Under paving, slabs-on-grade, and similar construction: 100 percent of maximum dry density within the upper 3ft and 95 percent of maximum dry density below 3ft.
 - b. At other locations: 95 percent of maximum dry density.

3.07 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.08 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D2922 or ASTM D3017.

- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Frequency of Tests: 1 test for every 50 linear feet of trench per 3 ft of depth, or fraction thereof.

3.09 PROTECTION

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- C. Keep excavations free of water. Provide dewatering by approved means. Water pumped or otherwise discharged from the site during construction shall be directed towards sediment containing devices prior to discharge.

3.10 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 31 2323

FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling, and compacting for building volume below grade and all non-airfield pavement areas.
- B. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

- A. Document 00 3100: Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 30 1000 - Basic Civil Requirements.
- C. Section 31 2200 - Grading: Site grading.
- D. Section 31 2316 - Excavation: Removal and handling of soil to be re-used.

1.03 REFERENCE STANDARDS

- A. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- C. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- D. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- E. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Samples: 10 lb sample of each type of fill; submit in air-tight containers to testing laboratory.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used. See Section 32 9219 Seeding for required testing of topsoil materials.
- E. Compaction Density Test Reports.

1.05 PROJECT CONDITIONS

- A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with Mn/DOT Standard Specification 2105.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill: Non-organic select compactible material conforming to Mn/DOT 2105 Common Borrow or salvaged excavated soils from on-site, and approved for reuse by Contracting Officer.
 - 1. Graded.
 - 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
 - 3. General Fill salvaged from on-site shall be selected, separated and protected to manage the soils moisture content. The Contractor shall dry or moisture condition the soil as necessary in order to achieve the required compaction densities.
 - 4. If onsite salvaged soils cannot be compacted due to moisture content and cannot be moisture conditioned due to uncontrollable factors such as the seasonal conditions then the contractor shall provide granular Borrow at no additional costs.
- B. Granular Fill (NFS): Imported Granular Material, conforming to Mn/DOT 3149.2B2, Select Granular Borrow Modified 7% or less passing the No. 200 sieve. 100% passing the 2" sieve. Less than 40% passing the No. 40 sieve.
- C. Sand: Imported Material, conforming to Mn/DOT 3149.2K Sand Cover modified 5% or less passing a No. 200 sieve.
- D. Topsoil: Friable loam; imported borrow. Topsoil excavated and salvage on-site may be used provided it conforms to items 1-3 below. If insufficient salvaged topsoil exists, Contractor shall import topsoil as needed to complete the work.
 - 1. Select.
 - 2. Graded.
 - 3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
 - 4. Acidity range (pH) of 5.5 to 7.5.
 - 5. Containing a minimum of 4 percent and a maximum of 25 percent organic matter.
- E. Drainage Fill: Coarse Filter Aggregate, conforming to Mn/DOT 3149.2H.
- F. Aggregate Bedding: Conforming to Mn/DOT 3149.2G.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work. If source must change than retest at no cost to the government.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the Work are as indicated.
- B. Identify required lines, levels, contours, and datum locations.
- C. See Section 31 2200 for additional requirements.
- D. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- E. Verify structural ability of unsupported walls to support imposed loads by the fill.

3.02 PREPARATION

- A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Granular Fill.

- C. The contractor shall compact the subgrade soils in the building areas prior to placement of Fill soils.
- D. Subgrade soils in the building areas shall be reviewed and approved by the geotechnical Engineer prior to placement of any fill in these areas.
- E. Subgrade soils shall be approved by Contracting Officer prior to placement of fill soils. Provide notification to Contracting Officer 24 hours in advance of filling operations.
- F. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Place and compact fill materials in equal continuous layers, not exceeding 8 inches compacted thickness.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- G. Correct areas that are over-excavated.
 - 1. Under paving, gravel surfaced areas, footings, slabs-on-grade and similar construction: Use Granular Fill, flush to required elevation, compacted to 100 percent of maximum dry density.
 - 2. Other areas: Use General Fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- H. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, gravel surfaced areas, footings, and similar construction: 100 percent of maximum dry density. 100 percent of maximum dry density within 3 feet of subgrade elevations in pavement areas.
 - 2. At all other locations: 95 percent of maximum dry density.
- I. Reshape and re-compact fills subjected to vehicular traffic.

3.04 FILL AT SPECIFIC LOCATIONS

- A. Use Granular Fill unless otherwise specified or indicated.
- B. Under Slabs-On-Grade:
 - 1. Use Granular Fill.
 - 2. Compact to 100 percent of maximum dry density.
 - 3. Cover with Sand.
 - 4. Compact to 100 percent of maximum dry density.
- C. At Foundation Walls and Footings:
 - 1. Use Granular Fill.
 - 2. Compact each lift to 100 percent of maximum dry density.
 - 3. Do not backfill against unsupported foundation walls.
- D. Under Exterior Paving , Gravel Surfaced Areas, or similar construction:
 - 1. Use Granular Fill.
 - 2. Compact each lift to 95 percent of maximum dry density in locations more than 3-feet below subgrade elevations.
 - 3. Compact to 100 percent of maximum dry density in locations within 3-feet of subgrade elevations.
- E. Over Buried Utility Piping and Conduits in Trenches :
 - 1. Use granular fill

2. Compact to 95% of maximum dry density
3. In pavement areas, compact to 100% of maximum dry density within 3-feet of subgrade elevations.

3.05 TOLERANCES

- A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.
- B. Top Surface of Filling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.06 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D2922 or ASTM D3017.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Frequency of Tests: Provide the minimum number of tests as follows, one test minimum.
 1. Slabs-On-Grade: One test for every 1000 sq. ft. per 1ft of depth of material placed or fraction thereof.
 2. Foundation Walls and Footings: One test for every 25 lin. ft. of wall/footing length and one test under each column footing.
 3. Exterior Paving and Similar Construction: One test for every 2500 sq. ft. per 1ft of depth of material placed or fraction thereof.
 4. Vegetated Areas: One test for every 10,000 sq. ft. per 1ft of depth of material placed or fraction thereof.
- F. Proof roll compacted fill at surfaces that will be under slabs-on-grade, paving, and gravel surfacing.

3.07 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 31 3219

GEOTEXTILE SOIL STABILIZATION AND LAYER SEPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This work shall consist of placing geotextile below the fill material at the location(s) shown in the Plan, or as directed by the Contracting Officer.
- B. The work shall be accomplished according to Mn/DOT 2105 or as directed by the Contracting Officer.
- C. The purpose of the geotextile layer is to provide separation between the fill and underlying softer soils, to prevent mixing, to provide stability during compaction, to provide some reinforcement and to minimize differential movement.
- D. The Contractor's proposed construction sequence for geotextile and fill placement shall be submitted to the Contracting Officer for review and approval at least 21 days prior to beginning of this element of construction.

1.02 RELATED SECTIONS

- A. Section 30 1000 - Basic Civil Requirements.
- B. Section 31 2323 - Fill.
- C. Section 32 1123 - Aggregate Base Courses.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Geotextile Fabric: Non-woven separator/strengthening material meeting the requirements of Mn/DOT Type I through Type V.

PART 3 EXECUTION

3.01 PREPARATION

- A. The prepared surface shall be relatively smooth and free of stones, sticks, or other debris or irregularities that would tend to puncture or tear the geotextile.
- B. Unless otherwise directed or approved by the Contracting Officer, the geotextile shall be placed with the highest strength direction (usually the "machine" or roll direction) oriented in the direction of the greatest expected field stress (this will usually be at right angles to the centerline of the construction).

3.02 INSTALLATION

- A. If multiple pieces of geotextile are required, adjacent strips shall be field or factory sewn. All seams shall be sewn using a "double spool" machine capable of sewing a Federal Type 401 locking stitch. Seam type (flat, "J", or butterfly), thread strength 11.34 kg (25 lbs.) minimum, number of rows of stitching (1 or 2) and stitches per inch (typically 5-7) shall be consistent with achieving the required seam strength and as recommended by the geotextile manufacturer.
- B. The geotextile shall be adequately secured so that it is not displaced during subsequent construction. No traffic or construction equipment will be permitted to operate directly on the geotextile. Any damaged geotextile shall be repaired to the satisfaction of the Contracting Officer by patching and sewing, or when appropriate, a 900 mm (36-inch) overlap on all sides without sewing.

- C. Fill shall be placed onto the fabric in uniform lifts as required by the applicable specification and approved by the Contracting Officer, but in no case shall lifts in excess of 300-450 mm (12-18 inches) be used, unless required to bring the fill above water level or provide stability. Fill material shall be as shown in the Plan or as directed by the Contracting Officer. For placement underwater and for 610 mm (2 feet) above water level, granular materials shall be used unless otherwise provided in the Plans or approved by the Contracting Officer.

END OF SECTION

SECTION 32 1123
AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course for gravel access road and concrete pavement areas.

1.02 RELATED REQUIREMENTS

- A. Section 30 1000 - Basic Civil Requirements.
- B. Section 31 2200 - Grading: Preparation of site for base course.
- C. Section 31 2323 - Fill: Compacted fill under base course.
- D. Section 32 1313 - Concrete Paving: Finish concrete surface course.

1.03 REFERENCE STANDARDS

- A. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- C. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- D. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- E. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Samples: 10 lb sample of each type of aggregate; submit in air-tight containers to testing laboratory.
- C. Materials Sources: Submit name of imported materials source.
- D. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports.

1.05 QUALITY ASSURANCE

- A. Aggregate Base courses shall be constructed in accordance with the provisions of Mn/DOT 2211, except as modified below.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Aggregate Base: Aggregate Base, Class 5, conforming to Mn/DOT 3138.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.
- B. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Provide materials of each type from same source throughout the Work. If source must change than retest at no cost to the Owner.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.

- B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

- A. For Gravel Access Road:
 - 1. Place Aggregate Base to a total compacted thickness indicated on the plans.
 - 2. Compact to 100 percent of maximum dry density.
- B. Under Portland Cement Concrete Paving:
 - 1. Place Aggregate Base to a total compacted thickness indicated on the plans.
 - 2. Compact to 100 percent of maximum dry density.
- C. Place aggregate in maximum 8 inch lifts and compact to specified density.
- D. Level and contour surfaces to elevations and gradients indicated.
- E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation From Design Elevation: Within 1/2 inch.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.
- B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D2922 or ASTM D3017.
- C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Frequency of Tests: Provide the minimum number of tests as follows, one test minimum.
 - 1. At Gravel Access Road and Concrete Walkway: Two tests at each location.
- F. Proof roll compacted aggregate at surfaces that will be under paving.

3.06 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

**SECTION 32 1313
CONCRETE PAVING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete paving for Guard Shack and Walkways.

1.02 RELATED REQUIREMENTS

- A. Section 30 1000 - Basic Civil Requirements.
- B. Section 31 2200 - Grading: Preparation of site for paving and base.
- C. Section 31 2323 - Fill: Compacted subbase for paving.
- D. Section 32 1123 - Aggregate Base Courses: Aggregate base course.
- E. Section 03 1000 - Concrete Forming and Accessories.
- F. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- B. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- C. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2012a.
- D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2013.
- E. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.
- F. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2012.
- G. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on joint filler and curing compound.

1.05 QUALITY ASSURANCE

- A. Concrete Pavement shall conform to Mn/DOT 2301.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. See Section 03 1000

2.02 CONCRETE MATERIALS

- A. Concrete Materials:
 - 1. Concrete Paving: Portland Cement concrete conforming to Mn/DOT 2461.

2.03 ACCESSORIES

- A. Curing Compound: White Membrane Curing Compound, conforming to ASTM C 309, Type 2.
- B. Polystyrene rigid insulation, 1 1/2" thickness, conforming to MnDOT 3760, "DOW Styrofoam HI 40" or "Certifoam 40" or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted Aggregate Base is acceptable and ready to support paving and imposed loads.

- B. Verify gradients and elevations of base are correct.

3.02 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole frames with oil to prevent bond with concrete pavement.
- C. Install rigid insulation over sub-grade as shown on plans.

3.03 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

3.04 PLACING CONCRETE

- A. Place concrete in accordance with Mn/DOT requirements.
- B. Do not place concrete when base surface is wet.

3.05 JOINTS

- A. Joint concrete in accordance with Mn/DOT requirements and the jointing patterns shown on the plans.
- B. Place 3/8 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.

3.06 FINISHING

- A. Concrete Paving: Light broom, texture perpendicular to pavement direction.
- B. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.07 TOLERANCES

- A. Maximum Variation From True Position: 1/8 inch.

3.08 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000.
 - 1. Provide free access to concrete operations at project site and cooperate with appointed firm.
- B. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 50 cu yd or less of each class of concrete placed.
- C. Perform one slump and air test at the point of discharge for each and every concrete truck delivery to the site.

3.09 PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION

SECTION 32 1723.13
PAINTED PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Parking lot markings, including parking bays, crosswalks, and curb markings.
- B. "No Parking" curb painting.

1.02 DELIVERY, STORAGE, AND HANDLING

- A. Deliver paint in containers of at least 5 gallons (18 L) accompanied by batch certificate.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.03 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Line and Zone Marking Paint: MPI No. 97 Latex Traffic Marking Paint; color(s) as indicated.
 - 1. Parking Lots: Yellow.
- B. Paint For Obliterating Existing Markings: FS TT-P-1952; black for bituminous pavements, gray for portland cement pavements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Obliteration of existing markings using paint is acceptable in lieu of removal; apply the black paint in as many coats as necessary to completely obliterate the existing markings.
- D. Clean surfaces thoroughly prior to installation.
 - 1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.
- E. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.
- F. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

3.03 INSTALLATION

- A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.
- B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F (10 degrees C) or more than 95 degrees F (35 degrees C).

- C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.
- D. Comply with FHWA MUTCD manual (<http://mutcd.fhwa.dot.gov>) for details not shown.
- E. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.
- F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on the drawings true, sharp edges and ends.
 - 1. Apply paint in one coat only.
 - 2. Wet Film Thickness: 0.015 inch (0.4 mm), minimum.
 - 3. Width Tolerance: Plus or minus 1/8 inch (3 mm).
- G. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings.
 - 1. Hand application by pneumatic spray is acceptable.
- H. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.04 DRYING, PROTECTION, AND REPLACEMENT

- A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.
- B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.
- C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.
- D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.
- E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.
- F. Replace removed markings at no additional cost to Government.

END OF SECTION

SECTION 32 3113
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fence framework, pickets, and accessories.
- B. Manual gates and related hardware.

1.02 REFERENCES

- A. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM F 567 - Standard Practice for Installation of Chain-Link Fence.
- D. CLFMI CLF 2445 - Product Manual; Chain Link Fence Manufacturers Institute.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on framework, posts, accessories, fittings, hardware, and control equipment.
- C. Shop Drawings: Indicate plan layout, spacing of components, dimensions, hardware anchorage.
- D. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.

1.04 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Chain Link Fences and Gates:
 - 1. Century Fence.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS AND COMPONENTS

- A. Materials and Components: Conform to CLFMI Product Manual.
- B. Fabric Size: CLFMI Heavy Industrial and Tennis Court service.
- C. Intermediate Posts: Type C rolled shape.
- D. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round.

2.03 ACCESSORIES

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.
- C. Hardware for Manual Single Swinging Gates: 180 degree hinges, 2 for gates up to 1525 mm (60 inches) high, 3 for taller gates; magnetic lock and card reader (refer to Electrical Sections); keeper to hold gate in fully open position.
- D. Concertina Wire: 40.5 cm (16") diameter.

2.04 FINISHES

- A. Components (Other than Fabric): Galvanized in accordance with ASTM A 123/A 123M, at 530 g/sq m (1.7 oz/sq ft).

- B. Fabric: Aluminum coated at 125 g/sq. m (0.40 oz/sq ft), when measured in accordance with ASTM A 428/A 428M.
- C. Hardware: Hot-dip galvanized to weight required by ASTM A 153/A 153M.
- D. Accessories: Same finish as framing.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install framework and gate in accordance with manufacturer's instructions.
- B. Posts shall be drive-set into ground to a minimum depth of 1651mm (5 feet 6 inches).
- C. Place fabric on outside of posts and rails.
- D. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.
- E. Provide top rail through line post tops and splice with 150 mm (6 inch) long rail sleeves.
- F. Stretch fabric between terminal posts or at intervals of 30 m (100 feet) maximum, whichever is less.
- G. Position bottom of fabric 50 mm (2 inches) above finished grade.
- H. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 380 mm (15 inches) on centers.
- I. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- J. Install bottom tension wire stretched taut between terminal posts.
- K. Install gate and hardware.

3.02 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 6 mm (1/4 inch).
- B. Maximum Offset From True Position: 25 mm (1 inch).
- C. Components shall not infringe adjacent property lines.

END OF SECTION

SECTION 32 3136
VERTICAL PIVOT LIFT GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vertical pivot lift gate system including gates and operator with accessories as required for complete operational installation.

1.02 RELATED REQUIREMENTS

- A. Section 31 2316 - Excavation: Excavating for footings, and utility trenching.
- B. Section 32 1313 - Portland Cement Concrete Paving: Installation of adjacent paved surfaces.
- C. Section 26 0534 - Conduit: Empty conduit between system components, per drawings.
- D. Section 32 3113 - Chain Link Fences and Gates.

1.03 REFERENCE STANDARDS

- A. ASTM F2656 - Standard Test Method for Vehicle Crash Testing of Perimeter Barriers; 2007.
- B. DOS SD-STD-02.01 - Test Method for Vehicle Crash Testing Of Perimeter Barriers and Gates; U.S. Department of State; 2003.
- C. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction.
- D. NFPA 70 Article 100 - Electrical components, Devices, and Accessories.
- E. UL 325 - Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate installation of units with utilities, fencing, and paving.
- B. Field Measurements: Take measurements and generate dimensions where Gate and Operator are to be located.
- C. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of work of this section; require attendance by all affected installers.
- D. Sequencing: Ensure that utility connections are completed in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for gate and operator and each manufactured accessory to be provided for this installation. Include maintenance data for operators, and parts manual.
- B. Shop Drawings: Provide detailed drawings showing:
 - 1. Layout and overall dimensions of each major element of the barrier equipment, including the hydraulic power unit and operator control panels, if applicable.
 - 2. Foundation and anchoring requirements of the barrier equipment.
 - 3. Electrical schematic including associated wiring, showing all electrically connected components, including interface points for connection to equipment; indicate minimum conduit size and number of wires required to run between each component of the barrier equipment.
 - 4. Schematic drawings of the entire barrier system, with all manufacturer supplied equipment connected and integrated.
 - 5. Provide setting diagrams, templates for anchorages, sleeves, and bolts installed by others.
- C. Certificate: Certify that products of this section meet or exceed specified requirements.

- D. Project Record Documents: After completion of field tests, provide 3 sets of updated drawings, showing exactly where equipment and controls are installed, owners manual, maintenance schedule, and manufacturer's warranty.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer's Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.08 WARRANTY

- A. Provide manufacturer's standard limited warranty for system and system components against failure resulting from normal use based on manufacturer's literature. Failure shall be defined as any defect in manufacturing which prevents gate from operating as intended.
- B. Correct defective Work within a one year period after Date of Substantial Completion.
- C. Provide three year manufacturer warranty for materials and workmanship from date of installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Vertical Pivot Lift Gates by:
 - 1. AutoGate Inc: www.autogate.com.

2.02 AUTOMATED GATES

- A. Automated Gates - General: Having following characteristics as well as characteristics specified for each type:
 - 1. Operation: Automatic raising and lowering.
 - 2. Size: Two each 7'-0" high measured from grade of pavement including barbed wire and 23'-5" length. See Detail drawings.
 - 3. Operator material: Hot-dipped galvanized steel with painted finish.
 - 4. Position Sensor: photoelectric cell and vehicle loop detectors.
 - 5. Control Type: card reader.
 - 6. Framing: Extruded structural aluminum pipe, alloy 6063-T6 complying with ASTM B429.
 - 7. Fabric: Match chain link fencing.
 - 8. Barbed Wire: Extend gate post and vertical framing members 12 inches above top of chain link fabric.
 - 9. Threaded Fasteners: All exterior screws, bolts, nut and washers shall be 300 series non-magnetic stainless steel.
 - 10. Main Operator Control Panel.
 - 11. Entrapment Sensing device: Operator shall have inherent motor current sensors as part of the gate operator system.
 - 12. Reversing Edge: Provide manufacturers standard reversing edge system.
 - 13. Secondary Entrapment Sensing Device: Provide Type B1 non-contact photoelectric sensor or equivalent. Provide Type B2 Safety edges. Provide adjustable timer for gate closure. Provide maximum run timer.
 - 14. Bracing: Provide 3/16 aircraft coated cable if wind bracing is required.
 - 15. Electrical Disconnect: Single pole snap switch at operator unit.
 - 16. Service Receptacle: Weatherproof GFCI type at operator unit.
 - 17. Battery Back-up (Power Failure): Provide manual bypass system, which allows barrier to be opened and closed in event of power failure.

18. Gate Operators: Provide gate operator system, including gate operator, field supplied manufacturer specified batteries, and external contact sensing equipment. Gate speed shall fully open or close within 12 seconds.
19. Yokes: See Detail drawings.
20. Operations: System to allow for minimum 2900 open and close operations per day.
21. Cold Weather Package.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 1. Verify location of existing utilities, grades and conditions of substrate.
 2. Verify existing vehicle detector loops, including their size, geometry and wiring.
 3. Verify integration requirements with other site security equipment including but not limited to gates and other automated barrier systems.

3.02 PREPARATION

- A. Protect existing work from damage due to installation of this work.

3.03 INSTALLATION

- A. Connect gate frame and operator in accordance with manufacturer's instructions. Install gate so that it is plumb and level when fully closed within the following tolerances:
 1. Maximum misalignment from true position: 1/4 inch.
 2. Maximum misalignment between adjacent separated members: 1/8 inch.
- B. Install yokes to concrete as shown in the Detail drawings

3.04 SYSTEM STARTUP

- A. Provide manufacturer's field representative to observe systems startup with Owner's personnel present. Instruct Owner's personnel in proper use, operations and maintenance.
- B. Prepare and start equipment in accordance with manufacturers' instructions and recommendations.
- C. Adjust for proper operation within manufacturer's published tolerances.

3.05 CLEANING

- A. Touch up scratched surfaces using materials recommended by manufacturer. Match touchup paint color with operator finish.

3.06 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate operation of the barrier to Owner's personnel.
 1. Use operation and maintenance data as reference during demonstration.
 2. Briefly describe function, operation, and maintenance of each component.

3.07 PROTECTION

- A. Protect installed units from subsequent construction operations.

END OF SECTION

SECTION 32 3136.10
VERTICAL LIFT BEAM BARRIER

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vertical lift beam barrier system including rigid beam assembly, latch end post, and hydraulic operator with accessories as required for complete operational installation.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete
- B. Section 31 2316 - Excavation: Excavating for footings, and utility trenching.
- C. Section 26 0534 - Conduit: Empty conduit between system components, per drawings.

1.03 REFERENCE STANDARDS

- A. ASTM F2656 - Standard Test Method for Vehicle Crash Testing of Perimeter Barriers; 2007.
- B. DOS SD-STD-02.01 - Test Method for Vehicle Crash Testing Of Perimeter Barriers and Gates; U.S. Department of State; 2003.
- C. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction.
- D. NFPA 70 Article 100 - Electrical components, Devices, and Accessories.
- E. UL 325 - Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate installation of units with utilities, fencing, gates and paving.
- B. Field Measurements: Take measurements and generate dimensions where Barrier and Operator are to be located.
- C. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of work of this section; require attendance by all affected installers.
- D. Sequencing: Ensure that utility connections are completed in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for barrier and operator and each manufactured accessory to be provided for this installation. Include maintenance data for operators, and parts manual.
- B. Shop Drawings: Provide detailed drawings showing:
 - 1. Layout and overall dimensions of each major element of the barrier equipment, including the hydraulic power unit and operator control panels, if applicable.
 - 2. Foundation and anchoring requirements of the barrier equipment.
 - 3. Electrical schematic including associated wiring, showing all electrically connected components, including interface points for connection to equipment; indicate minimum conduit size and number of wires required to run between each component of the barrier equipment.
 - 4. Schematic drawings of the entire barrier system, with all manufacturer supplied equipment connected and integrated.
 - 5. Provide setting diagrams, templates for anchorages, sleeves, and bolts installed by others.
- C. Certificate: Certify that products of this section meet or exceed specified requirements.
 - 1. Submit Certificate of Conformance that shows the barrier delivered conforms to the crash rating performance and requirements of this specification.

- D. Project Record Documents: After completion of field tests, provide 3 sets of updated drawings, showing exactly where equipment and controls are installed, owners manual, maintenance schedule, and manufacturer's warranty.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer's Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.08 WARRANTY

- A. Provide manufacturer's standard limited warranty for system and system components against failure resulting from normal use based on manufacturer's literature. Failure shall be defined as any defect in manufacturing which prevents barrier from operating as intended.
- B. Correct defective Work within a one year period after Date of Substantial Completion.
- C. Provide three year manufacturer warranty for materials and workmanship from date of installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hydraulically Operated Vertical Lift Beam Barrier by:
 - 1. Delta Scientific Corporation.

2.02 AUTOMATED BARRIERS

- A. Crash Beams and Bars -
 - 1. Delta Scientific Model DSC7000(H) or approved equal (2 required).
 - 2. Crash Test Rating: K12.
 - 3. Basic structure, hydraulic unit-19 ft, clear opening and hydraulic pump-1.5 hp @ 230/460/3 Phase 60 Hertz.
 - 4. One set hydraulic interconnect lines/barricade: length as needed per layout.
 - 5. Hinged, rigid beam assembly.
 - 6. Latch end post.
 - 7. Mounting hardware.
 - 8. Standard white/yellow paint.
 - 9. Complete instructions, start-up and trouble-shooting manual.
 - 10. Master control panel with reset and override, dual lane control.
 - 11. Remote control slave panel with annunciator, dual lane control.
 - 12. Digital loop detector, dual relay version, power resumption safety.
 - 13. Detector harness, 11 pin, Delta Scientific Assembly.
 - 14. Flashing lights, three.
 - 15. Stop Go Signal light(s).
 - 16. 48 inch high post with 12 inch square mounting flange, white.
 - 17. Barricade fully down auxiliary limit switch.
 - 18. Barricade fully up auxiliary limit switch.
 - 19. Emergency fast operate, EFO 2.0 seconds.
 - 20. Emergency manual operating system, hand pump.
 - 21. Power unit mounted electrical disconnect.
 - 22. Barrier system heater.
 - 23. Oil reservoir heater, beta units, 200W
 - 24. Battery back-up (controls only).

25. Two year warranty.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 - 1. Verify location of existing utilities, grades and conditions of substrate.
 - 2. Verify existing vehicle detector loops, including their size, geometry and wiring.
 - 3. Verify integration requirements with other site security equipment including but not limited to other automated gates.

3.02 PREPARATION

- A. Protect existing work from damage due to installation of this work.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide manufacturer's certified field supervisor during key milestones of installation of the barrier.

3.04 SYSTEM STARTUP

- A. Provide manufacturer's field representative to observe systems startup with Owner's personnel present. Instruct Owner's personnel in proper use, operations and maintenance.
- B. Prepare and start equipment in accordance with manufacturers' instructions and recommendations.
- C. Adjust for proper operation within manufacturer's published tolerances.

3.05 CLEANING

- A. Touch up scratched surfaces using materials recommended by manufacturer. Match touchup paint color with barrier finish.

3.06 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate operation of the barrier to Owner's personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Briefly describe function, operation, and maintenance of each component.

3.07 PROTECTION

- A. Protect installed units from subsequent construction operations.

END OF SECTION

SECTION 32 9219

SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of subsoil.
- B. Seeding, mulching and fertilizer.
- C. Maintenance.

1.02 RELATED REQUIREMENTS

- A. Section 31 2200 - Grading: Topsoil material.
- B. Section 31 2323 - Fill: Topsoil material.

1.03 QUALITY ASSURANCE

- A. Installer qualifications: Company specializing in installing and planting indigenous forbs, sedges and grasses in the upper midwest with at least 2 years documented experience.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. List and percentages of forb seeds for each seed mix.
- C. Laboratory test results for topsoil.

1.05 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- C. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

PART 2 PRODUCTS

2.01 SEED MIX

- A. Seed Mixture by weight:
 - 1. Sand Dropseed: 5 percent.
 - 2. Little Bluestem: 5 percent.
 - 3. Prairie Dropseed: 15 percent.
 - 4. Junegrass: 15 percent.
 - 5. Side Oats Grama: 5 percent.
 - 6. Blue Grama: 15 percent.
 - 7. Red Clover: 10 percent.
 - 8. Perennial Ryegrass: 30.

2.02 SOIL MATERIALS

- A. Topsoil: As specified in Section 02316.

2.03 ACCESSORIES

- A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable. Hydromulching material shall be MnDOT 3884 type 6.

- B. Fertilizer: 10-10-10; recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.
- C. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.
- D. Erosion Control Fabric: netting on 2 sides MnDOT 3885 Category 4 for slopes 1 vertical to 2 horizontal and greater.
- E. Staples: MnDOT 3885 B-4.

2.04 TOPSOIL TESTS

- A. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- B. Submit minimum 10 oz sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.
- C. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this Section.

3.02 PREPARATION

- A. Fine grade topsoil in accordance with Section 02310.

3.03 FERTILIZING

- A. Apply fertilizer at a rate of 30 lbs. per 1000.
- B. Apply after smooth raking of topsoil and prior to roller compaction.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.04 SEEDING

- A. Apply seed at a rate of 2 lbs per 1000 sq ft for lawn seeding, broadcast evenly in two intersecting directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- D. Roll seeded area with roller not exceeding 112 lbs.
- E. Immediately following seeding and compacting, apply mulch at a rate of approximately 2 tons per acre to allow 10% of soil surface to be visible through the mulch.
- F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.
- G. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.05 HYDROSEEDING

- A. Hydroseeding of seed mix is acceptable if coverage of seed is uniform and meets or exceeds the rates described above.
- B. Do not hydroseed area in excess of that which can be mulched on same day.

- C. Immediately following seeding, apply hydromulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.
- D. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.
- E. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.06 PROTECTION

- A. Cover all seeded slopes exceeding 1:4 vertical to horizontal ratio with erosion control fabric. Roll fabric onto slopes without stretching or pulling.
- B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Provide 12 inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
- C. Secure outside edges and overlaps at 36 inch intervals with stakes.
- D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.07 MAINTENANCE

- A. At lawn seed areas mow grass at regular intervals to maintain at a maximum height of 3 inches. Do not cut more than 1/3 of grass blade at any one mowing.
- B. Water to prevent grass and soil from drying out. Water for duration of contract and ensure grass is living within one year after substantial completion.
- C. Roll surface to remove minor depressions or irregularities.
- D. Immediately reseed areas that show bare spots.
- E. Protect seeded areas with warning signs during maintenance period.

END OF SECTION

SECTION 33 4111
SITE STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Storm drainage piping, fittings, and accessories.

1.02 REFERENCE STANDARDS

- A. AASHTO M 252 - Standard Specification for Corrugated Polyethylene Drainage Pipe; 2009.
- B. AASHTO M 294 - Standard Specification for Corrugated Polyethylene Pipe; 2011.
- C. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2011.
- D. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Material; 2012.
- E. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- F. ASTM F405 - Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings, 3"-6".
- G. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- H. ASTM F667 - Standard Specification for 8 through 24 inch Corrugated Polyethylene Pipe and Fittings.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Pipe size and type shall be as specified on plans.
- B. PVC: Schedule 40 pipe and fittings.
- C. Corrugated High Density Polyethylene Pipe (HDPE) Sewer (Solid or Perforated)
 - 1. Provide dual-wall corrugated polyethylene pipe and fittings in accordance with the Plans, MnDOT 2503, AASHTO M294 or M252, Design Section 18 of the AASHTO Standard Specifications for Highway Bridges, and the following:
 - a. Corrugated polyethylene pipe and fittings shall be manufactured from high density polyethylene (HDPE) virgin compounds.
 - b. Clean re-worked HDPE material from the manufacturer's own production may be used by the manufacturer of HDPE pipe, provided that the pipe and fittings produced meet all requirements of these Special Provisions and in AASHTO M294 or M252 and Design Section 18 of the AASHTO Standard Specifications for Highway Bridges.
 - c. The polyethylene compounds shall conform to the requirements of ASTM D 3350 Cell Class 335420C.
 - d. Wall thickness shall be the thickness of the inner liner measured between corrugation valleys of the outer rib wall. The wall thickness shall equal or exceed the minimum wall thickness values in Table 1.
 - e. The pipe stiffness shall be determined in accordance with AASHTO M294 at 5 percent deflection. The average pipe stiffness shall equal or exceed the minimum pipe stiffness value for each size of pipe listed in Table 1.
 - f. Table 1 - Dual Wall Corrugated High Density Polyethylene Pipe (HDPE) - Nominal Diameter (Inches):
 - 1) 12":
 - (a) Min. I.D.: 11.8
 - (b) Max. O.D.: 14.7
 - (c) Min. Wall Area (in../sq. ft.): 1.50
 - (d) Min. C (in.): 0.35

- (e) Min. I (in. cu. in.): 024
 - (f) Min. Pipe Stiffness (psi): 46
 - (g) Min. Wall Thickness (in.): .035
 - 2) 15":
 - (a) Min. I.D.: 14.8
 - (b) Max. O.D.: 18.0
 - (c) Min. Wall Area (in./sq. ft.): 1.91
 - (d) Min. C (in.): 0.45
 - (e) Min. I (in. cu. in.): .053
 - (f) Min. Pipe Stiffness (psi): 42
 - (g) Min. Wall Thickness (in.): .035
 - 3) 18":
 - (a) Min. I.D.: 17.7
 - (b) Max. O.D.: 21.5
 - (c) Min. Wall Area (in./sq. ft.): 2.34
 - (d) Min. C (in.): 0.50
 - (e) Min. I (in. cu. in.): .062
 - (f) Min. Pipe Stiffness (psi): 40
 - (g) Min. Wall Thickness (in.): .050
2. Couplings
- a. Connections may be made with bell and spigot joints or clamp-on bands. If bell and spigot joints are utilized, a gasket shall be incorporated to make the joint water-tight. If clamp-on bands are utilized, a closed cell expanded rubber or neoprene gasket shall be provided on one corrugation on each side of the joint. The band shall be securely lapped and fastened to prevent pipe movement and provide a water-tight joint. Only ties provided by the pipe manufacturer may be used.
 - b. All joints shall be water tight type joints, not soil tight.

2.02 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31 2316.13.
- B. Cover: As specified in Section 31 2316.13.

PART 3 EXECUTION

3.01 TRENCHING

- A. See Section 31 2316.13 for additional requirements.
- B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
- C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.
- B. Deflection Testing (shall apply to HDPE sewer only)

1. Deflection testing shall be performed by the Contractor using a nine point mandrel approved by the Engineer. The diameter of the mandrel shall be as indicated in Table 1 for the minimum inside diameter of the pipe size specified. Mandrel testing shall be done no less than thirty (30) days after installation or upon completion of construction of the roadway to the grading grade, whichever occurs first. The mandrel must be pulled through the pipe by non mechanical means. Pipe through which the mandrel does not pass will be considered unacceptable. New pipe or deformed pipe which is not damaged shall be relaid. The relaid pipe shall be tested for deflection after no less than five (5) calendar days.

END OF SECTION

SECTION 33 7119

ELECTRICAL UNDERGROUND DUCTS, HANDHOLES, AND MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonmetallic duct.
- B. Handholes.
- C. Manholes.

1.02 RELATED REQUIREMENTS

- A. Section 31 2316 - Excavation.
- B. Section 31 2323 - Fill: Bedding and backfilling.
- C. Section 07 1400 - Fluid-Applied Waterproofing.

1.03 DEFINITIONS

- A. Duct Bank: Underground parallel ducts grouped together; installed in clean sand or encased in concrete as indicated.
- B. Handhole: Underground structure intended for use as pull or junction box, accessible from above grade.
- C. Manhole: Underground structure intended for personnel entry and service of cables and connections.

1.04 REFERENCE STANDARDS

- A. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2012).
- B. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures; 2013.
- C. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures; 2010e1.
- D. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures; 2011.
- E. ASTM C1037 - Standard Practice for Inspection of Underground Precast Concrete Utility Structures; 2008.
- F. UL 651A - Type EB and A Rigid PVC Conduit and HDPE Conduit; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Action Submittals:
 - 1. Product Data: Provide for metallic conduit, nonmetallic conduit, and manhole accessories.
 - 2. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast handholes, manholes, and vaults.
- C. Closeout Submittals:
 - 1. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes.
 - 2. Operations & Maintenance Manual: Include Shop Drawings.

PART 2 PRODUCTS

2.01 CONDUIT AND DUCT

- A. Rigid Polyvinyl Chloride (PVC) Underground Conduit: UL 651A, Type A PVC.
 - 1. Manufacturers:

- a. Cantex Inc: www.cantexinc.com.
 - b. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com.
 - c. JM Eagle: www.jmeagle.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
2. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
 3. Fittings:
 - a. Manufacturer: Same as manufacturer of conduit to be connected.
 - b. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.02 PRECAST CONCRETE HANDHOLES AND MANHOLES

- A. Manufacturers:
 1. Olcastle Precast .
 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Precast manhole designed in accordance with ASTM C858, comprising modular, interlocking sections complete with accessories.
- C. Loading: ASTM C857, Class A-16.
- D. Shape: As indicated on Drawings.
- E. Nominal Inside Dimensions: As indicated on Drawings.
- F. Base Section: Include 3 inch deep x 14 inch round sump with cast sleeve, and two 1 inch ground rod openings.
- G. Top Section: Include 39 inch diameter grooved opening for frame and cover.
- H. Riser Casting: 6 inch, with manhole step cast into frame.
- I. Frames and Covers: ASTM A48; Class 30B gray cast iron, 27 inch size, machine finished with flat bearing surfaces. Provide cover marked ELECTRIC to indicate utility.
- J. Duct Entry Provisions: Single duct knockouts.
- K. Duct Entry Locations: As indicated on Drawings.
- L. Duct Entry Size: 4 inch.
- M. Cable Pulling Irons: Use galvanized rod and hardware. Locate opposite each duct entry. Provide watertight seal.
- N. Cable Rack Inserts: Minimum load rating of 800 pounds (365 kg). Locate at ____ feet on center.
- O. Cable Rack Mounting Channel: 1-1/2 x 3/4 inch steel channel, 48 inch length. Provide cable rack arm mounting slots on 1-1/2 inch centers.
- P. Cable Racks: Steel channel, 1-1/2 x 3/4 x 14 inches, with fastener to match mounting channel.
- Q. Cable Supports: Porcelain clamps and saddles.
- R. Manhole Steps: Polypropylene plastic manhole step with 1/2-inch steel reinforcement.
- S. Ladder: Aluminum, with top hook to engage manhole step in riser casting. Provide one ladder for each manhole.
- T. Sump Covers: ASTM A48; Class 30B gray cast iron.
- U. Source Quality Control: Inspect manholes in accordance with ASTM C1037.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify routing and termination locations of duct bank prior to excavation for rough-in.
- B. Verify locations of manholes prior to excavating for installation.
- C. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.
- D. Manhole locations are shown in approximate locations unless dimensions are indicated. Locate as required to complete ductbank system.

3.02 DUCT BANK INSTALLATION

- A. Excavate for duct bank installation under the provisions of Section 31 2316.
- B. Install duct to locate top of ductbank at depths as indicated on drawings.
- C. Install duct with minimum slope of 4 inches per 100 feet (0.33 percent). Slope duct away from building entrances.
- D. Cut duct square using saw or pipe cutter; de-burr cut ends.
- E. Insert duct to shoulder of fittings; fasten securely.
- F. Join nonmetallic duct using adhesive as recommended by manufacturer.
- G. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- H. Install no more than equivalent of three 90-degree bends between pull points.
- I. Provide suitable fittings to accommodate expansion and deflection where required.
- J. Terminate duct at manhole entries using end bell.
- K. Cover ducts with earth.
- L. Locate parallel ducts with 7-1/2 inches separation, center to center.
 - 1. Use suitable separators and chairs installed not greater than 4 feet on centers.
- M. Band ducts together before backfilling.
 - 1. Encase with clean sand, 6" all sides of ducts.
 - 2. Backfill with earth.
- N. Provide suitable pull string in each empty duct except sleeves and nipples.
- O. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.
- P. Backfill duct bank excavation under the provisions of Section 31 2323.
- Q. Interface installation of underground warning tape with backfilling. Install tape 6 inches below finished surface.

3.03 PRE-CAST HANDHOLE AND MANHOLE INSTALLATION

- A. Excavate for manhole installation under the provisions of Section 31 2316.
- B. Install and seal precast sections in accordance with ASTM C891.
- C. Install manholes plumb.
- D. Use precast neck and shaft sections to bring manhole cover to finished elevation.
- E. Waterproof exterior surfaces, joints, and interruptions of manholes after concrete has cured 28 days, under provisions of Section 07 1400.
- F. Backfill manhole excavation under the provisions of Section 31 2323.

END OF SECTION

MnANG Ridgeview Road Infrastructure
MANHOLES
LHB #120094

FMKM062039B

ELECTRICAL UNDERGROUND DUCTS, HANDHOLES, AND

**SECTION 33 7900
SITE GROUNDING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrodes, connectors, and conductors.
- B. Treatment wells.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- B. Section 31 2316 - Excavation: Trenching for grounding.

1.03 REFERENCE STANDARDS

- A. IEEE 142 - IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems; Institute of Electrical and Electronic Engineers; 2007.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SYSTEM DESCRIPTION

- A. Multiple vertical electrodes buried around perimeter of building foundation.
- B. Single vertical electrodes buried at gates and light poles.
- C. Provide grounding systems that provide overall resistance to ground of 5 ohms.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Submit all product data, shop drawings, and manufacturer's instructions concurrently.
- C. Action Submittals:
- D. Information Submittals:
 - 1. Construction Documentation:
 - a. Inform Architect of completion of below grade connections 7 days prior to cover.
 - b. Submit digital photographs of each below grade connections prior to cover.
 - 2. Field Quality Control Test Reports: Indicate overall resistance to ground at each system.
 - 3. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.
 - a. Include manufacturer's installation instructions for exothermic welds and mechanical connectors.
- E. Closeout Submittals:
 - 1. Project Record Documents: Accurately record actual locations of electrodes and connections.
 - 2. Operation and Maintenance Manual:
 - a. Test Reports: Include field quality control test reports.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Rod Electrodes: See Section 26 0526 - Grounding and Bonding for Electrical Systems.

- B. Exothermic Connections: See Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Wire: Stranded copper.
 - 1. Minimum Size: As indicated on Drawings.
 - 2. Connections: Exothermic weld.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that trenching is completed before installing horizontal electrodes.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install interconnecting wire 3.0 feet below finished grade level.
- C. Provide grounding wells as indicated.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.
- B. Test Criteria:
 - 1. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.
 - 3. Test site grounding in conjunction with testing and inspection of Section 26 0526 Grounding and Bonding.
- C. Test ground resistance at components as follows:
 - 1. Manhole Grounds.
- D. Test Procedures: IEEE 142, fall of potential method.
 - 1. Measure ground resistance without the soil being moistened by any means other than natural precipitation.
 - 2. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLOSEOUT ACTIVITIES

- A. Demonstrate to facility operation and maintenance personnel the location of each accessible grounding connection and each chemical treatment well.

END OF SECTION

APPENDIX A



- CONSULTANTS
- ENVIRONMENTAL
 - GEOTECHNICAL
 - MATERIALS
 - FORENSICS

**REPORT OF GEOTECHNICAL
EXPLORATION AND REVIEW**
MnANG New Entrance Guard Shack
Ridgeview Road
Duluth, Minnesota

AET Project No. 07-05347

Date:
January 17, 2014

Prepared For:

LHB, Inc.
21 West Superior Street, Suite 500
Duluth, Minnesota 55802

www.amengtest.com





- CONSULTANTS
- ENVIRONMENTAL
- GEOTECHNICAL
- MATERIALS
- FORENSICS

January 17, 2014

Mr. Dan Shaw, P.E.
LHB, Inc.
21 West Superior Street, Suite 500
Duluth, Minnesota 55802

RE: Report of Geotechnical Exploration and Review
MnANG Entrance Guard Shack
Ridgeview Road
Duluth, Minnesota
AET Project No. 07-05347

Dear Mr. Shaw:

We are pleased to present the results of our subsurface exploration program and geotechnical review for your New Entrance Guard Shack project in Duluth, Minnesota. These services were performed following your acceptance of our proposal to you dated May 6, 2013.

We are submitting two bound copies and one unbound copy of this report to you. This report is the instrument of service defined in our proposal.

We have enjoyed working with you on this phase of the project. Please contact us if you have questions about this report or require further assistance.

Sincerely,
American Engineering Testing, Inc.

A handwritten signature in blue ink, appearing to read 'Taryn J. Kuusisto', is written over a faint, larger version of the signature.

Taryn J. Kuusisto, EIT
Staff Engineer II



Report of Geotechnical Exploration and Review
MnANG New Entrance Guard Shack
Ridgeview Road; Duluth, Minnesota
January 17, 2014
AET Project No. 07-05347

AMERICAN
ENGINEERING
TESTING, INC.

Signature Page

Prepared for:

Mr. Dan Shaw, P.E.
LHB, Inc.
21 West Superior Street, Suite 500
Duluth, Minnesota 55802

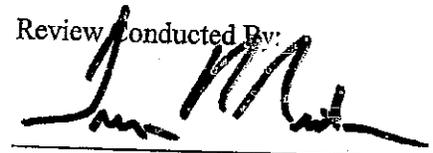
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Report Authored By:


Taryn J. Kuusisto, P.E.
Staff Engineer II

Review Conducted By:


Gregory R. Reuter, P.E., P.G., D.GE
Principal Engineer

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under Minnesota Statute Section 326.02 to 326.15

Name: Gregory R. Reuter

Date: 1/17/14 License #:19885

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1.0 INTRODUCTION

The Minnesota Air National Guard (MnANG) is planning the construction of a new vehicle entrance on Ridgeview Road; LHB, Inc. is providing the planning and design services for the project. To assist with planning and design, Mr. Dan Shaw, P.E., of LHB authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration program at the site and perform a geotechnical engineering review for the project. This report presents the results of the above services, and provides our engineering recommendations based on this data.

2.0 SCOPE OF SERVICES

AET's services were performed according to our proposal to LHB dated May 6, 2013, and authorized by the Professional Service Agreement between LHB and AET effective November 21, 2013. The authorized scope consists of the following:

- Drill and sample six standard penetration test borings, three to depths of 15 feet and three to depths of 5 feet;
- Perform visual-manual classification and limited laboratory testing of the recovered soil samples; and
- Perform a geotechnical engineering analysis based on this data and prepare this report.

These services are intended for geotechnical purposes, to evaluate the structural properties of the soil. The scope is not intended to explore for the presence or extent of environmental contamination in the soil or groundwater.

3.0 PROJECT INFORMATION

3.1 Project Plans

The new entrance will consist of a pre-fabricated guard shack, two Delta pop-up barricades, and a pivot gate (gate operator and stanchion). The guard shack will be heated and will cover a footprint of approximately 200 square feet. The finished floor elevation (FFE) of the guard shack is planned to be at about 1409.5 feet.

LHB provided AET with the product sheets for the Delta pop-up barricade DSC 501. According to these sheets, the barricades are 39 inches high, 60 to 180 inches wide, weigh 3,500 to 11,500 pounds and are supported on a mat foundation bearing 18 inches below grade. The barrier foundation is designed based on an allowable soil bearing capacity of 3,000 pounds per square foot.

The gate operator is planned to be supported on concrete footings at a depth of 7 feet, and foundation walls with slab on-grade; the stanchion is planned to be supported on a concrete pier at a depth of 7 feet. The traffic through the gate will include cars, light trucks, and heavy trucks.

Our foundation design assumptions include a minimum factor of safety of 3 with respect to localized shear or base failure of the bearing soils. We assume the structures will be able to tolerate total settlements up to 1 inch and differential settlements over a 30 foot distance up to ½ inch for footings of approximately equal size and load.

This information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that we be contacted if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

4.0 SUBSURFACE EXPLORATION AND TESTING

4.1 Field Exploration Program

Our subsurface exploration program for the project consisted of drilling six borings with standard penetration testing (SPT) and sampling on December 18, 2013. The number, depth, and locations of the borings were specified by LHB; LHB also staked the borings and recorded the surface elevations at the locations. The boring locations and surface elevations are shown on the figure provided by LHB in Appendix A.

Prior to drilling, we contacted Gopher State One Call to locate public underground utilities at the site. We also contacted MnANG to confirm the locations of private utilities in the area relative to the boring locations. We drilled the borings using 3/4-inch inside diameter hollow stem augers. Please refer to Appendix A for details on the drilling and sampling methods, the classification methods, and the water level measurement details.

The boring logs are found in Appendix A and contain information concerning soil layering, geologic description, moisture condition, and USCS classifications. Relative density or consistency is also noted for the natural soils, which are based on the standard penetration resistance (N-value).

4.2 Soil Classification

We visually-manually classified the samples based on texture and plasticity according to the Unified Soil Classification System (USCS) (ASTM D2488). Data sheets describing the USCS System, the descriptive terminology, and the symbols used on the boring logs are included in Appendix A.

5.0 SITE CONDITIONS

5.1 Surface Features

The area of the new entrance is to the northeast of the base. Based on the provided boring elevations the site slopes slightly downward from east to west, with a grade change of about 1.5 feet.

LHB told us that there is an existing storm pond to the southwest on the site with a water elevation of about 1403 feet; the low point on the site is located southwest of the guard shack at an approximate elevation of 1404 feet.

5.2 Subsurface Soils/Geology

5.2.1 Structure Borings

Borings SB-1, SB-2, and SB-3 were drilled for the new structures. The borings for the gate and pop-up barricades (SB-1 and SB-2) indicated 4 feet of fill with a layer of fabric at about 2 feet. The boring for the guard shack (SB-3) indicated 7.5 feet of fill. Below the fill, naturally-occurring alluvium and till deposits were encountered to the termination depths of the borings.

The fill soils consisted of sand with varying amounts of gravel and silt, gravel with sand and silt, clayey sand, and sandy silt. The coarse alluvium consisted of silt with sand and sand; the fine alluvium consisted of clay with sand and silt. The till consisted of silty sand and clayey sand with varying amounts of gravel, and silt with varying amounts of sand. The upper layer of naturally-occurring soils was loose to firm having N-values of 6 and 7. The soils, however, became denser with depth.

5.2.2 Roadway Borings

Borings SB-3, SB-4, and SB-5 were drilled along the existing Ridgeview Road. These borings indicated fill to about 4 to 5 feet deep overlying naturally-occurring alluvium and till. The fill consisted of sand with varying amounts and silt and gravel. The fine alluvium consisted of silt with sand and the till consisted of sandy silt and silty sand with gravel.

5.3 Water Level Measurements

We encountered groundwater in boring SB-1 at a depth of 6 feet (elevation 1403.2 feet) and in boring SB-3 at 5 feet (elevation 1402.3 feet); these water depths correspond to the provided storm

pond water elevation. The contractor may encounter hydrostatic groundwater in excavations for the project.

The silty/clayey soils on this site have a low permeability, and an extended period of time (days or weeks) would be needed for groundwater levels to reach equilibrium in open boreholes. Further, even in clayey soils, boreholes left open for days or weeks could cave in, resulting in misleading water level readings. It would be necessary to install piezometers (monitoring wells) in order to obtain extended groundwater level readings on the site, and such an installation was beyond our authorized scope of services.

The groundwater levels on this site, hydrostatic and perched, will vary in elevation seasonally and annually depending on local precipitation, infiltration, and runoff. The presence or absence of groundwater will depend in part on precipitation or snow melt prior to construction.

6.0 RECOMMENDATIONS

6.1 Approach Discussion

Based on the subsurface conditions found in our borings and our understanding of the project, it is our opinion that the guard shack and gate operator can be supported on conventional footing foundations, after proper site preparation has taken place. Site preparation should include the complete removal of the existing fill; surface compaction of soils loosened by the excavation process; placement of new, select compacted fill to bottom of slab elevation, and excavation to bottom of footing elevation. The gate stanchion can be supported on a concrete pier foundation.

The Delta-pop up barricades can be supported on the shallow foundation indicated in the product sheets after proper site preparation. Because of the shallow depth of the foundation and the high frost susceptibility of the fill and native soils, there will be potential for frost heave of the foundation, which could result in cracking and/or differential vertical movement of the foundation. The

placement of a non-frost susceptible fill section directly below the foundation would reduce this risk.

Details of our recommendations are presented below.

6.2 Guard Shack and Gate Operator

6.2.1 Excavation

To prepare the building and gate operator areas for foundation and slab support, we recommend complete removal of the existing fill. This zone of removal should extend laterally to at least 5 feet beyond the structures perimeters. Soils at the bottom of the excavations for these structures that are disturbed or loose should be compacted to improve density or subcut and replaced.

The following table provides our estimated minimum depths of subcutting at the borings we drilled for the structures. The actual depths of subcutting required will vary away from the boring locations. A geotechnical engineer or experienced technician should perform field observations during construction to determine actual subcutting requirements, which could be deeper or shallower than anticipated from the borings.

Estimated Subcut Depths

Boring Number	Structure	Surface Elevation	Recommended Subcut Depth (ft)	Subcut Elevation
SB-1	Gate	1409.2	4	1405.2
SB-2	Gate	1408.7	4	1404.7
SB-3	Guard Shack	1407.3	7.5	1399.8

Where subcutting extends below the proposed foundation grade, the excavation bottom and resultant engineered fill system must be oversized laterally beyond the planned outside edges of the foundations to properly support the lateral loads exerted by that foundation. This engineered fill lateral extension should at least be equal to the vertical depth of fill needed to attain foundation grade at that location (i.e., 1:1 lateral oversize).

The contractor may encounter hydrostatic groundwater in the excavations for this project and should be prepared to properly dewater the excavation prior to any fill or concrete placement.

6.2.2 Fill Placement and Compaction

New fill supporting the structure's footings and guard shack slab should be select granular soil meeting the gradation of Mn/DOT 3149.2B2, processed to have no boulders or cobbles or gravel larger than 3 inches. New fill supporting the gate operator slab should be non-frost susceptible fill meeting the gradation of Mn/DOT 3149.2B2, modified to less than 5% passing the No. 200 sieve. If the contractor wishes to propose a different gradation of material, they should submit a sample to AET at least three weeks before the start of construction for gradation testing and assessment by a geotechnical engineer.

The new fill should be placed in loose lifts about 6 to 8 inches thick, with each lift mechanically compacted to at least 95% of the maximum Modified Proctor dry density (ASTM: D 1557). Please refer to the attached standard sheet entitled "Excavation and Refilling for Structural Support" for general information regarding placing fill for buildings.

6.2.3 Foundation Design

The new structures can be supported on conventional spread footings, bearing on the medium dense naturally-occurring soils or on new granular fill placed and compacted over a suitable subgrade, provided the site has been prepared in accordance with the above recommendations. We recommend that continuous strip footings have a minimum width of 20 inches even if the resulting contact pressure is less than our recommended allowable bearing pressure. We recommend that perimeter foundations for the guard shack bear at least 6 feet below final exterior grade for frost protection; perimeter foundations for the gate operator should bear at least 7 feet below final exterior grade, because deeper frost penetration can occur away from heated areas.

Based on the subsurface conditions we encountered and provided our recommendations are

followed, it is our opinion the foundations for the structures can be designed based on a net maximum allowable soil bearing pressure of 2,500 psf. It is our judgment this design pressure will provide a factor of safety of at least 3 against bearing capacity failure of the soil. With this design we estimate maximum total building settlement of 1 inch or less, with differential settlement less than half this amount, if the bearing soils are not soft, wet, disturbed, or frozen at the time of construction.

6.2.4 Floor Slab Design

Interior backfill in footing trenches should consist of granular fill meeting the requirements of Section 6.2.2 of this report.

Based on a subgrade prepared as discussed in Section 6.2, the structural engineer may use a modulus of subgrade reaction of 250 pounds per cubic inch to design the floor slab thickness and reinforcement.

We recommend that a vapor retarder be placed under the floor slab of the guard shack; the purpose of a vapor retarder is to reduce the potential for the upward migration of water vapor from the soil into and through the concrete slab. Water vapor migrating upward through the slab can damage floor coverings such as the carpeting, wood, or paint/sealers and contribute to excess humidity and microbial growth in the building. Various methods of vapor retarder construction are described in Part 2, Section 302 of the American Concrete Institute *Manual of Concrete Practice*.

The slab-on-grade should be designed and constructed following the recommendations of the Portland Cement Association and the American Concrete Institute. The slab should have construction joints/control joints at spacings recommended by the Portland Cement Association and the American Concrete Institute to mitigate, but not eliminate, slab curling and cracking. The floor slab should be cast independent of the foundation walls of the building to allow relative movement of the slabs and footings to occur without causing excessive distress to the structures.

6.3 Gate Stanchion Foundation

We recommend that the concrete pier supporting the gate stanchion extend at least 7 feet below existing grade for protection from frost, to bear on the naturally-occurring medium dense till. The pier should have a minimum diameter of 18 inches. For a concrete pier bearing at or below this depth we recommend using a net allowable end bearing pressure of 3,000 pounds per square foot for design.

Based on these values of allowable bearing pressure, we estimate that post-construction settlement would be $\frac{3}{4}$ inch or less, if the bearing soils are not soft, wet, disturbed, or frozen before or after construction.

6.4 Delta Pop-up Barricades

6.4.1 Excavation

To prepare the barricade areas for foundation support, we recommend removing all of the existing fill or excavating to 5 feet below the bottom of slab, whichever is greater. Soils at the bottom of the excavations for these structures that are disturbed or loose should be compacted to improve density or subcut and replaced. A geotechnical engineer or experienced technician should perform field observations during construction of the barricades.

Subcutting will extend below the proposed foundation grade, therefore the excavation bottom and resultant engineered fill system must be oversized laterally beyond the planned outside edges of the foundations to properly support the lateral loads exerted by that foundation. This engineered fill lateral extension should at least be equal to the vertical depth of fill needed to attain foundation grade at that location (i.e., 1:1 lateral oversize).

6.4.2 Fill Placement and Compaction

We recommend that new fill supporting the barricade foundations be non-frost-susceptible granular fill meeting the gradation of Mn/DOT 3149.2B2 (modified), processed to have less than 5% passing the No. 200 sieve. We recommend placement of drain pipes at the base of the NFS zone, connected to a suitable discharge location (such as the storm water pond), to remove infiltrating water.

If the contractor wishes to propose a different gradation of material, he should submit a sample to AET at least three weeks before the start of construction for gradation testing and assessment by a geotechnical engineer.

The new fill should be placed in loose lifts about 6 to 8 inches thick, with each lift mechanically compacted to at least 95% of the maximum Modified Proctor dry density (ASTM: D 1557). Please refer to the attached standard sheet entitled "Excavation and Refilling for Structural Support" for general information regarding fill placement.

6.4.3 Foundation Design

The barricades can be supported on the shallow foundations indicated in the product sheets, bearing on the new NFS fill placed and compacted over a suitable subgrade, provided the site has been prepared in accordance with the above recommendations.

Based on the subsurface conditions we encountered and provided our recommendations are followed, it is our opinion the foundations for the barricades can be designed based on a net maximum allowable soil bearing pressure of 3,000 psf. It is our judgment this design pressure will provide a factor of safety of at least 3 against bearing capacity failure of the soil. With this design we estimate maximum total settlement of 1 inch or less, with differential settlement less than half this amount, provided that the bearing soils are not soft, wet, disturbed, or frozen at the time of construction.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Potential Difficulties

7.1.2 Groundwater

We encountered groundwater in two of our borings. We anticipate that the contractor may encounter hydrostatic groundwater in the excavations for the structures and should be prepared to properly dewater the excavation prior to any fill or concrete placement.

To allow observation of the excavation bases and to reduce the potential for soil disturbance or softening by standing water, we recommend that all water (groundwater seepage, precipitation, or runoff) be pumped out of excavations prior to placement of compacted fill or concrete. The contractor should not excavate in standing water, or place select fill or concrete into standing water in an attempt to displace it. This technique can result in trapping softened soils under the building, causing excess post-construction settlement even if the softened zone is only a few inches thick.

7.2 Excavation Sidesloping

The excavations for this project must have side slopes in accordance with OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, "Excavations" (can be found on www.osha.gov). Even with the required OSHA sloping, water could induce side slope erosion which could require slope maintenance. The decision on excavating safe slopes for this project should be made by the excavator's "competent person." AET will not accept any liability or responsibility for excavation safety on this project.

7.3 Soil Disturbance

The soils found at the site are susceptible to disturbance by construction equipment and workers' foot traffic, and should be protected until a final observation can be made immediately prior to placing concrete. The responsibility to avoid disturbing the soils by choosing proper equipment and methods lies solely with the contractor.

7.4 Observation and Testing

The recommendations in this report are based on the subsurface conditions found at our boring locations. We recommend that the base soils be observed and tested by an experienced material technician or a geotechnical engineer. The fill materials should be tested for gradation and Proctor values, and field density tests should be performed as the fill is placed and compacted.

8.0 GENERAL QUALIFICATIONS

This report has been prepared based on the soil and groundwater conditions found in our borings, and based on our understanding of the project. If there are any changes in size, location, finished floor elevation, structural loads, use or nature of the building or other structures from those outlined in the Introduction of this report, or if our understanding of the project is incomplete or incorrect, it is necessary that you contact us so we can review our recommendations to determine if they remain applicable. If we are not given the opportunity to review changes, then the recommendations in this report will not be valid.

We determined the soil and groundwater conditions at six locations for this project. The subsurface conditions we describe and discuss in this report are pertinent only at the borings and under the environment of our field exploration. Variations in the subsurface soils were found, and it is likely that additional variations exist that cannot be determined from our borings or our site observations. These variations would not become apparent until excavation is started. No warranty, express or implied, is presented in this report with respect to the soil, groundwater, and bedrock conditions on this site.

9.0 ASTM STANDARDS

When we refer to an ASTM Standard in this report, we mean that our services were performed in general accordance with that standard. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

10.0 STANDARD OF CARE

Within the limitations of the work scope, budget, and schedule, we have endeavored to provide our services in accordance with generally accepted geotechnical engineering practices at this time and location. Other than this, no warranty, express or implied, is intended.

Standard Data Sheets

AET Project No. 07-05347

Excavation and Refilling for Structural Support
Floor Slab Moisture/Vapor Protection

EXCAVATION AND REFILLING FOR STRUCTURAL SUPPORT

EXCAVATION

Excavations for structural support at soil boring locations should be taken to depths recommended in the geotechnical report. Since conditions can vary, recommended excavation depths between and beyond the boring locations should be evaluated by geotechnical field personnel. If ground water is present, the excavation should be dewatered to avoid the risk of unobservable poor soils being left in-place. Excavation base soils may become disturbed due to construction traffic, ground water or other reasons. Such soils should be subcut to underlying undisturbed soils. Where the excavation base slopes steeper than 4:1, the excavation bottom should be benched across the slope parallel to the excavation contour.

Soil stresses under footings spread out with depth. Therefore, the excavation bottom and subsequent fill system should be laterally oversized beyond footing edges to support the footing stresses. A lateral oversize equal to the depth of fill below the footing (i.e., 1:1 oversize) is usually recommended. The lateral oversize is usually increased to 1.5:1 where compressible organic soils are exposed on the excavation sides. Variations in oversize requirements may be recommended in the geotechnical report or can be evaluated by the geotechnical field personnel.

Unless the excavation is retained, the backslopes should be maintained in accordance with OSHA Regulations (Standards - 29 CFR), Part 1926, Subpart P, "Excavations" (found on www.osha.gov). Even with the required OSHA sloping, ground water can induce sideslope raveling or running which could require that flatter slopes or other approaches be used.

FILLING

Filling should proceed only after the excavation bottom has been approved by the geotechnical engineer/technician. Approved fill material should be uniformly compacted in thin lifts to the compaction levels specified in the geotechnical report. The lift thickness should be thin enough to achieve specified compaction through the full lift thickness with the compaction equipment utilized. Typical thicknesses are 6" to 9" for clays and 12" to 18" for sands. Fine grained soils are moisture sensitive and are often wet (water content exceeds the "optimum moisture content" defined by a Proctor test). In this case, the soils should be scarified and dried to achieve a water content suitable for compaction. This drying process can be time consuming, labor intensive, and requires favorable weather.

Select fill material may be needed where the excavation bottom is sensitive to disturbance or where standing water is present. Sands (SP) which are medium to coarse grained are preferred, and can be compacted in thicker lift thicknesses than finer grained soils.

Filling operations for structural support should be closely monitored for fill type and compaction by a geotechnical technician. Monitoring should be on a full-time basis in cases where vertical fill placement is rapid; during freezing weather conditions; where ground water is present; or where sensitive bottom conditions are present.

EXCAVATION/REFILLING DURING FREEZING TEMPERATURES

Soils that freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density loss depends on the soil type and moisture condition; and is most pronounced in clays and silts. Foundations, slabs, and other improvements should be protected from frost intrusion during freezing weather. For earthwork during freezing weather, the areas to be filled should be stripped of frozen soil, snow and ice prior to new fill placement. In addition, new fill should not be allowed to freeze during or after placement. For this reason, it may be preferable to do earthwork operations in small plan areas so grade can be quickly attained instead of large areas where much frost stripping may be needed.

FLOOR SLAB MOISTURE/VAPOR PROTECTION

Floor slab design relative to moisture/vapor protection should consider the type and location of two elements, a granular layer and a vapor membrane (vapor retarder, water resistant barrier or vapor barrier). In the following sections, the pros and cons of the possible options regarding these elements will be presented, such that you and your specifier can make an engineering decision based on the benefits and costs of the choices.

GRANULAR LAYER

In American Concrete Institute (ACI) 302.1-96, a "base material" is recommended, rather than the conventional cleaner "sand cushion" material. The manual maintains that clean sand (common "cushion" sand) is difficult to compact and maintain until concrete placement is complete. ACI recommends a clean, fine graded material (with at least 10% to 30% of particles passing a #100 sieve) which is not contaminated with clay, silt or organic material. We refer you to ACI 302.1-96 for additional details regarding the requirements for the base material.

In cases where potential static water levels or significant perched water sources appear near or above the floor slab, an underfloor drainage system may be needed wherein a draitile system is placed within a thicker clean sand or gravel layer. Such a system should be properly engineered depending on subgrade soil types and rate/head of water inflow.

VAPOR MEMBRANE

The need for a vapor membrane depends on whether the floor slab will have a vapor sensitive covering, will have vapor sensitive items stored on the slab, or if the space above the slab will be a humidity controlled area. If the project does not have this vapor sensitivity or moisture control need, placement of a vapor membrane may not be necessary. Your decision will then relate to whether to use the ACI base material or a conventional sand cushion layer. However, if any of the above sensitivity issues apply, placement of a vapor membrane is recommended. Some floor covering systems (adhesives and flooring materials) require a vapor membrane to maintain a specified maximum slab moisture content as a condition of their warranty.

VAPOR MEMBRANE/GRANULAR LAYER PLACEMENT

A number of issues should be considered when deciding whether to place the vapor membrane above or below the granular layer. The benefits of placing the slab on a granular layer, with the vapor membrane placed **below** the granular layer, include **reduction** of the following:

- Slab curling during the curing and drying process.
- Time of bleeding, which allows for quicker finishing.
- Vapor membrane puncturing.
- Surface blistering or delamination caused by an extended bleeding period.
- Cracking caused by plastic or drying shrinkage.

The benefits of placing the vapor membrane **over** the granular layer include the following:

- The moisture emission rate is achieved faster.
- Eliminates a potential water reservoir within the granular layer above the membrane.
- Provides a "slip surface", thereby reducing slab restraint and the associated random cracking.

If a membrane is to be used in conjunction with a granular layer, the approach recommended depends on slab usage and the construction schedule. The vapor membrane should be placed above the granular layer when:

- Vapor sensitive floor covering systems are used or vapor sensitive items will be directly placed on the slab.
- The area will be humidity controlled, but the slab will be placed before the building is enclosed and sealed from rain.
- Required by a floor covering manufacturer's system warranty.

The vapor membrane should be placed below the granular layer when:

- Used in humidity controlled areas (without vapor sensitive coverings/stored items), with the roof membrane in place, and the building enclosed to the point where precipitation will not intrude into the slab area. Consideration should be given to slight sloping of the membrane to edges where draitile or other disposal methods can alleviate potential water sources, such as pipe or roof leaks, foundation wall damp proofing failure, fire sprinkler system activation, etc.

There may be cases where membrane placement may have a detrimental effect on the subgrade support system (e.g., expansive soils). In these cases, your decision will need to weigh the cost of subgrade options and the performance risks.

Appendix A

AET Project No. 07-05347

Geotechnical Field Exploration and Testing

Boring Log Notes

Unified Soil Classification System

Figure 1 – Boring Locations

Subsurface Boring Logs

Geotechnical Field Exploration and Testing

AET Project No. 07-05347

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by performing six standard penetration test (SPT) borings on December 18, 2013. The locations of the borings appear on the Figure preceding the Subsurface Boring Logs in this appendix.

A.2 SAMPLING METHODS

A.2.1 Split-Spoon Samples (SS) - Calibrated to N_{60} Values

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586 with one primary modification. The ASTM test method consists of driving a 2-inch O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven a total of 18 inches into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the standard penetration resistance or N-value. Our method uses a modified hammer weight, which is determined by measuring the system energy using a Pile Driving Analyzer (PDA) and an instrumented rod.

In the past, standard penetration N-value tests were performed using a rope and cathead for the lift and drop system. The energy transferred to the split-spoon sampler was typically limited to about 60% of its potential energy due to the friction inherent in this system. This converted energy then provides what is known as an N_{60} blow count.

The newest drill rigs incorporate an automatic hammer lift and drop system, which has higher energy efficiency and subsequently results in lower N-values than the traditional N_{60} values. By using the PDA energy measurement equipment, we are able to determine actual energy generated by the drop hammer. With the various hammer systems available, we have found highly variable energies ranging from 55% to over 100%. Therefore, the intent of AET's hammer calibrations is to vary the hammer weight such that hammer energies lie within about 60% to 65% of the theoretical energy of a 140-pound weight falling 30 inches. The current ASTM procedure acknowledges the wide variation in N-values, stating that N-values of 100% or more have been observed. Although we have not yet determined the statistical measurement uncertainty of our calibrated method to date, we can state that the accuracy deviation of the N-values using this method is significantly better than the standard ASTM Method.

A.2.2 Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as "DS" or "SU" on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

A.2.3 Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring log.

Determining the thickness of "topsoil" layers is usually limited, due to variations in topsoil definition, sample recovery, and other factors. Visual-manual description often relies on color for determination, and transitioning changes can account for significant variation in thickness judgment. Accordingly, the topsoil thickness presented on the log should not be the sole basis for calculating topsoil stripping depths and volumes. If more accurate information is needed relating to thickness and topsoil quality definition, alternate methods of sample retrieval and testing should be employed.

A.3 CLASSIFICATION METHODS

Soil descriptions shown on the boring log are based on the Unified Soil Classification System (USCS). The USCS is described in ASTM: D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil descriptions shown on the boring log are visual-manual judgments. Charts are attached which provide information on the USCS system, the descriptive terminology, and the symbols used on the boring log.

The boring log includes descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted

Geotechnical Field Exploration and Testing

AET Project No. 07-05347

primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

A.4 WATER LEVEL MEASUREMENTS

The ground water level measurements are shown at the bottom of the boring log. The following information appears under "Water Level Measurements" on the log:

- **Date and Time of measurement**
- **Sampled Depth:** lowest depth of soil sampling at the time of measurement
- **Casing Depth:** depth to bottom of casing or hollow-stem auger at time of measurement
- **Cave-in Depth:** depth at which measuring tape stops in the borehole
- **Water Level:** depth in the borehole where free water is encountered
- **Drilling Fluid Level:** same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring location may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

A.5 TEST STANDARD LIMITATIONS

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

A.6 SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
B,H,N:	Size of flush-joint casing
CA:	Crew Assistant (initials)
CAS:	Pipe casing, number indicates nominal diameter in inches
CC:	Crew Chief (initials)
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RD:	Rotary drilling with fluid and roller or drag bit
REC:	In split-spoon (see notes) and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
REV:	Revert drilling fluid
SS:	Standard split-spoon sampler (steel; 1d" is inside diameter; 2" outside diameter); unless indicated otherwise
SU:	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and 140-pound hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level measured in borehole prior to abandonment
▽:	Interim water level measurement or estimated water level based on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q _p :	Pocket Penetrometer strength, tsf (approximate)
q _c :	Static cone bearing pressure, tsf
q _u :	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remoulded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES

The standard penetration test consists of driving the sampler with a 140 pound hammer and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM:D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

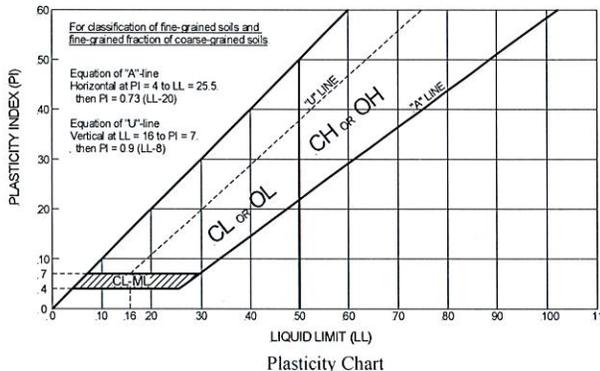
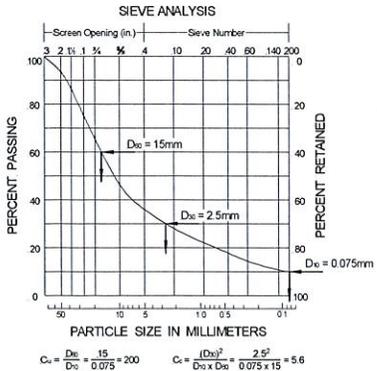
The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM:D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

**AMERICAN
ENGINEERING
TESTING, INC.**



Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification		Notes
				Group Symbol	Group Name ^B	
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines ^C	$Cu \geq 4$ and $1 < Cc \leq 3^E$	GW	Well graded gravel ^F	^A Based on the material passing the 3-in (75-mm) sieve. ^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name. ^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt GW-GC well-graded gravel with clay GP-GM poorly graded gravel with silt GP-GC poorly graded gravel with clay ^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt SW-SC well-graded sand with clay SP-SM poorly graded sand with silt SP-SC poorly graded sand with clay ^E $Cu = D_{60} / D_{10}$, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ ^F If soil contains $\geq 15\%$ sand, add "with sand" to group name. ^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM. ^H If fines are organic, add "with organic fines" to group name. ^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name. ^J If Atterberg limits plot is hatched area, soils is a CL-ML silty clay. ^K If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant. ^L If soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name. ^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name. ^N $PI \geq 4$ and plots on or above "A" line. ^O $PI < 4$ or plots below "A" line. ^P PI plots on or above "A" line. ^Q PI plots below "A" line. ^R Fiber Content description shown below.
		Gravels with Fines more than 12% fines ^C	Fines classify as ML or MH Fines classify as CL or CH	GM GC	Silty gravel ^{F,G,H} Clayey gravel ^{F,G,H}	
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines ^D	$Cu \geq 6$ and $1 < Cc \leq 3^E$	SW	Well-graded sand ^I	
			$Cu < 6$ and $1 > Cc > 3^E$	SP	Poorly-graded sand ^I	
		Sands with Fines more than 12% fines ^D	Fines classify as ML or MH Fines classify as CL or CH	SM SC	Silty sand ^{G,H,I} Clayey sand ^{G,H,I}	
			inorganic	$PI > 7$ and plots on or above "A" line ^J $PI < 4$ or plots below "A" line ^J	CL ML	
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	inorganic	Liquid limit – oven dried < 0.75 Liquid limit – not dried	OL	Organic clay ^{K,L,M,N} Organic silt ^{K,L,M,O}		
		inorganic	PI plots on or above "A" line PI plots below "A" line	CH MH	Fat clay ^{K,L,M} Elastic silt ^{K,L,M}	
	organic	Liquid limit – oven dried < 0.75 Liquid limit – not dried	OH	Organic clay ^{K,L,M,P} Organic silt ^{K,L,M,Q}		
		Primarily organic matter, dark in color, and organic in odor	PT	Peat ^R		



ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size		Gravel Percentages		Consistency of Plastic Soils		Relative Density of Non-Plastic Soils	
Term	Particle Size	Term	Percent	Term	N-Value, BPF	Term	N-Value, BPF
Boulders	Over 12"	A Little Gravel	3% - 14%	Very Soft	less than 2	Very Loose	0 - 4
Cobbles	3" to 12"	With Gravel	15% - 29%	Soft	2 - 4	Loose	5 - 10
Gravel	#4 sieve to 3"	Gravelly	30% - 50%	Firm	5 - 8	Medium Dense	11 - 30
Sand	#200 to #4 sieve			Stiff	9 - 15	Dense	31 - 50
Fines (silt & clay)	Pass #200 sieve			Very Stiff	16 - 30	Very Dense	Greater than 50
Moisture/Frost Condition (MC Column)		Layering Notes		Fiber Content of Peat		Organic/Roots Description (if no lab tests)	
D (Dry):	Absence of moisture, dusty, dry to touch.	Laminations:	Layers less than 1/2" thick of differing material or color.	Term	Fiber Content (Visual Estimate)	Soils are described as <i>organic</i> , if soil is not peat and is judged to have sufficient organic fines content to influence the soil properties. <i>Slightly organic</i> used for borderline cases.	
M (Moist):	Damp, although free water not visible. Soil may still have a high water content (over "optimum").	Lenses:	Pockets or layers greater than 1/2" thick of differing material or color.	Fibric Peat:	Greater than 67%	With roots:	Judged to have sufficient quantity of roots to influence the soil properties.
W (Wet/ Waterbearing):	Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.			Hemic Peat:	33 - 67%	Trace roots:	Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.
F (Frozen):	Soil frozen			Sapric Peat:	Less than 33%		



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DULUTH IAP, MINNESOTA

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THIS SQUARE APPEARS 1/2" x
1/2" ON FULL SIZE SHEETS.

NO DATE REVISION

PROJECT NAME

RIDGEVIEW ROAD
INFRASTRUCTURE

FWMM052398

DRAWING TITLE

SOIL BORINGS

FILE: ..120064630_DrawingsBase\120064630.PLAN (0).dwg

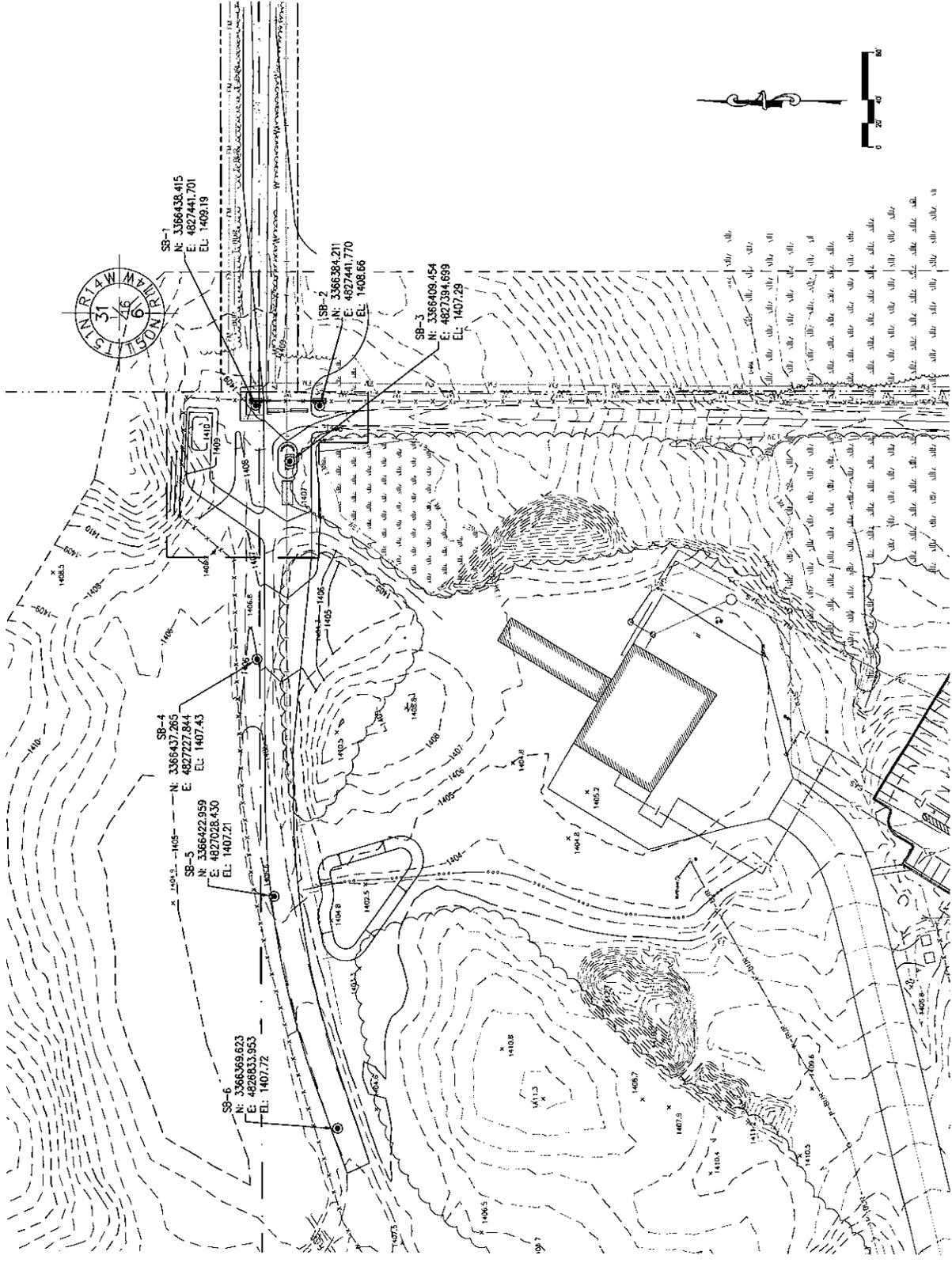
DRAWN BY: PAB

CHECKED BY: DGS

PROJ. NO.: 120064

DRAWING NO.:

SB1.00





SUBSURFACE BORING LOG

AET JOB NO: **07-05347**

LOG OF BORING NO. **SB-1 (p. 1 of 1)**

PROJECT: **MnANG New Entrance Guard Shack; Ridgeview Road; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: 1409.2 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
1	FILL, gravelly sand with silt, dark brown, frozen	FILL			SU						
2	FILL, sandy silt, a little gravel, brown, with fabric, frozen										
3			38	F/M	SS	3					
4	CLAY WITH SAND, a little gravel, brown, firm (CL)	FINE ALLUVIUM									
5			7	M/W	SS	5					
6											
7	SILT, brown, moist, medium dense (ML)		18	M	SS	6					
8											
9											
10	SILT WITH SAND, a little gravel, brown, moist, medium dense (ML)		25	M	SS	6					
11											
12	SAND, fine to medium grained, dark brown, wet, loose (SP)	COARSE ALLUVIUM									
13			10	W	SS	6					
14											
15	SILTY SAND, a little gravel, dark brown, moist, dense (SM)	TILL									
16			32	M	SS	12					
16	END OF BORING AT 16.0 FEET <i>Boring backfilled with auger cuttings</i>										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-14½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		12/18/13		13.5	12.0	12.0	--	11.0	
		12/18/13		16.0	14.5	14.5	--	11.0	
BORING COMPLETED:	12/18/13	12/18/13		16.0	--	10.0	--	6.0	
DR: LA	LG: SW	Rig: 51							



SUBSURFACE BORING LOG

AET JOB NO: 07-05347

LOG OF BORING NO. SB-2 (p. 1 of 1)

PROJECT: MnANG New Entrance Guard Shack; Ridgeview Road; Duluth, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>1408.7</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
1	FILL, gravel with sand and silt, frozen above about 1 foot	FILL		F/M	SU						
2	FILL, silty sand, a little gravel, trace roots, dark brown, with fabric	FILL	10	M	SS	5					
3											
4	CLAYEY SAND WITH GRAVEL, brown, moist, loose (SC)	TILL	6	M	SS	10					
5											
6	SILT WITH SAND, brown, moist, medium dense (ML)		20	M	SS	14					
7											
8	SANDY SILT, a little gravel, dark brown, moist, dense to very dense (ML)		33	M	SS	10					
9											
10			25	M	SS	4					
11											
12			48	M	SS	6					
13											
14											
15											
16	END OF BORING AT 16.0 FEET <i>Boring backfilled with auger cuttings</i>										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-14 1/2'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		12/18/13		16.0	14.5	16.0	--	None	
BORING COMPLETED:	12/18/13								
DR:	LA LG: SW Rig: 51								



SUBSURFACE BORING LOG

AET JOB NO: **07-05347**

LOG OF BORING NO. **SB-3 (p. 1 of 1)**

PROJECT: **MnANG New Entrance Guard Shack; Ridgeview Road; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: <u>1407.3</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
1	FILL, gravel with silty clayey sand, brown, frozen	FILL		F	SU						
2	FILL, clayey sand, a little gravel, trace roots, dark brown		9	M	SS	6					
3											
4											
5				▼							
6				M/W	SS	6					
7											
8	SILTY CLAYEY SAND, a little gravel, dark brown, moist, loose to medium dense (SC-SM)	TILL	6	M	SS	8					
9											
10				▼							
11				M/W	SS	10					
12	SILTY SAND WITH GRAVEL, dark brown, moist to wet, medium dense (SM)		23	M	SS	12					
13											
14											
15											
16				W	SS	6					
16	END OF BORING AT 16.0 FEET <i>Boring backfilled with auger cuttings</i>										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-14'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		12/18/13		16.0	14.5	14.5	--	10.0	
		12/18/13		16.0	--	10.0	--	5.0	
BORING COMPLETED: 12/18/13									
DR: LA LG: SW Rig: 51									



SUBSURFACE BORING LOG

AET JOB NO: **07-05347**

LOG OF BORING NO: **SB-4 (p. 1 of 1)**

PROJECT: **MnANG New Entrance Guard Shack; Ridgeview Road; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: 1407.4 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
1	FILL, sand with silt, gravel, and bituminous, black, frozen	FILL	120/0.5	F	SS						
2	FILL, gravelly sand with silt, with fabric between about 1.5 to 2 feet, frozen			F	SU						
3	FILL, silty sand with gravel, trace roots, brown, frozen		64	F	SS	12					
4											
5	SILT WITH SAND, trace roots, dark grayish brown, moist, loose (ML)	FINE ALLUVIUM TILL	5	M	SS	2					
6	SANDY SILT, a little gravel, dark grayish brown, moist, medium dense (ML)		12	M	SS	14					
7	END OF BORING AT 7.5 FEET <i>Boring backfilled with auger cuttings</i>										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-4½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		12/18/13		7.5	4.5	7.5	--	None	
BORING COMPLETED: 12/18/13									
DR: LA LG: SW Rig: 51									



SUBSURFACE BORING LOG

AET JOB NO: 07-05347 LOG OF BORING NO. SB-5 (p. 1 of 1)
 PROJECT: MnANG New Entrance Guard Shack; Ridgeview Road; Duluth, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>1407.2</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%#200
1	FILL, sand with silt and gravel, black, frozen	FILL	23	F/M	SU	14					
2	FILL, gravelly sand with silt, dark brown, with fabric at about 1.5 feet, frozen										
3	FILL, silty sand with gravel, trace roots, dark brown, frozen above about 3 feet										
4											
5	SILTY SAND WITH GRAVEL, brown, moist, loose (SM)	TILL	6	M	SS	12					
6	END OF BORING AT 6.0 FEET <i>Boring backfilled with auger cuttings</i>										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-4½'	3.25" HSA	12/18/13		6.0	4.5	6.0	--	None	
BORING COMPLETED: 12/18/13									
DR: LA LG: SW Rig: 51									



SUBSURFACE BORING LOG

AET JOB NO: **07-05347**

LOG OF BORING NO. **SB-6 (p. 1 of 1)**

PROJECT: **MnANG New Entrance Guard Shack; Ridgeview Road; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: <u>1407.7</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
1	FILL, gravel with sand and bituminous, black, frozen	FILL	30	F/M	SU	12					
2	FILL, gravelly sand with silt, dark brown, frozen										
3	FILL, silty sand with gravel, trace roots, dark brown, frozen above about 3-1/2 feet										
4	SILTY SAND WITH GRAVEL, brown, moist, medium dense (SM)	TILL	16	M	SS	12					
5											
6	END OF BORING AT 6.0 FEET <i>Boring backfilled with auger cuttings</i>										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-4 1/2'	3.25" HSA	12/18/13		6.0	4.5	6.0	--	None	
BORING COMPLETED: 12/18/13									
DR: LA LG: SW Rig: 51									

Appendix B

AET Project No. 07-05347

Geotechnical Report Limitations and Guidelines for Use

Geotechnical Report Limitations and Guidelines for Use

AET Project No. 07-05347

B.1 REFERENCE

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by ASFE¹, of which, we are a member firm.

B.2 RISK MANAGEMENT INFORMATION

B.2.1 Geotechnical Services are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. And no one, not even you, should apply the report for any purpose or project except the one originally contemplated.

B.2.2 Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

B.2.3 A Geotechnical Engineering Report is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typically factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, always inform your geotechnical engineer of project changes, even minor ones, and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

B.2.4 Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. Do not rely on a geotechnical engineering report whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

¹ ASFE, 8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 : www.asfe.org

Geotechnical Report Limitations and Guidelines for Use

AET Project No. 07-05347

B.2.5 Most Geotechnical Findings Are Professional Opinions

Site exploration identified subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

B.2.6 A Report's Recommendations Are Not Final

Do not overrely on the construction recommendations included in your report. Those recommendations are not final, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

B.2.7 A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

B.2.8 Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

B.2.9 Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In the letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need to prefer. A prebid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

B.2.10 Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their report. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

B.2.11 Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated environmental problems have led to numerous project failures. If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. Do not rely on an environmental report prepared for someone else.

INSTRUCTIONS TO BIDDERS

- 1) Use of Separate Bid Forms These contract documents include a complete set of bidding and contract forms which are for the convenience of bidders and are not to be detached from the contract document, completed, or executed. **Separate copies of bid forms are furnished for that purpose.**
- 2) Interpretations or Addenda No oral interpretation will be made to any bidder as to the meaning of the contract documents or any part thereof. Every request for such an interpretation shall be made in writing to the city of Duluth. Any inquiry received seven or more days prior to the date fixed for opening of bids will be given consideration. Every interpretation made to a bidder will be in the form of an addendum to the contract documents, and when issued, will be on file in the office of the city engineer at least five days before bids are opened. In addition, all addenda will be mailed to each person holding contract documents, but it shall be the bidder's responsibility to make inquiry as to the addenda issued. All such addenda shall become part of the contract and all bidders shall be bound by such addenda, whether or not received by the bidders.
- 3) Inspection of Site Each bidder should visit the site of the proposed work and fully acquaint himself with the existing conditions there relating to construction and labor, and should fully inform himself as to the facilities involved, the difficulties, and the restrictions attending the performance of the contract. The bidder should thoroughly examine and familiarize himself with the drawings, technical specifications, and all other contract documents. The contractor, by the execution of the contract, shall in no way be relieved of any obligation under it due to his failure to receive or examine any form or legal instrument or to visit the site and acquaint himself with the conditions there existing; the city of Duluth will be justified in rejecting any claim based on facts regarding which he should have been on notice as a result thereof.
- 4) Alternative Bids No alternative bids or bid items will be considered unless alternative bids are specifically requested by the technical specifications.
- 5) Bids
 - a) All bids must be submitted on forms supplied by the city engineer and shall be subject to all requirements of the contract documents, including the drawings, and these **Instructions to Bidders**. All bids must be regular in every respect; no interlineations, excisions, or special conditions shall be made or included in the bid form by the bidder.
 - b) Bid documents, including the bid and the bid guaranty, shall be enclosed in an envelope which shall be sealed and clearly labeled with the project number, if any, name of bidder, and date and time of bid opening, in order to guard against premature opening of the bid. If the proposal is mailed, this envelope shall be placed in another envelope which shall be sealed and labeled with project number, if any, name of bidder, and date and time of bid opening -- and addressed to city of Duluth purchasing manager, room 100 City Hall, Duluth, Minnesota 55802.
 - c) The city of Duluth may consider as irregular any bid on which there is an alteration of or departure from the bid form hereto attached and, at its option, may reject the same.
 - d) If the project is awarded, it will be awarded by the city of Duluth to the lowest responsible bidder assuming that the bids are within funds available based on the lowest base bid and or in combination with selected alternates (if any). The alternates will be accepted in descending order. By the award of the contract, it is assumed that the work will be completed within the time-frame as specified within the contract documents.
 - e) Each bidder shall include in his bid the following information:
 - Principals – names, home addresses including city, state, and zip code
 - Firm – name, federal i.d. number, address, city, state, and zip code
 - Mechanical & Electrical Subcontractors -- names of firms that will do the mechanical and electrical work and the amounts of the mechanical and electrical sub-bids, if applicable and when (where indicated on Bid Proposal form).
- 6) Bid Guaranty
 - a) The bid must be accompanied by a bid guaranty which shall not be less than five percent (5%) of the amount of the bid. At the option of the bidder, the guaranty may be a certified check, bank draft, negotiable U.S. Government bond (at par value), or a bid bond. No bid will be considered unless it is accompanied by the required guaranty. Certified check or bank draft must be made payable to the order of the city of Duluth, Minnesota. Cash deposits will not be accepted. The bid guaranty shall insure the execution of the agreement and the furnishing of the surety bond or bonds by the successful bidder, all as required by the contract documents.

- b) Revised bids submitted before the opening of bids, whether forwarded by mail, fax, or in person, if representing an increase in excess of two percent (2%) of the original bid, must have bid guaranty adjusted accordingly; otherwise, the bid will not be considered.
- c) Certified checks or bank drafts, or the amount thereof, bid bonds, and negotiable U.S. Government bonds of unsuccessful bidders, will be returned as soon as practical after the opening of bids.
- 7) Collusive Agreements
- a) The successful bidder on each city of Duluth construction project shall be required to execute a city of Duluth non-collusive affidavit to the effect that he has not entered into a collusive agreement with any other person, firm, or corporation in regard to any bid submitted.
- b) Before executing any subcontract, the successful bidder shall submit the name of any proposed subcontractor for prior approval on the MnDOT Request to Sublet Form TP-21834 (standard specification 1801).
- 8) Unit Prices The unit price, for each of the several items in the proposal of each bidder, shall include its prorata share of overhead so that the sum of the products obtained by multiplying the quantity shown for each item by the unit price bid represents the total bid. Any bid not conforming to this requirement may be rejected as informal. The special attention of all bidders is called to this provision; for should conditions make it necessary to revise the quantities, no limit will be fixed for such increased or decreased quantities nor extra compensation allowed, provided the net monetary value of all such additive and subtractive changes in quantities of such items of work (i.e., difference in cost) shall not increase or decrease the original contract price by more than twenty-five percent (25%) on major bid items, except for work not covered in the drawings and technical specifications.
- 9) Corrections Erasures or other changes in the bids must be explained or noted over the signature of the bidder.
- 10) Time for Receiving Bids
- a) Bids received prior to the advertised hour of opening will be securely kept, sealed. The officer, whose duty it is to open them, will decide when the specified time has arrived and no bid received thereafter will be considered; except that when a bid arrives by mail after the time fixed for opening, but before the reading of all other bids is completed, and it is shown to the satisfaction of the city purchasing office that the non-arrival on time was due solely to delay in the mails for which the bidder was not responsible, such bid will be received and considered.
- b) Bidders are cautioned that, while fax modifications of bids may be received as provided above, such modifications, if not explicit and if in any sense subject to misinterpretation, shall make the bid so modified or amended, subject to rejection.
- 11) Opening of Bids At the time and place fixed for the opening of bids, the city purchasing manager will cause to be opened and publicly read aloud every bid received within the time set for receiving bids, irrespective of any irregularities therein. Bidders and other persons properly interested may be present in person or by representative.
- 12) Withdrawal of Bids Bids may be withdrawn on written or faxed request dispatched by the bidder in time for delivery in the normal course of business to the time fixed for opening; provided, that written confirmation of any faxed withdrawal over the signature of the bidder is placed in the mail and postmarked prior to the time set for bid opening. The bid guaranty of any bidder withdrawing his bid in accordance with the foregoing conditions will be returned promptly.
- 13) Responsible Contractor Verification and Certification of Compliance The Department cannot award a construction contract in excess of \$50,000 unless the Bidder is a "responsible contractor" as defined in Minnesota Statutes §16C.285, subdivision 3. A Bidder submitting a Proposal for this Project must verify that it meets the minimum criteria specified in that statute by submitting the Responsible Contractor Verification and Certification of Compliance form. A company owner or officer must sign the Responsible Contractor Verification and Certification of Compliance form under oath verifying compliance with each of the minimum criteria. Bidders must obtain verifications of compliance from all subcontractors. A Bidder must submit signed copies of verifications and certifications of compliance from subcontractors upon the Department's request.
- A Bidder or subcontractor who does not meet the minimum criteria established in Minnesota Statutes §16C.285, subdivision 3, or who fails to verify compliance with the criteria, will not be a "responsible contractor" and will be ineligible to be awarded the Contract for this Project or to work on this Project. Making a false statement verifying compliance with any of the minimum criteria will render the Bidder or subcontractor ineligible to be awarded a

construction contract for this Project and may result in the termination of a contract awarded to a Bidder or subcontractor that makes a false statement.

A Bidder must also identify each subcontractor it intends to use on the Project. A Bidder must complete Attachment A-1 and submit it with the Responsible Contractor Verification and Certification of Compliance form, identifying each subcontractor it intends to use as of the time of bid submission. Include the project number specific to the bid on each form. The completed Certification Forms must be submitted with the Bid Proposal.

If the Bidder retains additional subcontractors after submitting its Responsible Contractor Verification and Certification of Compliance form, then the Bidder must submit Attachment A-2 within 14 days of retaining the additional subcontractor. Documents must be submitted to the Project Engineer. Include the project number specific to the bid on the form.

14) Award of Contract: Rejection of Bids

- a) The contract will be awarded to the responsible bidder submitting the lowest bid complying with the conditions of the Invitation to Bid. The bidder, to whom the award is made, will be notified at the earliest possible date. The city of Duluth, however, reserves the right to reject any and all such bids and to waive any informality in bids received whenever such rejection or waiver is in its interest.
- b) The city of Duluth reserves the right to consider as unqualified to do the work of general construction, any bidder who does not habitually perform with his own forces the major portions of the work involved in construction of the improvements embraced in the contract documents. A project labor agreement will be included in all contracts exceeding \$150,000.

15) Execution of Agreement: Performance and Payment Bond.

- a) Subsequent to the award and within ten (10) days after the prescribed forms are presented for signature, the successful bidder shall execute and deliver to the city of Duluth an agreement in the form as furnished by the City, in such number of copies as the city of Duluth may require.
- b) Having satisfied all conditions of award as set forth elsewhere in these documents, the successful bidder shall, within the period specified in paragraph "a" above, furnish:
 - 1) A performance bond for the use and benefit of the city of Duluth to complete the contract according to its terms, and conditioned on saving the city of Duluth harmless from all costs and charges that may accrue on account of completing the specified work; and
 - 2) A payment bond for the use and benefit of all persons furnishing labor and materials for the performance of the contract conditioned upon the payment, as they become due, of all just claims for labor and materials.

Both the performance bond and the payment bond shall be in a penal sum of not less than the amount of the contract awarded. Such bonds shall be in the same form as that included in the contract documents and shall bear the same date as, or a date subsequent to, that of the agreement. A current power of attorney for the person who signs for any surety company shall be attached to such bonds.

- c) The failure of the successful bidder to execute such agreement to supply the required bond or bonds within ten (10) days after the prescribed forms are presented for signature, or within such extended period as the city of Duluth may grant, based on reasons determined sufficient by the city of Duluth, shall constitute a default, and the city of Duluth may either award the contract to the next lowest responsible bidder or re-advertise for bids, and may charge against the bidder the difference between the amount of the bid and the amount for which a contract for the work is subsequently executed, irrespective of whether the amount thus due exceeds the amount of the bid bond. If a more favorable bid is received by re-advertising, the defaulting bidder shall have no claim against the city of Duluth for a refund.

16) Wages and Salaries

- a) Attention of bidders is particularly called to the requirements concerning the payment of not less than the prevailing wage and fringe benefit rates specified in the contract documents and the conditions of employment with respect to certain categories and classifications of employees.
- b) The rates of pay set forth in prevailing wage schedule(s) are *potentially* the minimums to be paid during the life of the contract. Project funding sources, bid opening date, contract award date, and the contract start date may be factors resulting in a change of prevailing wage schedules. It is, therefore, the responsibility of bidders to inform themselves as to local labor conditions, such as the length of work day hours in conjunction with the

project's funding sources, overtime compensation, health and welfare contributions, labor supply, and prospective changes or adjustments of rates. A project labor agreement will be included in all contracts exceeding \$150,000.

- 17) Equal Employment Opportunity Attention of bidders is particularly called to the requirement for ensuring that employees and applicants for employment are not discriminated against because of their race, color, religion, sex, or national origin. (See Supplementary General Conditions, Part II, Section 11).
- 18) Employment and Business Attention of bidders is particularly called to the requirement that, to the greatest extent feasible, opportunities for training and employment made possible by this project shall be given to lower income residents of the city of Duluth. Additionally, if any work is subcontracted, efforts should be made to award subcontracts to concerns located in or owned in substantial part by persons residing in the city of Duluth.
- 19) Sales and Use Taxes It is assumed that, in the preparation of his proposal, the bidder has taken into consideration his/her liability from any sales, use, or excise tax that might be assessed in the purchase of, storage, use, or consumption of any materials, services, or supplies for performance of the contract work. Any such tax paid by the contractor will be considered as his/her expense, for which no direct compensation will be made by the city to the contractor over and above the accepted bid.
- 20) Pre-Bid/Pre-Construction Meetings
 - a) Should a pre-bid meeting will be held, it will be conducted seven (7) days prior to the bid date (see **Invitation to Bid** for time and place). All potential bidders are encouraged to attend. All bidders will be allowed to make inquiries regarding the contract documents. All formal decisions will be documented by addendum.
 - b) Approximately seven (7) days after city council approval of contract award, the successful bidder is required to attend a pre-construction meeting. At this meeting, the successful bidder will present his/her construction schedule, cost breakdown, required submittals, etc.
- 21) Equal Employment Opportunity (EEO) Affirmative Action Police Statement and Compliance Certificate.
 - a) The successful bidder on each city of Duluth construction project shall be required to execute a certificate substantially in the form herein provided.
 - b) Before executing any subcontract in excess of \$2,500, the successful bidder shall require the subcontractor to execute a form similar in nature to the form herein provided.

DATA FOR LABOR COST BIDDING

NOTE:

Wage Decisions are subject to change due to lock-in rules and revisions near the bid opening.

Project No.: 1491

Name:

**Ridgeview Road Infrastructure
MnANG 148th Fighter Wing, Duluth, MN
FMKM062039B**

City Project Manager: Caroline Pedersen

Bid Opening Date: September 16, 2015

This project is funded by:

Federal funding

The base workweek:

OT after 40 hours per week

The project DOES NOT contain a *project labor agreement (PLA)*.

Should a project contain a project labor agreement:

- 1) Union scale may **not** be reflected in the prevailing wage schedule(s)
- 2) Note Article II Section 10 for trucking labor costs

OVERTIME REQUIREMENTS:

Overtime must be paid on hours worked in excess of 40 per week.

The overtime rate must be paid at NO LESS than the rate of pay as established in the project's wage decision multiplied by one and one-half OR the base rate the employee is being paid if it is higher than the wage decision base rate.

Project Prevailing Wage Decision:

**U S DOL Federal Building 7-31-15
U S DOL Federal Heavy 6-12-15**

General Decision Number: MN150041 07/31/2015 MN41

Superseded General Decision Number: MN20140041

State: Minnesota

Construction Type: Building

County: St Louis County in Minnesota.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Executive Order (EO) 13658 establishes an hourly minimum wage of \$10.10 for 2015 that applies to all contracts subject to the Davis-Bacon Act for which the solicitation is issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.10 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/02/2015
1	05/22/2015
2	05/29/2015
3	07/17/2015
4	07/31/2015

ASBE0049-007 06/01/2014

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Includes the application of all insulating materials, protective coverings, coatings & finishes to all types of mechanical systems).....	\$ 26.82	23.80

BOIL0647-007 01/01/2013

	Rates	Fringes
BOILERMAKER.....	\$ 32.40	25.37

BRMN0001-050 05/01/2015

ST LOUIS (Remaining Northern part)

Rates	Fringes
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TILE SETTER.....\$ 24.59 20.98

BRMN0003-008 05/01/2014

ST. LOUIS COUNTY (City of Duluth and South of a line between Townships #54 & #55, 2 miles north of Cotton)

Rates Fringes
BRICKLAYER.....\$ 32.20 20.10

BRMN0003-011 05/01/2008

ST. LOUIS (City of Duluth and south of Township Line 55)

Rates Fringes
TILE SETTER.....\$ 24.13 17.38

BRMN0016-002 05/01/2014

ST. LOUIS COUNTY (North of a line between Townships #54 & #55, 2 miles north of Cotton)

Rates Fringes
BRICKLAYER.....\$ 31.75 20.55

CARP0068-005 07/01/2012

Rates Fringes
SOFT FLOOR LAYER.....\$ 30.94 11.75

CARP0361-012 07/11/2011

DULUTH AREA including Alborn, Arnold, Bartlett, Birch, Brookstone, Canyon, Clinton, Culver, Floodwood, Gowan, Island, Kelsey, Lakewood, Meadowlands, Munger, Palmers, Payne, Prasit, Shaw, Taft)

Rates Fringes
CARPENTER (Including Acoustical Installation, Drywall Hanging, Form Work & Overhead Door Installation).....\$ 27.20 14.75

CARP0606-001 05/01/2012

EXCLUDING DULUTH AREA

Rates Fringes

CARPENTER (Including
 Acoustical Installation,
 Drywall Hanging, Form Work &
 Overhead Door Installation).....\$ 27.97 12.72

 ELEC0242-012 06/01/2014

ST. LOUIS (South part bounded on the north by the north line of
 Kelsey Township extended east & west)

	Rates	Fringes
ELECTRICIAN.....	\$ 32.54	24.07

 ELEC0294-006 06/01/2014

ST. LOUIS (North part bounded on the south by the south line of
 Ellsburg Township, extended east & west)

	Rates	Fringes
ELECTRICIAN.....	\$ 33.72	73.34%

 ENGI0049-045 05/01/2015

	Rates	Fringes
OPERATOR: Power Equipment		
GROUP 1.....	\$ 37.74	17.15
GROUP 2.....	\$ 37.40	17.15
GROUP 3.....	\$ 35.99	17.15
GROUP 4.....	\$ 35.65	17.15
GROUP 5.....	\$ 35.48	17.15
GROUP 6.....	\$ 33.97	17.15
GROUP 7.....	\$ 32.85	17.15
GROUP 8.....	\$ 30.84	17.15

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Truck & Crawler Crane with 200' of Boom & Over,
 including Jib (\$.50 premium with 300' of Boom & over,
 including jib); & Tower Crane 250' & Over.

GROUP 2: Truck & Crawler Crane with 150' of Boom, up to but
 not including 200' of Boom, including Jib; & Tower Crane
 200' & Over.

GROUP 3: Traveling Tower Crane; Truck & Crawler Crane, up to
 but not including 150' of Boom, including Jib; Tower Crane
 (Stationary) up to 200'; All-Terrain Vehicle Crane, Boom
 Truck over 100 ft.

GROUP 4: Backhoe/Track/Trackhoe, Hoist (3 drums or more);
 Overhead Crane (inside building perimeter), Excavator.

GROUP 5: Asphalt Spreader, Bulldozer, Curb Machine, Drill, Forklift, Compressor 450 CFM or over (2 or more machines); Boom Truck up to 100 ft, Loader over 1 cu yd, Hoist (1 or 2 drums); Mechanic; Milling Machine, Roller, Scraper, Tractor over D2.

GROUP 6: Bobcat/Skid Loader, Loader up to 1 cu. yd., Tractor D2 or similar size.

GROUP 7: Compressor 600 CFM or over, Crane Oiler.

GROUP 8: Oiler.

IRON0512-018 05/01/2015

	Rates	Fringes
IRONWORKER, ORNAMENTAL, REINFORCING, AND STRUCTURAL.....	\$ 31.04	23.45

LABO1091-011 01/01/2014

	Rates	Fringes
LABORER (ASBESTOS ABATEMENT) Removal from Floors, Walls & Ceilings.....	\$ 27.89	16.31

LABO1091-013 05/01/2012

ST. LOUIS (South of T 55 N)

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 21.95	14.93
GROUP 2.....	\$ 22.10	14.93
GROUP 3.....	\$ 22.35	14.93
GROUP 4.....	\$ 22.65	14.93

LABORER CLASSIFICATIONS

GROUP 1: Common or General, Asphalt Shoveler, Carpenter Tender, Form Stripping

GROUP 2: Vibrating Plate

GROUP 3: Pipelayer

GROUP 4: Mason Tender (Brick, Cement/Concrete)

LABO1097-008 05/01/2012

ST. LOUIS (North of T 55N)

	Rates	Fringes
LABORER		
GROUP 1.....	\$ 20.62	16.25
GROUP 2.....	\$ 21.02	16.25

LABORERS CLASSIFICATIONS

GROUP 1 - Common or General, Asphalt Shoveler, Carpenter Tender, Form Stripping, Mason Tender (Brick, Cement/Concrete)

GROUP 2 - Pipelayer, Vibrating Plate

PAIN0106-001 05/01/2013

	Rates	Fringes
GLAZIER.....	\$ 26.28	15.47

FOOTNOTE:

1 to 4 years service - 1 week paid vacation; 5 to 11 years - 2 weeks paid vacation; 11 years or more - 3 weeks paid vacation

PAIN0106-013 05/01/2014

	Rates	Fringes
Painters:		
New:		
Brush, Roller.....	\$ 28.81	15.27
Spray, Drywall Finisher/Taper.....	\$ 29.41	15.27
Repaint:		
Brush, Roller.....	\$ 27.31	15.27
Spray, Drywall Finisher/Taper.....	\$ 27.91	15.27

PLAS0633-024 05/01/2012

ST. LOUIS (North of White Face River) COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 26.71	14.64

PLAS0633-059 05/01/2012

CARLTON & ST. LOUIS (South of T 55N) COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 29.69	16.30

PLUM0011-019 05/12/2014

ST. LOUIS (South of an east-west line drawn through Cotton)

	Rates	Fringes
PLUMBER/PIPEFITTER.....	\$ 37.27	14.03

PLUM0589-007 05/01/2015

ST. LOUIS (North of an East- West line drawn through Cotton)

	Rates	Fringes
PLUMBER/PIPEFITTER		
Contracts \$90,000.00 and under.....	\$ 38.65	17.46
Contracts over \$90,000.00...	\$ 38.65	17.46

* ROOF0096-024 07/01/2015

ST. LOUIS (South of Hwy 16, excluding City of Forbes)

	Rates	Fringes
ROOFER.....	\$ 32.15	14.67

ROOF0096-025 05/01/2015

ST. LOUIS (Remaining Northern two-thirds)

	Rates	Fringes
ROOFER.....	\$ 28.89	11.13

SHEE0010-045 05/01/2009

ST. LOUIS (Southern one-third)

	Rates	Fringes
SHEET METAL WORKER (Including HVAC Duct Installation).....	\$ 31.61	16.52

SHEE0010-056 05/01/2008

ST. LOUIS (Northern two-thirds)

	Rates	Fringes
SHEET METAL WORKER (Including HVAC Duct Installation).....	\$ 29.99	16.08

SUMN2009-050 07/27/2009

	Rates	Fringes
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LABORER: Landscape.....\$ 12.88 4.61
TRUCK DRIVER: Dump Truck.....\$ 19.15 5.70

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and

non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations

Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

General Decision Number: MN150105 06/12/2015 MN105

Superseded General Decision Number: MN20140105

State: Minnesota

Construction Type: Heavy

County: St Louis County in Minnesota.

HEAVY CONSTRUCTION PROJECTS

Note: Executive Order (EO) 13658 establishes an hourly minimum wage of \$10.10 for 2015 that applies to all contracts subject to the Davis-Bacon Act for which the solicitation is issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.10 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/02/2015
1	05/22/2015
2	06/12/2015

BOIL0647-004 01/01/2013

	Rates	Fringes
BOILERMAKER.....	\$ 32.40	25.37

CARP0361-020 07/11/2011

ST LOUIS COUNTY (Southern 1/3 including Cotton, Floodwood, Fond Du Lac, and Proctor)

	Rates	Fringes
CARPENTER (Including Form Work).....	\$ 31.07	15.80

CARP0361-021 07/11/2011

ST LOUIS (Duluth)

	Rates	Fringes
CARPENTER (Including Form Work).....	\$ 31.47	15.80

CARP0606-010 05/01/2011

ST LOUIS COUNTY (Northeast 2/3 including Cook, Cusson, Ely; and Western part including Chisholm, Greaney, and Orr)

	Rates	Fringes
CARPENTER (Including Form Work).....	\$ 31.07	15.80

ELEC0242-012 06/01/2014

ST. LOUIS (South part bounded on the north by the north line of Kelsey Township extended east & west)

	Rates	Fringes
ELECTRICIAN.....	\$ 32.54	24.07

ELEC0294-006 06/01/2014

ST. LOUIS (North part bounded on the south by the south line of Ellsburg Township, extended east & west)

	Rates	Fringes
ELECTRICIAN.....	\$ 33.72	73.34%

ENGI0049-064 05/01/2015

	Rates	Fringes
OPERATOR: Power Equipment		
Group 2.....	\$ 33.78	17.90
Group 3.....	\$ 33.23	17.90
Group 4.....	\$ 32.93	17.90
Group 5.....	\$ 29.89	17.90
Group 6.....	\$ 28.68	17.90

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 2: Crane with over 135' Boom, excluding jib; Dragline & Hydraulic Backhoe with shovel-type controls, 3 cubic yards and over; Grader/Blade finishing earthwork and bituminous.

GROUP 3: Dragline & Hydraulic Backhoe with shovel-type controls up to 3 cubic yards; Loader 5 cu yd and over; Mechanic; Tandem Scraper; Truck Crane; Crawler Crane

GROUP 4: Bituminous Roller 8 tons & over; Crusher/Crushing Plant; Drill Rig; Elevating Grader; Loader over 1 cu yd; Grader; Pump; Scraper up; to 32 cu yd; Farm Tractor with Backhoe attachment; Skid Steer Loader over 1 cu yd with Backhoe attachment; Bulldozer over 50 hp.

GROUP 5: Bituminous Roller under 8 tons; Bituminous Rubber Tire Roller; Loader up to 1 cu yd; Bulldozer 50 hp or less.

GROUP 6: Oiler; Self-Propelled Vibrating Packer 35 hp and over.

CRANE OVER 135' BOOM, EXCLUDING JIB - \$.25 PREMIUM;
 CRANE OVER 200' BOOM, EXCLUDING JIB - \$.50 PREMIUM

UNDERGROUND WORK:
 UNNELS, SHAFTS, ETC. - \$.25 PREMIUM
 UNDER AIR PRESSURE - \$.50 PREMIUM

HAZARDOUS WASTE PROJECTS (PPE Required):
 LEVEL A - \$1.25 PREMIUM
 LEVEL B - \$.90 PREMIUM
 LEVEL C - \$.60 PREMIUM

 IRON0512-028 05/01/2015

	Rates	Fringes
IRONWORKER, STRUCTURAL AND REINFORCING.....	\$ 31.04	23.45

 LABO1091-006 05/01/2014

ST LOUIS (South of T. 55 N)

	Rates	Fringes
LABORERS		
(1) Common or General.....	\$ 26.97	16.21
(2) Mason Tender		
Cement/Concrete.....	\$ 27.17	16.21
(6) Pipe Layer.....	\$ 29.47	16.21

 LABO1091-007 05/01/2014

SOUTHERN ST. LOUIS COUNTY

	Rates	Fringes
LABORER		
Common or General (Natural Gas Pipeline only).....	\$ 26.97	16.21

 LABO1097-002 05/01/2014

NORTHERN ST. LOUIS COUNTY

	Rates	Fringes
LABORER		
Common or General (Natural		

Gas Pipeline only).....\$ 25.02 18.16

LAB01097-005 05/01/2014

ST LOUIS (North of T. 55 N)

	Rates	Fringes
LABORERS		
(1) Common or General.....	\$ 25.02	18.16
(2) Mason Tender		
Cement/Concrete.....	\$ 25.22	18.16
(6) Pipe Layer.....	\$ 27.52	18.16

PLAS0633-036 05/01/2012

ST. LOUIS COUNTY (North of T 55N)

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 26.71	14.64

PLAS0633-039 05/01/2012

ST. LOUIS COUNTY (South of T 55N)

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 32.78	16.80

* TEAM0160-018 05/01/2015

	Rates	Fringes
TRUCK DRIVER (DUMP)		
(1) Articulated Dump Truck..	\$ 28.70	15.20
(2) 3 Axles/4 Axles; 5 Axles receive \$0.30 additional per hour.....	\$ 28.15	15.20
(3) Tandem Axles; & Single Axles.....	\$ 28.05	15.20

SUMN2009-072 09/28/2009

	Rates	Fringes
LABORER: Landscape.....	\$ 12.88	4.61

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after

award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

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200 Constitution Avenue, N.W.
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END OF GENERAL DECISION

City of Duluth

Indemnification & Insurance Requirements

(Updated February 16, 2011)

(Please Be Sure These Requirements Can Be Met before Submitting Your Response)

INDEMNIFICATION CLAUSE

The Contractor will defend, indemnify and save the City harmless from all costs, charges, damages, and loss of any kind that may grow out of the matter covered by this contract. Said obligation does not include indemnification of the City for claims of liability arising out of the sole negligent or intentional acts or omissions of City but shall include but not be limited to the obligation to defend, indemnify and save harmless the City in all cases where claims of liability against the City arise out of acts or omissions of City which are derivative of the negligence or intentional acts or omissions of Contractor such as, and including but not limited to, the failure to supervise, the failure to warn, the failure to prevent such act or omission by Contractor and any other such source of liability. In addition, Contractor will comply with all local, state and federal laws, rules and regulations applicable to this contract and to the work to be done and things to be supplied hereunder.

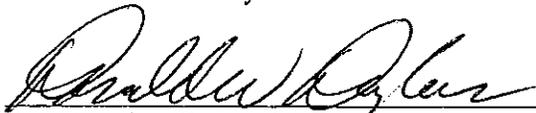
INSURANCE

- a. Contractor shall provide the following minimum amounts of insurance from insurance companies authorized to do business in the state of Minnesota, which insurance shall indemnify Contractor and City from all liability described in the paragraph above, subject to provisions of subparagraph below.
 - (1) Worker's compensation in accordance with the laws of the state of Minnesota.
 - (2) Public Liability and Automobile Liability Insurance with limits not less than **\$1,500,00** Single Limit, and twice the limits provided when a claim arises out of the release or threatened release of a hazardous substance; shall be in a company approved by the city of Duluth; and shall provide for the following: Liability for Premises, Operations, Completed Operations, Independent Contractors, and Contractual Liability.
 - (3) City of Duluth shall be named as **Additional Insured** under the Public Liability, Excess/Umbrella Liability* and Automobile Liability, or as an alternate, Contractor may provide Owners-Contractors Protective policy, naming itself and the City of Duluth. Contractor shall also provide evidence of Statutory Minnesota Worker's Compensation Insurance. Contractor to provide Certificate of Insurance evidencing such coverage with 30-days notice of cancellation, non-renewal or material change provisions included. The City of Duluth does not represent or guarantee that these types or limits of coverage are adequate to protect the Contractor's interests and liabilities.

**An umbrella policy with a "following form" provision is acceptable if written verification is provided that the underlying policy names the City of Duluth as an additional insured.*

- (4) If a certificate of insurance is provided, the form of the certificate shall contain an unconditional requirement that the insurer notify the City without fail not less than 30 days prior to any cancellation, non-renewal or modification of the policy or coverages evidenced by said certificate and shall further provide that failure to give such notice to City will render any such change or changes in said policy or coverages ineffective as against the City.
 - (5) **The use of an "Acord" form as a certificate of insurance shall be accompanied by two forms – 1) ISO Additional Insured Endorsement (CG-2010 pre-2004) and 2) Notice of Cancellation Endorsement (IL 7002) or equivalent, as approved by the Duluth City Attorney's Office.**
- b. The insurance required herein shall be maintained in full force and effect during the life of this Agreement and shall protect Contractor, its employees, agents and representatives from claims and damages including but not limited to personal injury and death and any act or failure to act by Contractor, its employees, agents and representatives in the negligent performance of work covered by this Agreement.
 - c. Certificates showing that Contractor is carrying the above described insurance in the specified amounts shall be furnished to the City prior to the execution of this Contract and a certificate showing continued maintenance of such insurance shall be on file with the City during the term of this Contract.
 - d. The City shall be named as an additional insured on each liability policy other than the workers' compensation policies of the Contractor.
 - e. The certificates shall provide that the policies shall not be changed or canceled during the life of this Contract without at least 30 days advanced notice being given to the City.
 - f. Contractor shall be required to provide insurance meeting the requirements of this Paragraph unless Contractor successfully demonstrates to the satisfaction of the City Attorney, in the exercise of his or her discretion, that such insurance is not reasonably available in the market. If Contractor demonstrates to the satisfaction of the City Attorney that such insurance is not reasonably available, the City attorney may approve an alternative form of insurance which is reasonably available in the market which he or she deems to provide the highest level of insurance protection to the City which is reasonably available.

Procedure verified by:



Don Douglas, Claims Adjuster
Duluth City Attorney's Office

Date

9/20/12

PRE-2004 CG 2010

A. **Section II - Who Is an Insured** is amended to include as an insured the person or organization shown in the Schedule, but only with respect to liability arising out of your ongoing operations performed for that insured.

NOTICE OF CANCELLATIONS ENDORSEMENT IL-7002 (10-90)

All Coverage Parts included in this policy are subject to the following condition: If we cancel this policy for any reason other than non-payment of premium, we will mail advance notice to the person(s) or organization(s) as shown in the Schedule.

Schedule	
Person or Organization (Name and Address)	Advance Notice (Days)
City of Duluth Purchasing Division Room 100 City Hall 411 West First Street Duluth, MN 55802	30



REQUEST FOR BID
 DATE 8/20/2015
 BID # 15-0558

RETURN BY BID OPENING TIME TO:

PURCHASING DIVISION
 100 CITY HALL
 Duluth, MN 55802

PHONE: 218-730-5340
 FAX: 218-730-5921

**Ridgeview Road Infrastructure
 MnANG - 148th Fighter Wing, Duluth, MN
 FMKM062039B
 City Project No. 1491**

BID OPENING DATE AT 2:00 P.M. ON WEDNESDAY, SEPTEMBER 16, 2015

Note: all bids must be written, signed and transmitted in a sealed envelope, plainly marked with the bid number, subject matter, and opening date. The City of Duluth reserves the right to split award where there is a substantial savings to the City, waive informalities and to reject any and all bids. Bidder should state in proposal if bid price is based on acceptance of total order. Sales tax is not to be included in the unit price. Bidder to state freight chargers if the proposal F.O.B. is shipping point, freight not allowed. Low bid will not be the only consideration for award of bid. All pages shall be signed or initialed by authorized bidder's representative as indicated at the bottom of the page(s) of the request for bid form.

RETURN BID IN DUPLICATE WITH DUPLICATE DESCRIPTIVE LITERATURE
 FOR BID RESULTS, ENCLOSE A SELF-ADDRESSED, STAMPED ENVELOPE WITH BID

BID DEPOSIT REQUIREMENTS: 5% OF BID AMOUNT

Deposit shall mean cash, cashier's check or corporate surety bond payable to or in favor of the City of Duluth.

A PERFORMANCE BOND AND A PAYMENT BOND shall be required of the successful bidder, BOTH in the full amount of the bid.

INSUREANCE CERTIFICATE required per attached requirements.

Designated F.O.B. Point:

Engineering Division	Tax:	Federal Excise Tax Exemption
Jobsite(s)		Account No. 41-74-0056 K

Vendor Email Address: _____ FREIGHT CHARGE \$ _____

NAME: _____ TOTAL BID PRICE # _____

ADDR1: _____ TO INCLUDE ANY ADDITIONAL PAGES.

ADDR2: _____

ADDR3: _____

BY: _____ PAYMENT TERMS \$ _____

(Print) _____ (Title) _____ F.O.B. POINT \$ _____

(Signature) _____ (Tele. #) _____ DELIVERY DATE \$ _____

****NOTE: Please self-identify as an MBE ____ or WBE ____ by checking if applicable.**

The City of Duluth is an Equal Opportunity Employer.

C I T Y O F D U L U T H

DATE: 8/20/2015

BID #: 15-0558

*****SCHEDULE OF PRICES*****

Ridgeview Road Infrastructure

City Project No. 1491

Bid No. 15-0558

Make all extensions and total the bid.

Item No.	Spec. #	Qty	U/OM	Item Description	Unit Price	Total Price
				All Costs to Construct Ridgeview Road Infrastructure Project		
001		1	Lump Sum		\$ _____	\$ _____
						TOTAL \$ _____

ADDENDUM RECEIPT ACKNOWLEDGEMENTS:

ADDENDUM NO. _____, DATED _____

ADDENDUM NO. _____, DATED _____

ADDENDUM NO. _____, DATED _____

TOTAL BID IN WORDS:

CONTRACTOR NAME:

THE CONTRACTOR AGREES TO ALL OF THE PROVISIONS CONTAINED IN THE CONTRACT DOCUMENTS. ENCLOSED HEREWITH FIND A CERTIFIED CHECK OR BID BOND IN THE AMOUNT OF AT LEAST 5% OF THE AMOUNT OF PROPOSAL MADE PAYABLE TO THE CITY OF DULUTH AS A PROPOSAL GUARANTEE WHICH IT
(see additional page(s))

(Initial)

C I T Y O F D U L U T H

DATE: 8/20/2015
 BID #: 15-0558

IS AGREED BY THE UNDERSIGNED WILL BE FORFEITED IN THE EVENT THE FORM OF CONTRACT AND BOND IS NOT EXECUTED, IF AWARDED TO THE UNDERSIGNED.

The bidder hereby certifies that he/she has received or viewed on-line the 2015 edition of the City of Duluth Public Works/Utilities Department Engineering Division Construction Standards including supplements and has incorporated the terms hereof in its bid.

SIGNED: _____ FOR

 A PARTNERSHIP (OR)

 A CORPORATION INCORPORATED UNDER THE LAWS OF THE STATE OF:

PRESIDENT _____
 VICE-PRES. _____
 SECRETARY _____
 TREASURER _____

ADDRESS (ES) _____

BEING DULY SWORN, DEPOSES AND SAYS THAT THERE ARE NO OTHER PERSONS COMPRISING ABOVE COMPANY OR FIRM THAN THE ABOVE NAMES, AND THAT THERE ARE NO PERSONS OR CORPORATIONS INTERESTED IN THE FORGOING PROPOSALS, EITHER AS PRINCIPAL OR SUBCONTRACTOR, OTHER THAN THE ABOVE NAMES; ALSO THAT THE PROPOSALS ARE MADE WITHOUT ANY CONNECTION WITH ANY PERSON OR PERSONS MAKING ANY PROPOSAL FOR THE ABOVE WORK; THAT THEY ARE IN ALL RESPECTS FAIR AND WITHOUT COLLUSION OR FRAUD; AND THAT NO PERSON ACTING IN ANY OFFICIAL CAPACITY FOR THE CITY OF DULUTH IS DIRECTLY OR INDIRECTLY INTERESTED THEREIN, OR IN ANY PORTION OF THE PROFIT THEREOF.

(see additional page(s))

 (Initial)

AFFIDAVIT AND INFORMATION REQUIRED OF BIDDERS

Affidavit of Non-Collusion:

I hereby swear (or affirm) under penalty of perjury:

- 1) That I am the bidder (if the bidder is an individual), a partner in the bidder (if the bidder is a partnership), or an officer or employee of the bidding corporation having authority to sign on its behalf (if the bidder is a corporation);
- 2) That the attached bid or bids have been arrived at by the bidder independently and have been submitted without collusion with and without agreement, understanding, or planned common course of action with any other vendor or materials, supplied, equipment or services described in the invitation to bid, designed to limit independent bidding or competition;
- 3) That the contents of the bid or bids have not been communicated by the bidder or its employees or agents to any person not an employee or agent of the bidder or its surety on any bond furnished with the bid or bids and will not be communicated to any such person prior to the official opening of the bid or bids; and
- 4) That I have fully informed myself regarding the accuracy of the statements made in this affidavit.

Signed: _____

Firm Name: _____

Subscribed and sworn to me before this ____ day of _____, _____

NOTARY PUBLIC _____

My commission expires: _____

Bidder's E.I. Number _____
(Number used on employer's quarterly Federal Tax return)

**EQUAL EMPLOYMENT OPPORTUNITY (EEO) AFFIRMATIVE ACTION
POLICY STATEMENT & COMPLIANCE CERTIFICATE**

TO: City of Duluth, Minnesota **PROJECT NUMBER & DESCRIPTION** _____

FROM: _____

(FIRM's name, address, telephone number)

A) Employment: It is the policy of the above named FIRM to afford equal opportunity for employment to all individuals regardless of race, color, creed, religion, national origin, ancestry, age, sex, marital status, status with respect to public assistance and/or disability. The FIRM will take affirmative action to ensure that we will: (1) recruit, hire, and promote all job classifications without regard to race, color, creed, religion, national origin, ancestry, age, sex, marital status, status with respect to public assistance, and/or disability, except where sex is a bona fide occupational qualification; (2) base decisions on employment so as to further the principle of equal employment opportunity; (3) ensure that promotion decisions are in accord with the principles of equal employment opportunity by imposing only valid requirements for promotional opportunities; (4) ensure that all personnel actions such as compensation, benefits, transfers, layoffs, return from layoff, FIRM sponsored training, education tuition assistance, social and recreational programs will be administered without regard to race, color, creed, religion, national origin, ancestry, age, sex, marital status, status with respect to public assistance, and/or disability. The FIRM also intends full compliance with Veteran affirmative action requirements. Additionally, minority and female employees shall be encouraged to participate in all FIRM activities and refer applicants.

I have designated (name) _____ to direct the establishment of and to monitor the implementation of personnel procedures to guide the FIRM's affirmative action program. Where PROJECTS exceed \$500,000, this official shall also serve as the liaison officer that administers the FIRM's "Minority Business Enterprise Program." This official is charged with designing and implementing audit and reporting systems that will keep management informed on a monthly basis of the status of the equal opportunity area.

Supervisors have been made to understand that their work performance is being evaluated on the basis of their equal opportunity efforts and results, as well as other criteria. It shall be the responsibility of the FIRM and its supervisors to take actions to prevent harassment of employees placed through affirmative action efforts.

B) Reports: Unless exempted by law and regulation, the FIRM shall make available and file those reports related to equal opportunity as may be required by the City of Duluth and State and Federal compliance agencies. Requirements and Reports are defined in 41CFR60 "Compliance Responsibility for Equal Opportunity" published by the U. S. Department of Labor which is incorporated herein by reference. Additional requirements are defined in various State and Federal Civil Rights Legislation and Rules promulgated thereunder.

C) Nonsegregated Facilities: The FIRM certifies that it does not maintain or provide for its employees any segregated facilities at any of its establishments and that it does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The FIRM certifies that it will not maintain or provide for its employees any segregated facilities at any of its establishments and that it will not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The FIRM agrees that a breach of this

certification is a violation of the Equal Opportunity Clause in this certificate. As used in this Certification, the term "segregated facilities" means any waiting rooms, work area, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation for entertainment area, transportation, and housing facilities provided for employees which are segregated by explicit directive or are, in fact, segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise.

- D) Affirmative Action Compliance Program:** Unless exempted by regulation and law, the FIRM—if the FIRM has 50 or more employees and if the value of current contracts with the City of Duluth exceeds \$50,000—shall prepare and maintain a written affirmative action compliance program that meets the requirement as set forth in 41CFR60.
- E) Non-Compliance:** The FIRM certifies that it is not currently in receipt of any outstanding letters of deficiencies, show cause, probable cause, or other such notification of non-compliance with EEO Laws and Regulations.
- F) Employment Goals - "Construction" Projects:** It shall be the goal of the FIRM if the PROJECT is of a construction nature that in all on-site employment generated that no less than 3% of the on-site workforce will be minority employees and that no less than 7% of the on-site workforce will be female employees. Further, it is the goal of the FIRM if the PROJECT is of a construction nature that in all on-site employment generated that no less than 3% of the work hours generated shall be worked by minority employees and that no less than 7% of the work hours generated shall be worked by female employees.
- G) Subcontractors:** The FIRM will for all its PROJECT subcontractors regardless of tier (unless exempted by law and regulation) that received in excess of \$2,500 require that: (1) the subcontractor shall execute an "EEO Statement and Certification" similar in nature to this "Statement and Certification", (2) said documentation to be maintained on file with the FIRM or subcontractor as may be appropriate.

Executed this _____ day of _____, 20__ by:

Printed name and title

Signature

NOTE: In addition to the various remedies prescribed for violation of Equal Opportunity Laws, the penalty for false statements is prescribed in 18 U.S.C. 1001.

ATTACHMENT A

RESPONSIBLE CONTRACTOR VERIFICATION AND CERTIFICATION OF COMPLIANCE

PROJECT TITLE: _____

Minn. Stat. § 16C.285, Subd. 7. **IMPLEMENTATION.** ... any prime contractor or subcontractor that does not meet the minimum criteria in subdivision 3 or fails to verify that it meets those criteria is not a responsible contractor and is not eligible to be awarded a construction contract for the project or to perform work on the project...

Minn. Stat. § 16C.285, Subd. 3. **RESPONSIBLE CONTRACTOR, MINIMUM CRITERIA.** "Responsible contractor" means a contractor that conforms to the responsibility requirements in the solicitation document for its portion of the work on the project and verifies that it meets the following minimum criteria:

- | | |
|-----|--|
| (1) | The Contractor: <ul style="list-style-type: none">(i) is in compliance with workers' compensation and unemployment insurance requirements;(ii) is currently registered with the Department of Revenue and the Department of Employment and Economic Development if it has employees;(iii) has a valid federal tax identification number or a valid Social Security number if an individual; and(iv) has filed a certificate of authority to transact business in Minnesota with the Secretary of State if a foreign corporation or cooperative. |
| (2) | The contractor or related entity is in compliance with and, during the three-year period before submitting the verification, has not violated section 177.24, 177.25, 177.41 to 177.44, 181.13, 181.14, or 181.722, and has not violated United States Code, title 29, sections 201 to 219, or United States Code, title 40, sections 3141 to 3148. For purposes of this clause, a violation occurs when a contractor or related entity: <ul style="list-style-type: none">(i) repeatedly fails to pay statutorily required wages or penalties on one or more separate projects for a total underpayment of \$25,000 or more within the three-year period;(ii) has been issued an order to comply by the commissioner of Labor and Industry that has become final;(iii) has been issued at least two determination letters within the three-year period by the Department of Transportation finding an underpayment by the contractor or related entity to its own employees;(iv) has been found by the commissioner of Labor and Industry to have repeatedly or willfully violated any of the sections referenced in this clause pursuant to section 177.27;(v) has been issued a ruling or findings of underpayment by the administrator of the Wage and Hour Division of the United States Department of Labor that have become final or have been upheld by an administrative law judge or the Administrative Review Board; or(vi) has been found liable for underpayment of wages or penalties or misrepresenting a construction worker as an independent contractor in an action brought in a court having jurisdiction. Provided that, if the contractor or related entity contests a determination of underpayment by the Department of Transportation in a contested case proceeding, a violation does not occur until the contested case proceeding has concluded with a determination that the contractor or related entity underpaid wages or penalties;* |

(3)	The contractor or related entity is in compliance with and, during the three-year period before submitting the verification, has not violated section 181.723 or chapter 326B. For purposes of this clause, a violation occurs when a contractor or related entity has been issued a final administrative or licensing order;*
(4)	The contractor or related entity has not, more than twice during the three-year period before submitting the verification, had a certificate of compliance under section 363A.36 revoked or suspended based on the provisions of section 363A.36, with the revocation or suspension becoming final because it was upheld by the Office of Administrative Hearings or was not appealed to the office;*
(5)	The contractor or related entity has not received a final determination assessing a monetary sanction from the Department of Administration or Transportation for failure to meet targeted group business, disadvantaged business enterprise, or veteran-owned business goals, due to a lack of good faith effort, more than once during the three-year period before submitting the verification;*
	* Any violations, suspensions, revocations, or sanctions, as defined in clauses (2) to (5), occurring prior to July 1, 2014, shall not be considered in determining whether a contractor or related entity meets the minimum criteria.
(6)	The contractor or related entity is not currently suspended or debarred by the federal government or the state of Minnesota or any of its departments, commissions, agencies, or political subdivisions; and
(7)	All subcontractors that the contractor intends to use to perform project work have verified to the contractor through a signed statement under oath by an owner or officer that they meet the minimum criteria listed in clauses (1) to (6).

<p>Minn. Stat. § 16C.285, Subd. 5. SUBCONTRACTOR VERIFICATION.</p>
<p>A prime contractor or subcontractor shall include in its verification of compliance under subdivision 4 a list of all of its first-tier subcontractors that it intends to retain for work on the project.</p> <p>If a prime contractor or any subcontractor retains additional subcontractors on the project after submitting its verification of compliance, the prime contractor or subcontractor shall obtain verifications of compliance from each additional subcontractor with which it has a direct contractual relationship and shall submit a supplemental verification confirming compliance with subdivision 3, clause (7), within 14 days of retaining the additional subcontractors.</p> <p>A prime contractor shall submit to the contracting authority upon request copies of the signed verifications of compliance from all subcontractors of any tier pursuant to subdivision 3, clause (7). A prime contractor and subcontractors shall not be responsible for the false statements of any subcontractor with which they do not have a direct contractual relationship. A prime contractor and subcontractors shall be responsible for false statements by their first-tier subcontractors with which they have a direct contractual relationship only if they accept the verification of compliance with actual knowledge that it contains a false statement.</p>

Minn. Stat. § 16C.285, Subd. 4. VERIFICATION OF COMPLIANCE.

A contractor responding to a solicitation document of a contracting authority shall submit to the contracting authority a signed statement under oath by an owner or officer verifying compliance with each of the minimum criteria in subdivision 3 at the time that it responds to the solicitation document.

A contracting authority may accept a sworn statement as sufficient to demonstrate that a contractor is a responsible contractor and shall not be held liable for awarding a contract in reasonable reliance on that statement. Failure to verify compliance with any one of the minimum criteria or a false statement under oath in a verification of compliance shall render the prime contractor or subcontractor that makes the false statement ineligible to be awarded a construction contract on the project for which the verification was submitted.

A false statement under oath verifying compliance with any of the minimum criteria may result in termination of a construction contract that has already been awarded to a prime contractor or subcontractor that submits a false statement. A contracting authority shall not be liable for declining to award a contract or terminating a contract based on a reasonable determination that the contractor failed to verify compliance with the minimum criteria or falsely stated that it meets the minimum criteria.

CERTIFICATION

By signing this document I certify that I am an owner or officer of the company, and I swear under oath that:

- 1) My company meets each of the Minimum Criteria to be a responsible contractor as defined herein and is in compliance with Minn. Stat. § 16C.285,**
- 2) I have included Attachment A-1 with my company's solicitation response, and**
- 3) if my company is awarded a contract, I will also submit Attachment A-2 as required.**

Authorized Signature of Owner or Officer:	Printed Name:
Title:	Date:
Company Name:	

NOTE: Minn. Stat. § 16C.285, Subd. 2, (c) If only one prime contractor responds to a solicitation document, a contracting authority may award a construction contract to the responding prime contractor even if the minimum criteria in subdivision 3 are not met.

ATTACHMENT A-2

ADDITIONAL SUBCONTRACTORS LIST

PRIME CONTRACTOR TO SUBMIT AS SUBCONTRACTORS ARE ADDED TO THE PROJECT

PROJECT TITLE: _____

This form must be submitted to the Project Manager or individual as identified in the solicitation document.

Minn. Stat. § 16C.285, Subd. 5. ... If a prime contractor or any subcontractor retains additional subcontractors on the project after submitting its verification of compliance, the prime contractor or subcontractor shall obtain verifications of compliance from each additional subcontractor with which it has a direct contractual relationship and shall submit a supplemental verification confirming compliance with subdivision 3, clause (7), within 14 days of retaining the additional subcontractors. ...

ADDITIONAL SUBCONTRACTOR NAMES (Legal name of company as registered with the Secretary of State)	Name of city where company home office is located

ADDITIONAL SUBCONTRACTOR NAMES (Legal name of company as registered with the Secretary of State)	Name of city where company home office is located

SUPPLEMENTAL CERTIFICATION FOR ATTACHMENT A-2	
<p>By signing this document I certify that I am an owner or officer of the company, and I swear under oath that:</p>	
<p>All additional subcontractors listed on Attachment A-2 have verified through a signed statement under oath by an owner or officer that they meet the minimum criteria to be a responsible contractor as defined in Minn. Stat. § 16C.285.</p>	
<p>Authorized Signature of Owner or Officer:</p>	<p>Printed Name:</p>
<p>Title:</p>	<p>Date:</p>
<p>Company Name:</p>	

IMPORTANT - NOTICE TO BIDDER

On the envelope submitting your bid, it is imperative

1. That your name and address appear in the UPPER left corner.
2. That the bottom portion of this label be filled in and pasted on the LOWER left corner.

S E A L E D	BID NO.	B I D E R
	DATE OF OPENING	
	TIME OF OPENING	
	DESCRIPTION	
	A.M. P.M.	

City of Duluth Purchasing Division General Specifications

The word "City" used in these specifications shall mean the city of Duluth and/or its Authorities.

1. Instruction to Bidders:

A. All bids must be completed in a non-erasable format on the form provided by city of Duluth, errors are to be crossed out and initialed.

B. All bids must be enclosed in a sealed envelope.

C. The enclosed blue and white sticker must be placed on the outside of envelope.

D. The bid envelope shall be addressed to the city of Duluth, Purchasing Division, Room 100 City Hall, Duluth, Minnesota 55802.

2. Non-Collusion Clause:

Vendor, their agent/employee hereby agree to comply and fully perform in accordance with the law and state that they have not, directly or indirectly, entered into an agreement or understanding, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the proposal submitted with respect to the above-referenced invitation to bid. Vendor fully acknowledges that such an act of non-compliance may be deemed unlawful and would be considered a violation of the law and subject to prosecution.

3. Award of Contract - Rejection of Bids:

The Contract will be awarded to the responsible bidder submitting the lowest bid complying with the conditions of the Invitation for bids. The bidders, to whom the award is made, will be notified at the earliest possible date. The city of Duluth, however, reserves the right to reject any and all bids and to waive any informality in bids received whenever such rejection or waiver is in its interest.

5. Obligation of Bidder:

At the time of the opening of bids, each bidder will be presumed to have read and to be thoroughly familiar with the plans, specifications and contract documents (including all addenda). The failure or omission of any bidder to examine any form, instrument, or document shall in no way relieve any bidder from any obligation in respect to their bid.

6. Liquidated Damages for Failure to Enter into Contract:

The successful bidder, upon their failure or refusal to accept a purchase order or execute and deliver the contract and bonds required within 10 days after receipt of a notice of the acceptance of their bid, shall forfeit to the city, as liquidated damages for such failure or refusal, the security deposited with their bid (if required).

7. Completion of Bid Request:

The city may consider as irregular any bid on which there is an alteration of or departure from the Bid Form hereto attached and at its option may reject the same.

8. E.E.O. Regulations:

Contractor will be required to comply with all applicable Equal Employment Opportunity (E.E.O.) laws and regulations. Affirmative action must be taken to insure that the employees and applicants for employment are not discriminated against because of their race, color, creed, sex or national origin.

The city of Duluth is an equal opportunity employer.

9. Participation:

FORM 17:01/28/94
Revised: 08/28/02

This document is intended to serve the city of Duluth, its Agents and Authorities. Each authority may issue their own purchase order and will be responsible for it. The City of Duluth Authorities are as follows:

1. Duluth Airport Authority
2. Spirit Mountain Recreational Area Authority
3. Duluth Entertainment and Convention Center
4. Duluth Transit Authority
5. Duluth Economic Development Authority
6. Duluth Housing and Redevelopment Authority

The city has a cooperative purchasing agreement with St. Louis county allowing the county to purchase from this bid when requested. St. Louis county will issue and be responsible for its own purchase orders.

10. Qualifications of Bidder

The city may make such investigations as deemed necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the city all such information and data for this purpose as the city may request. The city reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the city that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein. Conditional bids will not be accepted.

11. Addenda and Interpretations

Responses to general questions and clarifications of bids may be made at the discretion of the city. However, no interpretation of the meaning of the specifications or other pre-bid documents will be made to any bidder orally.

Every request for such interpretation should be in writing and delivered or sent by facsimile to the city purchasing agent or the buyer shown on the bid request, Duluth, Minnesota 55802, and to be given consideration must be received at least five days prior to the date fixed for the opening of bids.

12. Award of Contract - Rejection of Bids:

In determining the successful bidder, there will be considered in addition to price (per Ordinance 7050):

- A. The ability, capacity and skill of the bidder to perform the contract.
- B. The character, integrity, reputation, judgement, experience and efficiency of the bidder.
- C. The quality of performance of previous contract.
- D. The sufficiency of the financial resources, equipment available and ability of the bidder to perform the contract.

13. Quantities:

The city reserves the right to increase or decrease the quantities of items on this bid as required. Any exception to this provision must be noted by the vendor in its bid or proposal.

14. Wages and Salaries:

Attention of bidders is particularly called to the requirements concerning the payment of not less than the prevailing wage and salary rates specified in the contract documents and the conditions of employment with respect to certain categories and classifications of employees for all "Public Works" type projects estimated to exceed \$2,000.

B. The rates of pay set forth under General Conditions are the minimums to be paid during the life of the contract. It is therefore the responsibility of bidders to inform themselves as to local labor conditions, such as the length of work day and work week, overtime compensations, health and welfare contributions, labor supply, and prospective changes or adjustments of rates.

15. Validity of Bids:

All bids shall be valid for 60 days from the date of bid opening, unless an other period is noted in bid documents or if an extension is agreed upon, in writing prior to the end of the 60 day period.

16. Facsimile Bids:

Facsimile bids are acceptable if: bids are received at the designated facsimile number prior to the scheduled bid opening and an original copy of the bid, identical to the "faxed" bid, is received within 48 hours of the bid opening. Facsimile bid deposits are not acceptable. The city shall endeavor to keep bids confidential, but will accept no responsibility for the confidentiality of facsimile bids. All bids or proposals returned by facsimile are understood to incorporate these general specifications.

17. Insurance:

All vendors doing work on city property, except vendors making routine deliveries, shall submit an insurance certificate indicating insurance coverage as per current city requirements.

18. Website:

ci.duluth.mn.us/city/service/purchasing/index.htm