Indianapolis Airport Authority

INDIANAPOLIS INTERNATIONAL AIRPORT

REQUEST FOR QUOTE

QTA ROAD ACCESS CONTROL

Project No. Q-16-013

Issued:
October 6, 2016

Quotes Due By:

October 21, 2016 @ 2:00 p.m. Local Time

For notifications on new opportunities listed on our Web site and to learn other relevant business information about the IAA, connect with us on Twitter (www.twitter.com/IAA_business) and Facebook (www.facebook.com/IndianapolisAirportAuthority).

Notice: Please be advised that individuals interested in receiving information about potential business opportunities with the Indianapolis Airport Authority ("IAA") regarding employment opportunities, quote packages, Requests for Proposals and all other opportunities related to public procurement, should refer to IAA's social media pages solely as a supplement to, and not as a substitute for, the IAA's official procurement site, which is www.indianapolisairport.com.

Indianapolis Airport Authority

REQUEST FOR QUOTE

QTA ROAD ACCESS CONTROL

Project No. Q-16-013

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- Exhibit A: Technical Specifications
- Exhibit B: Drawings
- Exhibit C: Sample Contract
- Exhibit D: Work Permit Policy and Application

REQUEST FOR QUOTE

QTA ROAD ACCESS CONTROL

INTRODUCTION

- The Indianapolis Airport Authority (IAA) is issuing this Request for Quote (RFQ) for qualified contractors to install the required infrastructure to support new parking access control equipment on the rental car quick turnaround (QTA) road at Indianapolis International Airport (IND) as shown in the drawings.

STATEMENT OF WORK

- Contractor will perform construction to create the required infrastructure to support the new parking equipment at the QTA Road located west of the existing parking garage at the Indianapolis International Airport, located in Indianapolis, Indiana. The parking equipment will be installed separately by the Owner's equipment provider. All work will be performed utilizing the specifications and drawings included with this request.

  The scope of this project includes, but is not limited to:
  - Installation of new electrical and communication conduits, new power and communication cabinets, and wiring/cables from existing cabinets to new cabinets via trenching and backfilling
  - Installation of new electrical and communication conduits and wiring/cables from new cabinets to and within new concrete island, including detector loops in pavement
  - Contractor shall coordinate all work with Owner's parking equipment provider, such as final conduit layouts for electrical and communication, final bollard locations, detector loops, etc.
  - Modifying a portion of the existing QTA Road to widen the roadway at the new equipment, modify existing curbing, install new concrete island and provide final grading
  - Removal of pavement markings and painting of new pavement markings

All work must be completed prior to December 2, 2016.

LENGTH OF CONTRACT

- The completion time for the work shall be **thirty-six (36) calendar days** from the effective date of the Notice-to-Proceed. The time limit stated includes time required for delivery of all materials and equipment.

PROJECT OBJECTIVES-INSTALL REQUIRED INFRASTRUCTURE TO SUPPORT NEW PARKING ACCESS CONTROL EQUIPMENT ON RENTAL CAR QUICK TURNAROUND (QTA)

GENERAL REQUIREMENTS

1. Contractor shall provide labor and equipment to install the required infrastructure to support the new parking equipment at the QTA Road located west of the existing parking garage at the Indianapolis International Airport, located in Indianapolis, Indiana. The parking equipment will be installed separately by the Owner's equipment provider. This work shall consist of but is not limited to:
    a. Site demolition of roadway pavement, concrete curb, and pavement markings per plans and specifications with the RFQ
    b. Trenching and backfilling per plans and specifications with the RFQ
    c. Installation of new conduits, wiring/cables, and cabinets per plans and specifications with the RFQ
    d. Installation of new concrete island and new concrete curb per plans and specifications with the RFQ
    e. Installation of new asphalt pavement per plans and specifications with the RFQ
    f. Installation of new pavement markings per plans and specifications with the RFQ
    g. Installation of new pipe bollards per plans and specifications with the RFQ

2. All work will be performed utilizing the specifications and drawings included with this request.

3. All work is to be performed by accessing the site via public roadways. Contractor shall submit an access and maintenance of traffic plan for review and approval by Indianapolis Airport staff. Contractor will also advise of construction traffic on a daily basis prior to mobilizing to the site.

4. Work will be performed in conformance with the following schedule:

a.	RFQ Issued	October 6, 2016
b.	Pre-Quote Meeting	October 12, 2016
c.	Final Questions	October 14, 2016
d.	Quotes Due	October 21, 2016
e.	Award and Notice to Proceed	October 28, 2016
f.	Kick-Off Meeting	November 2, 2016
g.	Final Completion	December 2, 2016

5. The Contractor may store/stage equipment and materials at designated staging area(s) approved by the IAA. All equipment and material must be removed immediately following completion and the area restored to the Prework condition(s).

6. Work will be performed at the direction of the IAA or its designated representative.

7. It is the Contractor's responsibility to field-verify all measurements, locations, areas, and existing materials.

8. Contractor shall report in person each day to the IAA or its designated representative prior to beginning work each day.

9. Contractor and their employees shall be easily identifiable at all times and shall have identifying markings on all vehicles and if required to include safety alert lighting on vehicles to alert oncoming traffic.

10. Contractor shall promptly report, on the same day, of any damage to airport real estate, property, or equipment. Reporting shall consist of verbally informing the IAA or its designated representative(s), as well as submitting a written report to the IAA by the close of the next business day after the damage occurred.

11. Contractor is responsible for any damage resulting from the work or negligence of their own forces and/or subcontractor forces.

12. Contractor shall report any safety issues to the IAA or its designated representative.

13. Contractor shall have a ready means of communication access through cell phone while they are operating on-site in order that Contractor efforts and/or forces may be redirected, as required by the IAA or its designated representative. The Contractor shall provide to the IAA Project Manager an emergency contact list to be used should any condition arise on site requiring the immediate attention of the Contractor.

14. IAA will provide parking for contractor and its employees at no charge to the contractor.

15. Subsurface excavation may not take place during the Thanksgiving moratorium which is November 19 thru 28.

SUPPLIER DIVERSITY PARTICIPATION

It is the policy of the Indianapolis Airport Authority to ensure nondiscrimination in the award and administration of contractors. List in your quote the amount of MBE, WBE and VBE participation. If the submitted quote does not meet the goals set for supplier diversity participation, the contractor must be prepared to submit good faith efforts to meet the goals. Information must include evidence of certification by City of Indianapolis, or State of Indiana, or Mid States Minority Supplier Development Council (copy of certification letter from certifying agency should be attached). The Indianapolis Airport Authority's overall goals for supplier diversity participation in solicitations are MBE – 15%, WBE – 10% and VBE – 3%.

GENERAL TERMS AND CONDITIONS

A response to this RFQ does not commit IAA to a purchase agreement or contract, or to pay any costs incurred in the preparation of the response.

Unless specified in the RFQ, IAA may award the contract for any items/services or group of items/services in the RFQ and may increase or decrease the quantity specified.

A. IAA reserves the right to hold and accept any Quote for a period of ninety (90) days after the response deadline.

B. IAA reserves the right to negotiate the final terms of any and all purchase agreements with firms selected and such agreements negotiated as a result of this RFQ may be re-negotiated and/or amended in order to successfully meet the Owner's needs.

C. IAA reserves the right to waive any defect in this procurement process or to make changes to this solicitation as it deems necessary. IAA will provide notifications of such changes on the IAA website and/or notify known Proposers having received or requested an RFQ.

D. IAA reserves the right to contact any individual, agencies, or employers listed in a Quote, to contact others who may have experience and/or knowledge of the firm's relevant performance and/or qualifications; and to request additional information from any and all Proposers.

E. IAA reserves the right to conduct a review of records, systems, procedures, etc., of any entity selected for funding. This may occur prior to, or subsequent to, the award of a purchase agreement. Misrepresentation of the Proposer's ability to perform, as stated in the Quote(s), may result in cancellation of the award.

F. IAA reserves the right to withdraw or reduce the amount of an award, or to cancel any contract resulting from this procurement if adequate funding is not available.

G. Proposers shall not engage in any activity that will restrict or eliminate competition. Violation of this provision may cause a Proposer's quote to be rejected. This does not preclude joint ventures or subcontracts.

H. All Quotes submitted must be an original work product of the Proposers. The copying, plagiarizing or other use of substantial portions of the work product of others, and submitted hereunder as original work of the Proposer, is not permitted. Failure to adhere to this instruction may cause the Quote(s) to be rejected.

I. The only purpose of this RFQ is to ensure uniform information in the solicitation of Quotes and procurement of services. This RFQ shall not to be construed as a purchase agreement or contract, or as a commitment of any kind, nor does it commit IAA to pay for costs incurred prior to the execution of a formal contract, unless such costs are specifically authorized in writing by IAA.

J. The contents of a successful Quote may become a contractual obligation, if selected for award of a contract. Failure of the Proposer to accept this obligation may result in cancellation of the award. No plea of error or mistake shall be available to the successful

Proposer(s) as a basis for release of quoted services at the stated price/cost. Any damages accruing to IAA, as a result of the Proposer's failure to contract, may be recovered from the Proposer.

K. A contract with the selected Vendor may be withheld at the sole discretion of IAA if issues of contract compliance or questionable/disallowed costs exist, until such issues are satisfactorily resolved. If resolution is not satisfactory to IAA, Award of contract may be withdrawn by IAA.

L. Procurement Dispute Resolution Policy - IAA is the responsible authority for handling complaints or protests regarding the Quote selection process. This includes, but is not limited to, disputes, claims, and protests of award, source evaluation, or other matters of a contractual nature. Any litigation arising under this Contract shall be commenced and maintained only in the state or federal courts situated in Marion County, Indiana.

M. A current Acord Certificate of Insurance demonstrating compliance with the requested limits showing Liability, Workman's Compensation and Automobile coverage is required prior to starting the work. Indianapolis Airport Authority, must be listed as an additional insured.
    a. Comprehensive General Liability of $1 Million Aggregate and per occurrence.
    b. Workers Compensation of $1,000,000 per each accident and per employee/disease.
    c. Comprehensive Automobile Liability of $500,000.
    d. Excess/Umbrella Liability of $5 Million aggregate and per occurrence.

CONTRACT PARAMETERS

A. Sample of a standard IAA procurement contract (Exhibit C) is included with these documents and will be the basis for award. IAA reserves the right to modify the standard contract at any time prior to execution of the contract. Any request for changes to the standard contract should be identified in the response. Any request for changes may be grounds for rejecting the Quote.

B. Failure to sign and return the Itemized Quote, Supplier Diversity Form, Non-Collusion Affidavit, and Contract Signature Page may result in the rejection of the Quote.

PRE-QUOTE SITE VISIT

A site visit and Pre-Quote Meeting will be conducted on October 12, 2016 at 2:00 pm. at the Indianapolis International Airport, at 7800 Col. H. Weir Cook Memorial Drive, Indianapolis, Indiana 46241 in the Main Terminal Board Room – Level 4.

For questions regarding a site visit, please contact the IAA Project Manager, Webb Bernhardt, at 317.487.5197, wbernhardt@ind.com, or by fax at 317.487.5512.

SUBMITTAL INSTRUCTIONS

Respondents to this RFQ must submit one (1) original and two (2) reproducible copies of their Quote to IAA no later than **2:00 p.m. Local Time on October 21, 2016. All Quotes must be sealed and clearly marked as outlined below.** Quotes will be opened in the Main Terminal Board Room – Level 4. Deliver the envelope containing the sealed quote to the Guest Services counter on Level 3 of the Main terminal at 7800 Col. H. Weir Cook Memorial Drive, Indianapolis, Indiana 46241.

Quotes arriving after the deadline shall not be considered and shall be returned unopened. Faxed or e-mailed Quotes will not be accepted.

Respondent shall acknowledge receipt of all Addenda on the Itemized Quote Page. It is the respondent's responsibility to monitor activity for this project on the IAA Website to view applicable addenda: http://business.ind.com/employment_business/businessOpportunities.aspx

Address Quotes to:

Ms. Shannetta Griffin, P.E.
Senior Director of Planning & Development
Indianapolis Airport Authority
Guest Services Desk
7800 Col. H. Weir Cook Memorial Drive
Indianapolis, Indiana 46241

Outer envelope shall be marked:

- - - - - - - - - - - - - - - - - -FOLD/CUT ALONG DOTTED LINE, SECURE TO OUTSIDE OF PACKAGE- - - - - - - - - - - - -

TIME SENSITIVE DOCUMENT ENCLOSED

Shannetta Griffin, P.E.,
Sr. Director of Planning and Development

***c/o* GUEST SERVICES DESK**

Indianapolis Airport Authority
7800 Col. H. Weir Cook Memorial Drive
Indianapolis, Indiana 46241

IAA may accept or reject any or all parts of a Quote as well as re-solicit for Quotes. Contract award criteria will be based on meeting the stated specifications, experience of similar projects, cost considerations, and background.

All other inquiries and or requests for information regarding this quote must be submitted in writing no later than 4:00 p.m. Local Time on October 14, 2016. All questions must be submitted using the IAA's Questions Form included as part of this quote.

ITEMIZED QUOTE PAGE

The undersigned acknowledges receipt of Addendum:
No.: _____, _____, _____

The undersigned, having the authority to bind their company, affirms and declares that this Quote is executed and signed by the vendor with full knowledge and acceptance of the provisions of the services described, proposed schedule, and special needs and conditions as stated, which will be made a part of the contract.

Name of vendor: _____

Address: _____

City: _____ State:_____ Zip:_____

Telephone: ____(_____)_____ Fax: (_____)_____

E-mail address:_____

Authorized signature: _____

Name *(please print)*: _____

Title:_____

Date: _____

DESCRIPTION	Estimated Units** (a)	Unit(s)	Unit Price (b)	Total Cost* (c)
Infrastructure for QTA Road Parking Equipment	1	Lump Sum		
TOTAL QUOTE (written)				

*Total Cost = column a times column b
Price shall include all cost including, but not limited to equipment, mobilization, de-mobilization, supervision, traffic maintenance, security, operators, and labor.

REQUIRED SUPPLIER DIVERSITY PROGRAM ASSURANCE TO BE INCLUDED IN ALL QUOTES

This firm assures that it will utilize not less than _____% of Minority Business participation, _____% of Women Business participation, and _____% of Veteran Business participation and did not limit any Minority Business firms or Women Business firms from submitting Quotes to others.

NOTE: Penalty for making false statement in offers is prescribed in 23 U.S.C. 1001.

_____

Signature of Company's Authorized Representative

_____

Print Name of Company's Authorized Representative

_____

Print Title of Company's Authorized Representative

Date: _____

NON – COLLUSION AFFIDAVIT

State of _____

SS:

County of _____

The undersigned proposer or agent, being duly sworn on oath, says that he has not, nor has any other member, representative, or agent of this firm, company, corporation or partnership represented by him, entered into any combination, collusion or agreement with any person relative to the price to be quoted by anyone at such letting nor to prevent any person from quoting nor to induce anyone to refrain from quoting, and that this quote is made without reference to any other quote and without any agreement, understanding or combination with any other person in reference to such quoting.

He further says that no person or persons, firms, or corporation has, have or will receive directly or indirectly, any rebate, fee, gift, commission or thing of value on account of such sale.

OATH AND AFFIRMATION

I affirm under the penalties of perjury that the foregoing facts and information are true and correct to the best of my knowledge and belief.

Dated at _____ this _____ day of _____, 2016.

By: _____ (Name of Organization)
_____ (Signature)
_____ (Printed with Title)

ACKNOWLEDGEMENT

State of _____

SS:

County of _____

_____being duly sworn, deposes and says that he/she is _____
(Person signed above) (Title)

of the above _____ in the foregoing questionnaires and all
(Name of Organization)

statements therein contained are true and correct.

Subscribed and sworn to before me this _____ day of _____, 2016.

My Commission Expires: _____ _____
Notary Public

County of Residence: _____

IN WITNESS WHEREOF, the Parties have caused their respective duly authorized representatives to execute this Contract on the Effective Date.

_____
Company Name

_____
Signature of Company's Authorized Representative

_____
Print Name of Company's Authorized Representative

_____
Print Title of Company's Authorized Representative

Date: _____

INDIANAPOLIS AIRPORT AUTHORITY*:

By: _____

Printed: _____

Title: _____

Date: _____

Approved as to Form and Legality:

By: _____
IAA Legal Department

* Signature authorized by IAA Resolution No. 3-2016

REPONDENT'S QUESTIONS
INDIANAPOLIS AIRPORT AUTHORITY
QTA ROAD ACCESS CONTROL
INDIANAPOLIS INTERNATIONAL AIRPORT
Q-16-013

Please state your questions in the spaces provided below. The questions must be faxed to 317.487.5512, or e-mailed to: wbernhardt@ind.com.

All questions must be received no later than October 14, 2016.

NAME:_____

COMPANY:_____

NO	QUESTION

ATTACHMENTS:

Exhibit A: Technical Specifications

Exhibit B: Drawings

Exhibit C: Sample Contract

Exhibit D: Work Permit Policy and Application

Exhibit A Specifications

Indianapolis Airport Authority

Specifications

for

Indianapolis Airport QTA Road Access Control

Date: October 6, 2016

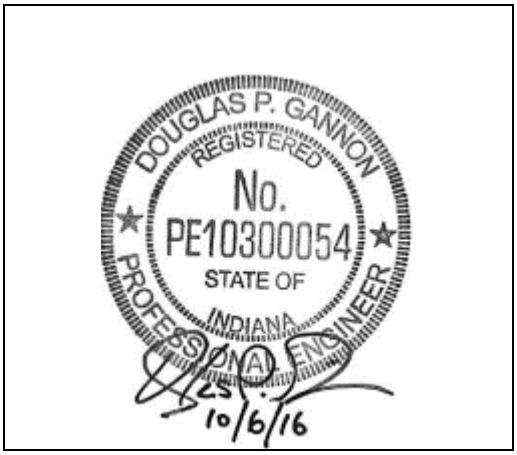
DOCUMENT 00 01 07 - SEALS PAGE

1.1 Design Professionals of Record

A. Civil Engineer: Nicholas B. Vergatos, P.E.
   1. BSA LifeStructures
   2. PE11500269
   3. Responsible for Divisions:

02 41 13	Selective Site Demolition
26 05 00	Common Work Results for Electrical
26 05 19	Low-Voltage Electrical Power Conductors And Cables
26 05 26	Grounding And Bonding For Electrical Systems
26 05 33	Raceways and Boxes for Electrical Systems
26 05 53	Identification for Electrical Systems
26 27 26	Wiring Devices
26 28 16	Enclosed Switches and Circuit Breakers
27 05 00	Common Work Results for Communications
27 15 00	Communications Cabling
31 20 00	Earthwork
32 12 16	Asphalt Paving
32 13 00	Site Concrete
32 92 19	Seeding

B. Structural Engineer and Parking Consultant: Douglas P. Gannon, P.E.
   1. Carl Walker, Inc.
   2. PE10300054
   3. Responsible for Divisions:



11 12 00	Parking Control Equipment
32 17 23	Pavement Markings

END OF DOCUMENT 00 01 07

SECTION 02 41 13 - SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 Summary

A. Section Includes:

1. Demolition of existing site improvements made obsolete by this project, as indicated or implied by the contract documents.
2. Removal of demolition items and debris from site.
3. Protection of items to remain.
4. Abandonment of items indicated in contract documents.
5. Removal, storage and protection of items to be salvaged.
6. The removal of asbestos or lead containing products is not included in this scope of work. If such materials are discovered during demolition, notify the Owner immediately.

1.2 Requirements

A. General:

1. Proper access and function of existing facility operations must be maintained at all times.
2. Demolition activities shall not interfere with or interrupt the operations of the facility, employees or the public.
3. A complete and operable utility system must be maintained at all times.
4. Sufficient parking and site access must be maintained at all times.
5. The route for construction traffic and the removal of debris shall be limited to specific areas.
6. Contractor is solely responsible for providing all permanent and temporary means to ensure site access, utility services and other required conditions are maintained at all times.

B. Miscellaneous:

1. On-site burning is not permitted.
2. Blasting or any other use of explosives is not permitted.
3. Use of heavy vibratory or other similar means that cause excessive nuisance to the public or compromise safety of existing facilities is not permitted.
4. Comply with NFPA 241 (latest edition).

PART 2 - PRODUCTS

2.1 Materials

A. Concrete: If required, shall comply with Division 32 Section “Site Concrete”.

B. All other materials not specifically described but required for proper completion of the Work, shall be selected by the Contractor subject to approval of the Architect/Engineer and Owner.

PART 3 - EXECUTION

3.1 Preparation

A. Refer to Division 02 Section "Maintenance of Existing Conditions" for verification and maintenance of existing site conditions.

B. Coordination:

1. Contact Owner prior to site mobilization to discuss and verify site access and routing requirements. Prepare a schedule if requested by Owner.
2. Before commencing the work of this Section, verify with the Architect/Engineer and Owner all items to be removed, all items to remain and all items to be salvaged.

3.2 GENERAL

A. Protection:

1. Demolition shall be done in such a manner to protect adjacent materials.
2. Use all necessary and appropriate means to prevent the spread of dust during demolition.
3. Protect employees and public from dust, noise, light, vibration, odor and all other types of nuisances and hazards.
4. Protect all existing items to remain. If such items are damaged, they shall be repaired or replaced by the Contractor to the Owner's satisfaction at no additional cost to Owner.
5. Items to be demolished as indicated in contract documents or made obsolete per field conditions shall be removed and disposed of off the project site. Abandoning such items in place shall not be permitted unless specifically indicated in the contract documents or approved by Architect/Engineer and Owner.
6. Avoid overloading of existing structures by either a build-up of demolished items or by impact loading of demolished items on the existing structure.
7. Bracing and shoring and other similar and appropriate mean shall be used where necessary to avoid collapse or other compromising of structures or materials.

B. Demolition:

1. Items indicated in contract documents to be demolished shall be removed, demounted or disconnected in the best possible manner to ensure that no damage will result to other adjacent items or surfaces to remain.
2. Abandoning demolished items in place is not permitted unless specifically indicated in the contract documents or approved by Architect/Engineer and Owner.
3. For items indicated or approved as being abandoned in place, the means of abandonment shall be reviewed and approved by the Architect/Engineer and Owner prior to abandonment.
4. Phase demolition as described in the contract documents, as required per field conditions and per Owner's request.

C. Salvage:

1. Protect items to be salvaged during removal, handling and storage.
2. All reusable items salvaged during demolition operations shall be retained for the Owner's inspection. Only items so inspected and rejected by the Owner shall be disposed. All other such items shall be turned over to the Owner.

D. Cleaning:

1. Areas in which demolition and salvage work are being done shall be cleaned daily.
2. All dirt, dust, debris, unsalvageable and non-reusable items and similar items shall be removed from the project site daily.
3. Under no circumstances shall such refuse be allowed to collect for longer periods.
4. Refuse shall not be allowed to block or otherwise impair circulation in corridors, stairs, sidewalks or other traffic areas at any time.

E. Disposal:

1. Except for items or materials indicated to be reused, salvaged, reinstalled or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them at an EPA-approved landfill.

3.3 JOB COMPLETION

A. At the completion of demolition activities, ensure all demolition debris is removed from site. Restore adjacent areas to original condition and repair any damaged items to Owner's satisfaction at no additional cost to Owner.

END OF SECTION 02 41 13

SECTION 11 12 00 – PARKING CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 Work Included

A. The Work of this Section shall include furnishing all material, equipment, labor, and supervision to install in place a fully operating Parking Control System, as specified herein and/or indicated on the Drawings. Included will be supply, delivery, unloading, setting, anchoring, control wiring installation, wiring termination, and startup of all parking, revenue control, and access control equipment.

1.2 Related Work

A. Related Work specified elsewhere:

1. Division 26 Electrical
2. Division 32 Exterior Improvements

B. The electrical Subcontractor shall furnish and install all conduit and power wiring in proper size and location to the parking control equipment and empty conduit for control wiring as required.

C. Manufacturer of the Parking Control System shall provide those responsible for related work with:

1. Installation diagrams and details for setting indoor and outdoor mounted equipment.
2. Templates for setting indoor and outdoor mounted equipment.
3. Templates and cast-in inserts to anchor freestanding equipment to curbs and bases.
4. Electrical wiring diagrams and details.
5. Electrical installation requirements.
6. Electrical power requirements.

1.3 System Description

A. General

1. This parking entry and exit lanes are to be used by:

a. Airport Vehicles – Airport Vehicles will enter and exit via Automatic Vehicle Identification (AVI) tags.

b. Rental Car Agency personnel will enter and exit via Proximity Card Readers.

2. The parking access control equipment shall be connected to and controlled by the existing access control system(s). All features, function, and capabilities of the existing access control system shall be available for the operation of the entry and exit lanes.

B. Lane Operational Descriptions

a. Dedicated Entry Lane and Exit Lane

1) The presence of the vehicle over the detector loops shall activate the card reader and AVI antenna The presentation of a valid credential proximity card to the card reader or AVI tag to the antenna shall automatically signal the gate to open. The entrance lane gate shall close automatically after the vehicle has passed over the closing detector loop.

2) The access control system shall only accept properly coded credential proximity cards or AVI tags meeting current anti-passback criteria. If the card or AVI tag passes all validity and anti-passback checks the gate shall open. If the proximity card or AVI tag fails validity or anti-passback checks the central controller shall record an "invalid attempt" event indicating card reader or AVI antenna location, user I.D. number, and type of invalid access (English text), and the gate shall open (soft anti-passback) or remain closed (hard anti-passback) at the Owner's programmable option.

1.4 Quality Control

A. Supplier / Installer of Parking Control System shall provide an experienced field representative to meet with Electrical Subcontractor, before any rough-in work begins, to review building plans as they relate to Parking Control Equipment, to explain details or precautions necessary to assure that all parking and revenue control equipment, and in particular, detector loops will work properly and to determine that all required conduits and wiring are properly laid out.

B. Installer shall have previously worked successfully with the equipment Manufacturer.

C. Installers shall be approved in writing by the Parking Control System Manufacturer.

D. Installer shall provide repair and maintenance service and have an equipment service center located to provide on-site service within eight hours of problem notification as required by the warranty requirements.

1.5 Submittals

A. Submit Shop Drawings for review and approval. Included are equipment wiring diagrams, equipment cut sheets and specifications, and equipment color charts.

B. Submit for record 30 days prior to completing the installation of the Parking Control Equipment, procedures for testing electrical, mechanical, and program functions of the system.

C. Provide the Owner with two final copies of each of the following:

1. Maintenance Manual

2. Operating Manual

3. Equipment electrical circuitry diagram

4. As built equipment wiring diagram

D. Provide Owner with two sets of keys for each piece of equipment with locks and two sets of master keys. Keys shall be unique to this location/Owner; they shall not fit any other equipment in the same city. Each equipment type shall be master keyed including but not limited to:

1. Cabinets for gates

1.6 Transportation and Handling

A. Deliver equipment to the site packaged to prevent damage and marked for easy identification.

B. Store equipment in a clean, dry location protected from damage. Replace damaged materials at no cost to the Owner.

C. Deliver items required to be built into the concrete promptly to the site so they may be built in as the work progresses.

1.7 Operating Conditions

A. Equipment shall be designed, fabricated, and installed to operate effectively under the climate and exposure conditions for the recorded weather extremes for the equipment location.

B. The equipment supplier / installer shall review the plans showing the equipment locations before construction starts and assess the suitability of the equipment with the locations. The contractor shall notify the Architect/Engineer in writing of any locational compatibility issues.

C. The equipment supplier / installer shall inspect the equipment locations prior to beginning the installation of the equipment. The contractor shall notify the Architect/Engineer in writing of any locational compatibility issues. Starting the installation of equipment shall constitute acceptance of the conditions at the equipment locations and suitability of the equipment for the locations.

D. It is recognized that certain solid state and computer based parking and revenue control equipment may require special electrical power and grounding considerations. The Supplier/Installer of the Parking Control System shall:

1. Include in the bid amount the cost to provide and install voltage stabilization modules or devices to protect each component from normal voltage variations at the site.

2. Advise the Engineer in writing at the time of the award of contract of any special electrical power, uninterruptible power supplies, and grounding requirements.

1.8 Warranty

A. Provide Manufacturer's Warranty

1. Warranty shall be for one year covering all labor, computer hardware and software, lane equipment, system components, and furnished equipment.

2. Warranty shall commence when equipment is 100 percent operational and acceptable to the Owner, as approved in writing by the Owner and Engineer.

3. Maintain equipment to be completely operational during the warranty period such that, if defective, equipment shall be serviced on-site within eight business hours, following notification by the Owner. Business hours are 8 a.m. to 5 p.m. Monday through Friday, excluding holidays.

4. Warranty shall include preventative maintenance cleaning, testing, and minor repair no less than twice per year.

5. Warranty shall include software maintenance services.

6. Warranty shall cover all equipment furnished under this specification section – both manufacture and installation, excluding misuse or vandalism.

PART 2 - PRODUCTS

2.1 General

A. All equipment colors shall be standard Manufacturer colors except where specifically noted.

B. All parking control equipment must be compatible with the electrical system as specified in Division 26 and shown on the Drawings.

2.2 Equipment List

A. The following equipment list consists of basic system components. Provide auxiliary items required for the proper functioning of the system, whether mentioned or not, including but not limited to, heaters, coolers, wiring, transformers, relays, stands, housings, pedestals, etc. It is the SOLE RESPONSIBILITY of the Parking Control Equipment (Sub) Contractor to provide every component necessary for a complete functioning system.

B. Locate equipment as indicated on the Drawings. Equipment List
Provide Parking Control Equipment for each lane as indicated:

LANE DESCRIPTIONS			EQUIPMENT LIST				
Lane #	**Type**	**Users**	Gate	Digital Self-tuning Detector	Detector Loops - sawcut (1)	Card Reader	AVI Antenna
1	Entry Lane,	Rental Car Personnel. Airport Personnel	1	2	3	1	1
2	Entry Lane,	Rental Car Personnel. Airport Personnel	1	2	3	1	1
		Total Required	2	4	6	2	2

Notes:
(1) Equipment manufacturer shall determine quantity, location, and dimension of detector loops.

2.3 Gates

A. The parking gate shall provide an effective barrier to vehicles in the entrance and exit lanes.

B. The barrier arm shall retract quickly in a vertical plane on a command signal from the ticket dispenser, fee computer, card reader, AVI reader, or detector loop depending on location, and return to the lower position upon a signal from a detector beyond the gate location. The parking gate shall be installed as located on Drawings and shall incorporate in one housing all necessary components for the functioning of this unit. The assembly shall operate satisfactorily in the environmental conditions stated elsewhere in this specification.

C. The unit shall be a 12-foot arm of wood or aluminum construction. The barrier arm shall be a break-away design that can be easily and inexpensively replaced when broken. The height of

the gate arm or the extended portion of folding arms shall be approximately 36 inches from drive level in DOWN position.

D. The gate arm shall have a down-strike safety feature. Should any object be struck by the gate arm during its descent, the arm shall immediately reverse and return to the UP position without damage, and remain up from 2 to 60 seconds, until automatically reset by variable control. The sensory function shall be initiated by sensing the internal mechanical action. The external mounting of tubes, wiring, and electrical devices on the gate arm shall not be acceptable.

2.4 Embedded Loops and Vehicle Detectors

A. The parking equipment detector loops shall be sawcut (maximum 3/4" depth) into the slab-on-grade.

B. Directional logic detection shall be provided by a count system. Provide loops as required for directional detection and counting.

C. Detectors shall be installed within the barrier gate housings.

D. Contractor shall locate embedded reinforcement and electrical conduit in the slab prior to saw-cutting for loop detectors. Contractor shall take all necessary precautions to prevent damage to reinforcement and conduit, and shall repair all damage caused by Contractor’s work at no cost to the owner.

PART 3 - EXECUTION

3.1 Inspection

A. Inspect setting surfaces, power wiring and conduit installation for equipment and report immediately in writing to the Engineer, as required in the General Conditions, any conditions of Related Work which are unsuitable for proper execution of this Work.

3.2 Installation

A. Install parking control system in accordance with Manufacturer's recommendations and the approved shop drawings. Also see Quality Control requirements.

B. Installation shall be by factory-trained mechanics experienced in installation of equipment of this type.

C. Provide and pull control wiring and make final connections of all wiring.

3.3 Adjustment and System Start-Up

A. Adjust and tune the system as required to assure proper operation. After installation, test all functions of the Parking and Revenue Control Systems.

B. Test the operation of all in lane devices:

1. AVI readers

2. Proximity card readers

3. Gates

C. Demonstrate the satisfactory electrical and functional performance of the entire parking control system by the following operations:

1. The successful use of a credential to enter and exit the facility with all information recorded.

2. The successful transfer of credential access data from the on-line equipment to the access system controller.

3. Proper operation of the gate opening switches.

4. The parking and revenue control systems will be considered acceptable after being 100 percent operational and after having performed satisfactorily for fourteen (14) continuous business days with no down time.

END OF SECTION 11 12 00

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 Related Documents

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

1.2 Summary

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.
6. Electrical demolition.
7. Cutting and patching for electrical construction.

1.3 Definitions

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 Submittals

A. Product Data: For sleeve seals.

1.5 Quality Assurance

A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended used.

B. Comply with NFPA 70.

C. Include in the Work, as a part of the Bid Proposal, labor, materials, services, apparatus, drawings (in addition to the Contract Documents) as required to complete the intended work.

D. Work for the Project must be performed in accordance with Federal, State and Local Laws, Ordinances, Codes, Rules and Regulations, pertaining to the Work which are hereby made a part of the Contract Documents by reference, the same as if repeated herein in their entirety. Where Contract Documents exceed these requirements, the Contract Documents shall govern. In no case shall Work be installed contrary to or below the minimum legal standards.

1.6 Coordination

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Firestopping."

PART 2 - PRODUCTS

2.1 Sleeves for Raceways and Cables

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum metal thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 Sleeve Seals

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

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

a. Advance Products & Systems, Inc.

b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure plates: Carbon steel. Include two for each sealing element.
4. Connecting bolts and nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 Grout

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, non-corrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 Common Requirements for Electrical Installation

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 Sleeve Installation for Electrical Penetrations

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 Sleeve Seal Installation

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 Demolition

A. Refer to Division 2 for general demolition requirements and procedures.

B. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

C. Accessible Work:

1. Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

D. Abandoned Work:

1. Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

E. Remove, store, clean, reinstall, reconnect and make operational components indicated for relocation.

F. Locate and identify electrical services passing through affected area and serving other areas outside the work limits.

G. Services to areas outside work limits shall be maintained uninterrupted unless specifically authorized otherwise in writing by the Owner. When transient services must be interrupted, provide temporary services for affected areas outside work limits.

H. Existing raceway and boxes may be reused where found to be suitable and meeting applicable codes and Contract Documents. Provide extension rings on existing boxes as required to be compatible with new building finishes. Provide blank cover matching other devices plates on unused device boxes that must remain.

I. All reusable salvaged material shall remain the property of the Owner and be retained for his inspection. Only items so inspected and rejected by the Owner shall be disposed by the Contractor. All other such items shall be turned over and deposited as directed by the Owner.

3.5 Cutting and Patching

A. Refer to Division 2 for general cutting and patching requirements and procedures.

B. Cut, channel, chase and drill floors, walls, partitions, ceilings and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

C. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.6 Firestopping

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."

3.7 Cleaning and Protection

A. On completion of installation, including outlets, fittings and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 26 05 00

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 Related Documents

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

1.2 Summary

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Sections include the following:

1. Division 26 Section "Medium-Voltage Cables" for single-conductor and multi-conductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.
2. Division 26 Section "Under-Carpet Electrical Power Cables" for flat cables for under-carpet installations.
3. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 Submittals

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.4 Quality Assurance

A. Contractor with qualifications and minimum ten (10) years experience in installation, splicing and testing of low voltage power conductors may be considered at discretion of Architect/Engineer, as acceptable agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 Conductors and Cables

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

1. Encore Wire.
2. Nexans.
3. Southwire Company.
4. United Copper Industries.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THW and THHN-THWN.

D. Multi-conductor Cable: Comply with NEMA WC 70 for non-metallic sheathed cable with ground wire.

2.2 Connectors and Splices

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

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type and class for application and service indicated.

PART 3 - EXECUTION

3.1 Conductor Material Applications

A. Feeders: Copper.

B. Branch Circuits: Copper, stranded.

C. The minimum conductor size shall be #12 AWG.

D. Voltage Drop: Branch circuit conductors shall be sized for a maximum voltage drop of 3 percent to comply with the requirements of ASHRAE Standard 90.1-2007. The following are minimum allowable conductor sizes based on circuit length. The circuit length shall be measured from the branch panelboard to the furthest device in that circuit. The phase and neutral conductors

shall be sized as indicated on the entire length of that circuit unless a larger size conductor is indicated on the drawings.

1. Conductor sizes for 20A/1-Phase/120 volt circuits shall be as follows unless noted otherwise:

    a. Circuit length of 0 to 95 feet: #12 awg.
    b. Circuit length of 96 to 150 feet: #10 awg.
    c. Circuit length of 151 to 235 feet: #8 awg.
    d. Circuit length of 236 to 380 feet: #6 awg.

2. Conductor sizes for 20A/1-Phase/277 volt circuits shall be as follows unless noted otherwise:

    a. Circuit length of 0 to 200 feet: #12 awg.
    b. Circuit length of 201 to 350 feet: #10 awg.
    c. Circuit length of 351 to 550 feet: #8 awg.

3.2 Conductor Insulation and Multi-Conductor Cable Applications and Wiring Methods

A. Feeders: Type THHN-THWN, single conductors in raceway.

B. Branch Circuits (minimum #12 AWG): Type THHN-THWN, single conductors in raceway.

C. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh and strain relief device at terminations to suit application.

D. Class 1 Control Circuits: Type THHN-THWN, in raceway.

E. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 Installation of Conductors and Cables

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

G. Each branch circuit shall be provided with a dedicated neutral conductor. Sharing of the neutral conductor between multiple circuits will not be allowed.

H. A single raceway shall be limited to a maximum of six current carrying conductors.

3.4 Connections

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 Field Quality Control

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors for compliance with requirements.

   a. Megger test for insulation integrity.
   b. Test all branch circuit wiring for leakage current requirements for NFPA 99 for isolation panelboard.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

   a. Follow-up infrared scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
   b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   c. Record of infrared scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEM

PART 1 - GENERAL

1.1 Related Documents

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

1.2 Summary

A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:

1. Overhead-lines grounding.
2. Underground distribution grounding.
3. Common ground bonding system.

1.3 Submittals

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.
5. Grounding for sensitive electronic equipment.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells based on NFPA 70B.

   a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
   b. Include recommended testing intervals.

1.4 Quality Assurance

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 Conductors

A. Insulated Conductors: Tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid conductors: ASTM B 3.
2. Stranded conductors: ASTM B 8.
3. Tinned conductors: ASTM B 33.
4. Bonding cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned bonding jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 awg minimum, soft-drawn copper.
2. Conductor protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

D. Grounding Bus: Rectangular bars of annealed copper, ¼” thick X 6” high X 18” long with holes, unless otherwise indicated; with insulators.

2.2 Connectors

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 Grounding Electrodes

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch in diameter by 10 feet long.

PART 3 - EXECUTION

3.1 Applications

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 4/0 AWG minimum.

1. Bury at least 24 inches below grade.
2. Duct-bank grounding conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and communication rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.

E. Conductor Terminations and Connections:

1. Pipe and equipment grounding conductor terminations: Bolted connectors.
2. Underground connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to ground rods at test wells: Bolted connectors.
4. Connections to structural steel: Welded connectors.
5. Water service: Bolted connectors.
6. Fire protection service: Bolted connectors.
7. Natural gas service: Bolted connectors.

3.2 Grounding Underground Distribution System Components

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Hand-holes: Install a driven ground rod through manhole or hand-hole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-

sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, non-shrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or hand-hole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductor's level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and non-current-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 awg for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.3 Equipment Grounding

A. Install insulated equipment grounding conductors for all electrical distribution, in addition to those required by NFPA 70 and as follows:

1. Feeders and branch circuits.
2. Receptacle circuits.
3. Single-phase motor and appliance branch circuits.
4. Flexible raceway runs.
5. Armored and metal-clad cable runs.

3.4 Installation

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

D. Test Wells: Ground rod driven through drilled hole in bottom of hand hole. Hand holes are specified in Division 2 Section "Underground Ducts and Utility Structures," and shall be at least 12 inches deep with cover.

1. Test wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding straps and jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to equipment mounted on vibration isolation hangers and supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal water service pipe: Provide bonding as per NEC 250, install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water meter piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each above ground portion of gas piping system downstream from equipment shutoff valve.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each indicated steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building foundation.

I. Pull Boxes:

1. Provide grounding type bushings on conduit entrance into pull boxes. The equipment grounding conductor shall be bonded to the box via threaded, locking type ground bushing at the conduit entrance.

J. Junction Boxes and Device Boxes:

1. Bond junction boxes and device boxes to the equipment grounding conductor within the branch circuit serving the box via an approved method.

K. Panelboards:

1. Bond panelboards to the equipment grounding conductor within the feeder conduit by a threaded grounding type insulated bushing at the conduit entrance into the tub. The equipment grounding conductor shall continue from the bushing to the panelboard ground bus and be bonded.

2. Bond the equipment grounding buses of normal and essential branch circuit panelbaords serving the same patient care areas as required by NEC 517. Bond with a minimum #10 awg insulated continuous copper conductor routed in conduit.

3.5 Field Quality Control

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
3. Perform tests by fall-of-potential method according to IEEE 81 and submit test.

B. Report measured ground resistances that exceed the following values:

1. Power and lighting equipment or system with capacity 500 KVA and less: 10 ohms.
2. Substations and pad mounted equipment: 5 ohms.
3. Manhole grounds: 10 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 Related Documents

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

1.2 Summary

A. This Section includes the following:

1. Raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
2. Surface raceway.
3. Conduit sleeve and firestop.
4. Core drill for electrical work.

B. Related Section includes the following:

1. Division 26 “Underground Ducts and Raceway for Electrical Systems.”

1.3 Definitions

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquid-tight flexible metal conduit.

G. LFNC: Liquid-tight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.4 Submittals

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

D. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified."

2. Dimensioned outline drawings of equipment unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Source quality-control test reports.

1.5 Quality Assurance

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70, 79.

C. Product shall be UL approved.

D. Comply with ANSI C2.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, provide product by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc., a unit of Southwire.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.

5. Electri-Flex Co.
6. Republic Conduit, a unit of Tenaris.
7. Western Tube and Conduit Corporation.
8. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating thickness: 0.040 inch (1 mm), minimum.

F. EMT: ANSI C80.3.

G. FMC: Zinc-coated steel.

H. LFMC: Flexible steel conduit with PVC jacket and UL label.

I. Fittings for Conduit (Including all Types and Flexible and Liquid-tight): NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit fittings for hazardous (classified) locations: Comply with UL 886.
2. Fittings for EMT: Steel or die-cast, compression type.
3. Coating for fittings for PVAC coated conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
4. Fittings for rigid and intermediate steel conduit: Threaded rigid steel conduit.
5. PVC externally coated, rigid steel conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide product by one of the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. CANTEX Inc.
4. Dura-Line.
5. Electri-Flex Co.
6. Lamson & Sessions; Carlon Electrical Products.
7. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

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

1. Dura-Line.
2. Endot Industries Inc.
3. Lamson & Sessions; Carlon Electrical Products.

B. Description: Comply with UL 2024; flexible type, approved for general-use installation.

2.4 METAL WIREWAYS

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

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 3R, unless otherwise indicated.

1. Indoor, JIC type, minimum 16 gage, 14 gage for 6” X 6” or larger, finish with gray enamel finish.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type.

E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

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

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

B. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.6 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

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

   a. Thomas & Betts Corporation.
   b. Walker Systems, Inc.; Wiremold Company (The).
   c. Wiremold Company (The); Electrical Sales Division.

B. Surface Non-Metallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

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

   a. Enduro Systems, Inc.; Composite Products Division.
   b. Hubbell Incorporated; Wiring Device-Kellems Division.
   c. Lamson & Sessions; Carlon Electrical Products.
   d. Panduit Corp.
   e. Walker Systems, Inc.; Wiremold Company (The).
   f. Wiremold Company (The); Electrical Sales Division.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, provide product by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Spring City Electrical Manufacturing Company.
10. Thomas & Betts Corporation.
11. Walker Systems, Inc.; Wiremold Company (The).

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1, minimum 4” X 4” X 2-1/8” deep. Provide with single gang plaster ring unless two gang plaster ring is specifically noted elsewhere to be provided.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover. Minimum 4” X 4” X 2-1/8” deep. Provide with single gang plaster ring unless two gang plaster ring is specifically noted elsewhere to be provided.

D. Non-Metallic Outlet and Device Boxes: NEMA OS 2.

E. Non-Metallic Floor Boxes: Nonadjustable, round.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1 gasketed cover.

H. The box support bracket shall be with support leg to eliminate movement of box in wall. The box support shall be attached to metal stud by using screw gun. The box support shall have an offset for drywall.

I. Device rough-in boxes shall be securely and rigidly attached and supported plumb, level and true to the building lines using one of the following:

1. Box mounting bracket: Allow 4” or 4-11/16” boxes. Bendable leg serves as a bracket stabilizer.
2. Extension plate bracket: Allow outlet boxes 12” or 18” offset from either metal stud track or a stud. Allow 4” or 4-11/16” outlet boxes, 2-1/8” deep, bracket with bendable stabilizer leg for use on 2-1/2” and 3-1/2” metal studs for bracket sterilizer.

J. Hinged-Cover Enclosures: Continuous hinged door in front cover with flush latch and concealed hinge (door-in-door) unless otherwise indicated.

1. Metal enclosures: NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic enclosures: Plastic.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed conduit: Rigid steel conduit.
2. Concealed conduit, Aboveground: Rigid steel conduit.
3. Underground conduit: RNC, Type EPC-PVC, direct buried for utility power system, RNC Type EPC-40 in concrete encased for standby power system.
4. Connection to vibrating equipment (including transformers and hydraulic, pneumatic, electric solenoid or motor driven equipment: LFMC.
5. Boxes and enclosures, above ground: NEMA 250, Type 3R.

B. Indoors: Apply raceway product as specified herein, unless otherwise indicated:

1. Below grade: PVC Coated GRC.
2. Branch circuit: EMT.
3. Concrete wall/column: GRC.
4. Equipment feeder, 2" and larger: EMT.
5. Connection to vibrating equipment (including transformers and hydraulic, pneumatic, electric solenoid, or motor-driven equipment): LFMC.
6. Damp or wet locations: Rigid steel conduit.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Install non-ferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

E. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical System" and "Vibration and Seismic Controls for Electrical Work."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit within finished walls and ceilings, unless otherwise indicated.

H. Raceways embedded in slabs or below slab inside the building envelope are not permitted unless shown on Contract Documents.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including bushing for size No. 6 AWG and larger conductors.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic, rigid, as follows:

1. 3/4-inch trade size and smaller: Install raceways in maximum lengths of 50 feet.
2. 1-inch trade size and larger: Install raceways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, use LFMC for equipment subject to vibration, noise transmission, or movement; transformers, motors and damp/wet location.

O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

P. Set metal floor boxes level and flush with finished floor surface.

Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

R. Expansion coupling/fitting shall be installed for conduit passing through building expansion joint. Provide bonding jumper with conduit/pipe clamp to maintain raceway as grounding continuity. The expansion fitting shall be similar to O-Z/Gedney EX Series. Expansion fitting/coupling length and diameter shall be as required for the application.

S. Raceways shall run parallel and perpendicular to the building surface walls or exposed structural members and follow the surface contours to present a neat appearance. This shall apply to exposed structure, accessible ceiling and hard ceiling area of the facility.

3.3 DEVICE ROUGH-IN BOX

A. Finish plates shall not span different types of wall finishes either vertically or horizontally. Plates shall cover mortar joints and cut openings completely.

B. Outlet, junction and pull boxes, and their covers shall have corrosion protection suitable for the atmosphere in which they are installed. Provide gaskets for all boxes installed outside and other wet or damp locations (tunnels, crawl spaces, pits, etc.).

C. Outlet boxes shall be protected to prevent entrance of plaster, and debris shall be thoroughly cleaned from the box prior to installation of conductors.

D. Single gang opening outlet boxes shall be mounted with the long axis vertical unless otherwise noted for horizontal mounting. Three or more gang boxes shall be mounted with the long axis horizontal.

E. Finish plates shall be a type designed, intended, and appropriate for the use and location.

F. Existing outlet boxes are being reused, provide extension rings compatible with new wall surfaces or finishes.

G. Radiology/Imaging areas where lead shielding is required behind outlet boxes, Contractor shall provide such shielding.

H. Provide outlet box with barrier for grouped or ganged light switched where voltage between adjacent switches exceeds 300 volt AC per NEC Article 380.

I. Provide outlet box with barrier and separate conduit feed for switches grouped or ganged where connected to utility power and standby power.

3.4 METAL RACEWAY

A. Metal raceway duct shall be installed level and true to building construction lines such that removable or hinged covers can be operated to be fully accessible.

B. Routing shall be pre-planned by the Contractor to assure right-of-way and accessibility; routing indicated by Contract Documents shall be considered schematic in nature and may require job site alteration to avoid interference.

C. Metal raceway duct shall be adequately supported at not more than 5'-0" intervals. The support accessories shall be of the same manufacturer as metal raceway.

D. Metal raceway duct penetrations of walls shall be unbroken lengths, scaled to the wall opening; dead ends shall be closed with manufactured closures.

E. Metal raceway duct to be installed surface mounted; flush in wall or in floor as indicated by the Contract Documents.

F. Provide approved wall flanges and fully seal all penetrations of fire and smoke rated walls and partitions, cutting and patching as needed.

G. Provide divider to compartment the metal raceway duct as indicated by Contract Documents.

3.5 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to

provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."

4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

5. Warning tape: Bury warning tape approximately 12 inches above direct-buried conduits or duct bank placing them 24 inches o.c. Align tape along the width and along the centerline of conduit.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Firestopping."

END OF SECTION 26 05 33

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 Related Documents

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

1.2 Summary

A. This Section includes the following:

1. Identification for raceway.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 Submittals

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 Quality Assurance

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.5 Coordination

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 Raceway Identification Materials

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power circuits:

a. Utility power: Black letters on a white field.

2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 Conductor and Communication and Control Cable Identification Materials

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch with stamped legend, punched for use with self-locking nylon tie fastener.

E. Refer to specification section 27 15 00 for additional communication labeling requirements.

2.3 Underground Line Warning Tape

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.4 Warning Labels and Signs

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Metal-Backed, Butyrate Warning Signs: Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple power source warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace clearance warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 42.

D. Refer to specification section 27 15 00 for additional communication labeling requirements.

2.5 Instruction Signs

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Refer to specification section 27 15 00 for additional communication labeling requirements.

2.6 Equipment Identification Labels

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background for utility power. Minimum letter height shall be 3/8 inch.

2.7 Device, Receptacle and Switch Labels

A. Label shall be self-adhesive vinyl and shall be computer or machine printed. Minimum size shall be ¼" label with 1/8" letter.

1. Label background shall be clear or match to device plate.
2. Black letter for normal power.
3. Red letter for emergency power.
4. Legend: Indicates panel and circuit number.

B. Special Receptacles:

1. Special purpose receptacles shall include an engraved or embossed legend appropriate for load serviced and labeled as specified in Paragraph A.
2. Receptacles not available with factory red color for emergency power circuits shall be identified with engraved or embossed label with the word "EMERGENCY POWER."

2.8 Miscellaneous Identification Products

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum width: 3/16 inch.
2. Tensile strength: 50 lb. minimum.
3. Temperature range: Minus 40 to plus 185 deg. F.
4. Color: Black, except where used for color-coding.

B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

D. Refer to specification section 27 15 00 for additional communication labeling requirements.

PART 3 - EXECUTION

3.1 Application

A. Raceways and Duct Banks More Than 600 V Concealed within Buildings: 4-inch wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways, 600 V or Less, for Feeder and Branch Circuits: Identify with preprinted self-adhesive vinyl label.

C. Accessible Raceway for Standby System: Identify with self-adhesive vinyl tape and comply with NFPA 70-700.9(A).

D. Color for Printed Legend: The following color codes are general. Verify with Owner’s standard before implementation. If Owner’s do not have the standard then following these standards.

1. Fire alarm system: Red.
2. Fire-suppression supervisory and control system: Red and yellow.
3. Combined fire alarm and security system: Red and blue.
4. Security system: Blue and yellow.
5. Mechanical and electrical supervisory system: Green and blue.
6. Telecommunication system: Green and yellow.
7. Control wiring: Green and red.

E. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and hand-holes use marker tape.

Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

F. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number.

G. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.

H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

I. Instruction Signs:

1. Operating instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency operating instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels on each power and system equipment/panel power equipment. Label shall include device identification and source.

1. Labeling instructions:

a. Indoor equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label where 2 lines of text are required, use labels 2 inches high.
b. Outdoor equipment: Engraved, laminated acrylic or melamine label.
c. Elevated components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to be labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Access doors and panels for concealed electrical items.
c. Electrical switchgear and switchboards.
d. Transformers.
e. Electrical substations.
f. Emergency system boxes and enclosures.
g. Motor-control centers.
h. Disconnect switches.
i. Enclosed circuit breakers.
j. Motor starters.
k. Push-button stations.
l. Power transfer equipment.
m. Contactors.
n. Remote-controlled switches, dimmer modules, and control devices.
o. Battery inverter units.

p. Battery racks.
q. Power-generating units.
r. Voice and data cable terminal equipment.
s. Master clock and program equipment.
t. Intercommunication and call system master and staff stations.
u. Television/audio components, racks, and controls.
v. Fire-alarm control panel and annunciators.
w. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
x. Monitoring and control equipment.
y. Uninterruptible power supply equipment.
z. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
aa. Audio/paging system.
bb. Video surveillance.

3. Equipment schedule:

a. Panelboards shall include correct, typewritten circuit directory cards identifying load served by branch circuit protective devices.
b. Panelboards located in a renovated area shall have their schedules updated for all spares, spaces and circuits connected to the panelboard.

3.2 Installation

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for feeder and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208/120-V circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

d. Neutral: White.
e. Ground: Green.

3. Colors for 480/277-V circuits:

a. Phase A: Brown.
b. Phase B: Orange.
c. Phase C: Yellow.
d. Neutral: White with yellow strips or tape.
e. Ground: Green with yellow strips or tape.

4. Isolated power system:

a. Phase A: Orange.
b. Neutral: Brown.
c. Ground: Green.

5. Field-applied, color coding conductor tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

K. Refer to specification section 27 15 00 for additional communication labeling requirements.

END OF SECTION 26 05 53

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 Related Documents

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

1.2 Summary

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Receptacles with integral surge suppression units.
4. Wall-box motion sensors.
5. Isolated-ground receptacles.
6. Hospital-grade receptacles.
7. Snap switches and wall-box dimmers.
8. Solid-state fan speed controls.
9. Wall-switch and exterior occupancy sensors.
10. Pendant cord-connector devices.
11. Cord and plug sets.
12. Floor service outlets, poke-through assemblies, service poles, and multi-outlet assemblies.
13. Communications outlet.
14. Safety type receptacle (tamperproof).

1.3 Definitions

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

G. IG: Isolated ground type.

H. ST: Safety type (tamperproof).

1.4 Submittals

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 Quality Assurance

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 Coordination

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and plug sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices, a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated, Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand, Wiring Devices & Accessories (Pass & Seymour).

2.2 Straight Blade Receptacles

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

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

   a. Cooper 5351 (single), 5352 (duplex).
   b. Hubbell HBL5351 (single), CR5352 (duplex).
   c. Leviton 5891 (single), 5352 (duplex).
   d. Pass & Seymour 5381 (single), 5352 (duplex).

B. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.

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

   a. Cooper 8300 (duplex).
   b. Hubbell HBL8310 (single), HBL8300H (duplex).
   c. Leviton 8310 (single), 8300 (duplex).
   d. Pass & Seymour 9301-HG (single), 9300-HG (duplex).

2.3 Isolated Ground Receptacles

A. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

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

   a. Cooper IG 5362BLS.
   b. Hubbell CR 5253IG.
   c. Leviton 5362-IG.
   d. Pass & Seymour IG6300.

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

B. Isolated-Ground, Hospital-Grade, Duplex Convenience Receptacles, 125V, 20A: Comply with NEMA WD1, NEMA W06 Configuration 5-20R and UL 498:

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

   a. Cooper IG8300HGBLS.
   b. Hubbell IG8362SA.
   c. Leviton 8380-IG.
   d. Pass and Seymour IG 8300.

2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Comply with UL 498 Supplement SD. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from

mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.4 Safety Type (Tamper-Resistant) Receptacles

A. Tamper-Resistant Hospital grade duplex receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

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

   a. Cooper TR8300.
   b. Hubbell HBL8300SG.
   c. Leviton 8300-SGG.
   d. Pass & Seymour 63H.

2. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article “Pediatric Locations” Section.

2.5 GFCI Receptacles

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

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

   a. Cooper GF20.
   b. Hubbell GF 5352.
   c. Leviton 8898.
   d. Pass & Seymour 2084.

C. Hospital-Grade, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL 498 Supplement SD.

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

   a. Cooper HGF20.
   b. Hubbell HGF8300.
   c. Leviton 6898-HG.
   d. Pass & Seymour 2091-SHG.

2.6 TVSS Receptacles

A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.

1. TVSS components: Multiple metal-oxide varistors with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
2. Active TVSS indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex TVSS Convenience Receptacles:

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

   a. Cooper 5362BLS.
   b. Hubbell HBL5362SA.
   c. Leviton 5380.
   d. Pass and Seymour.

2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.

2.7 Hazardous (Classified) Location Receptacles

A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.

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

   a. Cooper Crouse-Hinds.
   b. EGS/Appleton Electric.
   c. Killark; a division of Hubbell Inc.

2.8 Twist Locking Receptacles

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

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

   a. Cooper L520R.
   b. Hubbell HBL2310.
   c. Leviton 2310.
   d. Pass & Seymour L520-R.

2.9 Pendant Cord Connector Devices

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External cable grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.10 Cord and Plug Sets

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.11 Wall Plates

A. Single and combination types to match corresponding wiring devices.

1. Plate-securing screws: Metal with head color to match plate finish.
2. Material for finished spaces: Smooth, high-impact thermoplastic.
3. Material for unfinished spaces: Galvanized steel.
4. Material for damp locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant thermoplastic with lockable cover.

PART 3 - EXECUTION

3.1 Installation

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

1. Receptacles: 18 inches A.F.F. to center unless noted otherwise.
2. Switches/dimmer/wall occupancy sensor: 46 inches A.F.F. to center unless noted otherwise.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing conductors:

   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pig-tailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 awg are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.

3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 Identification

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black letter for utility power filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 Field Quality Control

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line voltage: Acceptable range is 105 to 132 V.
2. Percent voltage drop under 15-A load: A value of 6 percent or higher is not acceptable.
3. Ground impedance: Values of up to 2 ohms are acceptable.
4. GFCI trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight blade hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

END OF SECTION 26 27 26

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 Related Documents

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

1.2 Summary

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Non-fusible switches.
3. Bolted-pressure contact switches.
4. High-pressure, butt-type contact switches.
5. Molded-case circuit breakers.
6. Molded-case switches.
7. Enclosures.

1.3 Definitions

A. GFCI: Ground-fault circuit interrupter.

B. HD: Heavy duty.

C. RMS: Root mean square.

D. SPDT: Single pole, double throw.

1.4 Submittals

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current rating.
4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches and circuit breakers, accessories, and components will withstand seismic forces defined in

Division 26 Section "Vibration and Seismic Controls for Electrical Systems" Include the following:

1. Basis of certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned outline drawings of equipment unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 Quality Assurance

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 Project Conditions

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

1.7 Coordination

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 Manufacturers

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.2 Fusible and Non-Fusible Switches

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Non-fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment ground kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
3. Auxiliary contact kit: Auxiliary set of contacts arranged to open before switch blades open.

2.3 Fused Power Circuit Devices

A. Bolted-Pressure Contact Switch: UL 977; operating mechanism shall use a rotary-mechanical-bolting action to produce and maintain high-clamping pressure on the switch blade after it engages the stationary contacts.

1. Manufacturers:

a. Boltswitch, Inc.

b. Eaton Corporation; Cutler-Hammer Products.
c. Pringle Electrical Mfg. Co.
d. Siemens Energy & Automation, Inc.
e. Square D/Group Schneider.

B. High-Pressure, Butt-Type Contact Switch: UL 977; operating mechanism shall use butt-type contacts and a spring-charged mechanism to produce and maintain high-contact pressure when switch is closed.

1. Manufacturers:

a. General Electric Co.; Electrical Distribution & Control Division.

2. Main contact interrupting capability: Twelve times the switch current rating, minimum.
3. Operating mechanism: Manual handle operation to close switch stores energy in mechanism for closing and opening.

a. Electrical trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
b. Mechanical trip: Operation of mechanical lever or push button or another device causes switch to open.

4. Auxiliary switches: Factory installed, SPDT, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
5. Service-rated switches: Labeled for use as service equipment.
6. Ground-fault relay: Comply with UL 1053. Self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.

a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground fault indicator.
b. Internal memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
c. No-trip relay test: Operation of "no-trip" test control permits ground-fault simulation test without tripping switch.
d. Test control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).

7. Open-fuse trip device: Arranged to trip switch open if a phase fuse opens.

2.4 Molded Case Circuit Breakers and Switches

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Moeller Electric Corporation.
4. Siemens Energy & Automation, Inc.
5. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-magnetic circuit breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable instantaneous trip setting for circuit-breaker frame sizes 150 A and larger.
2. Circuit breakers with rating plug: RMS sensing with field changeable rating plug for 250A and larger frame.
3. Circuit breakers electronic trip: RMS sensing; field-changeable rating plug; with the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.

4. GFCI circuit breakers: Single- and two-pole configurations with 30-mA trip sensitivity.
5. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
6. Ground-fault protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
7. Communication capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
8. Shunt trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
9. Under-voltage trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
10. Auxiliary switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
11. Key interlock kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
12. Fault protection function.

C. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
2. Application listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Shunt trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage. Provide "dummy" trip unit where required for proper operation.
4. Under-voltage trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay. Provide "dummy" trip unit where required for proper operation.
5. Auxiliary switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
6. Key interlock kit: Externally mounted to prohibit operation; key shall be removable only when switch is in off position.

2.5 Enclosures

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor locations: NEMA 250, Type 3R.
2. Kitchen areas: NEMA 250, Type 4X, stainless steel.

3. Other wet or damp indoor locations: NEMA 250, Type 4.
4. Hazardous areas indicated on drawings: NEMA 250, Type 7C.

PART 3 - EXECUTION

3.1 Examination

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Concrete Bases

A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.

B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 3.

3.3 Installation

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.4 Identification

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems."

3.5 Field Quality Control

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.
2. Verify switch and relay type and labeling verification.
3. Verify rating of installed fuses.
4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

C. Perform the following field tests and inspections and prepare test reports:

1. Test mounting and anchorage devices according to requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
2. Perform each electrical test and visual and mechanical inspection. Certify compliance with test parameters.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
4. Infrared scanning:

   a. After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors or panels so connections are accessible to portable scanner.
   b. Follow-up infrared scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of Substantial Completion.
   c. Instruments, equipment and reports:

      1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
      2) Prepare a certified report that identifies enclosed switches and circuit breakers included and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 Adjusting

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.7 Cleaning

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 26 28 16

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 Related Documents

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

1.2 Summary

A. Section Includes:

1. Communications equipment coordination and installation.
2. Sleeves for pathways and cables.
3. Sleeve seals.
4. Grout.
5. Common communications installation requirements.

1.3 Definitions

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 Submittals

A. Product Data: For sleeve seals.

1.5 Coordination

A. Coordinate arrangement, mounting, and support of communications equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting pathways, cables, wire-ways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Firestopping."

PART 2 - PRODUCTS

2.1 Sleeves for Pathways and Cables

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum metal thickness:

   a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
   b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 Sleeve Seals

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

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

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Hilti.
   d. Metraflex Co.
   e. Pipeline Seal and Insulator, Inc.
   f. Specified Technologies, Inc.

2. Sealing elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
3. Pressure plates: Carbon steel. Include two for each sealing element.
4. Connecting bolts and nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 Grout

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 Common Requirements for Communications Installation

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

END OF SECTION 27 05 00

SECTION 27 15 00 - COMMUNICATIONS CABLING

PART 1 – GENERAL

1.1 Related Documents

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

B. Specific reference in Specifications to codes, rules, regulations, standards, manufacturer's instructions or requirements of regulatory agencies shall mean the latest printed edition of each in effect at date of contract unless the Document is shown dated.

C. Conflicts:

1. Between referenced requirements: Comply with the one establishing the more stringent requirements.
2. Between referenced requirements and contract documents: Comply with the one establishing the more stringent requirements.

D. References: Installation and testing shall comply with the following codes, standards, and design guidelines:

1. Building Industry Consulting Services International (BICSI)
2. National Fire Protection Association (NFPA).

   a. NFPA 70 (2002); National Electrical Code.

3. Telecommunications Distribution Methods Manual (TDMM)
4. Telecommunications Industry Association and Electronic Industry Alliance (TIA/EIA)
5. Local codes and ordinances, as applicable.

1.2 Summary

A. Design Criteria: The structured cabling system provides a consolidated communications infrastructure to be used by network systems and is comprised of copper and fiber optic cables routed throughout the facility. This system shall provide transmission media for all voice, data, and video signals. The Contractor shall provide structured cabling transmission media, components, and testing as specified herein or shown on the plans and in conformance with manufacturers' requirements and recommendations.

B. This Section includes the innerduct, racks, cabinets, patch panels, connectors, outlets, terminal blocks, etc. as required to provide a complete structured system. This section specifies the following types of control and signal transmission media:

1. UTP Copper: ANSI/TIA/EIA-568B.2-1 Compliant, 4-Pair Category 6.
2. UTP Copper: Category 3 Backbone Cable.
3. Fiber Optic Cable: ANSI/TIA/EIA-568-A and ISO/IEC 11801 Compliant.
4. Multi-conductor Cable.

C. Unless agreed to in writing, the system shall be documented as specified herein or shown on the drawings.

1.3 System Description

A. The structured cabling system shall provide a consolidated infrastructure of backbone and horizontal media. The system shall provide communication transmission for the Local Area Networks (LAN), which will support various airport-owned systems. The structured cabling system shall provide all associated cabling, termination equipment, enclosures, testing, and cable management capabilities specified herein.

B. The fiber optic backbone media shall provide one series of dual redundant connectivity. One series shall be an Airport infrastructure and connect the Airport Communications Rooms and Main Airport Communications Rooms.

C. The copper backbone media shall provide connectivity between the Main Communications Rooms and Airport and Tenant Communications Rooms.

1.4 Submittals

A. Shop Drawings:

1. Proposed Products Data Sheets: The Contractor shall submit catalogue cut-sheets for approval that include manufacturer, trade name, and complete model number for each product specified. Model number shall be hand written and/or hi-lighted to indicate exact selection. Identify applicable specification section reference for each product.
2. Samples: Provide (1) one sample of each type of the following cables for approval:

    a. Fiber optic breakout cable with connectors attached to each end.
    b. Cat 6 cable with connectors attached to each end.
    c. RG-59U coaxial cable with BNC connectors attached to each end.

3. Qualifications: The Contractor shall supply qualification data sheets for firms and persons as specified in the “Quality Assurance” article of this specification to demonstrate their capabilities and experience.

B. Testing Plan: Provide for review and approval a test plan for media testing as described in the article Field Quality Control. Gain approval of proposed testing prior to commencement. The tests shall clearly demonstrate that the media and its components fully comply with the requirements specified herein. The following minimal items shall be submitted for review:

1. Indicate all testing methods.
2. Certifications and qualifications of all persons conducting the testing.
3. Calibration certificates for all test equipment.
4. Examples of all graphs, tables, and charts necessary for display of testing results.

1.5 Quality Assurance

A. Certification: Engage an experience Installer with a minimum BICSI Technician Level certification to manage installation of the Structured Cabling System.

B. Fiber Optic Cable Installer Qualifications: Engage an experienced Installer to install fiber

optic cables. The manufacturer of each type of fiber optic product shall certify all personnel performing installation, splices and fiber optic connector terminations.

C. Cat 6 UTP Installer Qualifications: Engage an experienced Installer to install Cat 6 cables. The manufacturer of each type Cat 6 product shall certify all personnel performing installation and connector terminations.

D. Cat 3 UTP, multipaired Cable Installer Qualifications: Engage an Installer with minimum five (5) years experience installing Cat 3, coax, and multipaired cable.

E. Testing Firm's Field Supervisor Qualifications: A person currently certified by the International Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

F. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.

   a. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
   b. Compliance: Comply with NFPA 70 "National Electrical Code" for components and installation.
   c. Single Point of Contact Responsibility: All cable and components of each kind shall be covered by a single warranty program with a single point of contact. Cable and connecting hardware do not need to be manufactured by the same company. All components of, and the entire horizontal copper cabling channel, shall exceed all requirements for ANSI/TIA/EIA-568B.2-1, “Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components, Addendum 1 – Transmission Performance Specifications for 4 pair 100 Ohm Category 6 Cabling”.

1.6 Warranty

A. General:

1. The Contractor shall provide a joint written warranty of the manufacturer(s) and the installer(s), on a single document. The document shall warrant complete installation of the equipment, system, and software to be free from defects in materials and workmanship for a period of no less than twenty (20) years, starting with the date of Final System Acceptance.

B. Hardware Warranty:

1. The Contractor shall warrant that the proposed merchandise will conform to its description and any applicable specifications, and shall be of good quality for the known purpose for which it is intended.
2. The warranty can be supplied by a service contract. If a service contract is used to provide warranty, the price of the contract shall be separately identified, and shall include a per year price for continuing the contract.

PART 2 – PRODUCTS

2.1 Manufacturers

A. Cable:

1. UTP Cat 6:

   a. Avaya: Systimax Gigaspeed Cable Series.
   b. Belden: Mediatwist Series.
   c. Berk-Tek: LANmark-2000 Series.
   d. CommScope: Ultra Media Series.
   e. Superior Essex Nextgain Series.

2. UTP Cat 3:

   a. Avaya.
   b. Essex Communications Products.
   c. CommScope.
   d. General Cable.
   e. Mohawk/CDT.
   f. NORDX/CDT.

3. Fiber Optic:

   a. AMP.
   b. Avaya.
   c. Belden.
   d. Berk-Tek.
   e. CommScope.
   f. OCC.
   g. Mohawk/CDT.
   h. NORDX/CDT.
   i. Siecor.

4. Blown Fiber Optic Cable:

   a. Sumitomo Electric Lightwave.

5. Multiconductor and Paired:

   a. AMP.
   b. Avaya.
   c. Belden.
   d. Berk-Tek.
   e. CommScope.
   f. West Penn/CDT.

B. Terminating Equipment: (Connectors, Fiber Optic Splice Boxes, Patch Panels, etc.)

1. UTP Cat 6:

   a. AMP.
   b. Avaya.
   c. Hubbell.
   d. Krone.
   e. Leviton.

f. NORDX/CDT.
g. Ortronics.
h. Panduit.
i. Siemon.

2. Fiber Optic:

a. AMP.
b. Avaya.
c. Panduit.
d. Ortronics.
e. Siecor.
f. Siemon.

C. Patch Cords:

1. UTP Cat 6:

a. AMP.
b. Avaya.
c. Hubbell.
d. Krone.
e. Leviton.
f. NORDX/CDT.
g. Ortronics.
h. Panduit.
i. Siemon.

2. Fiber Optic:

a. AMP.
b. Avaya.
c. Panduit.
d. Ortronics.
e. Siecor.
f. Siemon.

D. Racks and Cabinets:

1. APC.
2. Avaya.
3. Chatsworth.
4. Devtek.
5. Great Lakes.
6. Middle Atlantic.
7. Ortronics.
8. Panduit.
9. Rittal.

E. Nonmetallic optical fiber raceway (Innerduct):

1. Arnco Corporation.
2. Carlon.
3. Pyramid Industries.

4. Maxcell

F. Blown Fiber Tube Bundles and Termination Equipment:

1. Sumitomo Electric Lightwave.

G. Testing Equipment

1. Cat 6:

a. Fluke.
b. Microtest.

2. Optical Fiber:

a. Fluke.
b. Siecor.
c. Tektronix.

2.2 Cable

A. Category 6 Cable:

1. General: Unshielded Twisted-Pair Cat 6 cable shall exceed all requirements for ANSI/TIA/EIAB.2-1 and support high-speed communication network applications.
2. Rating: UL-listed Communications Cable Type CMP for plenum applications, Type CMR for riser applications, Type CMG for general-purpose applications.
3. Manufacturer Testing: Furnish a copy of the factory certified test report verifying that final production reels are tested to at least 250 MHz and conform to all ANSI/TIA/EIA Cat 6 requirements.
4. Field Testing: All cabling and connectors shall comply with and be tested to ANSI/TIA/EIA- 568B.2-1 and as specified in Part 3.

B. Category 3 Backbone Riser Cable

1. General: Unshielded Twisted-Pair Cat 3 Riser Cable shall be distributed in a star configuration from each Main Distributing Frame (MDF) to Intermediate Distributing Frames (IDFs). Size and routing of riser cables shall be as indicated on drawings.
2. Rating: UL-listed Communications Cable Type CMP for plenum applications, Type CMR for riser applications, Type CMG for general-purpose applications.
3. Compliance:

a. All copper cabling and components shall comply with, and be tested to, appropriate codes and specifications.

4. Mechanical Details:

a. Minimum Bend Radius: Manufacturer specifications based on cable type and size.

C. Fiber Optic Cable

1. General: The fiber optic cable construction shall consist of laser optimized 50/125 µm multimode optical fibers or single mode optical fibers, or both, typically formed in to groups of twelve (12) fibers, twenty-four (24) or forty-eight (48) fibers each. Size and

routing of fiber optic cables shall be as indicated on the drawings. These groups and individual fibers shall exceed all requirements for ANSI/TIA/EIA-568B.3 and support high-speed communication network applications. These groups are assembled to form a single compact core, which is covered by a protective sheath. The sheath consists of an overall jacket and shall contain one or more layers of dielectric material applied over the core.

2. Rating: UL-listed Fiber Optic Cable Type OFNP for plenum applications, Type OFNR for riser applications, Type OFNG for general-purpose applications.

    a. UL-listed Fiber Optic Cable for use in ductbank and buried applications.

3. Cable Construction:

    a. Cable shall use loose tube construction for exterior applications and tight buffer construction for interior applications unless otherwise noted. All cable shall be dielectric.
    b. Loose tube construction: Optical fibers shall be surrounded by a tube buffer, be contained in a channel, or otherwise loosely packaged to provide clearance between the fibers and the inside of the container to allow for thermal expansion without constraining the conductor. Cable core shall contain water-blocking compound to prevent water migration into the cable.
    c. Tight buffer construction: The cable shall contain optical fibers that have a 245 □m mechanically strippable acrylate coating. Additionally, there shall be a 900 □m thermoplastic coating applied directly to the fiber. The fibers will be surrounded by aramid yarn and be contained in a flame resistant thermoplastic outer jacket.

4. Cable Jacket:

    a. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness; jackets extruded under high pressure are not acceptable.
    b. For cables with more than two fibers, the cable jacket shall be designed for easy removal without damage to the optical fibers by incorporating a ripcord under each cable jacket.
    c. The nominal thickness of the cable outer jacket shall be sufficient to provide adequate cable protection while meeting the mechanical, flammability, and environmental test requirements of this document over the life of the cable.

5. Identification:

    a. The individual fibers shall be color coded for identification. The fiber optic color coding shall be in accordance with ANSI/TIA/EIA-598, "Color Coding of Fiber Optic Cables" The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color-coded, buffered fibers shall not adhere to one another. When fibers are grouped into individual units, each unit shall be numbered on the unit jacket for identification. The number shall be repeated at regular intervals.
    b. Jacket Printing: The outer jacket shall be marked with the manufacturer's name or UL file number, date of manufacture, fiber type, flame rating, UL symbol, and sequential length markings every two (2) feet (e.g. "COMPANY-01/98-62.5/125 MICRON-Type OFN - (UL) 00001 FEET"). The printing shall be permanent and legible for the life of the cable.

6. Manufacturer Testing: Furnish a copy of the factory certified optical test report verifying that final production reels comply with the attenuation requirement listed within this specification.
7. Field Testing: All cabling and connectors shall comply with and be tested to ANSI/TIA/EIA- 568B.3 and as specified in Part 3.
8. Installation: Fiber optic backbone cable shall be installed in innerduct when within cable tray and in maxcell in backbone conduit.

D. Blown Fiber Optic Cable:

1. General: The fiber optic cable construction shall consist of laser optimized 50/125 µm multimode optical fibers in an 18-fiber bundle intended solely for use in blown fiber application. Size and routing of fiber optic cables shall be as indicated on the drawings. These bundles and individual fibers shall exceed all requirements for ANSI/TIA/EIA-568B.3 and support high-speed communication network applications. These bundles are assembled to form a single compact core, which is covered by a protective sheath. The sheath consists of an overall jacket and shall contain one or more layers of dielectric material applied over the core.
2. Rating: UL-listed Fiber Optic Cable Type OFNP for plenum applications, Type OFNR for riser applications, Type OFNG for general-purpose applications.

    a. UL-listed Fiber Optic Cable for use in ductbank and buried applications.

3. Cable Construction:

    a. All cable shall be dielectric and rated for indoor and outdoor operation.

4. Cable Jacket:

    a. The jacket shall be compatible with blown fiber installation, continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness; jackets extruded under high pressure are not acceptable.
    b. For cables with more than two fibers, the cable jacket shall be designed for easy removal without damage to the optical fibers by incorporating a ripcord under each cable jacket.
    c. The nominal thickness of the cable outer jacket shall be sufficient to provide adequate cable protection while meeting the mechanical, flammability, and environmental test requirements of this document over the life of the cable.

5. Identification:

    a. The individual fibers shall be color coded for identification. The fiber optic color coding shall be in accordance with ANSI/TIA/EIA-598, "Color Coding of Fiber Optic Cables" The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color-coded, buffered fibers shall not adhere to one another. When fibers are grouped into individual units, each unit shall be numbered on the unit jacket for identification. The number shall be repeated at regular intervals.

    b. Jacket Printing: The outer jacket shall be marked with the manufacturer's name or UL file number, date of manufacture, fiber type, flame rating, UL symbol, and se-

quential length markings every two (2) feet (e.g. "COMPANY-01/98-62.5/125 MICRON-Type OFN - (UL) 00001 FEET"). The printing shall be permanent and legible for the life of the cable.

6. Manufacturer Testing: Furnish a copy of the factory certified optical test report verifying that final production reels comply with the attenuation requirement listed within this specification.
7. Field Testing: All cabling and connectors shall comply with and be tested to ANSI/TIA/EIA- 568B.3 and as specified in Part 3.
8. Installation: Blown fiber optic cable shall be installed in blown fiber tube cable – one fiber bundle per tube.

E. Multi-conductor Cable

1. Low Voltage Power: 2 conductor # 16 AWG copper, unshielded.

2.3 Connectors

A. Category 6 Connectors/Jacks/Outlets:

1. All outlets, jacks, and connectors shall exceed all requirements of ANSI/TIA/EIA-568B.2-1, "Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components, Addendum 1 – Transmission Performance Specifications for 4 pair 100 Ohm Category 6 Cabling".
2. All locations shall utilize "RJ-45 style" 8-position, 8-conductor T568A data jacks in quantities as required and detailed on drawings. (Verify scheme A or B with owner)
3. Jacks shall be modular and identified by color or with a color icon or tab differentiating function (voice/data/miscellaneous).
4. Flush mount faceplates and boxes shall be provided at all locations unless otherwise noted. Exceptions to the specifications which request surface mounting in lieu of flush must be submitted and obtain approval prior to installation.
5. Coordination with the modular furniture provider shall be necessary to determine type and design of outlet configurations to be incorporated into the furniture.

B. Fiber Optic Connectors:

1. All outlets, jacks, and connectors shall exceed all requirements of ANSI/TIA/EIA-568B.3.
2. Fiber optic cable connectors shall be capable of terminating optical fiber glass cables with outside diameters ranging from one hundred twenty-five (125) through nine hundred (900) microns. Fabricate connectors with optical fiber, self-centering, axial alignment mechanisms. ST and SC type connectors shall have an insertion loss of not greater than 0.3 dB. Connectors shall be SC type except for connectors at fiber optic transceivers which shall be ST type.

C. Fiber Optic Splices:

1. Make no splices except at indicated splice points, or specifically approved by the Owner. Splices shall be fusion type and shall be located within closures, distribution centers, or splice trays rated for the location. All splice locations must be clearly indicated on shop drawings required by Section 1.3.
2. Splices shall not exceed a maximum optical attenuation of 0.3 dB when measured in accordance with ANSI/TIA/EIA-455-59.

2.4 Patch Panels

A. Category 6: Patch panels for data circuits shall be Cat 6, T568A preloaded with 110 connection blocks on the rear and eight (8) position modular jacks on the front. Each jack shall be terminated to a 110-type connector attached to the PCB mounted connectors, providing terminations for 22-26 AWG solid cable. Each jack shall be provided with designation strips or labels on the front and rear for labeling each circuit. Panels shall be rack-mounted and sized as per the drawings.

B. Riser & Voice Punchdown Blocks: Punchdown blocks for riser terminations and horizontal voice circuits (telephone and/or intercom) shall be rack mountable standard Cat 6, 110-type connecting blocks providing terminations for 22-26 AWG solid cable. 110 wiring base shall feature sturdy single- piece construction of fire-retardant plastic rate UL 94V-O. Each panel shall be provided with designation strips or labels for labeling each circuit. Blocks shall be rack-mounted and sized as per the drawings.

C. Fiber Optic: Rack-mounted customer premises type unit with port capacities as designated on the drawings. Panels shall contain dual grounding and strain relief lug for support of fiber during installation. Each panel shall be provided with loaded plates containing required quantity of SC type adapters for all single mode and multimode fibers as described in the drawings. Panels shall feature front and rear hinged cover, open sides for cable egress, and slide-out drawer.

D. Fiber Optic: Wall-mounted cabinet with port capacities as designated on the drawings. Cabinets shall contain cable routing and strain relief supports for support of cable during and after installation. Cabinet shall allow for top and bottom cable entry, via conduits. Cabinets shall be provided with loaded plates containing required quantity of SC type adapters as shown on drawings. Cabinet shall be provided with locking hinged door.

2.5 Patch Cords

A. Patch cords shall be provided by Systems Integrator under a separate contract.

2.6 Racks and Cabinets

A. Construction: Equipment racks shall be made of high-grade 6061-T6 aluminum and cabinets shall be made of 12gauge steel. Adjustable vertical mounting rails shall be drilled and tapped with 10/32 mounting holes at universal EIA spacing.

B. Power Strip: Each rack shall contain a power strip(s) containing ten (10) simplex (NEMA 5-15R) outlets. In enclosed cabinets, power strip shall be vertically mounted on the interior side wall of the cabinet so as not to interfere with cable routing. In open frame racks, power strip shall be mounted horizontal in orientation. Outlet shall contain a resettable overload circuit breaker and on/off switch. Provide bonding straps between all racks and frames.

C. Mounting: All racks and cabinets shall be floor mounted and permanently fixed to the floor with bolt- down kits. Except for co-location style cabinets, multiple cabinets shall be connected together with side panels removed for routing of cables between racks, provide ganging kits as required.

D. Cable Management: Provide horizontal cable management on front of rack as indicated on the drawings. Minimum size of horizontal manager shall be 1.75” high. Provide vertical cable management on both sides of each rack as indicated on the drawings. The vertical manager shall be 3” in width and shall be double sided. The vertical manager shall have large grommeted holes for easy pass through of cables.

E. Cabinet and Rack Accessories: All shelves, fans, panels, and drawers shall be made of similar material as rack/cabinet. Provide accessories as necessary to house equipment for optimal use.

F. Bonding: Provide bonding straps between all racks and frames. Bond a #4 AWG conductor to at least one rack and also to the ground bus within each special system room.

G. Freestanding Cabinets – 84" Tall Type:
1. Size: Fully adjustable 19-inch mounting verticals, minimum 23" wide, and 36" usable depth. Overall height shall be a minimum of 84", with at least 77" of usable height (44U).
2. Panels: Front, side, bottom and top panels shall be fully and easily removable by a latching mechanism. Rear panels shall be vented to allow airflow with a keyed locking mechanism. Bottom panel shall be vented for airflow and slotted for cable access from below. Front panel shall consist of a perforated metal door with a keyed locking mechanism. Top panel shall be equipped with a fully assembled fan tray kit consisting of fans generating a combined minimum of 200 CFM. The use of the fan tray kit shall not occupy any usable rack space.

H. Freestanding Cabinets – 72" Tall Type:

1. Size: Fully adjustable 19-inch mounting verticals, minimum 23" wide, and 36" usable depth. Overall height shall be a minimum of 72", with at least 66.5" of usable height (38U).
2. Panels: Front, side, bottom and top panels shall be fully and easily removable by a latching mechanism. Rear panels shall be vented to allow airflow with a keyed locking mechanism. Bottom panel shall be vented for airflow and slotted for cable access from below. Front panel shall consist of a perforated metal door with a keyed locking mechanism. Top panel shall be equipped with a fully assembled fan tray kit consisting of fans generating a combined minimum of 200 CFM. The use of the fan tray kit shall not occupy any usable rack space.

I. Freestanding Equipment Racks (Open Frame):

1. Size: Fully adjustable 19-inch mounting verticals, minimum 23" square footprint. Overall height shall be a minimum of 84", with at least 78.75" of usable height (45U).
2. Provide vertical wire management between racks as specified on rack elevations.

J. Co-Location Freestanding Equipment Cabinets:

1. Size: 19-inch mounting verticals. Overall height shall be a minimum of 84-inches with three compartments each with at least 24.5" of usable height (14U). Cabinet shall be Great Lakes Cabinets model GL840-CL3 or equal with optional equipment as specified below.
2. Panels: Front, side, bottom and top panels shall be fixed and attached to the frame from inside of the cabinet. Panels shall be vented to allow airflow. Bottom panel shall be vented for airflow and slotted for cable access from below. Front panel shall consist of perforated metal doors with uniquely-keyed doors for each compartment. Top panel shall be equipped with a fully assembled fan tray kit consisting of fans generating a combined minimum of 200 CFM. The use of the fan tray kit shall not occupy any usable rack space.
3. For co-location cabinets designated to be installed backed up to a wall, each compart-

ment shall contain vertical mounting rails attached to a sliding apparatus that extends horizontally from the compartment and rotates on center once extended to allow access to the rear side of objects mounted to the rails. The sliding and rotating apparatus shall not reduce usable height of the compartment by more than 3U.

4. Each compartment shall have its own wire raceway to the top of the cabinet to keep wiring for one compartment separate from wiring for all other compartments. Each compartment shall also contain its own power plug strip.
5. Coordinate compartment keying with airport and airlines to provide the compartments in multiple rooms occupied by a user with the same key.

2.7 Nonmetallic Flexible Optical Fiber Raceway (Innerduct)

A. Description: Nonmetallic flexible optical fiber raceway shall be a flame-retardant corrugated flexible raceway for the protection and isolation of optical fiber cable. Raceways shall be rated for the environment installed, contain a pre-installed pull rope, and possess the following ratings:

1. General Purpose Applications: Shall meet UL94 V-O flame test.
2. Riser Applications: Shall meet UL 1666 standard for riser applications, white color.
3. Plenum Applications: Shall meet UL 910 standard for plenum applications, white color.
4. Outdoor Applications: Shall be rated for ductbank and/or direct burial applications as shown
   on the drawings, orange color.
5. All innerduct installed in conduit shall be maxcell providing the largest amount of cells for the diameter

B. Couplings, Fittings, and Conduit Bodies: Nonmetallic raceway couplings, fittings, and conduit bodies shall be provided as required to connect raceways and be rated for use with the applicable installation environment.

2.8 Blown Fiber Tube Bundles and Termination Equipment

A. Bundle Description: Blown fiber tube bundles shall be seven (7) individual tubes grouped together with flame resistant PVC jacket. Tubes shall create pathways continuous pathways for installation of blown fiber optic cables. Bundle shall contain a rip cord, flame barrier tape surrounding the tubes, bundle length markings every two feet, and tube ID number every two (2) feet. Provide fittings and couplings as necessary to construct a fully operating system of tubes.

B. Termination Equipment Description: Blown fiber termination cabinet shall be wall mounted enclosure mounted within equipment cabinets. Termination cabinet shall feature top, bottom, or side entry and provide space for termination of 24 strands of either single mode or multimode fibers regardless of connector type.

PART 3 – EXECUTION

3.1 Examination

A. The Owner assumes no responsibility or liability for storage fees, drayage, import taxes, duty taxes, or other costs associated with the delivery and storage of system components.

B. The Contractor shall be responsible for any and all loss or damage in the shipment and delivery of all material until transfer of title to the Airport.

C. General: The Contractor shall ensure that all work performed under these Specifications is in accordance with the requirements and standards defined and referenced in these Specifications. Any work performed in deviation of these Specifications, any of the referenced material, or any applicable standards or requirements, shall immediately be corrected by the Contractor without additional charges, regardless of the stage of completion. The Contractor shall record all inspection observations. As a minimum, the record shall include the name(s) of personnel conducting the inspection, a brief description of the inspection and the observations. These records shall be available for the Owner to review at any time. Also, these records shall be delivered to the Owner before final acceptance.

D. Installation Inspections: Installation inspections shall be undertaken through the performance of pre- installation, in-progress, and final inspections.

E. Pre-Installation Inspection: The Contractor shall make an inspection of all equipment and material to be used prior to installation. All items shall be verified for compliance with the requirements of these Specifications and all other applicable standards. All equipment, cable, and associated hardware identified for installation shall be inspected for damage and completeness utilizing standard practices to determine integrity and acceptability.

F. In-Progress Inspection: At the Owner's discretion, the Contractor shall perform in-progress inspections that shall include visual inspections of equipment, wiring practices, cabling, placement of equipment, marking of cables and adherence to safety procedures. In addition, the Owner, or his representative, may conduct additional inspections any time.

G. Final Inspection: The Contractor shall conduct a final inspection that encompasses all portions of the installation. This inspection shall be performed to ensure that all aspects of the installation have been performed in accordance with these Specifications, standard industry practices and the publications referenced herein. All non-compliance items shall be noted by the Contractor during this inspection. The Owner, or his representative, shall witness this inspection.

H. Corrective Action and Verification Inspection: The Contractor and the Owner, or his representative, shall perform a corrective action and verification inspection to ensure that all non-compliance items identified during the final inspection have been corrected.

3.2 Installation

A. Standards: All installation activities shall be performed in a neat and professional manner in accordance with all applicable local and national codes. Additionally, the Contractor and all subsequent Sub-Contractors employed to satisfy the requirements of these specifications shall obtain, or satisfy, the following prior to installation:

1. All licenses and permits.
2. All insurance and bonding as required.
3. All other standards or requirements specified in this document.

B. The Contractor shall install and inspect all hardware required in this specification in accordance with the manufacturer's installation instructions.

C. The Contractor shall adhere to the following during installation of the system:

1. Underwriter's Laboratories (UL) listing for restricted access installations in business and customer premises applications. This listing is required by the National Electric Code for customer premise installations.

D. System installation and construction methods shall conform to the requirements of the Federal Communications Commission and local state, county, and city ordinances.

E. Where undefined by codes and standards, Contractor shall apply a safety factor of at least two (2) times the rated load to all fastenings and supports of system components.

F. The Contractor shall install all system components including furnished equipment, and appurtenances in accordance with the manufacturer's instructions, NFPA 70, ANSI-C2 and as shown, and shall furnish all cables, connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.

G. All media shall be listed for the application, marked and protected as per the NEC. Articles 770 and 800 shall define the power source limitations, installation guidelines, insulation properties, applications and allowable cable substitution schedules. Solid conductor materials shall be substituted for the specified 7-strand conductor materials as required by the NEC. All media substitutions shall conform to the NEC and be approved by the Engineer.

H. Install all media in approved raceway, according to manufacturer's written instructions.

1. Install transmission media without damaging conductors, shield, or jacket.
2. Do not bend cable, in handling or installation, to smaller radii than minimum required or recommended by manufacturer.
3. Conduit for horizontal voice and data cabling shall be 1” minimum.
4. 90-degree sweeps and field bends shall be used. Pre-manufactured elbows and factory bends shall not be used.
5. No more than two 90-degree bends in 100 feet of conduit without the addition of a pull-box shall be acceptable.

I. Grounding: Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

J. Rack Mounted Equipment:

1. As a general practice, the Contractor shall run power cables, control cables, and high level cables on the left side of an equipment rack as viewed from the rear.

2. Contractor shall run other cables on the right side of an equipment rack, as viewed from the rear.

K. Cable Splices: All cable runs should be continuous; splices, both optical fiber and copper, shall be done only upon receipt of written approval from the Owner. The Owner reserves the right to reject any splicing request. If any un-approved splices are found before acceptance, the Contractor shall replace the entire spliced cable without any additional charges, regardless of the stage of completion. All splice locations shall be recorded on the “as built” drawings.

L. Pulling Tensions: Pull cables without exceeding cable manufacturer's required or recommended pulling tensions.

1. Pull cables simultaneously where more than one is being installed in same raceway.
2. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway.

M. Install exposed media in controlled Telecommunications Rooms parallel and perpendicular

to surfaces or exposed structural members, and follow surface contours where possible.

N. Use splice and tap connectors that are compatible with cable material. Make no splices except at indicated splice points, or specifically approved by Owner.

O. Bond shields and drain conductors to ground at only one point in each circuit.

P. Connect components to wiring system and to ground as indicated and instructed by manufacturer and according to ANSI/TIA/EIA-607. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torque's specified in UL Standard 486A.

Q. Fiber Optic Terminations: For fiber optic backbone cabling provide 20 feet of slack located on each end of the cable. The excess fiber will be coiled up and supported by suitable means so that it is suspended above the ceiling or rack. Terminate fiber optic connectors in accordance with the manufacturer's instructions. Unless otherwise shown on the drawings, terminate strands from left to right, and top to bottom (front view).

R. Optical fiber cabling placed in cable tray and/or conduits larger than 2" shall be placed in nonmetallic flexible optical fiber raceway (innerduct).

S. Cat 6 Cable: Total cable length for each location shall not exceed 90 meters. The contractor shall notify the engineer of any location that exceeds this limitation prior to cable installation.

T. All outdoor cabling shall have both 2"x3" stainless steel tag and plastic tag attached to the cable at the entrance and exiting point of all pull boxes, manholes, and termination points. They shall also have a continuous toner cable installed with the cabling.

3.3 Documentation

A. As-Built Drawings: The Contractor shall supply drawings that accurately depict all equipment and materials to be installed. Contractor shall develop all drawings and all "as-built" drawings using AutoCAD format.

1. System Wiring Diagrams: These drawings shall show all system components, wire numbers, color codes, pin numbers, component locations and connections, depicting the "as-built", final configuration.
2. Rack Elevation and Wiring Diagrams: The elevation diagrams shall depict the front views of the equipment racks identifying all equipment installed within. Complete wiring diagrams of the racks shall also be included.

3.4 Identification

A. Cabling: All installed cables shall be labeled using a pre-printed stick-on self-adhering labeling system. The label must be applied on both ends of the cable, and shall remain clearly visible after completion of the installation. The labels must utilize the complete cable identifier developed with the cable matrix specified herein.

B. Copper Data Cables: As part of the as-built documentation, a separate voice/data cable matrix must be supplied. This will consist of a typed listing that identifies each data cable by CR, patch panel location, and device location. See example below:

HORIZONTAL Cat 6 CABLE MATRIX

CR	Patch Panel	Position	Cable ID#	Jack Location	Device	Outlet Position
ACR T1	A	1	ACRT1-A-1	Gate 24	Printer	1

C. Each voice/data cable must be identified on the patch panels and at the outlets with the identification number developed with the cable matrix specified herein.

D. Backbone Fiber: As part of the as-built documentation, a separate fiber cable matrix must be supplied. This will consist of a typed listing that identifies each backbone fiber cable by CR and patch panel location. See example below:

BACKBONE FIBER OPTIC CABLE MATRIX

Fiber ID	CR	Panel	Position	:	CR	Panel	Position
ACRT1-A-1: ACRT2-A-1	ACR T1	A	1	:	ACR T2	A	1

E. Horizontal Fiber: As part of the as-built documentation, a separate fiber cable matrix must be supplied. This will consist of a typed listing that identifies each backbone fiber cable by CR, patch panel location, and device location. See example below:

HORIZONTAL FIBER OPTIC CABLE MATRIX

CR	Patch Panel	Position	Fiber ID#	Location	Device	Position
ACR B1	A	1	ACRB1-A-1	Gate 24	Printer	1

F. Each backbone and horizontal fiber optic cable must be identified at every fiber optic patch panel with the identification number developed with the cable matrix specified herein.

G. Information regarding fiber optic cable routing, terminations, and test documentation shall be entered into the Structured Cabling Management Software specified herein.

3.5 Field Quality Control

A. Testing: Upon installation of cable and before energizing, demonstrate product capability and compliance with requirements as contained in ANSI/TIA/EIA-568B.2-1 testing and certification standards. All Category 6 cabling shall be bi-directionally tested using a Level III-compliant tester. All fiber optic cable shall be bi-directionally tested using an optical loss test set (OTS), as well as an optical time domain reflectometer (OTDR). Testing shall be performed in accordance with ANSI/TIA/EIA-568B.2-1 and with testing equipment manufacturer recommendations.

B. The test procedures shall contain at a minimum the following elements:

1. Statements of purpose identifying the goals of the test.
2. The methods used for testing.
3. Duration and schedule of tests.
4. Examples of all graphs, tables, and charts necessary for display of testing results.
5. Certifications and qualifications of all persons conducting the testing.
6. Calibration certificate of test equipment.

C. Calibration: Test equipment used shall have been certified calibrated by an independent test and calibration firm, to the manufacturer's specifications.

D. Copper cable procedures: Inspect for physical damage and test cable for continuity, polarization

and shorts. Applicable for Category 3, Category 6, and multi-conductor cables.

E. Cat 6 Cable: Shall be tested in channel configuration. Basic link testing will not be considered compliant with the contract requirements. Testing shall be accomplished with a test set with a minimum spectral frequency range of 1 to 250MHz. The test specifications for all installed cables must exceed the specifications for Cat 6 cabling that are documented within ANSI/TIA/EIA-568B.2-
1. Results that indicate a FAIL, *FAIL OR *PASS are unacceptable. Correct malfunctioning cables and retest to demonstrate compliance; otherwise remove and replace with new and retest. In addition to the ANSI/TIA/EIA requirements, test and provide results for the following:

1. Propagation delay, report total delay and delay skew between pairs.
2. Power Sum ACR.
3. Attenuation, NEXT, Power Sum NEXT, Power Sum ELFEXT, and Return Loss.

F. Optical Loss Test Set (OTS): Using an OTS, measure each installed fiber link from patch panel to patch panel or patch panel to outlet and report optical loss in dB. Losses shall be less than or equal to 2.0dB/km at 850nm and 1.5dB/km at 1300nm for horizontal runs. Multimode fibers should be tested bi-directionally at 850 and 1300 nm. Singlemode fibers shall be tested bi-directionally at 1310 and 1550 nm. Acceptable attenuation values shall be determined from ANSI/TIA/EIA-568B.3, Section 11. Links found to have greater than acceptable values must be tested using an OTDR, with problems corrected and retesting to demonstrate compliance. Provide typed documentation detailing the results of all attenuation testing. See example below:

FIBER OPTIC CABLE ATTENUATION TESTING RESULTS

Fiber ID	nm	dB loss / From	dB loss / From	Test Date	Tester Name
B1-A-1:204-A-1	850	1.8dB/B1	2.1dB/204	3/1/98	Joe Jones
B1-A-1:204-A-1	1300	1.3dB/B1	2.1dB/204	3/1/98	Joe Jones

G. Optical Time Domain Reflectometer (OTDR): Using an OTDR, bi-directionally test every fiber link between Telecommunications Rooms. Also bi-directionally test each fiber link that fails the OTS attenuation test, is greater than two thousand (2000) meters in length, or contains splices. Test links for overall length, faulty connectors, splices, terminations, and the integrity of the cable and its component parts. Multimode fibers shall be tested at 850 or 1300 nm and singlemode fibers shall be tested at 1310 or 1550 nm. Mated connector pairs with losses in excess of .75 dB and splices with losses in excess of .3 dB shall be replaced. Retest to demonstrate compliance. Identify the losses attributed to each individual component of the fiber run.

H. Coaxial Cable: Coaxial cabling shall be tested to confirm adherence with manufacturer specifications. Testing results shall include both TDR and VSWR data on each cable's performance. Maximum VSWR shall not exceed 1.5:1.

I. Documentation: Typed or printed documentation must be provided listing all runs by location. The documentation must include the original instrument printouts detailing the results of all the tests. The documentation must also detail the date each cable was tested and the tester's name. All test result data including detailed plot analysis and tabular data shall be permanently stored in the Structured Cabling Management Software as specified herein.

3.6 Test Failures: Any cable that repeatedly fails the testing requirements as outlined by these specifications after all trouble shooting means have been exhausted shall be replaced with a second cable. Acceptable trouble shooting criteria include but are not limited to replacing

connectors and/or patch cables.

3.7 Maintenance and Support

A. General

1. The Contractor shall provide maintenance and support of all components associated with this system at no additional charge during the warranty period.
2. The Contractor shall supply a list of special tools, test equipment, and outside inventory required for this Project.

B. Definitions:

1. Preventive and Routine Maintenance: Preventive and routine maintenance services shall be provided in accordance with the provisions of the maintenance manual for each component. Preventative maintenance services shall include inspection, test, necessary adjustment, lubrication, parts cleaning, and upgrades. Routine maintenance services shall include scheduled overhauls as recommended by the equipment manufacturer.
2. Emergency Failure: A system failure is considered an emergency if any of the key components are inoperative to the extent the system cannot function in a normal manner. Emergency services shall include inspections and necessary tests to determine the causes of equipment or software malfunction or failure. The emergency services shall include furnishing and installing components, parts, or software changes required to replace malfunctioning system elements. The Contractor shall provide telephone support twenty-four (24) hours a day, seven (7) days a week. The Contractor shall provide support on-site within eight (8) hours of request.
3. Support: Support shall be supplied by the Contractor directly or by a Sub-Contractor approved by the Engineer. Support shall cover all equipment referenced in this specification.

3.8 Cleaning

A. Upon completion of system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

3.9 Demonstration

A. The Contractor shall not apply powered equipment to the system until after:

1. System and components have been installed and inspected in accordance with the manufacturer's installation instructions.
2. A visual inspection of the system components has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
3. System wiring has been tested and verified as correctly connected as indicated.
4. All system grounding and transient protection systems have been verified as properly installed and connected, as indicated.
5. Power supplies to be connected to the system and equipment have been verified as the correct voltage, phasing, and frequency as indicated.

B. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installations, defective equipment items, or collateral damage as a result of Contractor work/equipment.

C. Operate control/signal systems to demonstrate proper functioning. Replace malfunctioning cable with new materials, and then retest and re-commission until satisfactory performance is achieved.

D. Train Owner's maintenance personnel on procedures and schedules for start-up and shut-down, troubleshooting, servicing, and preventive maintenance. Include training on Cat 6 wiring requirements and methods. Include training on fiber optic splicing and connector attachment techniques.

E. Review data in operating and maintenance manuals. Refer to Division 1 Section "Operating and Maintenance Data."

F. A final course schedule and syllabus shall be prepared by the Contractor for each course to be conducted for personnel, and submitted for review at least four (4) weeks prior to the scheduled date of course commencement.

G. Each course outline shall include, in addition to the subject matter, a short review of the prerequisite subjects (where appropriate); how this course fits into the overall training program; the objective; the standards of evaluation; and any other topics that will enhance the training environment.

H. Schedule training with Owner, through the Engineer, with at least seven (7) days' advanced notice.

I. All training requirements identified are minimum requirements.

3.10 Acceptance

A. Acceptance will be withheld until the following have been completed successfully:

1. Acceptance of all submittals
2. Delivery of final documentation
3. Successful testing
4. Successful demonstration, including operation of systems using the cables, training and manual review.

END OF SECTION 27 15 00

SECTION 31 20 00 - EARTHWORK

PART 1 - GENERAL

1.1 Summary

A. Section Includes:

1. Excavation, filling, backfilling and compacting.
2. Trenching and trench backfilling.
3. Mass earthwork and rough grading.
4. Finish grading, including spreading of topsoil.
5. Dewatering.
6. Soil stabilization.
7. Testing and inspection.

B. Related Sections:

1. Division 02 Section “Selective Site Demolition”.

1.2 Quality Assurance

A. Testing and Inspection:

1. All testing and inspection shall be performed by the Contractor.
2. The Contractor is responsible for all testing, sampling and inspection.
3. The Contractor is responsible for providing these services.

B. Topsoil:

1. All topsoil shall be tested by the Contractor.
2. Refer to 1.3 Submittals for more information.

C. Any work in public right-of-way or other areas subject to the jurisdiction of any body shall be performed either to the requirements of that jurisdiction or to the requirements of this Specification, whichever is more stringent.

1.3 Submittals

A. All submittals shall be reviewed approved by Architect/Engineer.

B. Product Data and Test Reports:

1. Field and laboratory tests and inspections.
2. Drainage fill: Include material specifications and sieve analysis. Include signed material certificate from manufacturer/supplier.
3. Chemical modification: Include material specifications and signed material certificate from manufacturer/supplier.

4. Geo-synthetic materials: Include material specifications and signed material certificate from manufacturer/supplier.

C. Topsoil:

1. Furnish topsoil analysis.
2. Analysis shall state the following: (Refer to Part 2 for minimum requirements)

   a. Percentage of organic matter.
   b. Gradation of sand, silt and clay, Include USDA textural classification.
   c. Cation exchange capacity.
   d. Deleterious material.
   e. pH.
   f. Mineral and plant nutrient content (phosphorus, potassium, magnesium, calcium).

3. Analysis shall state if topsoil is suitable for the intended use and as defined in this Specification, and shall state any requirements or recommendations necessary to make it suitable.
4. Analysis shall state annual nutrient requirements and recommendations.
5. This analysis is required for both on site and off site topsoil.
6. Samples of the topsoil shall be taken under the following conditions:

   a. Within four (4) weeks prior to placing topsoil, take three representative samples of proposed topsoil.
   b. Within one week after placing topsoil, take three representative samples of in-place topsoil.
   c. All samples shall be taken in witness of the Owner, in areas approved by the Owner. Contractor to coordinate with Owner as required.

7. Provide copies of all topsoil analysis and recommendations to Owner and Architect/Engineer.

PART 2 - PRODUCTS

2.1 Materials

A. General:

1. All soil materials shall be tested by the Contractor.
2. All soil materials shall be suitable for each application.
3. Suitable soils are defined as soils which provide proper strength, compaction and drainage requirements.
4. Fill material which is unsuitable due to excess moisture will not be classified as unsuitable if it can be dried to optimum moisture specified herein by manipulation, aeration or blending with other materials satisfactorily.

B. Fill Materials:

1. Note: The following describes fill materials and their application for use. The materials shall be used for the listed applications, unless designated otherwise on the Drawings. If the Contractor has any questions or concerns regarding the materials or intended

application, contact the Architect/Engineer for direction. Compaction requirements are the percentage of maximum dry density per ASTM D698 Standard Proctor Test.

2. General fill:

    a. Suitable on-site or off-site fill material free of debris, roots, organic and frozen materials, and stones having a maximum dimension of 2”.
    b. Minimum compaction: 95%.
    c. Application: General filling and backfilling of excavations and trenches outside of the building.

3. Granular fill:

    a. Clean, natural or manufactured sand per requirements of INDOTSS Type “B” borrow, 4.75mm (No. 4) gradation. Pea gravel is not acceptable.
    b. Minimum compaction: 95%.
    c. Application: Backfilling of excavations and trenches which are under or within 5’ of pavement, and underneath exterior concrete pavement, walks, curbs and slabs on grade.

4. Aggregate fill: Unless otherwise indicated, shall meet the following:

    a. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone and natural or crushed sand.
    b. ASTM D2940, with 100 percent passing a 1 ½ inch sieve and not more than 8 percent passing a No. 200 sieve.
    c. Application: base course under concrete and other items per plans.

C. Topsoil:

1. Topsoil shall be fertile, friable, natural surface soil obtained from well-drained areas and possessing characteristics of representative soils in the project vicinity that produce heavy growths of crops, grass or other vegetation.
2. Topsoil shall consist of friable loam, reasonably free of subsoil, clay lumps, brush, roots, weeds or other objectionable vegetation, stones or similar objects larger than 1-1/2" in any dimension, litter or other materials unsuitable or harmful to plant growth.
3. Supplement on-site topsoil with off-site topsoil as necessary.
4. Unless otherwise indicated, minimum compacted thickness in lawn areas is 4".
5. The mechanical analysis of topsoil shall be as follows:

    a. 1" mesh sieve size; 99%-100% passing.
    b. 1/4" mesh sieve size: 97%-99% passing.
    c. No. 100 mesh sieve size: 40%-60% passing.
    d. No. 200 mesh sieve size: 20%-40% passing.

6. The following minimum requirements shall also be met:

    a. Organic matter: 3-5%.
    b. pH: 6.5 to 7.3.
    c. Sand, silt, clay content: per USDA loam textural classification.
    d. Minerals and nutrients: Per Geotechnical Engineer recommendations and amendments suitable for use in local area.

D. Soil Separator Fabric:

1. Nonwoven, needle-punched geotextile fabric manufactured from polyolefins or polyesters per ASTM M288, suitable for subsurface drainage and other specified applications.
2. Application: subsurface drains and as specified in Contract Documents.
3. Specifications (values based on Mirafi 140N):

   a. Apparent opening size: 70 (U.S. Standard Sieve Size); ASTM D-4751-99A.
   b. Flow rate: 135 gpm/sf; ASTM D-4491-99A.
   c. Puncture strength: 65 lbs; ASTM D-4833-00.
   d. Mullen burst: 225 lb/sq. in.
   e. Grab tensile/elongation: 155 lbs/50%.
   f. UV resistance: 70% at 500 hours.

E. Geo-synthetic Reinforcement:

1. General: TriAx Geogrid TX5 as manufactured by Tensar International Corp., Atlanta Georgia.
2. Application: Soil stabilization as required and as recommended by the Geotechnical Engineer.

F. Chemical Modification:

1. General: INDOTSS 215.
2. Materials: Hydrated lime per INDOTSS 913.04(b) and Type I Portland cement per INDOTSS 901-01(b).
3. Quantity: 4.0 +/- 0.5% by dry unit mass of the soils.
4. Application: Chemical modification may be needed for soil stabilization.

G. Other Materials:

1. All other materials not specifically described but not required for proper completion of the Work of this Section, shall be as selected by the Contractor subject to the approval of the Architect/Engineer and Geotechnical Engineer.

PART 3 - EXECUTION

3.1 Requirements

A. General:

1. Weather: Do not perform earthwork activities during inclement weather.
2. Dust: Use all necessary and appropriate means, such as water sprinkling, as required to prevent dust from being a nuisance to the Owner, public and concurrent performance of other work on the site.
3. Conflicts: Should the preceding job conditions or other items specified herein because actual or possible conflicts, notify the Architect/Engineer immediately and do not proceed until such conflict has been resolved.

B. Preparation: Verify that the following has been completed prior to beginning earthwork:

1. Protective fencing has been installed for trees and vegetation to remain.

2. Selective site demolition.

C. Protection:

1. For items indicated to remain, provide protection to prevent damage from construction activities. Any damage or destruction to items intended to remain intact shall be repaired or replaced to the satisfaction of the Owner at the Contractor's expense.
2. Topsoil: Protect placed topsoil from heavy machinery traffic. Remove and replace topsoil that is compacted by heavy machinery traffic.
3. Subgrade: Ditches and drains along the subgrade shall be maintained to drain effectively at all times. Repair subgrade of any ruts that may occur by reshaping and recompacting as required.
4. Utilities: Determine locations of existing utilities and the extent to which they may affect earthwork operations. Where service and utility lines are to remain, provide protection to prevent damage or disruption of services.
5. Damaged utilities shall be repaired immediately at the Contractor's expense.
6. Open excavation:

    a. The Contractor is responsible for ensuring all open excavations are properly barricaded and protected at all times. This includes work such as mass excavation and trenching, and also includes other potentially dangerous conditions such as retention ponds.
    b. Provide and install all necessary and appropriate means such as, but not limited to, signage, fencing, traffic barricades, and lighting to warn, discourage, and prevent danger to adjacent workers and general public.
    c. Unless otherwise indicated, install a minimum 6' 10-guage chain link fence around all open excavations, retention ponds, and other areas of potential danger, and maintain them while such conditions exist. Increase measures as required per site conditions.

3.2 Layout

A. References: Establish and maintain lines, corners, elevations and general reference points. Verify dimensions indicated on Drawings. If conflicts exist, immediately notify the Architect/Engineer before continuing work.

3.3 Excess Water Control

A. Excess moisture: If excess moisture is present in soils, do not resume operations until moisture content and density are reported to be satisfactory by the Geotechnical Engineer.

B. Flooding: Provide berms or channels to prevent flooding of subgrade. Promptly remove all water collecting in depressions.

C. Softened subgrade: Where soil has been softened or eroded by flooding or placement during inclement weather, remove all damaged areas and recompact as specified for fill and compaction.

D. Dewatering:

1. Provide and maintain ample means and devices with which to promptly remove and dispose of all water from every source entering the excavations or other parts of the work at all times during construction.
2. Dewater by means which will ensure dry excavations and the preservation of the final lines and grades at bottom of excavations, such as sump pumps, trenching, etc.
3. Do not use extreme measures or durations as to cause adverse effects to Project Site or adjoining properties.

3.4 Chemical Modification

A. General:

1. Scarify and/or disc area to a depth of 12” prior to distributing modifiers.
2. Utilize screw type, cyclone, or pressure manifold type distributors to apply modifier.
3. Do not apply when wind conditions create potential hazards or transference of material to adjacent areas.
4. Mix modifiers with rotary speed mixers or disc harrow, and continue until a homogenous layer of the required thickness is obtained.
5. Compaction:

    a. Lime modified soils shall be compacted within 3 days.
    b. Cement modified soils shall be compacted within 30 minutes.

6. Observation and testing: Quantities of materials, placing, mixing, and compacting shall be, as recommended, observed and tested by the Contractor.

3.5 Excavation

A. General:

1. Excavation shall conform to OSHA and all other applicable safety regulations.
2. Excavation shall conform to the dimensions and elevations indicated on the Drawings, except as specified herein.
3. Excavation shall extend sufficient distance from walls and footings to allow for placing and removal of forms, installation of services and inspection.
4. Remove unsuitable material below indicated depths and replace with suitable, compacted material or lean concrete, at the Architect/Engineer discretion.
5. Topsoil stripping: Strip topsoil to its depth from areas to be covered by building, by walks and by other work and where existing surface areas required grading in order to establish new elevations.
6. Subgrade: Unless otherwise indicated, excavate to following subgrades:

    a. Slab-on-grade: Sub-grade at bottom of drainage fill or at bottom of existing topsoil, whichever is lower.
    b. Drives and paving: Sub-grade at bottom of aggregate base.
    c. Footing: Sub-grade at indicated bottom of footing.
    d. Lawn area: Sub-grade 4” below indicated surface elevation.

3.6 Trenching

A. General:

1. All trenching shall conform to OSHA and all other applicable safety standards.
2. Verification:

   a. Contractor shall verify all existing grades, inverts, utilities, obstacles and topographical conditions prior to any trenching, excavation or underground installations.
   b. In the event existing conditions are such as to prevent installations in accordance with the Contract Documents, immediately notify the Architect/Engineer and await decision before continuing work.
   c. Architect/Engineer decision will be final and binding upon the Contractor, and installations shall be in accordance with same.

3. Saw cut existing pavements to proper width for trenching.
4. Legally dispose materials unsuitable for trench backfilling off-site.

B. Width:

1. Trenches for piping shall be not less than 12” wide or more than 16” wider than the outside diameter of the pipe to be laid therein, and shall be excavated true-to-line, so that a clear space not less than 6” or more than 8” in width is provided on each side of the pipe.
2. For sewers, the maximum width of trench specified shall apply to the width at and below the level at the top of the pipe. The width of the trench above that level may be made as wide as necessary for sheeting and bracing, and proper installation of the Work.
3. Trenches shall be open vertical construction.

C. Depth:

1. Trench as required to provide the elevations shown on the drawings.
2. Where elevations are not shown on the drawings, trench to sufficient depth to give a minimum of 36” of fill above the top of the pipes measured from the adjacent finish grade.
3. Where trench excavation is inadvertently carried below proper elevation, backfill with approved material and then compact to provide a firm and unyielding subgrade and/or foundation at no additional cost to the Owner.

D. Trench Bracing:

1. Properly support all trenches in strict accordance with all pertinent rules and regulations.
2. Brace, sheet, and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind, whether on public or private property, will be fully protected from damage.
3. In the event of damage to such improvements, immediately make all repairs and replacements necessary at no additional cost to the Owner.
4. Arrange all bracing, sheeting, and shoring so as to not place stress on any portion of the completed Work until the general construction thereof has proceeded far enough to provide sufficient strength.
5. All shoring and sheeting required to perform and protect the excavation and as required for the safety of employees and abutting structures shall be performed. All workmen

performing work in 48” or deeper trench or excavation shall be protected by use of a welded sheet steel “safety box.”

6. Removal: Exercise care in the drawing and removal of sheeting, shoring, bracing, and timbering to prevent collapse or caving of the excavation faces being supported.

E. Bedding:

1. Where pipes or conduits are to be installed, excavate below the proposed alignment of the pipe and backfill with clean sand to provide uniform support unless otherwise noted on the drawings.
2. Unless shown otherwise on Drawings, minimum bedding to be 4” below pipe.
3. Refer to drawings and details for further information and requirements.

F. Grading and Handling of Trenched Material:

1. During excavation, material shall be stacked in an orderly manner a sufficient distance back from edges of trenches to avoid overloading and prevent slides or cave-ins.
2. Control the temporary stockpiling of trenched material in a manner to prevent water from running into the excavations.
3. Do not obstruct the surface drainage but provide means whereby stormwater is diverted into existing gutters, surface drains or other temporary drains.
4. Any water accumulated in the trenches shall be removed by pumping or by other approved methods.

3.7 Filling, Backfilling and Compacting

A. Prior to filling, backfilling and compacting, proof-roll and remediate subgrade per Part 3 Quality Assurance.

B. Unless otherwise indicated, maximum lift thickness is 8” of un-compacted material.

C. Moisture:

1. Thoroughly mix each layer to assure uniformity of material.
2. Supplement mixing with wetting or drying as required to obtain the moisture content required for the indicated percentages of compaction.
3. All fill shall be placed so that the moisture content is within +/- 2% of the optimum moisture content according to ASTM D698.
4. Do not use frozen materials in the fill or allow the fill to be placed upon frozen materials.

D. Compaction:

1. Compaction shall be accomplished by approved means and shall meet the following densities for various parts of the Work. See Part 2 for density requirements of individual soil materials.
2. Compaction by flooding is not acceptable.
3. In cut areas where pavement is planned, scarify the upper 12” of subgrade prior to compaction.

E. Equipment:

1. Tracked equipment shall not be used as compaction equipment.

2. The static weight of compaction equipment utilized for the compaction of backfill materials near walls as defined in No.3 below shall not exceed 2,000 lbs. for non-vibratory equipment and 1,000 lbs. for vibratory equipment.
3. All heavy equipment, including compaction equipment heavier than noted herein, shall not be allowed closer to walls than 3 feet plus the vertical distance from backfill surface to the bottom of the wall.

3.8 Grading

A. General:

1. After filling and backfilling operations are complete, neatly and evenly grade areas to be seeded or sodded.
2. Scarify subgrade to a depth of 6” and place minimum 4” topsoil (6” maximum).
3. Grade to obtain the elevations indicated within a tolerance of plus or minus 0.1 foot.
4. Slope finished subgrade surface to provide drainage away from building walls.

B. Treatment After Completion of Grading:

1. After grading is completed and inspected, permit no further excavation, filling, or grading except with the review of and the inspection by the Owner.
2. Use all necessary means to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.9 Quality Assurance

A. Coordination:

1. A representative from the Contractor shall be present to observe and perform tests at all times earthwork is in progress.

B. Testing:

1. To verify adequacy of compaction, the Contractor shall perform field density tests.
2. A grid pattern shall be established with a maximum area of 1,000 square feet.
3. For each grid, provide minimum one test per each lift of compacted material.

C. Proofrolling:

1. Proofrolling shall be supervised by the Contractor.
2. Since standard test procedures are not available for proofrolling, the necessary scope and method of testing shall be determined by the Contractor, subject to review by the Architect/Engineer.

D. Approval and Remediation:

1. When testing and proofrolling indicate proper compaction has been obtained, continue fill and backfill work until the indicated elevation is achieved.
2. If required density has not obtained, the Contractor shall remove the defective material and repeat operations until the required density is obtained.

3. Cost of material removal, replacement, compaction and re-testing shall be the responsibility of the Contractor.

3.10 Surplus Soil Materials

A. Unless otherwise indicated or directed by Owner, remove excess soil materials and legally dispose of off-site.

3.11 Job Completion

A. Upon completion of the Work of this Section:

1. Remove all trash and debris from earthwork operations.
2. Remove surplus equipment and tools.
3. Leave the site in a neat and orderly condition.
4. Restore all adjacent areas disrupted by earthwork activities to their original condition.

END OF SECTION 31 20 00

SECTION 32 12 16 - ASPHALT PAVING

PART I - GENERAL

1.1 Summary

A. Section Includes:

1. Asphalt paving as shown or implied by Contract Documents.
2. Asphalt paving required as a result of trenching through or demolition of existing asphalt.

B. Related Sections:

1. Division 32 Section “Pavement Marking”.

1.2 Quality Assurance

A. All materials and work shall comply with the Indiana Department of Transportation Standard Specifications (INDOTSS), current edition.

B. Any work in public right-of-way or other areas subject to the jurisdiction of any body shall be performed either to the requirements of that jurisdiction or to the requirements of this Specification, whichever is more stringent.

C. Testing and Inspection:

1. All testing and inspection shall be performed by the Contractor.
2. The Contractor is responsible for all testing, sampling and inspection.
3. The Contractor is responsible for providing these services.

1.3 Submittals

A. Materials Certificates:

1. Materials certificates must be signed by material supplier and Contractor.
2. Certificates must be submitted for all asphalt paving items.
3. Certificates must state that each material item meets or exceeds specified requirements.

B. Job Mix Formulas:

1. Submit a job mix formula (JMF) for all asphalt paving work.
2. The JMF must state that the mix meets the requirements of INDOTSS Section 402 as specified herein.
3. The JMF must include the following, at a minimum:

    a. Aggregate type, source and gradation.
    b. Type and percent of binder (actual and extracted).

c. Voids in mineral aggregate (VMA).
d. Voids filled with asphalt (VFA).
e. Percent of air voids.
f. Density.
g. Amount of recycled materials in intermediate course, if applicable.

C. Other:

1. Testing and inspection reports.

PART 2 - PRODUCTS

2.1 Paving

A. Aggregates:

1. Fine aggregates: INDOTSS Section 904.02
2. Course aggregates: INDOTSS Section 904.03
3. All crushed stone for the aggregate base shall be per the INDOTSS gradations and CAPP specifications.
4. Commercial grade aggregates are not acceptable.

B. Asphalt Materials:

1. General: INDOTSS Section 402.
2. Binder: Performance Graded Asphalt Binder, INDOTSS 902.01 (a).
3. Prime coat: Asphalt Emulsion, AE-PMP, INDOTSS 902.01 (b).
4. Tack coat: Asphalt Emulsion, AE-PMT, INDOTSS 902.01 (b).
5. Recycled asphalt materials:

a. Per INDOTSS 401.06.
b. Maximum 15% in the surface course.
c. Maximum of 25% in the intermediate course.

C. Mixtures:

1. Percent of aggregates passing sieves.

Sieve Size	**Surface**	**Intermediate**
19.0 mm (3/4 in.)	100	100
12.5 mm (1/2 in.)	100	70-92
9.5 mm (3/8 in.)	96-100	50-75
4.75 mm (No. 4)	75±5	40±5
2.36 mm (No. 8)	36-66	18-45
1.18 mm (No. 16)	19-50	10-36
600 mm (No. 30)	10-38	6-26
300 µm (No. 50)	5-26	2-18
150 µm (No. 100)	2-17	0-11
75 µm (No. 200)	0-5	0-4
Percent of Bitumen	5.7 – 7.2	4.1 – 5.2
Percent Air Voids	4.0	4.0

2. Contractor is responsible for adjusting mix, if required for proper placement and performance. Any such modifications shall be approved by the Architect/Engineer.

D. Unless otherwise indicated or required by jurisdictions having authority, a prime coat is to be used at the discretion of the Contractor, as necessary and appropriate to ensure proper protection and placement of paving.

PART 3 - EXECUTION

3.1 General

A. Protection:

1. Provide all necessary barricades and markers in order to keep vehicular traffic off freshly placed paving until the paving has cooled and hardened for at least twelve hours.
2. During paving operations, exercise care not to chip, spall, scar or otherwise damage curbs, walks, buildings and other work. Any such damage shall be repaired to the Owner's satisfaction by the Contractor at the Contractor's expense.

B. Job Conditions:

1. Weather limitations:

   a. Apply prime and tack coats when ambient temperature is above 50 degrees F, (10 degrees C), and when temperature has not been below 35 degrees F, (1 degree C), for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.
   b. Place intermediate course when air temperature is above 30 degrees F, (-1 degree C), and rising.
   c. Place surface course when air temperature is above 40 degrees F, (4 degrees C), and when intermediate course is dry.

2. Asphalt temperature: The paving mixture shall be placed and compacted at a temperature between 250˚F (121˚C) and 300˚F (149˚C).

3.2 Paving

A. Grading and Drainage:

1. Ensure positive and adequate grading for all work. Notify Architect/Engineer of any concerns or conflicts prior to installation.

B. Preparation:

1. Immediately prior to placing the base course, proof-roll the sub-base with a pneumatic tire roller.

2. Remove and replace all areas of failures, irregularities and roller marks in the sub-base so that it meets the compaction requirements of Division 31 Section “Earthwork”.

C. Placement:

1. Aggregate base course:

   a. Place base course only on solid, dry and unfrozen subsurface.
   b. Unless specified otherwise on the Drawings, the aggregate base shall consist of the following minimum requirements: a 4” layer of compacted No. 53 crushed stone on top of a 4” layer of compacted No. 2 crushed stone, for a minimum overall compacted thickness of 8”.

2. Intermediate course:

   a. Immediately prior to the placing of the intermediate course, proofroll the aggregate base course by making a minimum of two passes over the entire areas with a pneumatic tire roller. Remove and replace all areas of failures, irregularities and roller marks in the base course.
   b. Place intermediate course only on clean, solid, dry and unfrozen sub-course.
   c. Spread each course concurrently, within practical limits, using mechanical spreaders.
   d. Intermediate course shall have minimum 3” compacted thickness, unless specified otherwise on the Drawings.

3. Surface course:

   a. Place surface course only on clean, solid, dry and unfrozen sub-course.
   b. Apply tack coat to underlying surface as necessary to ensure proper placement.
   c. Spread each course concurrently, within practical limits, using mechanical spreaders.
   d. Surface course shall have minimum 1 1/2” compacted thickness, unless specified otherwise on the Drawings.

4. Abutting existing asphalt pavement:

   a. Saw cut the existing pavement straight and true.
   b. Ensure new pavement elevation matches existing.
   c. Ensure joint is clean and tight, with no gap or raveling.
   d. Refer to Drawings for abutment detail.

D. Compaction:

1. Aggregate base course:

   a. Prior to compacting, remove any foreign materials that have become incorporated into the base course.
   b. Thoroughly compact base course to the proper elevations and density.

2. Intermediate and surface courses:

   a. Prior compacting, remove any foreign materials that have become incorporated into the paving courses.

b. Follow the spreading processes immediately with rollers of sufficient size to compact the paving courses to their proper densities and elevations.
c. Ensure no low spots exist which might retain water.
d. Perform additional rolling as required to produce a well compacted, crack-free, fissure-free surface of uniform texture, without evidence of tool or machine marks.
e. Do not roll over the unprotected edge of a spread.

3.3 Patching

A. Saw cut around areas to be patched or repaired.

B. Remove existing pavement down to sound base, excavating with vertical faces.

C. Replace with full depth patch, making neat, even and crisp joint with adjacent areas.

D. Patched areas shall match adjacent areas in texture and grade.

3.4 Field Quality Control

A. Coordination:

1. The Contractor shall be present to observe and perform tests at all times paving work is in progress.

B. Testing:

1. Contractor shall take one sample per lift of asphalt concrete for each 5,000 square feet of pavement area, with a minimum of two samples per lift of asphalt concrete each day before paving operation. The following laboratory tests shall be performed:

   a. Aggregate gradation.
   b. Binder content.
   c. Density.
   d. Percent air voids.

2. Contractor shall test in-place compacted asphalt for density with nuclear penetrometer (backscatter, no drilling of pavement). Contractor shall take one reading per lift of asphalt concrete for each 1,000 square feet of pavement area, with a minimum of two readings per lift of asphalt concrete each day. The in-place density shall be a minimum of 94% of the maximum theoretical density per the Job Mix Formula.

C. Thickness:

1. The in-place compacted thickness will not be acceptable if it exceeds the following allowable variation from the required thickness:

   a. Base course: ½”.
   b. Intermediate course: ¼”.
   c. Surface course: ¼”.

D. Surface Smoothness:

1. The finished surface will not be acceptable if it exceeds the following tolerances, using 10' straightedge applied parallel with and at right angles to centerline of paved area:

   a. Base course: 1/4".
   b. Intermediate course: 1/8".
   c. Surface course: 1/8".
   d. Finished grade shall be within ½" of grade specified on the drawings.

E. Unsatisfactory Pavement:

1. Contractor is responsible for removing and replacing pavement that does not meet the Specifications herein, as well as any pavement deemed unacceptable by Architect/Engineer, Geotechnical Engineer or Owner.
2. The Contractor is responsible for the cost of any re-testing due to unsatisfactory pavement replacement.

3.5 Completion of Work

A. At the completion of paving operations, the Contractor shall perform the following:

1. Remove all protective barricades and markers.
2. Clean paving materials from all structures, curbs, walks, mechanical and electrical items, and other surfaces to which the paving is incidental and not intended.

END OF SECTION 32 12 16

SECTION 32 13 00 - SITE CONCRETE

PART 1 - GENERAL

1.1 Summary

A. Section Includes:

1. Cast-in-place concrete outside of the building for site improvements including, but not limited to, the following:

   a. Curbing, gutters, walks and pavement.

B. Related Sections:

1. Division 32 Section “Pavement Marking”.

1.2 Quality Assurance

A. Any work in public right-of-way or other areas subject to the jurisdiction of anybody shall be performed either to the requirements of that jurisdiction or to the requirements of this Specification, whichever is more stringent.

B. Qualifications of Workers:

1. Provide at least one person who shall be present at all times during execution of this portion of the work.
2. This person shall be thoroughly familiar with the type of materials being installed and the best methods for their installation.
3. This person shall direct all work performed under this Section.

C. Manufacturer: manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.

D. Codes and Standards:

1. In addition to complying with all pertinent codes and regulations, comply with all pertinent requirements of the following American Concrete Institute Publications:

   a. “Building Code Requirements for Reinforced Concrete” ACI 318-99.
   b. “Recommended Practice for Cold Weather Concreting” ACI 306 R-88.
   c. “Recommended Practice for Hot Weather Concreting” ACI 305 R-91.
   d. “Recommended Practice for Evaluation of Strength Test Result for Concrete” ACI 214-77.
   e. “Standard Practice for Selecting Proportions for Normal, Heavy Weight, and Mass Concrete” ACI 211.1-98.

2. Where provisions of pertinent codes and standards conflict with this Section, the more stringent provisions shall govern.

E. Testing and Inspection:

1. All testing and inspection shall be performed by the Contractor.
2. The Contractor is responsible for all testing, sampling and inspection.
3. The Contractor is responsible for providing these services.

1.3 Submittals

A. Mix Designs.

B. Testing and inspection reports.

C. Chloride ion tests or total chloride tests (with generally accepted method to relate total chloride to chloride ion) to show compliance with maximum ion concentrations.

PART 2 - PRODUCTS

2.1 Materials

A. Concrete:

1. Cement: ASTM C150, Type I or III.
2. Fine aggregate: ASTM C33.
3. Coarse aggregate: ASTM C33.

    a. Crushed stone shall be used for exterior concrete, unless otherwise noted.
    b. Maximum aggregate size is 3/4 of the minimum clear spacing (per code) between reinforcing bars or between bars and forms.

4. Water: Clean, fresh, potable.
5. Air-entraining admixture: ASTM C260.
6. Fly ash: ASTM C618.
7. Fiber mesh:

    a. Fiber mesh shall be polypropylene fibrillated and mix shall contain minimum 1.5 lbs. of fiber per cubic yard of concrete, unless otherwise prescribed by manufacturer and approved by Architect/Engineer.
    b. Fiber shall be mixed at batch plant, field mixing is not acceptable.

8. Sealer/curing compound:

    a. ASTM C309, Type I, clear.
    b. Compatible with texture of surfaces.

B. Mix Design:

1. Strength: 4000 psi, ready mixed in accordance with ASTM C94.
2. Slump: 4” +/- 1”.
3. Minimum cement content: 517 pounds per cubic yard (adjust for air entrainment)
4. Fly ash shall not replace more than 20% of the cement.
5. Maximum water/cement ratio: 0.40.

6. Air entrainment: 6%. Percentage of air content shall be determined in accordance with the admixture manufacturer's recommendations based on aggregate size and a moderate level of exposure.
7. No color pigment added.

C. Other Requirements:

1. Proportions of materials for concrete shall be established in accordance with Section 5.2 of ACI 318 (Latest edition).
2. Follow ACI 211 and ACI 301 to determine the water-cement ratios.
3. Concrete shall not exceed maximum chloride ion content for corrosion protection as defined in ACI 318 Table 4.4.1.
4. Do not use calcium chloride or admixtures containing soluble chlorides.
5. Do not use re-tempered concrete or concrete that has been contaminated by foreign materials.
6. All exterior concrete shall be air entrained.
7. Unless otherwise indicated, all reinforcing for concrete pavement shall be epoxy coated.

D. Isolation Joints: Unless specified otherwise on Drawings, use the following:

1. Asphalt saturated cellulosic fiber:

   a. Joint material: AASHTO M213; 1/2 inch thick.
   b. Do not place sealant on asphalt saturated cellulosic fiber isolation joints.
   c. Application: Use this type of isolation joint for items such as curbs and walks, which are in areas not adjacent to buildings, structures and columns, etc. Do not use in areas of colored concrete.

2. Contact Architect/Engineer if further direction is needed for proper application in specific areas.

2.2 Steel Reinforcing

A. Reinforcing Bars:

1. Reinforcing bars and dowels: ASTM A615, Grade 60.
2. Reinforcing to be welded: ASTM A615, Grade 40.
3. Epoxy coated bars and dowels: ASTM A884, Grade 60.

B. Welded Wire Fabric:

1. ASTM A185 6"x6"xW1.4xW1.4, unless otherwise indicated.
2. Provide in flat sheets, not rolled form.

C. Other Embedded Items: Provide standard manufactured products as approved by the Architect/Engineer.

D. Bar Supports:

1. Conform to the requirements of the "Manual of Standard Practice", published by the Concrete Reinforcing Steel Institute.
2. Accessories shall be plastic protected Class "C" for all concrete exposed in the finished structure, except as specified below.

3. Accessories shall be Class “A”, bright basic, for unexposed concrete.
4. Utilize Call “E,” stainless steel bar supports, for exterior concrete to be finished by sand blasting.
5. Do not use continuous high chairs. Use individual high chairs laced with bottom cross bars plus #5 support bars. (Minimum of 2 rows of support for all reinforcing).
6. Supports must be capable of supporting construction loads without failing. Contractor to furnish additional supports at no cost to the Owner if in the Architect/Engineer estimation the supports are not adequate.

2.3 Formwork

A. Form Lumber:

1. All form lumber in contact with exposed concrete shall be new or of sufficient quality to insure an unblemished texture.
2. All form lumber shall be plywood, board lumber, hardwood or other material of grade or quality to best suit each particular usage.

B. Fiber Forms:

1. Fiber forms may be utilized to construct round columns/piers.
2. Seamless forms must be used for concrete exposed in the finished structure.
3. Standard seamed tubes are permissible for non-exposed concrete.

C. Form Release Agent:

1. Standards:

   a. Release agent shall be similar to Symons Manufacturing Company Magic Kote.
   b. Grace Construction Products Formshield Chemical Release Agent.

D. Bracing/Shoring/Studs:

1. Such supports shall be selected for economy consistent with safety requirements and the quality required in the finished work. The Contractor is responsible for the design, illustration, safety and serviceability of all formwork.

E. Other Materials: All other materials, not specifically described, but required for proper completion of concrete formwork, shall be as selected by the Contractor subject to advance acceptance by the Architect/Engineer.

PART 3 - EXECUTION

3.1 General

A. Job Conditions:

1. Extreme temperature conditions:

   a. When extreme hot or cold weather conditions occur, or are expected to occur, which might detrimentally affect concrete, employ handling and placing techniques to guard against such effects.
   b. Comply with the recommendations of American Concrete Institute for hot and cold weather concreting. ACI Publications ACI 306 and ACI 305.

2. Inclement weather: Unless adequate protection is provided, do not place exterior concrete during rain, sleet or snow.

B. Preparation and Verification:

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly begin.
2. Verify all items to be embedded in concrete are in place.
3. Verify concrete may be placed to the lines and elevations indicated on the Drawings, with all required clearances for reinforcement.
4. Verify forms may be constructed in accordance with all pertinent codes and regulations, the referenced standards and the original design.
5. Remove all dirt, oil, paint, loose rust and other foreign materials from the concrete reinforcement prior to placement.
6. In the event of discrepancy, contact Architect/Engineer immediately and do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

C. Other: Unless otherwise indicated, all exterior concrete shall be placed on a compacted aggregate fill per the following:

1. Minimum depth equal to the concrete thickness for pavement, walks and other slabs on grade.
2. Minimum 6” depth of fill for curbing and other support bases.

3.2 Formwork

A. Protection:

1. Use all necessary and appropriate means to protect formwork materials before, during and after installation.
2. Protect the installed work and materials of all others trades.
3. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to Owner or other trades.

B. General:

1. Forms shall have sufficient strength and be sufficiently tight to prevent leakage of mortar.
2. The design and engineering of the formwork shall be the responsibility of the Contractor.
3. Refer to this Section for construction joint requirements.
4. Tolerances: Construct all forms straight, true, plumb and square within the tolerances recommended by ACI 347.
5. Embedded items: Set all required steel frames, angles, grilles, bolts, reglets, inserts, pipe, conduit and other such items required to be anchored in the concrete before the concrete is placed.
6. Wetting: Keep forms sufficiently wetted to prevent joints opening up before concrete is placed, except as recommended in ACI 306 R-78, "Recommended Practice for Cold Weather Concreting."

C. Layout:

1. Form all required cast-in-place concrete to the shapes, sizes, lines and dimensions indicated on the Drawings.
2. Exercise particular care in the layout of forms to ensure the proper finish structure size and shape.
3. Make proper provision for all openings, offsets, recesses, anchorage, blocking and other features of the Work as shown or required.
4. Carefully examine the Contract Documents and consult with other trades as required to ensure proper provisions for openings, reglets, chases, and other items in the forms.

D. Bracing and Shoring:

1. Properly brace and tie the forms together so as to maintain position and shape and to ensure safety to personnel.
2. Construct all bracing, supporting members, and centering of ample size and strength to safely carry, without excessive deflection, all dead and live loads to which they may be subjected.
3. Properly space the forms apart and securely tie them together, using metal spreader ties that give positive tying and accurate spreading.
4. All shoring shall extend to adequate foundations.
5. The Contractor is responsible for both the proper design and installation of all bracing and shoring, to properly insure the safety and serviceability of the structure.

E. Plywood Forms:

1. Assembly: Nail the plywood panels directly to studs and apply in a manner to minimize the number of joints.
2. Joints: Make all panel joints tight butt joints with all edges true and square.

F. Reuse of forms:

1. Reuse of forms shall in no way delay or change the schedule for placement of concrete from the schedule obtainable if all forms were new.
2. Reuse of forms shall in no way impart less structural stability to the forms, nor less acceptable appearance to finished concrete.

G. Cleaning:

1. Before concrete is placed the forms shall be cleaned of all debris, ice, snow, frost, and standing water.

2. Remove all loose earth materials from the surfaces of earth forms.

H. Removal of Forms:

1. Forms shall be removed in such a manner to ensure complete safety of the structure.
2. Formwork for columns, walls, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations with the following minimums:

    a. Formwork for walls and columns shall remain in place a minimum of two (2) days during which the temperature of the air surrounding the concrete must be above 50˚ F.
    b. This minimum time period represents a cumulative number of days or fractions thereof.
    c. Such formwork for concrete placed during cold weather with surrounding air temperatures 50˚ F shall remain in place one day after the artificial heating and/or freeze protection is discontinued/removed.

3. Forms and false-work:

    a. Any supporting vertical loads shall remain in place until the members have acquired sufficient strength to safety support their weight and any superimposed loads.
    b. Such forming shall remain in place until the concrete has attained its specified 28 day strength as indicated by the test cylinders unless re-shores are installed in sufficient quantities to transmit the loads to adequate foundations without over stressing the particularly cured structure.
    c. The requirements of ACI 305 and 306 must also be met before forms may be removed.
    d. Removal of forms and false-work is the responsibility of the Contractor, and the Contractor shall bear the full responsibility for this operation.
    e. Concrete damaged by too early removal of forms or false-work shall be repaired or replaced as directed by the Architect/Engineer.

4. Concrete exposed by form removal during the curing period shall be cured by one of the methods specified in this Section.
5. Curing compound is not permitted in certain locations. In these cases, curing is to be by an alternate method. Refer alternate methods in this Section.
6. In no case shall the superimposed load or relatively new concrete exceed 50 pounds per square foot unless proper shoring to suitable foundations is installed as required by the Architect/Engineer.
7. Use all necessary and appropriate means to protect workman, public, the installed work and materials of other trades, and the complete safety of the structure.
8. Cut nails and similar fasteners off flush and leave all surfaces smooth and clean.

3.3 Reinforcement

A. Protection:

1. Use all necessary and appropriate means necessary to protect concrete reinforcement before, during and after installation and to protect the installed work and materials of all other trades.
2. Store in a manner to prevent excessive rusting and fouling with dirt, grease, and other bond-breaking coatings.

3. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the Owner.

B. Placing:

1. Reinforcing bars:

   a. Positively secure reinforcing to bar supports and tie or otherwise anchor bars to prevent displacement by construction loads or by the placing of concrete.
   b. Splice bars with a minimum lap of 40 bar diameters, unless otherwise indicated.
   c. Use mechanical splicers/couplers where quantity of reinforcement restricts placement of concrete if lapped splices are utilized.
   d. Splice bars only at locations indicated on the Contract Documents and shop drawings.
   e. Both shop and field bending shall be accomplished without heating the bars.
   f. Minor placing adjustments can be made to avoid interference with other reinforcement and/or embedded devices. The final arrangement, however, is subject to review and acceptance of the Architect/Engineer.
   g. Immediately notify the Architect/Engineer if reinforcing cannot be installed as shown on drawings. No cutting of reinforcing shall occur unless the Architect/Engineer has reviewed and approved such cuts.

2. Embedded devices:

   a. Set hangers, anchor bolts, inserts, and other embedded devices accurately in place.
   b. Make sure all such devices are installed so that work to be attached thereto will be properly received.
   c. Keep devices straight and true-to-line.

3. Welded wire fabric:

   a. Splice by lapping each section at least two meshes wide plus one wire with the adjacent section, but not less than 8”.
   b. Extend fabric into all openings, doorways, and the like, unless otherwise indicated.

C. Final Cleaning:

1. Prior to placing concrete, remove all loose mill and rust scale, oil, mud, ice, and other foreign coatings which destroy and/or reduce bond between the reinforcement and concrete.
2. Use wire brushing and/or other suitable methods to complete cleaning operations.

3.4 Concrete Placement

A. Preparation:

1. Remove all wood scraps, ice, snow, frost, standing water and debris from the area in which concrete will be placed.
2. Thoroughly wet the surface of excavations (except in freezing weather), coat forms with release agent and remove all standing water.

B. Method:

1. Convey concrete from mixer to place of final deposit by methods that will prevent separation and loss of materials.
2. For chuting, pumping and pneumatically conveying concrete, use only equipment of such size and design as to ensure a practically continuous flow of concrete at the delivery end without loss or separation of materials.
3. Deposit concrete as nearly as possible in its final position to avoid segregation due to re-handling and flowing.
4. Use screed poles or similar devices to ensure that all slabs are cast at the proper elevations and that specified tolerances are maintained.

C. Rate of Placement:

1. Place concrete at such a rate that concrete is at all times plastic and flows readily between reinforcement.
2. Once placing is started, carry it on as a continuous operation until placement of the panel or section is complete.
3. Do not pour a greater area at one time than can be properly finished. This is particularly important during hot or dry weather.

D. Consolidation:

1. Thoroughly consolidate all concrete by mechanical vibration, hand, and other suitable means during placement, working it around all embedded fixtures and into corners of forms.
2. Do not over-consolidate with when using mechanical vibration as to cause separation of the aggregate.

3.5 Joints

A. Unless otherwise shown on Drawings, joints shall meet the following minimum requirements. If questions or concerns exist, contact Architect/Engineer for direction.

B. Isolation Joints:

1. General:

a. Tool concrete on both sides of joint (1/4” radius).
b. Install joint material to full depth of concrete.
c. See Part 2 Products for type of joint material to be used.
d. Install sufficient smooth doweling reinforcing to prevent differential movement in curbing, walks and pavement.
e. Do not dowel into such items as columns and exterior building walls/foundations, unless specified on drawings. Refer to structural drawings also.
f. Unless otherwise indicated, install isolation joints per the following minimum requirements.

2. Curbing:

a. Provide each side of inlet castings.
b. Provide at all tangent points and changes in direction.

3. Other:

    a. Contact Architect/Engineer if any areas of question or concern are encountered.

C. Control Joints:

1. General:

    a. Control joint depth shall be minimum ¼ of the slab thickness.
    b. Continue one half of reinforcing through joint.
    c. Install joints by tooling or saw cutting as described below, unless otherwise indicated.
    d. Construction joints may be used where appropriate.

2. Curbing: Saw cut at intervals not exceeding 10 feet.
3. Other:

    a. Contact Architect/Engineer if any areas of question or concern are encountered.

D. Construction Joints:

1. Joints shall be made with properly constructed bulkheads and formed keyways.
2. Extend reinforcing through construction joints, unless otherwise indicated.
3. The Contractor shall consult with the Architect/Engineer before starting concrete work to establish a satisfactory placing schedule and to confirm joint locations.

E. Tooled Joints and Scoring:

1. Make straight, clean and non-ragged.
2. Tool or score concrete on both sides of joint (1/4” radius).
3. Provide window pane joint finish unless otherwise indicated.

F. Bond Break: 15# per 100 square foot building paper.

3.6 Finishing

A. Unless otherwise indicated, provide a light-broom finish on all exterior slabs, walks and stairs.

B. Provide a dry-rub finish for all exposed concrete walls, curbs or edge surfaces.

3.7 Curing

A. Formed Surfaces:

1. Cure formed surfaces by either of the following methods:

    a. Leave forms in place until the cumulative number of days or fractions thereof, not necessarily consecutive, has totaled seven days during which the temperature of the air in contact with the concrete is 50˚F or above.
    b. Remove forms at an earlier time, but apply curing compound to concrete surfaces.
    c. Apply compound in accordance with manufacturer’s recommendations.

2. If curing compound is not used and the forms are stripped prior to 7 days curing, the following methods are approved:

    a. Ponding or continuous sprinkling.
    b. Continuously wet mats.
    c. Sand kept continuously wet.

3.8 Patching

A. Patch existing concrete to receive new finish in a manner so that existing and patched surfaces are smooth and continuous and have a uniform appearance.

3.9 Quality Assurance

A. Coordination:

1. The Contractor shall perform tests at all times site concrete work is in progress.

B. Inspection:

1. Immediately after forms and curing membranes have been removed, inspect all concrete surfaces and patch all pour joints, voids, rock pockets, form tie holds and other imperfections before the concrete is thoroughly dry.
2. If the defects are serious or affect the strength of the structure, or if patching does not satisfactorily restore the quality and appearance of the surface, the concrete shall be removed and replaced complete, at no additional cost to the Owner.

C. Testing: The Contractor shall perform the following:

1. Compression tests:

    a. Secure three standard cylinders from each pour of concrete, in accordance with ASTM C31, and cure under standard moisture and temperature conditions.
    b. Test in accordance with ASTM C39.
    c. Test one cylinder at 7 days and two cylinders at 28 days.
    d. Submit duplicate test reports of results from testing to Architect/Engineer.
    e. Take steps immediately to evaluate unsatisfactory test results.
    f. In the event of unsatisfactory test results, an investigation as outlined in Section 5.6.5 of ACI 318-99 shall be employed.

2. Slump and air entrainment:

    a. Perform slump tests in accordance with ASTM C143.
    b. Determine the air content of concrete in accordance with ASTM standards.
    c. Submit results of slump tests and air content on each compression test report.

3. Should additional testing be required because of unsatisfactory test results, the Contractor is responsible for the costs incurred for correcting any deficiencies and the cost of additional testing.

END OF SECTION 32 13 00

SECTION 32 17 23 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 Work Included

A. The Work of this Section includes furnishing all material, labor, equipment and services to paint the following items of the types, patterns, sizes and colors as indicated on the Drawings.
   1. Parking stripes
   2. Walkway stripes
   3. Text

1.2 Submittals

A. Action Submittals
   1. Manufacturer's Spec Data Sheets of each product to be used.
   2. Shop Drawings: Indicating stall size, spacing, tolerances, etc.

B. Informational Submittals
   1. Material Safety Data Sheets of each product, solvent, or related chemicals to be used, and certification that the materials conform to local, state, and federal environmental and worker’s safety laws and regulations.
   2. Standard color chip for each color.

1.3 Environmental Requirements

A. Manufacturer and Installer are required to confirm that all materials used in accordance with this Section conform to local, state, and federal environmental and workers' safety laws and regulations.
   1. VOC content of materials shall not exceed the limits per Environmental Protection Agency National Volatile Organic Compound Emission Standards for Architectural Coatings (40CFR59).

B. The Installer is solely responsible for fume control and shall take all necessary precautions against injury to personnel or adjacent building occupants during application. As a minimum, Installer shall take the following precautions:
   1. Provide and maintain barricades.
   2. Locate and protect building air intakes during application.
   3. Follow all state, federal, and local safety regulations.
   4. Follow all Manufacturers’ safety requirements.
   5. Dispose empty containers immediately and properly.
   6. Use protective equipment.
   7. Ensure work area is well vented to the exterior.

1.4 Transportation and Handling

A. Deliver all materials to site in original, unopened containers bearing the following information:
   1. Name of Product
   2. Name of Manufacturer
   3. Date of Manufacture
   4. Lot or Batch Number

B. Store materials under cover and protected from the weather.

C. Replace containers showing any signs of damage with new material at no additional cost to Owner.

D. Mix and prepare coatings only in areas designated by the Contractor for that purpose.

E. Take precautions to prevent fire in or around coatings materials. Provide and maintain hand fire extinguisher near storage and mixing area.

PART 2 - PRODUCTS

2.1 Pavement Markings – Acrylic Waterborne

A. All materials shall meet Federal Specification TT-P-1952B.

B. Provide pavement markings as indicated on the Drawings.

C. Approved acrylic waterborne pavement markings are:
   1. SetFast Acrylic Waterborne Traffic Marking Paint, The Sherwin Williams Company, Cleveland, Ohio.
      a. TM226 White
      b. Handicap Blue Use SetFast Low VOC Acrylic Paint TM5626 White as Base and tint
      c. Handicap Blue Use SetFast Low VOC Latex Traffic Marking Paint TM2133
   2. Water Reducible Acrylic Traffic Paint, ICI Paints, Cleveland, Ohio.
      a. 25524/22683 White
      b. 20089/20090 Handicap Blue
   3. Or approved equivalent

2.2 Pavement Markings – Low VOC Acrylic

A. All materials shall meet Federal Specification TT-P-1952B and shall have a VOC content less than <100 g/L (0.83 lblgal).

B. Provide pavement markings as indicated on the Drawings.

C. Approved low VOC acrylic pavement markings are:

1. SetFast Low VOC Acrylic Traffic Marking Paint, The Sherwin Williams, Cleveland, Ohio.
   a. TM5626 White
   b. Handicap Blue Use TM5626 White as base and tint
2. Or approved equivalent

2.3 Pavement Markings – Low VOC Latex

A. All materials shall meet Federal Specification TT-P-1952B and shall have a VOC content less than <100 g/L (0.83 lblgal).

B. Provide pavement markings as indicated on the Drawings.

C. Approved low VOC latex pavement markings are:
   1. SetFast Low VOC Latex Traffic Marking Paint, The Sherwin Williams, Cleveland, Ohio.
      a. TM2133 Handicap Blue
   2. Or approved equivalent

2.4 Pavement Marking Beads

A. All materials shall meet AASHTO Standard Specification M247, Glass Beads used in traffic paints, Type I. Beads shall be treated with a performance adhesion coating.

B. Provide Glass Beads at a rate of 6 pounds per gallon into all traffic arrows, center traffic lines, walkway stripes and floor text to produce reflectorized pavement markings. Glass beads are not required in parking space striping.

C. Approved pavement marking bead manufacturers are:
   1. Cataphote Inc., Jackson, MS.
   2. Potters Industries Inc., Valley Forge, PA.
   3. Flex-O-Lite, St. Louis, MO.
   4. Or approved equivalent

PART 3 - EXECUTION

3.1 Inspection

A. Inspect surfaces to which paint will be applied and report immediately in writing to the Engineer as required in the General Conditions any conditions detrimental to the proper execution of this work.

B. Do not proceed until unsatisfactory conditions are acceptably remedied. Commencement of work implies acceptance of related work.

3.2 Preparation

A. Before commencing work, make certain that surfaces are thoroughly cleaned, dry, and in sound condition. The cleaning of concrete floor surfaces shall meet the requirements of ASTM Designation: D 4258 for Water Cleaning and Detergent Water Cleaning.

B. Do not paint any surface that is wet or damp.

C. Remove all oil, dust, grease, dirt, and other foreign material to ensure adequate adhesion.

D. Lay out all striping using dimensions indicated on the Drawings. Report any discrepancies, interferences or changes in striping due to field conditions to the Engineer prior to painting. Paint Contractor shall be required to remove paint, repair surface and repaint stripes not applied in strict accordance with the Drawings.

3.3 Mixing

A. Do not mix different types of materials or materials from different Manufacturers.

B. Do not thin material except as recommended by Manufacturer for spray application.

C. Mix paint thoroughly by boxing, stirring or power agitation before use.

3.4 Application

A. Apply painting and finishing materials in accordance with the Manufacturer's directions. Use techniques best suited for the material and surfaces to which applied. Apply at 15 mils wet thickness.

B. Do not apply paint when the air and/or surface temperature is below 50 degrees F, when relative humidity exceeds 85%, when rain is threatening or late in the evening when dew might form before drying.

C. Parking space striping dimensions indicated on the Drawings are nominal dimensions. Tolerances shall be as follows:
   1. Parking space length shall equal indicated length ± 2 inches.
   2. Parking space width (or base line dimension) shall equal indicated width ± 1 inch.
   3. A string of parking spaces shall equal indicated dimension ± 2 inches per run.
   4. Stripe width shall equal 4 inches ± 1/4 inch.

D. For traffic arrows, walkways stripes, and floor text add glass beads on wet paint so that proper bead embedment and retention is achieved.

3.5 Cleaning

A. Immediately upon completion of work, clean up all paint spots, remove excess materials and equipment, and repair all paint damage to other finishes.

END OF SECTION 32 17 23

SECTION 32 92 19 - SEEDING

PART 1 - GENERAL

1.1 Summary

A. Section Includes:

1. Furnish and install all labor, material, and equipment necessary for seeding all areas as indicated or implied by the Contract Documents.

B. Related Sections:

1. Division 31 Section "Earthwork".

1.2 Quality Assurance

A. Refer to Division 31 Section "Earthwork" for topsoil requirements and amendment recommendations to bring soil to optimal condition for growing lawn grass seed.

B. Applicable Publications:

1. Publications of the following institutes, associations, societies, and agencies are referred to in this Section.
2. American Joint Committee on Horticulture Nomenclature Standard: Standardized Plant Names, 1942 Edition and Additions.

C. Requirements of Regulatory Agencies:

1. Certificates of inspection: All shipments of orders of seed shall be properly inspected at the nursery or at the growing site by the authorized Federal and State authorities. All necessary inspection certificates shall accompany the invoice for each shipment or order of stock, as may be required by law for the necessary transportation. Certificates shall be filed with the Architect/Engineer, prior to acceptance of the materials.

1.3 Submittals

A. Topsoil Analysis: Refer to Division 31 Section "Earthwork".

1.4 Scheduling

A. Seasonal Requirements:

B. Scheduling:
1. Begin installation of seeding after preceding related work is accepted.

1.5 Product Handling

A. Storage:

1. Store in a dry, secure location off the ground, free from physical abuse.
2. Protect from adverse weather conditions.

PART 2 - PRODUCTS

2.1 Seed

A. Grass Seed: Fresh, clean, dry new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: Seed of grass species as follows, with not less than 98 percent pure seed, not less than 90 percent germination, and not more than 0.5 percent weed seed:

1. Permanent seed: Full sun or partial shade:

a. 80% Hybrid Bluegrass blend – a minimum of 3 varieties evenly blended, such as Midnight II, Rugby II, Nuglade, or as approved by Architect/Engineer..
b. 20% Perennial Rye Grass.

2. Permanent seed: Full shade:

a. 20% Hybrid Bluegrass.
b. 40% Creeping Red Fescue.
c. 20% Hard Fescue.
d. 20% Chewings Fescue.

3. Temporary seed:

a. 100% Annual Rye Grass.

2.2 Inorganic Soil Amendments

A. Lime: ASTM C602 agricultural limestone containing a minimum 80 percent calcium carbonate equivalent as follows:

1. Class: Class T with a minimum 99 percent passing through No 8 sieve and a minimum 75 percent passing through No 60 sieve.

B. Aluminum Sulfate: Commercial grade, unadulterated.

C. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate

D. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.3 Organic Soil Amendments

A. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 – 4.8.

B. Compost: Well-composted, stable and weed free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1 inch sieve; not exceeding 0.5 percent inert contaminants and free of substances toxic to humans and plantings.

2.4 Mulches

A. Straw Mulch: Provide air dry, clean mildew and seed free, salt hay or thrashed straw of wheat, rye, oats, or barley.

2.5 Water

A. Potable.

PART 3 - EXECUTION

3.1 General

A. Inspection:

1. Verify soil preparation and related preceding work have been completed.
2. Do not start work until conditions are satisfactory.

B. Preparation:

1. Protect structures, utilities, sidewalks, pavements and other facilities, trees, shrubs and plantings from damage caused by planting operations.
2. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil bearing water runoff or airborne dust to adjacent properties or walkways.

3.2 Lawn Preparation

A. Limit lawn preparation to areas to be planted.

B. Newly Graded Subgrades:

1. Loosen subgrade to a minimum depth of 6”.
2. Remove stones larger than 1” in any dimension, sticks, roots, trash, and other extraneous matter.

C. Finish Grading:

1. Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture.
2. Grade to within plus or minus 1/2 inch of finish elevation.
3. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

F. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

3.3 Seeding

A. General:

1. Sow seed with spreader or seeding machine.
2. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
3. Do not use wet seed or seed that is moldy or otherwise damaged.
4. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray.
5. Unless otherwise indicated, sow seed at the rate of 4 to 6 lb/1000 sq. ft.

3.4 Protection

A. Description:

1. Protect newly seeded areas against pedestrians and vehicular traffic.

3.5 Cleaning

A. Description:

1. Immediately clean spills from paved and finished surface areas.
2. Remove debris and excess materials from project site.
3. Dispose of protective barricades and warning signs at termination of lawn establishment.
4. Remove erosion control measures after lawn establishment period.

3.6 Lawn Establishment

A. Watering:

1. Water daily for the first 14 days after seeding.

B. Mowing:

1. When grass reaches 2-1/2 inches in height, mow to 1-3/4 inch in height.
2. Maintain grass between 1-3/4 inch and 2-1/2 inch height.
3. Do not cut off more than 40% of grass leaf in single mowing.
4. Remove grass clippings.
5. Re-seed spots larger than 1 square foot not having uniform strands of grass.

C. Fertilizer:

1. Apply fertilizer uniformly at 1 lb of nitrogen per 1000 square feet 30 days and 60 days after seeding and water immediately.

D. Satisfactory Seeded Lawn:

1. At end of maintenance period, a healthy, uniform, close stand of grass has been established free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 inches by 5 inches.

END OF SECTION 32 92 19

INDIANAPOLIS AIRPORT AUTHORITY
INDIANAPOLIS INTERNATIONAL AIRPORT

Indianapolis Airport QTA Road Access Control
October 6, 2016

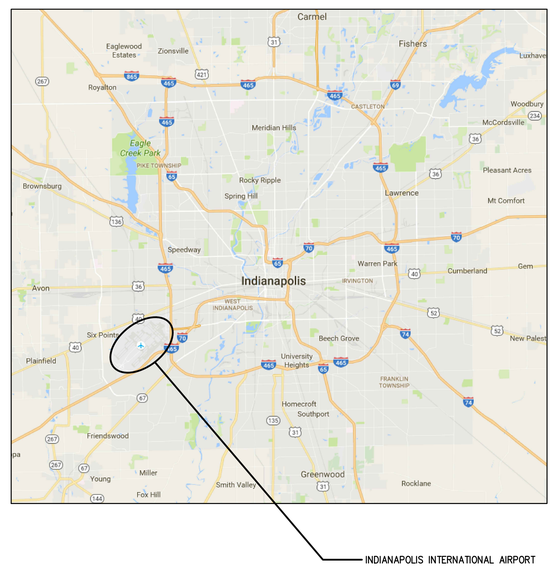
Carl Walker
Carl Walker, Inc.
8910 Purdue Rd.
Suite 400
Indianapolis, IN 46268
Tel. 317.735.3349
www.carlwalker.com

DOUGLAS P. GANNON
REGISTERED
No. PE10300054
STATE OF INDIANA
PROFESSIONAL ENGINEER
10/6/16

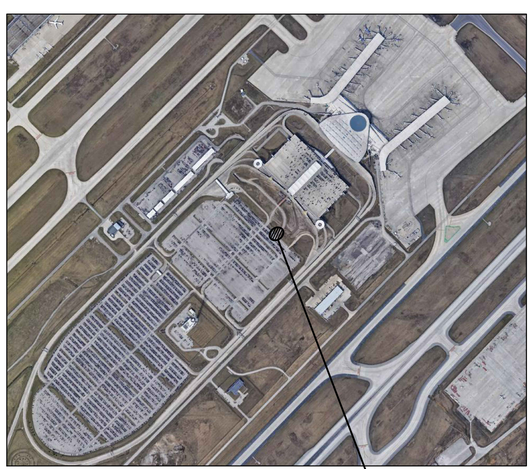
Indianapolis Airport QTA Road Access Control

Indianapolis, Indiana

VICINITY MAP



SITE MAP



SHEET INDEX

GENERAL

G-001 COVER SHEET & SHEET INDEX

CIVIL

C100 SITE DEVELOPMENT PLAN
C110 SITE DETAILS

ARCHITECTURAL PARKING

AP100 OVERALL PLAN
AP101 ENLARGED PARCS PLANS

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PROJECT MGR. RTS
DESIGN ENG. DPG
DRAWN BY RMM-DEB

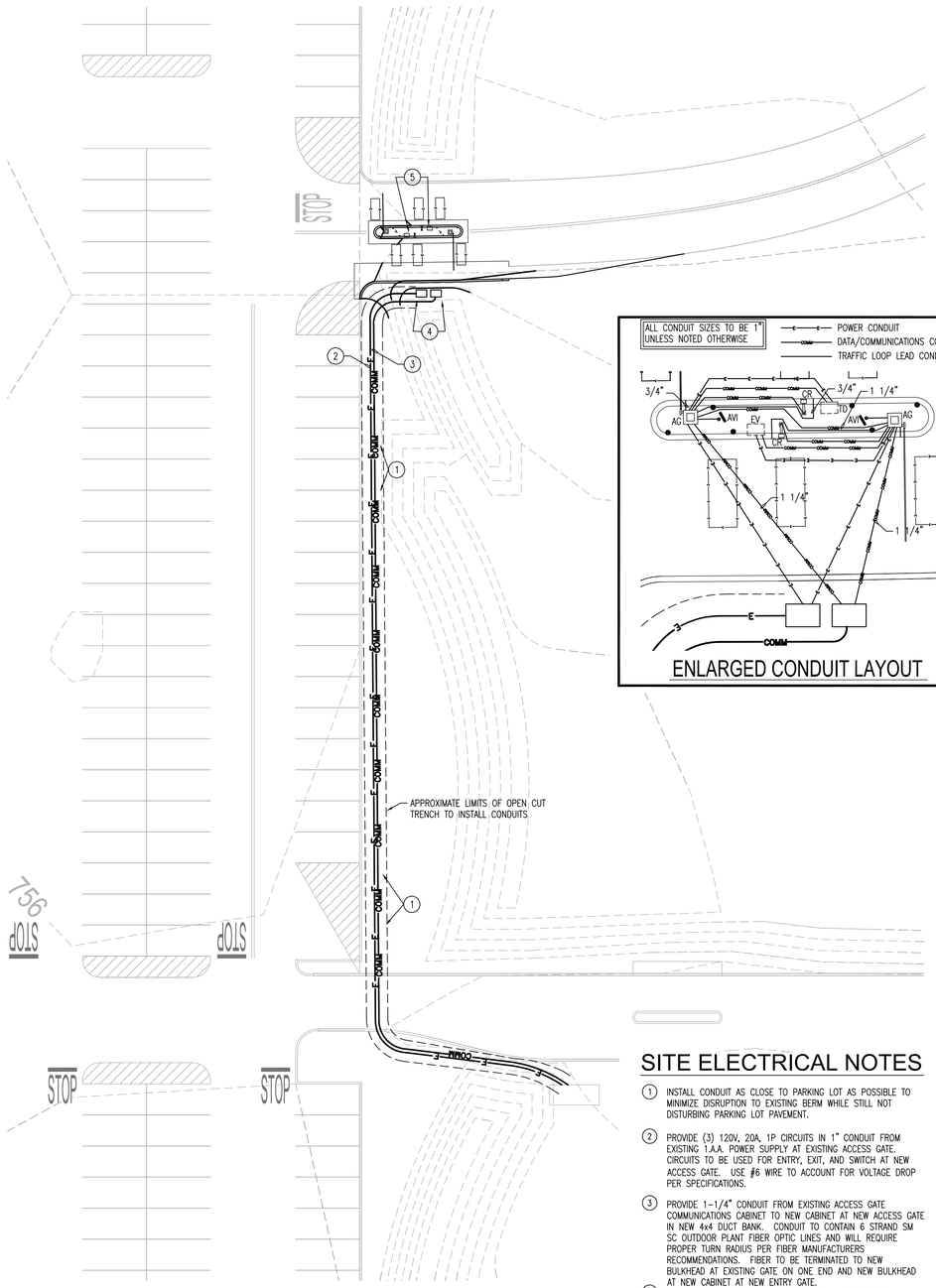
ISSUED/ REV. NO.	DATE	DESCRIPTION
	10/06/2016	ISSUED FOR CONSTRUCTION

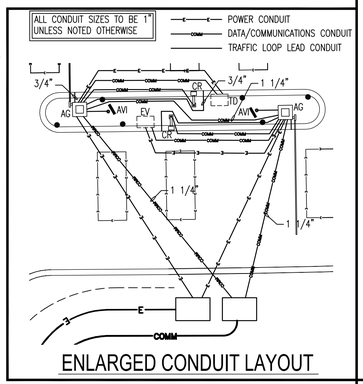
DRAWING TITLE
COVER SHEET & SHEET INDEX

PROJECT NO.
S1-2016-170

DRAWING NO.
G-001

Carl Walker, Inc : DRAWING:P:\SOC\S-2016\S1-2016-170 IND Airport Feasibility Analysis & Strategic Planning\CAD\QTA PARCS\S1-2016-170-G001.dwg...Wednesday, October 05, 2016, 2:27pm DanielB





ENLARGED CONDUIT LAYOUT

GENERAL NOTES

EXISTING CONDITIONS SHOWN ARE BASED ON OWNER FURNISHED AS-BUILT DRAWINGS AND AERIAL INFORMATION AND ARE UNCONFIRMED. CONTRACTOR MUST CONFIRM AND VERIFY LOCATIONS, DIMENSIONS, GRADING, AND ALL EXISTING CONDITIONS AND NOTIFY ENGINEER OF ANY MAJOR DISCREPANCIES. PROVIDE POSITIVE DRAINAGE ALONG NEW CURB AND ASPHALT PAVEMENT AND MATCH EXISTING DRAINAGE PATTERNS.

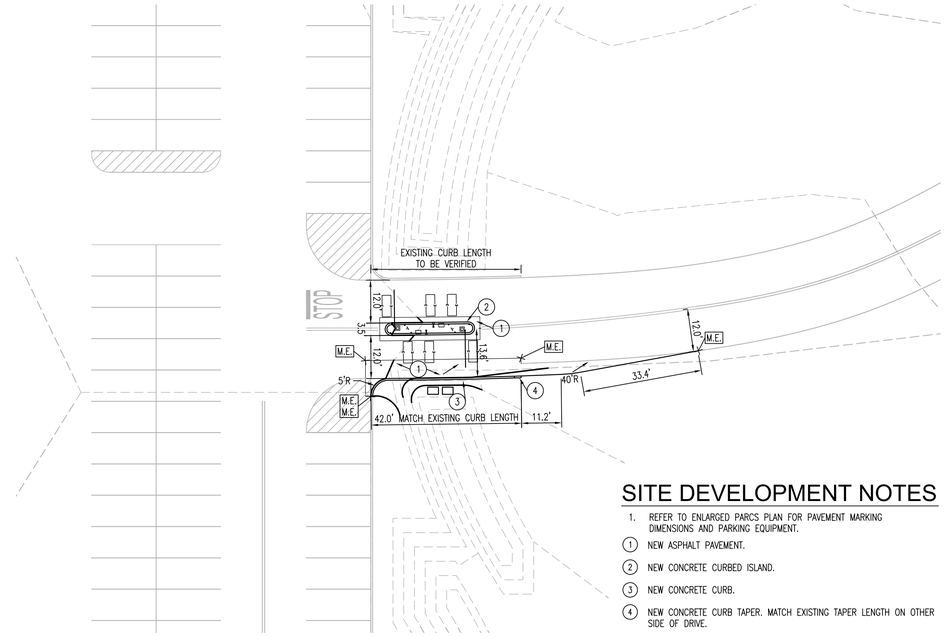
03 SITE ELECTRICAL PLAN
SCALE: 1"=20'

NORTH

SITE ELECTRICAL NOTES

1. INSTALL CONDUIT AS CLOSE TO PARKING LOT AS POSSIBLE TO MINIMIZE DISRUPTION TO EXISTING BERM WHILE STILL NOT DISTURBING PARKING LOT PAVEMENT.
2. PROVIDE (3) 120V, 20A, 1P CIRCUITS IN 1" CONDUIT FROM EXISTING 1.A.A. POWER SUPPLY AT EXISTING ACCESS GATE. CIRCUITS TO BE USED FOR ENTRY, EXIT, AND SWITCH AT NEW ACCESS GATE. USE #6 WIRE TO ACCOUNT FOR VOLTAGE DROP PER SPECIFICATIONS.
3. PROVIDE 1-1/4" CONDUIT FROM EXISTING ACCESS GATE COMMUNICATIONS CABINET TO NEW CABINET AT NEW ACCESS GATE IN NEW 4x4 DUCT BANK. CONDUIT TO CONTAIN 6 STRAND SM SC OUTDOOR PLANT FIBER OPTIC LINES AND WILL REQUIRE PROPER TURN RADIUS PER FIBER MANUFACTURERS RECOMMENDATIONS. FIBER TO BE TERMINATED TO NEW BULKHEAD AT EXISTING GATE ON ONE END AND NEW BULKHEAD AT NEW CABINET AT NEW ENTRY GATE.
4. PROVIDE (2) CABINETS, ONE FOR POWER AND ONE FOR COMMUNICATIONS, MATCHING EXISTING CABINETS LOCATED AT EXISTING ACCESS GATE.
5. REFER TO ENLARGED CONDUIT LAYOUT PLAN FOR CONDUIT PATHWAYS BETWEEN NEW CABINETS AND ISLAND. CONTRACTOR TO PROVIDE POWER AND DATA CONNECTIONS AS REQUIRED BETWEEN THE NEW CABINETS AND THE FOLLOWING EQUIPMENT ON THE ISLAND:
   - AG – AUTOMATIC GATE
   - AVI – AUTOMATIC VEHICULAR IDENTIFICATION READER
   - CR – CARD READER
   - TD – FUTURE TICKET DISPENSER
   - EV – FUTURE EXIT VERIFIER

   FUTURE EQUIPMENT TO HAVE CONDUIT STUBBED ABOVE CONCRETE WITH RATED WEATHERPROOF ENCLOSURE TO ALLOW FOR POWER AND DATA AS REQUIRED IN THE FUTURE. CONTRACTOR TO COORDINATE FINAL LAYOUT OF CONDUITS AND EQUIPMENT WITH OWNER EQUIPMENT PROVIDER PRIOR TO INSTALLATION.



SITE DEVELOPMENT NOTES

1. REFER TO ENLARGED PARCS PLAN FOR PAVEMENT MARKING DIMENSIONS AND PARKING EQUIPMENT.

(1) NEW ASPHALT PAVEMENT.

(2) NEW CONCRETE CURBED ISLAND.

(3) NEW CONCRETE CURB.

(4) NEW CONCRETE CURB TAPER. MATCH EXISTING TAPER LENGTH ON OTHER SIDE OF DRIVE.

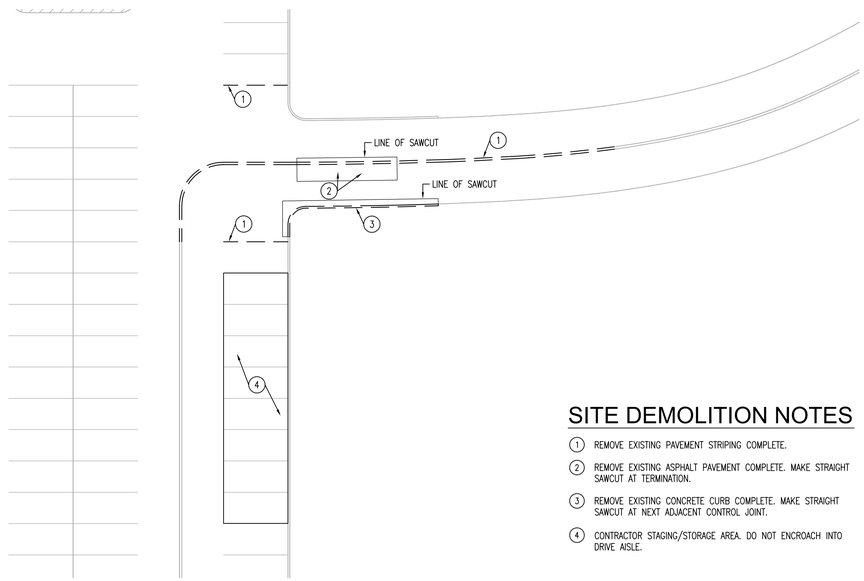
SLOPE DIRECTION. MATCH EXISTING DRAINAGE PATTERN.

02 SITE DEVELOPMENT PLAN
SCALE: 1"=20'

NORTH

GENERAL NOTES

EXISTING CONDITIONS SHOWN ARE BASED ON OWNER FURNISHED AS-BUILT DRAWINGS AND AERIAL INFORMATION AND ARE UNCONFIRMED. CONTRACTOR MUST CONFIRM AND VERIFY LOCATIONS, DIMENSIONS, GRADING, AND ALL EXISTING CONDITIONS AND NOTIFY ENGINEER OF ANY MAJOR DISCREPANCIES. PROVIDE POSITIVE DRAINAGE ALONG NEW CURB AND ASPHALT PAVEMENT AND MATCH EXISTING DRAINAGE PATTERNS.



01 SITE DEMOLITION PLAN
SCALE: 1"=20'

NORTH

SITE DEMOLITION NOTES

1. REMOVE EXISTING PAVEMENT STRIPING COMPLETE.
2. REMOVE EXISTING ASPHALT PAVEMENT COMPLETE. MAKE STRAIGHT SAWCUT AT TERMINATION.
3. REMOVE EXISTING CONCRETE CURB COMPLETE. MAKE STRAIGHT SAWCUT AT NEXT ADJACENT CONTROL JOINT.
4. CONTRACTOR STAGING/STORAGE AREA. DO NOT ENCROACH INTO DRIVE AISLE.

GENERAL NOTES

EXISTING CONDITIONS SHOWN ARE BASED ON OWNER FURNISHED AS-BUILT DRAWINGS AND AERIAL INFORMATION AND ARE UNCONFIRMED. CONTRACTOR MUST CONFIRM AND VERIFY LOCATIONS, DIMENSIONS, GRADING, AND ALL EXISTING CONDITIONS AND NOTIFY ENGINEER OF ANY MAJOR DISCREPANCIES. PROVIDE POSITIVE DRAINAGE ALONG NEW CURB AND ASPHALT PAVEMENT AND MATCH EXISTING DRAINAGE PATTERNS.

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Indianapolis Airport
QTA Road
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PROJECT MGR. ADS
DESIGN ENG. NBV
DRAWN BY NBV

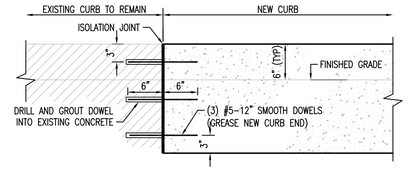
ISSUED/ REV. NO.	DATE	DESCRIPTION
	10/06/2016	ISSUED FOR CONSTRUCTION

DRAWING TITLE
SITE DEVELOPMENT PLAN

PROJECT NO.
S1-2016-170

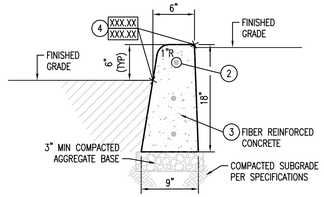
DRAWING NO.
C100

BSA LifeStructures - \\bsalifestructures.com\indy1\BSA\0467\04670014_DWG Files_Civil Files\C100.dwg June 30, 2006 - 9:47 AM Vergatos, Nicholas



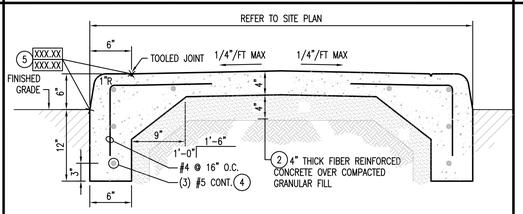
NOTE:
1. WHEN CONSTRUCTION OCCURS WITHIN PUBLIC RIGHT-OF-WAY, THE WORK SHALL COMPLY WITH THE GOVERNING AGENCY REQUIREMENTS.

04 NEW CONCRETE CURB TO EXISTING CONCRETE CURB DETAIL
NO SCALE



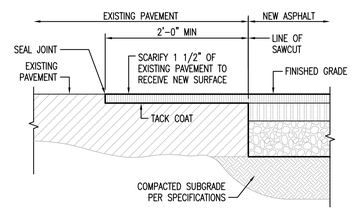
NOTES:
1. WHEN CONSTRUCTION OCCURS WITHIN PUBLIC RIGHT-OF-WAY, THE WORK SHALL COMPLY WITH THE GOVERNING AGENCY REQUIREMENTS.
2. (3) #5x18" SMOOTH DOWELS REQUIRED AT ALL ISOLATION JOINTS.
3. REFER TO SPECIFICATIONS FOR CONCRETE AND JOINT REQUIREMENTS.
4. LOCATION OF CURB AND GUTTER ELEVATIONS. REFER TO GRADING PLAN.

03 STRAIGHT CONCRETE CURB DETAIL
NO SCALE



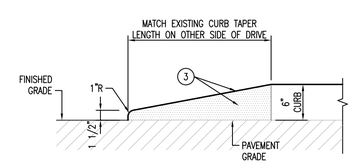
NOTES:
1. WHEN CONSTRUCTION OCCURS WITHIN PUBLIC RIGHT-OF-WAY, THE WORK SHALL COMPLY WITH THE GOVERNING AGENCY REQUIREMENTS.
2. REFER TO SPECIFICATIONS FOR CONCRETE AND JOINT REQUIREMENTS.
3. REFER TO IMPROVEMENT PLAN FOR WALK WIDTH AND JOINT PATTERN.
4. END CONTINUOUS REBAR AT ISOLATION/CONSTRUCTION JOINTS. PLACE (3) #5x12 SMOOTH DOWELS (DO NOT OVERLAP).
5. LOCATION OF CURB AND GUTTER ELEVATIONS. REFER TO GRADING PLAN.

06 CONCRETE ISLAND DETAIL
NO SCALE



NOTE:
1. WHEN CONSTRUCTION OCCURS WITHIN PUBLIC RIGHT-OF-WAY, THE WORK SHALL COMPLY WITH THE GOVERNING AGENCY REQUIREMENTS.
2. REPAIR DAMAGED OR FAILING PAVEMENT PRIOR TO APPLICATION OF NEW SURFACE.
3. REFER TO SPECIFICATIONS FOR HOT ASPHALTIC MIX REQUIREMENTS.

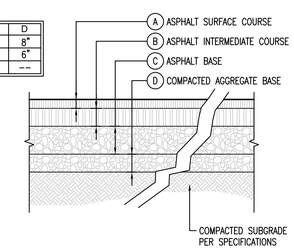
02 NEW ASPHALT PAVEMENT TO EXISTING ASPHALT PAVEMENT DETAIL
NO SCALE



NOTE:
1. WHEN CONSTRUCTION OCCURS WITHIN PUBLIC RIGHT-OF-WAY, THE WORK SHALL COMPLY WITH THE GOVERNING AGENCY REQUIREMENTS.
2. REFER TO GRADING PLAN FOR CURB AND PAVEMENT ELEVATION INFORMATION.
3. WHEN CURB IS ADJACENT TO PEDESTRIAN TRAFFIC, PAINT TOP AND SIDES OF CURB YELLOW IN LOCATIONS WHERE CURB HEIGHT IS BETWEEN 0" AND 6". APPLY SILICA SAND TO WET PAINT PER SPECIFICATIONS.

05 CURB TAPER DETAIL
NO SCALE

LOCATION	A	B	C	D
REGULAR DUTY	1 1/2"	3"	--	8"
HEAVY DUTY	1 1/2"	3"	4"	6"
RIGHT-OF-WAY	--	--	--	--



NOTE:
1. WHEN CONSTRUCTION OCCURS WITHIN PUBLIC RIGHT-OF-WAY, THE WORK SHALL COMPLY WITH THE GOVERNING AGENCY REQUIREMENTS.
2. REFER TO SPECIFICATIONS FOR AGGREGATE GRADATION AND HOT ASPHALTIC MIX REQUIREMENTS.

01 ASPHALT PAVEMENT DETAIL
NO SCALE

Carl Walker, Inc.
8910 Purdue Rd.
Suite 400
Indianapolis, IN 46268
Tel. 317.735.3349
www.carlwalker.com

BSA LifeStructures
9365 Counselors Row
Indianapolis, IN 46240-1478
ph 317.819.7878 fx 317.819.7288
www.bsalifestructures.com

Indianapolis Airport
QTA Road
Access Control
Indianapolis, Indiana

NICHOLAS BIJAN VERGATOS REGISTERED No. PE11500269 STATE OF INDIANA PROFESSIONAL ENGINEER

Nicholas Bijan Vergatos

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PROJECT MGR. ADS
DESIGN ENG. NBV
DRAWN BY NBV

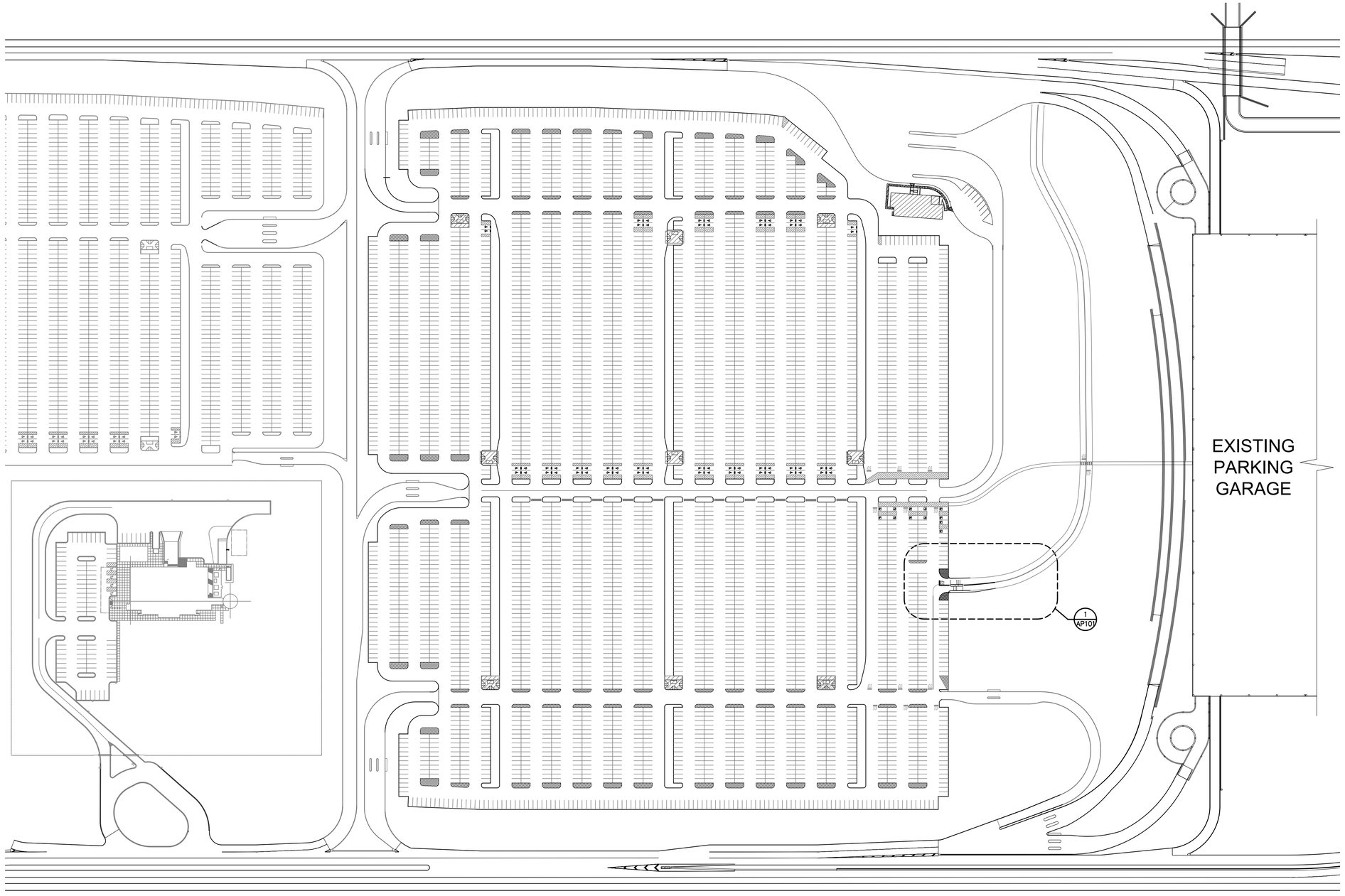
ISSUED/ REV. NO.	DATE	DESCRIPTION
	10/06/2016	ISSUED FOR CONSTRUCTION

DRAWING TITLE
SITE DETAILS

PROJECT NO.
S1-2016-170

DRAWING NO.
C110

BSA LifeStructures - \\bsalifestructures.com\indy1\BSA\0467\04670014_DWG Files_Civil Files\C110.dwg June 30, 2006 - 10:10 AM Vergatos, Nicholas



1 OVERALL PLAN
1" = 100'-0"

NORTH

Carl Walker

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www.carlwalker.com

DOUGLAS P. GANNON
REGISTERED
No. PE10300054
STATE OF INDIANA
PROFESSIONAL ENGINEER
10/6/16

Indianapolis Airport QTA Road Access Control

Indianapolis, Indiana

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PROJECT MGR. RTS
DESIGN ENG. DPG
DRAWN BY RMM-DEB

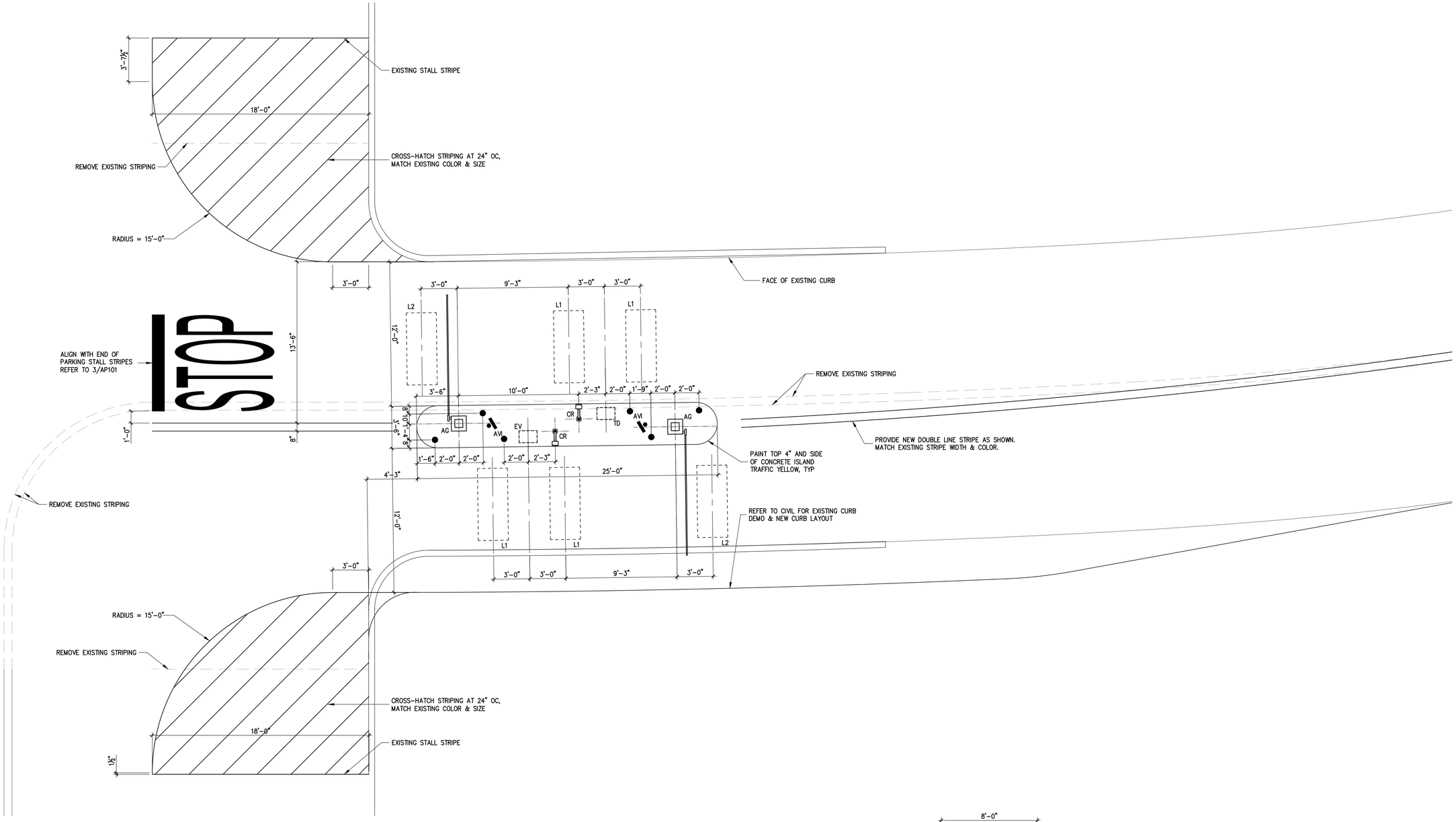
ISSUED/ REV. NO.	DATE	DESCRIPTION
	10/06/2016	ISSUED FOR CONSTRUCTION

DRAWING TITLE
OVERALL PLAN

PROJECT NO.
S1-2016-170

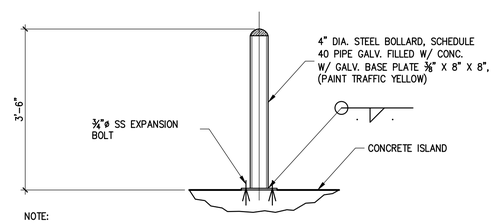
DRAWING NO.
AP100

Carl Walker, Inc : DRAWING:P:\SOC\S-2016\S1-2016-170 IND Airport Feasibility Analysis & Strategic Planning\CAD\QTA PARCS\S1-2016-170-AP100-AP101.dwg...Wednesday, October 05, 2016, 10:25am .DanielB



1 ENARGED PARCS PLAN
1/4" = 1'-0"

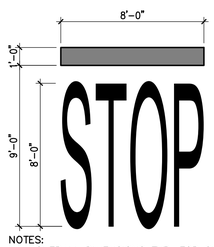
NORTH



NOTE:
1. ¼"x 8"x 8" NEOPRENE PAD BETWEEN CONC. & STEEL BASE PL

2 BOLLARD DETAIL
3/4"=1'-0"

FBD008



NOTES:
1. OVERALL DIMENSIONS TYP. FOR SINGLE WORD PAVEMENT MARKINGS.
2. REFER TO MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES, "MARKINGS" SECTION, FOR ADD'L INFO.
3. PAINT TRAFFIC WHITE.

3 MARKING DETAIL
1/8"=1'-0"

PARKING EQUIPMENT LEGEND:

AG	–	AUTOMATIC GATE W/10' FOLDING ARM
AVI	–	AUTOMATIC VEHICULAR IDENTIFICATION READER
TD	–	FUTURE TICKET DISPENSER
EV	–	FUTURE EXIT VERIFIER
L1	–	DETECTOR LOOP SIZED BY MANUFACTURER
L2	–	CLOSING LOOP SIZED BY MANUFACTURER
●		4" CONCRETE FILLED STEEL BOLLARD, REFERENCE 2/AP101

Carl Walker

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Tel. 317.735.3349
www.carlwalker.com

DOUGLAS P. GANNON REGISTERED No. PE10300054 STATE OF INDIANA PROFESSIONAL ENGINEER
10/6/16

Indianapolis Airport QTA Road Access Control

Indianapolis, Indiana

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PROJECT MGR. RTS
DESIGN ENG. DPG
DRAWN BY RMM-DEB

ISSUED/ REV. NO.	DATE	DESCRIPTION
	10/06/2016	ISSUED FOR CONSTRUCTION

DRAWING TITLE
ENLARGED PARCS PLAN

PROJECT NO.
S1-2016-170

DRAWING NO.
AP101

Carl Walker, Inc : DRAWING:P:\SOC\S-2016\S1-2016-170 IND Airport Feasibility Analysis & Strategic Planning\CAD\QTA PARCS\S1-2016-170-AP100-AP101.dwg...Wednesday, October 05, 2016, 10:26am .DanielB

Exhibit C Sample Contract

Indianapolis Airport Authority

CONTRACT FOR CONSTRUCTION SERVICES

Contract made as of _____, 2016

BETWEEN the Owner:	Indianapolis Airport Authority 7800 Col. H. Weir Cook Memorial Drive Indianapolis, IN 46241
and the Contractor:	Insert Contractor's Name Address City, State, Zip
for the following Project:	Indianapolis Airport Authority QTA Road Access Control Project No. Q-16-013

CONTRACT FOR CONSTRUCTION SERVICES

THIS CONTRACT FOR CONSTRUCTION SERVICES (the "Contract") is made and entered into on _____, 2016 (the "Effective Date"), by and between the Indianapolis Airport Authority, an Indiana municipal corporation ("AUTHORITY"), and **ABC COMPANY**, an **Indiana** Corporation ("CONTRACTOR"). The AUTHORITY and CONTRACTOR are sometimes hereinafter referred to as a "Party", or collectively as the "Parties".

W I T N E S S E T H:

NOW, THEREFORE, in consideration of the mutual covenants contained herein, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties agree as follows:

SECTION I - CONTRACT DOCUMENTS

The Parties agree that the "Contract Documents" shall consist of this Contract, the drawings, the specifications (general, federal, special and technical provisions), and all addenda issued prior to, and Change Orders issued after, the execution of this Contract. These items form an integral part of the "Contract", and are hereby incorporated by reference and made a part of this Contract as if attached hereto. Other component parts of this Contract, and the Contract Documents, which are incorporated herein by reference, include the following:

- Request for Quotes
- Quote Forms
- Itemized Quote
- Affidavit of Non-Collusion
- Supplier Diversity Assurance Forms

SECTION II - SCOPE OF WORK

CONTRACTOR shall provide construction services for **QTA Road Access Control, Project No. Q-16-013** in accordance with the quote dated **_____, 2016.**

CONTRACTOR shall furnish all labor, materials, equipment, tools, transportation, supplies and services required to complete this project in accordance with the Contract Documents.

SECTION III - NOTICE TO PROCEED

CONTRACTOR shall begin the work to be performed under this Contract within three (3) days from the date set by AUTHORITY in its written "Notice to Proceed".

CONTRACTOR shall notify AUTHORITY at least twenty-four (24) hours in advance of the time that actual construction will begin.

SECTION IV - COMPLETION OF WORK

CONTRACTOR shall complete the work set forth in this Contract within ____ **calendar days** from the date of the issuance of the "Notice to Proceed".

If CONTRACTOR is delayed at any time in the progress of the work by any act of AUTHORITY, or by any other circumstances that AUTHORITY considers to be outside of CONTRACTOR's control, then the completion date of the Contract may be extended by Change Order for a reasonable time, as determined by AUTHORITY.

SECTION V - COMPENSATION

Based upon the completion of work described herein, CONTRACTOR shall receive and accept compensation based on the total sum quote for **Enter an amount spelled out and Again in numbers** **$ ___**. The quote amount shall include the costs of furnishing all equipment, labor, incidentals, materials (if applicable), premiums on insurance and bonds, and completion of all work in full compliance with the plans and specifications. Also included in the compensation will be costs for loss or damage arising out of the nature of this work, or from any unforeseen obstruction or difficulties that may be encountered.

Request for payment must be filled-out and signed by CONTRACTOR, and shall cover the work completed as of the date of the request. The request must also include any data and schedules that AUTHORITY may reasonably require. Request for payment will be in an amount equal to ninety-five percent (95%) of the work completed.

For any additional services requested by AUTHORITY, CONTRACTOR shall receive and accept compensation by Change Order, in an amount agreed upon by the Parties.

SECTION VI - RETAINAGE

For Contracts in excess of $200,000, retainage of five percent (5%) will be placed in escrow in accordance with the provisions of Indiana Code § 36-1-12-14(d).

For Contracts under $200,000, retainage of five percent (5%) will be held by AUTHORITY in a separate project account.

After approval of the final request for payment, retainage will be released upon written request to AUTHORITY. This request must state the amount held in escrow and be accompanied by all waivers of lien pertinent to this project. Retainage will be released no sooner than sixty-one (61) days from approval by the AUTHORITY's Board of the final payment request.

SECTION VII – RECORDKEEPING REQUIREMENTS AND AUDITS

A. CONTRACTOR shall maintain records related to this Contract, including, but not be limited to, accounting records, written policies and procedures, subcontract files (including proposals of successful and unsuccessful bidders), original estimates, estimating worksheets, correspondence, change order files (including documentation covering negotiated settlements), back charge logs and supporting documentation, general ledger entries detailing cash and trade discounts earned, insurance rebates and dividends, and any other supporting evidence necessary to substantiate charges related to this Contract. All of the foregoing records shall be open to inspection and subject to audit and/or reproduction, during normal working hours, by AUTHORITY's agent or its authorized representative, to the extent necessary to adequately permit evaluation and verification of any invoices, payments or claims submitted by CONTRACTOR or any of its payees pursuant to the execution of this Contract. Records that are subject to examination by AUTHORITY shall also include, but not be limited to, those records necessary to evaluate and verify direct and indirect costs, including, but not limited to, overhead allocations as they may apply to costs associated with this Contract.

B. For purpose of audits, inspections, examinations and evaluations, AUTHORITY's agent or its authorized representative shall have access to said records from the Effective Date, for the duration of the work, and until a period of three (3) years after the date of the final payment by AUTHORITY to CONTRACTOR pursuant to this Contract.

C. AUTHORITY's agent or its authorized representative shall have access to CONTRACTOR's facilities and all necessary records. AUTHORITY's agent or its authorized representative shall also be provided adequate and appropriate work space in order to conduct audits in compliance with this Section VII, and shall be allowed to interview all current or former employees to discuss matters pertinent to the performance of this Contract. AUTHORITY's agent or its authorized representative shall give auditees reasonable advance notice of intended audits.

D. CONTRACTOR shall require all subcontractors, insurance agents and material suppliers (payees) to comply with the provisions of this Section VII by insertion of the requirements hereof into a written contract between CONTRACTOR and payee. Failure to obtain written contracts that include such provisions shall be cause to exclude some or all of the related payees' costs from amounts payable to CONTRACTOR pursuant to this Contract or to recover such costs from CONTRACTOR in the event payment has been made to such CONTRACTOR.

E. If an audit inspection or examination in accordance with this Section VII discloses overpricing or overcharges of any nature by CONTRACTOR to AUTHORITY in excess of one-half of one percent (0.5%) of the total contract billings, then, in addition to repayment or credit for the overcharges, the reasonable actual cost of AUTHORITY's audit shall be reimbursed by CONTRACTOR to AUTHORITY. Any adjustments and/or payments that must be made as a result of any such audit or inspection of

CONTRACTOR's invoices and/or records shall be made within a reasonable amount of time, which may not exceed ninety (90) days from the presentation of AUTHORITY's findings to CONTRACTOR.

SECTION VIII - STANDARD TITLE VI ASSURANCES

During the performance of this Contract, CONTRACTOR agrees, on behalf of the CONTRACTOR and any of its assignees and successors, as follows:

A. **Compliance with Regulations:** CONTRACTOR shall comply with the regulations relative to nondiscrimination in Federally assisted programs of the U.S. Department of Transportation ("DOT"), Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time (hereinafter referred to as the "Regulations"), which are herein incorporated by reference and made a part of this Contract.

B. **Nondiscrimination:** CONTRACTOR, with regard to the work performed during this Contract, shall not discriminate on the grounds of, race, color, disabilities, sex or national origin, in the selection and retention of subcontractors, including procurements of materials or leases of equipment. Each potential subcontractor or supplier shall be notified by CONTRACTOR of CONTRACTOR's obligations under this Contract and the Regulations relative to nondiscrimination on the grounds of, race, color, disabilities, sex and national origin.

C. **Information and Reports:** CONTRACTOR shall provide all information and reports required by the Regulations or directives issued pursuant thereto, and shall permit access to books, records, accounts, other sources of information, and to CONTRACTOR's facilities as may be determined by AUTHORITY or the Federal Aviation Administration ("FAA") to be pertinent to ascertain compliance with such Regulations, orders and instructions. Where any information required of CONTRACTOR is in the exclusive possession of another who fails or refuses to furnish this information, CONTRACTOR shall certify this to AUTHORITY or the FAA, as appropriate, and shall set forth what efforts have been made to obtain the information.

D. **Sanctions for Noncompliance:** In the event of CONTRACTOR's noncompliance with the nondiscrimination provisions of this Contract, AUTHORITY shall impose such contract sanctions as it or the FAA may determine to be appropriate, including, but not limited to:

1. Withholding of payments to CONTRACTOR under the Contract, until CONTRACTOR complies; and/or

2. Cancellation, termination or suspension of the Contract, in whole or in part.

E. **Incorporation of Provisions:** CONTRACTOR shall include the provisions of Paragraphs A through D of this Section VIII in every subcontract to this Contract, including procurement(s) of materials and leases of equipment, unless exempt by the Regulations or directives issued pursuant thereto. CONTRACTOR shall take such action with respect to any subcontract or procurement as AUTHORITY or the FAA may direct as a means of enforcing these provisions, including sanctions for noncompliance; provided, however, in the event CONTRACTOR becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, CONTRACTOR may request the U.S. to enter into such litigation to protect the interest of the United States.

F. **Executive Order No. 11246**: CONTRACTOR shall comply with Executive Order No. 11246, entitled "Equal Employment Opportunity".

G. **Solicitations for Subcontracts, including Procurements of Materials and Equipment:** In all solicitations for competitive bidding or negotiation made by CONTRACTOR for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or supplier shall be notified by CONTRACTOR of CONTRACTOR's obligations under this Contract and the Regulations relative to nondiscrimination on the grounds of, race, color, disabilities, sex or national origin.

SECTION IX - COMPLIANCE WITH STATE AND OTHER LAWS

A. CONTRACTOR specifically agrees that, in the performance of the construction services as described herein, enumerated by CONTRACTOR or an approved subcontractor or anyone acting on behalf of either, that they will comply with any and all State, Federal, and local statutes, ordinances and regulations.

B. CONTRACTOR specifically agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act of 1979, as amended.

SECTION X - WORKING STANDARDS

CONTRACTOR agrees to comply with Sections 103 and 107 of the Contract Work Hours and Safety Standards Act (40 USC § 327 *et seq.*), as supplemented by U.S. Department of Labor Regulations (29 CFR, Part 5) for contracts in excess of $2,500 that involve employment of mechanics or laborers.

SECTION XI - RESPONSIBILITY FOR CLAIMS AND LIABILITIES

A. CONTRACTOR shall be responsible for all damage to life and property due to negligent activities of CONTRACTOR, approved subcontractors, agents or employees, in connection with such services, and shall be responsible for all parts of their work, both temporary and permanent, until the services under this Contract are declared accepted by AUTHORITY.

B. It is expressly understood that CONTRACTOR agrees to indemnify and hold

harmless AUTHORITY, the Construction Managers, and the Engineer, and their respective officers, directors, employees and agents (the "Indemnified Parties"), of and from any and all claims, Administrative actions, suits, actions, fines, penalties, damages, judgments, defense costs (including attorney's fees and all other costs of every name and description), arising out of or resulting from the negligent services of CONTRACTOR under this Contract, and such indemnity shall not be limited by reason of the enumeration of any insurance coverage provided under or in connection with this Contract. CONTRACTOR's duty to indemnify shall survive any termination or expiration of this Contract.

C. In the event of a material conflict in the terms of this Section XI and the indemnity provisions of the project specifications, the project specifications shall control.

SECTION XII - WORKMEN'S COMPENSATION AND LIABILITY INSURANCE

CONTRACTOR shall follow the insurance requirements outlined in General Terms and Conditions Section of the Request for Quotes.

Before commencing the work, CONTRACTOR shall furnish to a certificate(s) of insurance to AUTHORITY, in a form and substance satisfactory to AUTHORITY, showing that CONTRACTOR has complied with this Section XII. The certificate(s) shall designate AUTHORITY, the Construction Managers, and the Engineer as "additional insureds". The policies shall not be changed or cancelled, in any respect, until and unless at least thirty (30) days written notice thereof has been given to AUTHORITY.

SECTION XIII - ARBITRATION

Arbitration of all questions in dispute under this Contract shall occur if agreed upon by both Parties, and shall be in accordance with the rules of the American Arbitration Association. This Contract shall be specifically enforceable under the prevailing arbitration law, and judgment upon the award rendered may be entered in the court of the forum, state or federal, having jurisdiction. The decisions of the arbitrators shall not be binding, but are conditions precedent to the right of any legal action.

SECTION XIV - SUCCESSORS AND ASSIGNS

AUTHORITY, insofar as authorized by law, binds itself and its successors, and CONTRACTOR binds itself, its successors, executors, administrators and assigns, to the other Party and to the successors, executors, administrators and assigns thereof, as the case may be and insofar as authorized by law, in respect to all covenants of this Contract. Except as above set forth, neither Party shall assign, sublet or transfer its or their own interest in this Contract, in whole or in part, without the written consent of the other Party.

SECTION XV - SPECIAL PROVISIONS

The Parties mutually agree that the provisions hereof, and the exhibits attached hereto and/or incorporated herein, represent the entire Contract between the Parties. This Contract shall be subject to the FAA's approval.

CERTIFICATE

I hereby certify that I am the duly authorized representative of the entity listed herein, and that neither I, nor the above entity here represented, has:

a.) Employed or retained for a commission, percentage, brokerage, contingent fee or other consideration, any entity or person other than a *bona fide* employee working solely for me or the above-referenced CONTRACTOR to solicit or secure this Contract;

b.) Agreed, as an express or implied condition for obtaining this Contract, to employ or retain the services of any entity or person in connection with carrying out the Contract, except as expressly noted below; or

_____

_____

c.) Paid, or agreed to pay, to any entity, organization or person (other than a *bona fide* employee working solely for me or the above-referenced CONTRACTOR), any fee, contribution, donation or consideration of any kind for, or in connection with, procuring or carrying out the contract, except as expressly noted below:

_____

_____

If this Contract involves participation of Airport Improvement Program ("AIP") funds, I acknowledge that this certificate will be furnished to the FAA, and is subject to applicable State and Federal laws, both criminal and civil.

IN WITNESS WHEREOF, the Parties have caused their respective duly authorized representatives to execute this Contract on the Effective Date.

_____
Company Name

_____
Signature of Company's Authorized Representative

_____
Print Name of Company's Authorized Representative

_____
Print Title of Company's Authorized Representative

Date: _____

INDIANAPOLIS AIRPORT AUTHORITY *

By: _____

Printed: _____

Title: _____

Date: _____

Approved as to Form and Legality:

By: _____
IAA Legal Department

* Signature authorized by IAA Resolution No. 3-2016