October 28, 2024

IDEA PUBLIC SCHOOLS – IDEA Edinburg College Prep Cafeteria

GMS ARCHITECTS
BROWNSVILLE, TEXAS 78526
(956) 546-0110

ADDENDUM NO. 2

A. PURPOSE AND INTENT

This addendum is issued for the purpose of modifying the plans and specifications for the Idea Public Schools – IDEA Edinburg College Prep Cafeteria*.*

This addendum shall become part of the contract, and all CONTRACTORS shall be bound by its content. All aspects of the specifications and drawings not covered herein shall remain the same.

The General Conditions and the Special Conditions of the specifications shall govern all parts of the work and apply in full force to this addendum.

B. SCOPE

I. CLARIFICATION:

- Exterior Sheathing shall be equal to Dens-Element as specified.
- Sign-In Sheet from Pre-Bid Meeting – 10/24/2024.

II. SPECIFICATIONS:

- Delete Table of Contents and Replace with Attached Table of Contents - 5 Pages.
- Add 006100a – AIA form A310 (2 Pages) to Construction Documents
- Add 066100B – AIA Form A312 (4Pages) to Construction Documents.
- Add 02100 – Site Prep (3 Pages) to Construction Documents
- Add 019113 – General Commissioning Requirements (17 Pages) to Construction Documents
- Add 077200 – Roof Accessories (3 Pages) to Construction Documents
- ADD 077300 – Wind Load Rated Roof Curbs and Restraint Brackets (2) Pages to Construction Documents
- Delete Addendum #1 - Section 270000 – Structured Cabling System and Add IDEA Technology Infrastructure Building Standards – 35 Pages to Construction Documents.

- Supplemental Conditions to AIA Contract A201
  - 3.7 Permits, Fees, Notices and Compliance with Laws; a. Building Permit General Contractor will be responsible for building permits and tap fees, in lieu of by Owner Direct Payment. General Contractor to include fees in base bid proposal
- Add Geotechnical Report (46 Pages) to Construction Documents.

III. PLANS:

- Add SK2.1 – Dumpster Enclosure Details to Construction Documents.
- Addendum#1 -Sheet C3

    - Refer to SK2.2 for Fire Line routing to Riser Room.
    - Delete note “FDC Line to be Re-Routed”. FDC line to remain in place.
- Sheet A1.01
    - Keyed Noted #3: Refer to SK2.1 for Dumpster Enclosure Details.
    - Keyed Noted #5: Increase rolling gate width to cover the 32’-4” wide pavement entrance.
- Sheet A2.01 – Room Finish Schedule
    - Provide SAC II at Rooms 101, 102, 105 and 109, in lieu of SAC I.

GMS ARCHITECTS

IDEA Edinburg College Prep
Cafeteria Addition

10/24/2024

Name	Company	Phone Number	E-Mail
Roan Gomez, AIA	GMS Architects	956-546-0110	rgg@gmsarchitects.com
David Gómez	IDEA Pub Schools	956·499·6731	david.gomez3 david @IDEApublicschools.org
FRANK WILM	GERLACH	956-655-0203	
Santos Galvan	IDEA Publicschools	(956) 536-7397	
Gilberto Garza	Greco Construction	956 293 1197	gilberto@grecoconstruction.net
CARLOS MARTIN III	GERLACH BLDRS	956-960-2879	CARLOS@GBLDRSLLC.COM
ERIK Humphrey	IDEA Public Schools	956-373-6011	ehumphrey@ideapublicschools.org
RAMIRO GOMEZ JR	IDEA Public Schools	956·373·6258	ramiro.gomez@ideapublicschools.org
Ruben Manzanares	IDEA Public Schools		

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AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)
IDEA Public Schools
2115 W. Pike Blvd.
Weslaco, Texas 78596

BOND AMOUNT: $

PROJECT:
(Name, location or address, and Project number, if any)
IDEA Public Schools - Edinburg College Prep Cafeteria
2553 N Roegiers Road
Edinburg, TX 78541

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so

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furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of ,

	(Contractor as Principal) *(Seal)*
(Witness)	*(Title)*
	(Surety) *(Seal)*
(Witness)	*(Title)*

AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)
IDEA Public Schools
2115 W. Pike Blvd.
Weslaco, Texas 78596

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)
IDEA Public Schools - Edinburg College Prep Cafeteria
2553 N Roegiers Road
Edinburg, TX 78541

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: None See Section 18

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

2115 W. Pike Blvd.
Weslaco, Texas 78596

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Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

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SECTION 02110 - SITE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Site preparation shall include furnishing necessary equipment and labor to remove vegetation and rubbish and the placement of approved excess excavation in conformity with the lines, grades, dimensions, and details shown on the Contract Documents.

B. Within limits shown on the Contract Documents, or in areas where existing grade is altered, strip existing topsoil to a depth of 6-inches and stockpile in approved areas for subsequent replacement. Contractor to remove and dispose of all excess materials.

1.2 RELATED SECTIONS

A. Section 02060 - Demolition

1.3 REFERENCES

A. ASTM D698-1991: Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft [600 kN-m/m]).

1.4 DEFINITIONS

A. Borrow. Material taken from designated areas to make up any deficit of excavated material.

1.5 SUBMITTALS AND WORK

A. Coordinate activities with other work being performed so as not to cause any interruption of activities being completed under other Sections of the Contract Documents.

1.6 REGULATORY REQUIREMENTS

A. Work under this Section shall conform to applicable City Regulations for disposal of debris, including safety requirements during performance of the work.

B. Work under this Section shall be coordinated with utility companies and any the management of any existing facilities in order to prevent any disruption in operation and/or utility service.

C. Permits, fees, disposal charges and licenses shall be secured and paid by Contractor.

PART 2 - PRODUCTS

2.1 MANUFACTURER(S) (not used)

2.2 EQUIPMENT

A. The Contractor may use equipment and materials necessary to properly complete the tasks described under this Section.

2.3 MATERIALS

A. Fill:

1. Source: Obtain embankment fill from required excavation or, if excavated material is insufficient, from borrowed areas approved by the Geotechnical Engineer.

2. Suitability: Use the best material available from excavation or borrow. Suitability of fill material is subject to the Geotechnical Engineer's approval.

3. Quality: Fill material must be free of excessive silts. Do not use soil containing brush, roots, sod or similar perishable material.

4. Excess Excavation: Use excess excavation or borrowed material with prior approval of the Engineer. Borrow material from the approved source and excavate. On completion of work borrowed area to be cleaned and dressed. Reuse of material stripped from borrow site is not allowed unless specifically indicated on the Drawings.

2.4 FABRICATION (not used)

2.5 QUALITY CONTROL

A. Fill materials to be acquired as specified in Plans and/or by the Geotechnical Engineer.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify existing plant life designated to remain and tag as such.

B. Locate, identify and protect all utilities.

C. Locate, identify and protect benchmarks and existing structures.

D. Maintain surface drainage on site during construction. Remove unsatisfactory fill material and waste vegetation from jobsite and dispose of properly.

3.2 PRESERVATION AND RESTORATION

A. Protect trees that are to remain in the project area or in adjacent areas. Take special care not to damage trees outside limits of construction.

B. Fill depressions made by grubbing with suitable material to make new surface conform to the existing adjacent ground surface.

C. Final Cleanup: Level washes, ruts, depressions, and mounds to give areas smooth finish.

3.3 CLEARING

A. Remove designated trees and shrubs along with stumps, roots, rubbish and other objectionable material from the designated areas.

B. Remove grass and weeds to a depth of two (2) inches below existing soil line.

C. Remove stumps, roots, muck and spongy materials within the area to a depth of eighteen (18) inches.

D. For areas where paving will be built remove stumps and roots within pavement section to depth of two feet below finish subgrade elevation.

E. Provide demolition as required and specified in Section 02115 and the Drawings.

3.4 REMOVING MATERIAL

A. Unless otherwise specified, cleared and grubbed material shall become property of the Contractor and be removed from the work site or disposed of in manner not to damage the Owner.

B. Burning of cleared and grubbed material on the Owner's property is not permitted.

END OF SECTION

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Basis-of-Design documentation is referenced for information only, and not included here.

1.2 SUMMARY

A. Section Includes:

1. General requirements for coordinating and scheduling commissioning.
2. Commissioning meetings.
3. Commissioning reports.
4. Equipment and systems installation, startup, and field quality-control testing indicated in the Contract Documents.
5. Use of test equipment, instrumentation, and tools for commissioning.
6. System readiness checklists, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
7. Commissioning tests and commissioning test demonstration.
8. Work to correct commissioning issues.
9. Work to repeat tests when equipment and systems fail acceptance criteria.
10. Adjusting, verifying, and documenting identified systems and assemblies.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submittal procedures requirements for commissioning.
2. Section 017700 "Closeout Procedures" for certificate of Construction Phase Commissioning Completion submittal requirements.
3. Section 017823 "Operation and Maintenance Data" for preliminary operation and maintenance data submittal.
4. Section 260800 "Commissioning of Electrical Systems" for technical commissioning requirements for electrical systems.

1.3 DEFINITIONS

A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, system readiness checklists, performance tests, performance test demonstrations, commissioning tests and commissioning test demonstrations.

B. Basis-of-Design Document (BoD): A document prepared by Engineer, or Commissioning Authority that records concepts, calculations, decisions, and product selections used to comply

with Owner's Project Requirements and to suit applicable regulatory requirements, standards, and guidelines.

C. Commissioning Authority (CxA): An entity engaged by Owner, and identified in Section 011000 "Summary," to evaluate Commissioning-Process Work.

D. Commissioning Plan: A document, prepared by Commissioning Authority, that outlines the organization, schedule, allocation of resources, and documentation requirements of commissioning.

E. Commissioning (Cx): A quality-focused process for verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, and tested to comply with Owner's Project Requirements. The requirements specified here are limited to the construction phase commissioning activities. The scope of commissioning is defined in this section and is in accordance with the requirements in the IECC.

F. Construction Phase Commissioning Completion: The stage of completion and acceptance of commissioning when resolution of deficient conditions and issues discovered during commissioning and retesting until acceptable results are obtained has been accomplished. Owner will establish in writing the date Construction Phase Commissioning Completion is achieved. See Section 017700 "Closeout Procedures" for certificate of Construction Phase Commissioning Completion submittal requirements.

1. Commissioning is complete when the work specified in this Section and related Sections has been completed and accepted, including, but not limited to, the following:

    a. Completion of tests and acceptance of test results.
    b. Resolution of issues, as verified by retests performed and documented with acceptance of retest results.
    c. Comply with requirements in Section 017900 "Demonstration and Training."
    d. Completion and acceptance of submittals and reports.

G. Functional Test: Test of dynamic function of systems, as opposed to components, under full operation in various modes through all control system’s sequences of operation using manual (direct observation) or monitoring methods following prescribed test procedures in sequential written form

H. Owner's Project Requirements (OPR): A document that details the functional requirements of a project and the expectations of how it will be used and operated, including Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

I. Owner's Witness: Commissioning Authority, Owner's Project Manager, or Architect-designated witness authorized to authenticate test demonstration data and to sign completed test data forms.

J. Construction or System readiness Checklist: List, provided by Commissioning Authority to installer, of items to inspect and elementary component tests to conduct to verify proper installation of equipment prior to functional testing.

K. Sampling: Functionally testing only a fraction of total number of identical or near identical pieces of equipment.

L. Seasonal Commissioning: Testing of equipment that can be done only during periods of peak heating or cooling, when HVAC equipment is operating at full-load or heavy-load conditions.

M. Simulated Condition: Condition created for purpose of testing response of system.

N. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

O. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.

P. Trending: Monitoring using building control system.

1.4 COMPENSATION

A. Should Architect, Commissioning Authority, other Owner's witness, or Owner's staff perform additional services or incur additional expenses due to actions of Contractor listed below, compensate Owner for such additional services and expenses.

1. Failure to provide timely notice of commissioning activities schedule changes.
2. Failure to meet acceptance criteria for test demonstrations.

B. Contractor shall compensate Owner for such additional services and expenses at the rate of $150.00 per labor hour plus $100.00 per round trip plus per diem allowances for meals and lodging according to current U.S. General Services Administration (GSA) Per Diem Rates.

1.5 COMMISSIONING TEAM

A. Members Appointed by Contractor(s):

1. Commissioning Coordinator: A person or entity employed by Contractor to manage, schedule, and coordinate commissioning.
2. Project superintendent and other employees that Contractor may deem appropriate for a particular portion of the commissioning.
3. Subcontractors, installers, suppliers, and specialists that Contractor may deem appropriate for a particular portion of the commissioning.
4. Appointed team members shall have the authority to act on behalf of the entity they represent.

B. Members Appointed by Owner:

1. Commissioning Authority (CxA), plus consultants that CxA may deem appropriate for a particular portion of the commissioning.

    a. CxA: Ethos Engineering, Mark Warren, PE. Cell (512) 563-3495

2. Owner representative(s), facility operations and maintenance personnel, plus other employees, separate contractors, and consultants that Owner may deem appropriate for a particular portion of the commissioning.

a. Owner’s Rep: Director of Facilities and Construction.

3. Architect, plus employees and consultants that Architect may deem appropriate for a particular portion of the commissioning.

a. Architect: GMS Architects

4. MEP Engineer, plus employees and consultants that Architect may deem appropriate for a particular portion of the commissioning.

a. MEP: Ethos Engineering, Guillermo Quintanilla. Cell (956) 564-2811.

1.6 INFORMATIONAL SUBMITTALS

A. Comply with requirements in Section 013300 "Submittal Procedures" for submittal procedures general requirements for commissioning.

B. Commissioning Plan Information:

1. List of Contractor-appointed commissioning team members to include specific personnel and subcontractors to the performance of the various commissioning requirements.
2. Schedule of commissioning activities, integrated with the construction schedule. Comply with requirements in Section 013200 "Construction Progress Documentation" for construction schedule general requirements for commissioning.
3. Contractor personnel and subcontractors to participate in each test.
4. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.

C. Commissioning schedule.

D. Two-week look-ahead schedules.

E. Test Reports:

1. Pre-Startup Report: Prior to startup of equipment or a system, submit signed, completed system readiness checklists.
2. Test Data Reports: At the end of each day in which tests are conducted, submit test data for tests performed.
3. Commissioning Issues Reports: Daily, at the end of each day in which tests are conducted, submit commissioning issue reports for tests for which acceptable results were not achieved.
4. Weekly Progress Report: Weekly, at the end of each week in which tests are conducted, submit a progress report.
5. Data Trend Logs: Submit data trend logs at the end of the trend log period.
6. System Alarm Logs: Daily, at the start of days following a day in which tests were performed, submit print-out of log of alarms that occurred since the last log was printed.

F. System readiness checklists:

1. Material checks.

2. Installation checks.
3. Startup procedures, where required.

1.7 CLOSEOUT SUBMITTALS

A. Commissioning Report:

1. At Construction Phase Commissioning Completion, include the following:

a. Pre-startup reports.
b. Test data forms, completed and signed.
c. Commissioning issues report log.
d. Commissioning issues reports showing resolution of issues.
e. Correspondence or other documents related to resolution of issues.
f. Other reports required by commissioning.
g. List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction Phase Commissioning Completion.
h. Report shall include commissioning work of Contractor.

B. Request for Certificate of Construction Phase Commissioning Completion.

C. Operation and Maintenance Data: For proprietary test equipment, instrumentation, and tools to include in operation and maintenance manuals.

1.8 COMMISSIONING TEAM RESPONSIBILITIES

A. COMMISSIONING AUTHORITY: Responsibilities of the CxA during the Construction Phase include the following:
1. Coordinate and direct steps of the total Commissioning Process for systems being installed as part of this contract. Coordinate commissioning work schedule with Owner and Contractor.
2. Provide Commissioning Plan.
3. Attend planning and construction-site meetings as required to obtain information relating to Commissioning Process. Convene commissioning team meetings as required.
4. Plan and conduct commissioning scoping and coordination meetings. Provide notice to all Team members to attend scheduled commissioning meetings.
5. Request all information required for Commissioning Process from manufacturers, Contractor, and Design Professionals.
6. Verify that systems and equipment have been installed and started in accordance with manufacturer's recommendations and with generally recognized construction standards, and that documentation of such has been provided.
7. Assist in resolving discrepancies.
8. Prepare System readiness checklists to ensure systems have been installed according to project specifications. Verify that System readiness checklists have been addressed by Contractor and are accurate. Deliver final System readiness checklists to Owner.
9. Prepare Functional Test procedures to demonstrate performance of systems according to project specifications. Observe and document performance of systems, as per process detailed in Functional Test procedures.

10. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, system readiness checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.
11. Prepare and maintain an Issues Log.
12. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.
13. Review testing and balancing (TAB) reports; notify Owner of deficiencies.
14. Recommend acceptance or non-acceptance of systems to Owner.
15. Verify that training has taken place by collecting training documentation from Contractor.
16. Compile and maintain commissioning record.
17. Provide pre-final and final commissioning reports to all commissioning team members. The report shall include:
    a. Communications between Owner, CxA, Design Professionals, Vendors, and/or Contractor and Subcontractors related to Commissioning Process.
    b. Minutes of commissioning meetings.
    c. Findings and pertinent observations.
    d. A listing of any deficiencies, unresolved issues, and compromises in the environmentally responsive features.
    e. Manufacturer's start-up reports.
    f. An Issues Log which:
        1) Describes design, installation, and performance issues which are at variance with the Owner's project requirements and Contract Documents.
        2) Identifies and tracks issues as they are encountered, documenting the status of unresolved and resolved issues.
        3) Documents corrective modifications made.
    g. System readiness checklists.
    h. Testing plans and Functional Test reports.
    i. Listing of off-season test(s) not performed and a schedule for their completion.
18. Conduct an inspection of the building and its systems within 10 months after substantial completion and prior to the expiration of warranties. Prepare a report documenting findings that should be addressed prior to expiration of warranties.

B. CONTRACTOR: Responsibilities of the General Contractor (GC) as related to Commissioning Process include, but are not limited to the following:
1. Facilitate coordination of Commissioning work by CxA.
2. Attend Commissioning meetings or other meetings called by CxA to facilitate the Commissioning Process.
3. Integrate and coordinate commissioning process activities with construction schedule.
4. Review CxA's Functional Test procedures for feasibility, safety, and impact on warranty, and provide CxA with written comment on same.
5. Provide all documentation relating to manufacturer's recommended performance testing of equipment and systems.
6. Provide Operations and Maintenance Data to CxA for preparation of checklists and training manuals.
7. Provide testing and balancing report.
8. Provide As-built drawings and documentation to facilitate Functional Testing.

9. Assure and facilitate participation and cooperation of specialty subcontractors (electrical, mechanical, Building Automation, etc.), and equipment suppliers as required for the Commissioning Process.
10. Require subcontractors to inspect systems installed and fill-out System readiness checklists (provided by CxA) to verify installation has taken place in accordance with manufacturer's instructions, and in a workmanlike manner in accordance with project documents and generally accepted construction practices. Certify to CxA that installation work listed in System readiness checklists has been completed and accompany CxA during verification of completed System readiness checklists.
11. Install systems and equipment in strict conformance with project specifications, manufacturer's recommended installation procedures, and System readiness checklists, as prepared by CxA.
12. Provide data concerning performance, installation, and start-up of systems.
13. Provide copy of manufacturer's filled-out start-up forms for equipment and systems.
14. Ensure systems have been started and fully checked for proper operation prior to arranging for Functional Testing with CxA. Prepare and submit to CxA written certification that each piece of equipment and/or system has been started according to manufacturer's recommended procedure, and that system has been tested for compliance with operational requirements.
    a. GC shall carry out manufacturer's recommended start-up and testing procedures, regardless of whether or not they are specifically listed in CxA's Functional Test procedures.
    b. GC is not relieved of obligation for systems / equipment demonstration where performance testing is required by specifications, but a Functional Performance Test is not specifically designated by CxA.
15. Coordinate with CxA to determine mutually acceptable date of Functional Performance Tests.
16. Review and accept construction checklists provided by the CxA.
17. Direct and coordinate commissioning testing among subcontractors, suppliers, and vendors.
18. Complete commissioning process test procedures.
19. Provide qualified personnel to assist and participate in Commissioning.
20. Provide test instruments and communications devices, as prescribed by CxA and where identified in this specifications manual, as required for carrying out Functional Testing of systems.
21. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
22. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
23. Ensure deficiencies found in the Commissioning Process are corrected within the time schedule shown in the CA report.
24. Provide CxA with all submittals, start-up instructions manuals, operating parameters, and other pertinent information related to Commissioning Process. This information shall be provided directly to the CxA as a digital PDF file at the same time that the submittals are made to the architect and/or engineer.
25. Prepare and submit to CxA proposed Training Program outline for each system.
26. Coordinate and provide training of Owner's personnel. Provide CxA with proposed training agenda no less than 14 days prior to scheduled training sessions. Provide documentation that training took place (including system being trained on, trainer's name and contact information, sign-in sheet verifying who attended training, length of training, and signature of owner's authorized person certifying training took place satisfactorily).

27. Prepare Operation and Maintenance manuals and As-Built drawings in accordance with specifications; submit copy to CxA in addition to other contractually required submissions. Revise and resubmit manuals in accordance with Design Professionals and CxA's comments.
28. All costs associated with the participation of GC, Sub-Contractors, Design Professionals, and Equipment Vendors in the Commissioning Process shall be included as part of the Construction Contract.

C. Subcontractors and vendors shall prepare and submit to Commissioning Authority Manufacturer's installation and performance test procedures to demonstrate performance of systems according to these specifications and checklists prepared by Commissioning Authority.

D. Owner's Representative: Responsibilities of the Owner's Representative as related to Commissioning Process include, but are not limited to the following:

1. Provide the OPR documentation to the CxA and GC for information and use.
2. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
3. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and GC for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.
4. Manage contracts of Architect and GC.
5. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions.
6. Provide final approval for completion of Commissioning Work.
7. Warranty Period: Ensure that seasonal or deferred testing and deficiency issues are addressed.

E. Architect: Responsibilities of the Architect as related to Commissioning Process include, but are not limited to the following:

1. Attend commissioning scoping meeting and other commissioning team meetings as requested by Commissioning Authority and as selected by Architect.
2. Perform normal submittal review, construction observation, record drawing preparation, and operations and maintenance data preparation, as required by Contract Documents.
3. Coordinate resolution of system deficiencies identified during commissioning, as required by Contract Documents. Review Commissioning Issues Logs and issue directives to GC and/or Design Professionals as applicable.
4. Prepare and submit final as-built design intent documentation for inclusion in Operation and Maintenance Data Manual, and review and approve Operation and Maintenance Data Manual.
5. Review Commissioning Report and issue directive to resolve all outstanding deficiencies prior to project close-out.
6. Warranty Period: Coordinate resolution of design non-conformance and design deficiencies identified during warranty period commissioning.

F. Design Professionals Responsible for Design of Each Portion of Work Being Commissioned:

1. Perform normal submittal review, construction observations, and record drawing preparation, as required by Contract Documents. Perform site observation immediately preceding system startup.

2. Respond to deficiencies identified by Commissioning Authority as directed by Architect.
3. Provide design narrative and sequence documentation requested by Commissioning Authority. Assist, along with GC, in clarifying operation and control of commissioned equipment in areas where specifications, control drawings, or equipment documentation are not sufficient for writing detailed testing procedures.
4. Attend commissioning scoping meetings and other commissioning team meetings as requested by Commissioning Authority and as selected by Architect or responsible design professional.
5. Participate in resolution of system deficiencies identified during commissioning, as required by Contract Documents.
6. Prepare and submit final as-built design intent and operating parameters documentation for inclusion in Operation and Maintenance Manual, and review and approve Operation and Maintenance Manual.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Test equipment and instrumentation required to perform the commissioning shall remain the property of Contractor unless otherwise indicated.

2.2 REPORT FORMAT AND ORGANIZATION

A. General Format and Organization:

1. Bind report in three-ring binders.
2. Label the front cover and spine of each binder with the report title, volume number, project name, Contractor's name, and date of report.
3. Record report on compact disk.
4. Electronic Data: Portable document format (PDF); a single file with outline-organized bookmarks for major and minor tabs and tab contents itemized for specific reports.

B. Commissioning Report:

1. Include a table of contents and an index to each test.
2. Include major tabs for each Specification Section.
3. Include minor tabs for each test.
4. Within each minor tab, include the following:

    a. Test specification.
    b. Pre-startup reports.
    c. Test data forms, completed and signed.
    d. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within the minor tab, in reverse chronological order (most recent on top).

PART 3 - EXECUTION

3.1 PREPARATION

A. Review preliminary system readiness checklists and preliminary test procedures and data forms.

3.2 GENERAL

A. Authority
   1. The Commissioning Authority carries out the Cx responsibilities as the Owner's authorized agent in accordance with plans, specifications, and contractual requirements.
   2. CxA reports deficiencies found to the GC, Architect and Owner.
   3. The Architect evaluates deficiencies and issues directive to GC to remedy CxA's deficiencies lists, in accordance with contract documents.
   4. No change in scope work is to take place without express written consent of Owner. Any deficiencies identified by CxA that are deemed by Architect to be outside of the scope of work shall be discussed with Owner for consideration.
   5. GC and CxA are to copy Architect on all correspondence related to the commissioning process.

B. Participation In The Commissioning Process
   1. GC shall attend meetings related to Commissioning process and arrange for attendance by subcontractors and vendors prior to commissioning of their systems, at the discretion of CxA.
   2. Provide skilled technicians to start and test all systems, and place systems in complete and fully functioning service in accordance with contract documents and design intent.
   3. Provide skilled technicians, experienced and familiar with systems being commissioned, to assist CxA in commissioning process.
   4. Attend initial commissioning team scoping meeting, pre-commissioning meetings specific to each system, and other meetings requested by CxA as required to discuss resolution of deficiencies.
   5. Coordinate with sub-Contractors and equipment vendors/representatives to set aside adequate time to address System readiness Checklists, Functional Testing, Operations and Maintenance Training, and associated coordination meetings.

C. Work Prior To Testing
   1. A commissioning team scoping meeting shall be held at a time and place designated by Commissioning Authority. Owner, Architect, Commissioning Authority, Contractor, and Mechanical, Electrical, and Controls Contractors, shall be present at this meeting. The main objectives of the meeting are to familiarize all parties with the requirements of the commissioning process; to ensure that the responsibilities of each party are clearly understood; and obtain information to develop the preliminary commissioning plan, including:
      a. Personnel representing the various entities participating in the process (GC, subcontractors, Owner, Architect, Engineer, CxA)
      b. Lines of communications;
      c. Assignment of responsibilities;
      d. Review system readiness checklists;
      e. Submittal schedule;

f. Preliminary construction schedule

2. Following the initial commissioning team scoping meeting, and upon reviewing submittals, CxA shall prepare a preliminary Commissioning Plan outlining procedures and responsibilities, including names and contact information of responsible parties, tentative dates for commissioning activities, and system readiness checklists. Preliminary Commissioning Plan shall be distributed to GC and Owner electronically for review and comment. CxA shall modify the Commissioning Plan based on feedback from GC and Owner and will generate a final Cx Plan.
3. Prior to system readiness and functional testing, CxA will conduct site inspections at critical times and issue Cx Field Reports with observations on installation deficiencies so that they may be issued by Architect as deemed appropriate
4. GC shall complete all phases of the work so the systems can be started, tested, adjusted, balanced, and otherwise commissioned.
5. GC shall verify requirements of Divisions 22, 23 and 26 outlining responsibilities for start-up of equipment with obligations to complete systems, including all sub-systems so that they are fully functional.
6. A minimum of fourteen (14) days prior to date of system readiness performance test, submit to Commissioning Authority for review, detailed description of equipment start-up procedures which GC proposes to perform to demonstrate conformance of systems to specifications and commissioning checklists.
7. Convene system-specific pre-commissioning meetings prior to start of system readiness testing of each system. The GC shall hold a pre-commissioning meeting with all Team members in attendance. The purpose of the meeting is to review the system readiness checklists, and equipment start-up procedures for each system to be commissioned, confirm that systems are ready for testing, and define a schedule for testing activities.

D. System readiness checks and functional performance tests

1. The GC shall provide all materials, services, and labor required to operate equipment and/or system in order to perform the system readiness checks and functional performance tests. A system readiness check or functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating commissioning team member of which participation is specified is not present for the test. The GC shall reimburse the Owner and A/E for all costs associated with effort lost due to tests that are aborted. These costs shall include salary, travel costs and per diem (where applicable).
2. Functional performance tests may sometimes duplicate the checking, testing, and inspection methods established in related Sections. Where checking, testing, and inspection methods are not specified in other Sections, methods shall be established which will provide required information. Testing and verification required by this section shall be performed during the Commissioning phase. Requirements in related Sections are independent from the requirements of this Section and shall not be used to satisfy any of the requirements specified in this Section without the approval of CxA.
3. Follow start-up and initial checkout procedures listed in article titled “RESPONSIBILITIES” in Part 1, and additional requirements specified in this Section. Divisions 22, 23 and 26 have startup responsibilities and are required to complete systems and sub-systems so systems are fully functional, meeting design requirements of Contract Documents. Commissioning procedures and functional testing do not relieve or lessen this responsibility or shift this responsibility, in whole or in part, to Commissioning Agent or Owner.

E. Work To Resolve Deficiencies

1. Complete corrective work in a timely manner to allow expeditious completion of commissioning process. If deadlines pass without resolution of identified problems, Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs thus incurred will be GC's responsibility.

3.3 SUSTAINABILITY REQUIREMENTS

A. Comply with requirements listed in specifications and drawings as it relates to sustainability features that will be verified during the Commissioning process.

3.4 SYSTEM READINESS CHECKLISTS

A. General
   1. System readiness checklists are important to ensure that equipment and systems are properly connected and operational, and installed in accordance with specifications, drawings, manufacturer's requirements, and all applicable codes.
   2. Checklists ensure that functional performance testing (in-depth checkout) may proceed without unnecessary delays.
   3. Performance of system readiness checklists, startup, and checkout shall be directed and executed by subcontractor or vendor. Only individuals that have direct knowledge and who witnessed that line item task on system readiness checklist was performed shall initial or check item off.
   4. Each piece of equipment and major distribution system receive full system readiness checkout. No sampling strategies are used.
   5. System readiness checkout for given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of given system.

B. System readiness Checklist
   1. System readiness performance tests shall be documented in a checklist format, as prepared and provided by CxA, for each piece of equipment. Each checklist shall be initialed by GC, verifying that all items on checklist have been addressed and completed.
   2. Commissioning System readiness checklists are not to preclude GC from applying his own construction inspection checklists.
   3. All system elements shall be checked to verify that they have been installed, adjusted, and calibrated properly, that all connections have been made correctly, and that it is ready to function as specified. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, control sequence, and other conditions which may cause damage.
   4. Verify that tests, meter readings and specific electrical characteristics agree with those required by equipment or system manufacturer.
   5. All discrete elements and sub-systems shall be adjusted and shall be checked for proper operation. Verify wiring and support components for equipment are complete and tested.
   6. Do not conduct start-up procedure recommended by equipment/system manufacturer at prior to system readiness testing.
   7. Subcontractors shall clearly list outstanding items of initial start-up and system readiness procedures that were not completed successfully at bottom of procedures form or on separate sheet attached to form. Completed forms and attached sheets shall be provided to Commissioning Authority within 2 days of test completion. Installing subcontractor or vendor shall correct deficient or incomplete areas in timely manner and shall submit

updated system readiness checklist and startup report with statement of correction on original non-compliance report.

8. When system readiness checklists for a particular system or subsystems are completed, GC will request verification by CxA. GC and subcontractors shall accompany CxA during system readiness checklist verification.
9. If during system readiness checklist verification, CxA finds a significant number of deficiencies, GC shall have all the checklists associated with similar system redone.

3.5 SYSTEM START-UP

A. GC will arrange for start-up of operating equipment and systems after (or at the same time as) system readiness testing and prior to scheduling Functional Testing.

B. Start-up of equipment and systems shall be performed only by a manufacturer's representative, or person(s) who are specifically manufacturer-approved. All start-up personnel shall be trained and authorized, experienced and knowledgeable in the operations of such equipment and systems.

C. Coordinate schedule for start-up of various equipment and systems so that subsystems required for major systems operation are tested first.

D. Manufacturer's start-up reports must be submitted to CxA prior to scheduling Functional Testing.

3.6 FUNCTIONAL TESTING

A. The objective of Functional Testing is to demonstrate that each system is operating according to documented design intent and Contract Documents, through all possible modes of operation.

B. GC and sub-Contractors shall include in his bid proposal all costs associated with preparation and execution of Testing Procedures for all systems to be commissioned.

C. Functional testing is intended to begin upon completion of each system and after system readiness checklists have been completed. Functional testing may proceed prior to completion of systems or sub-systems at discretion of Commissioning Authority. Beginning system testing before completion does not relieve GC from fully completing system, including system readiness checklists as early as possible.

D. GC and sub-Contractors shall provide detailed Testing Procedures that will allow all items on checklists to be verified.

E. Testing shall be conducted under specified operating conditions as recommended or approved by Commissioning Authority.

F. A Functional Performance Test shall be performed on each complete system. Each function shall be demonstrated to the satisfaction of Commissioning Authority in accordance with proposed test procedures developed to demonstrate compliance with specifications.

G. Each Functional Test shall be witnessed and signed off by Commissioning Authority upon satisfactory completion. Functional Test is not to be considered complete until Owner accepts Commissioning Authority's recommendation for completion.

H. All elements of system shall be tested to demonstrate that total systems satisfy all requirements of these specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each subsystem, followed by the entire system, followed by any inter-ties to other major systems.

I. Notification, Scheduling Of Functional Testing and Re-Testing
   1. Notify CxA and Owner, in writing, of request for scheduling Functional Testing. Submit request no fewer than five days prior to desired date for beginning functional testing.
      a. GC must certify that systems and equipment are functioning satisfactorily, according to specifications and design intent, prior to requesting Functional Testing. Upon receipt of such certification, CxA will schedule with GC a time for the particular system test.
         1) CxA will attempt to schedule Functional Testing when convenient for GC and his vendors, and to minimize lost time to GC.
      b. GC will resolve all deficiencies identified during initial test prior to submitting request, in writing, for re-testing. Such request for re-testing shall certify that GC has resolved all deficiencies, or list reason why any deficiencies remain which cannot be resolved.
      c. CxA will re-test to ensure that all deficiencies have been resolved.
         1) Deficiencies that were not detected in first Functional Test, but are discovered in subsequent re-testing, are to be resolved by GC as if they had been discovered in initial testing.

J. Functional Testing Requirements And Procedures
   1. GC and sub-Contractors shall perform tests in the presence of CxA. Tests not witnessed by CxA shall not be considered complete.
   2. To facilitate Functional Testing, when requested by CxA, GC shall provide services of personnel to accompany CxA for the duration of Functional Testing, including any follow-up testing. Such personnel must be experienced, qualified, and intimately familiar with the system being tested.
      a. Participation by representative(s) of direct digital controls (DDC) systems is of particular importance in Functional Testing. All systems which are controlled and/or monitored by DDC are to be thoroughly tested, point by point, through all modes of operation, with the assistance of manufacturer's representative. DDC graphics, setpoints, and programming are to be included as a part of Functional Testing as well.
      b. GC must provide services of personnel to accompany CxA for equipment and systems which may pose particular health and safety concerns, such as boilers.
      c. Should he fail to provide representative to accompany CxA during Functional Testing, GC continues to bear full responsibility for equipment warranty. Owner and CxA will not be held responsible for damage to equipment, or other actions which might impact warranty, when performing Functional Testing of systems where GC has not provided authorized accompanying representative to operate equipment.
   3. Each system shall be operated through all modes of operation including, but not limited to seasonal, occupied, unoccupied, warm-up, cool-down, part-load, and full-load, where system response is specified.

a. For multiple units, sampling strategy established by Commissioning Authority and subject to approval of Owner may be used.
b. Verification of each sequence in sequences of operation is required.
c. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, and the like, shall also be tested.

4. Where possible, inspections carried out on systems by local Authorities Having Jurisdiction (AHJ) may serve as Functional Testing for purposes of Commissioning.
   a. CxA will accompany AHJ during testing procedures required by AHJ.
   b. It is responsibility of GC to arrange for testing by AHJ and to coordinate with CxA to find mutually convenient times for testing. Provide CxA a minimum of four days in advance of intent to schedule testing by AHJ.
   c. CxA will issue a separate report on results of testing.
   d. CxA reserves the right to require additional testing, should testing by AHJ not adequately cover all system components in all modes of operation.
5. Functional Testing is to be dedicated solely to testing of equipment and systems, and not to resolution of deficiencies. Deficiencies identified during testing process must be corrected by GC at a time other than during Functional Testing.
6. Within six days of performing functional test, CxA will issue test report with findings a list of deficiencies that must be addressed by GC or sub-Contractors.
7. Commissioning Authority shall submit a Final Report to Owner recommending acceptance or non-acceptance of individual system components as well as the systems as a whole.

K. Re-Testing And Failure To Remedy Deficiencies
1. Despite GC's best efforts to ensure systems are problem-free, it is expected that some deficiencies will be found during initial inspection of System readiness Checklist, and during initial Functional Testing; such deficiencies are expected to be minimal.
2. It is GC's responsibility to remedy identified deficiencies, both in System readiness Checklist and in Functional Testing phases of work, in a timely and thorough manner.
3. It is GC's responsibility to ensure that all deficiencies are corrected prior to requesting a re-inspection or re-test of systems and equipment. Do not request re-inspection or re-test until deficiencies are corrected.
   a. At his discretion, CxA may agree to re-testing systems or equipment where deficiencies remain which are beyond GC's control to resolve expeditiously.
   b. Typically such re-testing of incomplete systems and equipment will take place only if remaining deficiencies are minor in scope and nature, and are of such nature that they cannot be resolved in a timely manner (such as those due to difficulties in obtaining parts, or where Owner has requested a change that has delayed work, etc.)
4. CxA will carry out a second re-inspection or re-test of systems and equipment subsequent to receiving GC's request.
   a. If CxA finds deficiencies identified in initial inspection or test have not been remedied (with exception of un-resolvable deficiencies noted above), and such remaining deficiencies are significant enough to require additional inspection or re-testing, GC will be back-charged for CxA's expenses, per Article 1.5.

3.7 TRAINING

A. The following requirements are in addition to operation and maintenance requirements specified elsewhere in this specifications manual. GC shall be responsible for training coordination and scheduling, and ultimately to ensure that training is completed.

B. Scheduling
   1. Organize training to fit Owner's schedule and to optimize the learning experience. Limit continuous sessions to no more than four hours, or otherwise only as approved by Owner and/or Architect.
   2. Provide an outline of the proposed training agenda for review by Owner and CxA a minimum of 10 days prior to proposed date for training session.
   3. Provide CxA a minimum 5 days advance notice of intent to carry out a training session.
   4. The CxA will not be required to attend all training sessions for building personnel, but will attend selected sessions and monitor progress and content.
   5. No training will take place prior to successful completion of Functional Testing.

C. Training Materials
   1. Develop Training Manuals to meet requirements of individual equipment specification sections.
   2. Operating and Maintenance Manuals alone are NOT considered training manuals. O&M Manuals may be used as reference, but shall not be considered to meet requirements for training materials.
   3. Develop a detailed outline showing how training program will be organized, including classroom and hands-on training as required by individual specifications sections.
   4. Provide with training materials, a quick-reference "how-to" index which will allow operators to easily access information included in Training Manuals and/or O&M Manuals. This reference will include, as a minimum; routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions.
   5. Refer to individual equipment or system specifications for minimum material to be covered as part of the training program.

D. Documentation
   1. All training sessions are to be fully documented. Document:
      a. Basic information on training session (name of system, time, date, and location of training, name of presenter, length of training session, etc.).
      b. Names of persons who attended the training session (provide a sign-in sheet).
      c. Signature from authorized Owner’s representative indicating that training took place and was satisfactory.
   2. Provide CxA copy of sign-in sheet with training session documentation.

3.8 O&M MANUALS

A. Provide operation and maintenance manuals as specified in section 017700 Closeout Submittals, and as outlined in individual sections of Divisions 22, 23 and 26.

B. Provide CxA with a single copy of Operation and Maintenance Manuals for review. CxA’s copy of O&M manuals shall be submitted through Architect.

C. CxA shall review O&M Manuals and submit comments through the Architect.

3.9 SYSTEMS TO BE COMMISSIONED

A. Refer to commissioning specifications sections in Related Sections, including the following:
   1. 260100 - COMMISSIONING OF ELECTRICAL SYSTEMS: Lighting and Lighting Controls.

END OF SECTION 019113

SECTION 077200 - ROOF ACCESSORIES

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: Factory fabricated roof curbs.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, materials, dimensions of individual components and profiles, and finishes.

B. Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:
1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Coordinate dimensions with shop drawings of equipment to be supported.

1.4 QUALITY ASSURANCE

A. Substitutions: Requests for substitution shall be submitted in writing at least 10 days prior to bid date and shall be accompanied by product literature and samples. No substitution will be permitted after bid date.

B. Standards: Comply with the following:
1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. G-90 galvanized steel with paint-grip coating.

B. Insulation: Manufacturer's standard rigid or semirigid glass-fiber board of 2” thickness, 1-1/2lb density, R8 value.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.

D. Fasteners: Stainless steel metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.

E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

F. Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coating.

G. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

H. Elastomeric Sealant: Generic type recommended by unit manufacturer that is compatible with joint surfaces; ASTM C 920, Type S, Grade NS, Class 25, and Uses NT, G, A, and, as applicable to joint substrates indicated, O.

I. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.2 ROOF CURBS

A. General: Provide roof curbs capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

B. Fabrication: Unless otherwise indicated or required for strength, fabricate units from minimum 16 gauge, galvanized steel with paint grip coating, with welded corners and with seams joined by continuous water and air-tight welds. Tack or spot welding is unacceptable.
1. All external welds shall be prepared and coated with corrosion inhibitor compound.
2. Curb adapter walls shall be insulated with 1-1/2” thick, three-pound density insulation. Exposed edges shall be encapsulated to ensure no insulation erodes into the air stream. Insulation shall be either foil faced or coated with antimicrobial coating such that the fibers are not airborne over the life of the building.
3. Provide preservative-treated wood nailers at tops of curbs and formed flange at perimeter bottom for mounting to roof.
4. Provide formed cants and base profile coordinated with roof insulation thickness.
5. The Manufacturer shall limit static pressure gain to .25 inches/water gauge
6. Fabricate units to minimum height of 18 inches, unless otherwise indicated.
7. Changes in airflow direction to be accomplished by 90-degree elbows with turning vanes.
8. Curb adapters shall be manufactured in one piece except when width exceeds 108”. If width exceeds 108”, the curb shall be designed with prefabricated joints for ease of installation. It will be manufactured in separate pieces with the number and length of the pieces determined by the total length of the unit. The Manufacturer shall supply drawings for assembly and installation.
9. Curb adapters shall provide full support of the new unit and shall include 3/8” gasketing.
10. Counter flashing shall extend over the original curb a minimum of 1” and be welded and weatherproof.

2.3 FINISHES, GENERAL

A. Surface preparation: Oil, grease and other deposits of surface contamination shall be removed by solvent or detergent washing. All surfaces must be clean, dry and free of any dirt, dust, grease, oil or other deleterious materials prior to coating. Care shall be taken to ensure surfaces remain clean before and during coating process.

B. Application system:
   1. Coating shall provide a standard 5 year manufacturer's limited warranty.
   2. Metal surfaces shall be finished with a corrosion protection system equal to one of the following:
      a. Energy Guard ZRU Primer. Finish coat shall consist of EnergyGuard DCC Cabinet Casing polyurethane coating. Coatings shall be applied by a certified applicator and shall result in a finish with an ASTMB117-90 salt spray rating of 10,000 hours.
      b. Prime coat of ICI Devran 201 Universal Epoxy Primer to thickness of not less than 3.0 mils DFT (dry film thickness) nor more than 8.0 mils DFT. Minimum recoat time for Devran 201 Universal Epoxy Primer is 3.5 hours at 77 F with 80% relative humidity. Finish coat shall consist of Devthane 379 UVA Aliphatic Urethane Gloss Enamel applied to thickness of not less than 1.0 mils DFT nor more than 5.0 mils DFT.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written instructions. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weather tight. Anchor roof accessories securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

B. Separation: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.

C. Flange Seals: Unless otherwise indicated, set flanges of accessory units in a thick bed of roofing cement to form a seal.

D. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counter flashing). Seal overlap with thick bead of mastic sealant.

E. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

3.2 CLEANING AND PROTECTION

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION 077200

SECTION 077300 - WIND LOAD RATED ROOF CURBS AND RESTRAINT BRACKETS

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. Design, construct, furnish and install roof curbs, brackets and related items to meet governing building codes, as demonstrated by comprehensive analysis that the load resisting capabilities meet or exceed requirements.

1.3 QUALITY ASSURANCE

A. Meet requirements of the International Building Code, ASCE Std 7, TDI, and other applicable codes for the location. This specification shall be a minimum requirement for wind load design consideration, and is not intended as a substitute for legislated, more stringent, national, state or local requirements.

B. Wind-induced forces shall be determined by governing code requirements. See attached Design Wind Pressure Requirements Memo by Structural Engineer.
   1. Wind-generated force shall be reduced into an equivalent statically applied force.
   2. The statically applied force shall act in horizontal and vertical directions at the center of gravity of the rooftop mounted equipment, resulting in torsion, flexure, tension and shear forces that the wind restraint brackets shall be shown to be able to resist.

C. Install products in strict accordance with applicable codes and manufacturers' standards. Whenever a conflict occurs between the manufacturers or construction standards, the most stringent shall apply.

1.4 SUBMITTALS

A. Manufacturer's statement showing that the curbs and wind load restraint brackets meet the applicable code requirements, signed and sealed by a licensed professional engineer (PE). Provide the following:
   1. Wind restraint calculations for all connections of rooftop-mounted equipment to roof curb, and roof curb to the structure.
   2. Drawings showing curbs, wind restraint bracket dimensions, make and model compatible with rooftop unit, including type of connection hardware required.

PART 2 - PRODUCTS

2.1 ROOF CURBS AND RESTRAINTS

A. Approved manufacturers of roof curbs and wind load restraint brackets:
   1. Curbs Plus, Complete Curbs, Thybar Corporation.
   2. Others shall obtain a written pre-approval one week prior to bidding.

B. Products shall be made of a material (Prime G-90 galvanized steel or galvalume) compatible with roof curb and the rooftop unit base-rail material. Dissimilar metals shall not to be used.
   1. Fully welded mitered corners for wind load consideration
   2. Base flange attachments for securing curb to structure.
   3. Factory installed wood nailer for attachment of roofing material.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Attach rooftop equipment to roof curbs with wind load restraint brackets of size, type and quantity as determined by equipment manufacturer.

C. Attach roof curb to the building structure at the curb base flanges. Base flange attachment options include anchor bolts, welded connections and mechanical fasteners.

D. Do not install wind load restraint brackets in a manner that will result in inadequate maintenance access, base-rail damage, or roof curb reduced weight carrying capacity.

E. Prior to performing installation of restraint brackets, notify Engineer of any conflicts with other trades or equipment that may result in undesirable contact due to inadequate space or other unforeseen conditions. Notify Engineer of any discrepancies between the specifications and field conditions or changes required due to specific equipment selection prior to installation.

F. Corrective work necessitated by discrepancies or conflicts after installation shall be at the contractor's expense.

3.2 INSPECTION

A. On completion of installation, inspect the completed system and report in writing any installation error or other faults in the system that could affect the wind load resistant capabilities of the roof top assembly.

B. The Contractor shall submit a report to the project designer, including the above report with consequent steps taken to properly complete the wind load restraint installation.

END OF SECTION

TECHNOLOGY INFRASTRUCTURE BUILDING STANDARDS

01-03-2024

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Codes, Standards, and their Abbreviations

General Requirements

This primary scope of work is to provide a complete, “turnkey” structured cable infrastructure. If applicable, that will serve the district reliably for many years. All cabling, copper and fiber optic must be plenum rated. Vendor is responsible for old cable removal when needed. This also includes rack and old network equipment.

Codes and Standards

1 General: All work, including but not limited to: cabling, pathways, support structures, wiring, equipment, installation and workmanship shall comply with the latest editions of the requirements of the Authority Having Jurisdiction (AHJ), National Electrical Code, National Electrical Safety Code, all applicable local rules and regulations, equipment manufacturer's instructions, and the National Electrical Contractors Association (NECA) Standard of Installation. In case of discrepancy or disagreement between the documents noted above, the Contractor shall satisfy the most stringent requirements.

2 Codes

A. Insulated Cable Engineers Association (ICEA)

ANSI/ICEA S-80-576-2002, Category 1 & 2 Individually Unshielded Twisted-Pair Indoor Cables for Use in Communications Wiring Systems

ANSI/ICEA S-84-608-2002, Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor

ANSI/ICEA S-90-661-2002, Category 3, 5, & 5e Individually Unshielded Twisted-Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems

ICEA S-102-700-2004, ICEA Standard for Category 6 Individually Unshielded Twisted-Pair Indoor Cables for Use in LAN Communication Wiring Systems Technical Requirements, 2004

3 B. National Fire Protection Association (NFPA)

NFPA 70, National Electrical Code® (NEC®)

NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces,

NFPA 72, National Fire Alarm Code®

NFPA 75, Standard for the Protection of Electronic Computer/Data Processing Equipment

NFPA 76, Recommended Practice for the Fire Protection of Telecommunications Facilities

NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems

NFPA 101, Life Safety Code®

NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials

NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces

NFPA 780, Standard for the Installation of Lightning Protection Systems

NFPA 5000™, Building Construction and Safety Code

4 Reference Standards

A. Telecommunications Industry Association (TIA)

B. ANSI/NECA/BICSI 568-2006, Standard for Installing Telecommunications Systems

ANSI X3T9.5, Requirements for UTP at 100 Mbps

ANSI/TIA-526.7-A, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

ANSI/TIA-568.0-D, Generic Telecommunications Cabling for Customer Premises

ANSI/TIA-568.1-D, Commercial Building Telecommunications Cabling Standard

ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard

ANSI/TIA-568.3-D, Optical Fiber Cabling and Components Standard

ANSI/TIA-568-C.4, Broadband Coaxial Cabling and Components Standard

ANSI/TIA-569-D, Telecommunications Pathways and Spaces

ANSI/TIA-606-C, Administration Standard for Telecommunications Infrastructures

ANSI/TIA-862-B, Structured Cabling Infrastructure Standard for Intelligent Building Systems

ANSI/TIA-942-B, Telecommunications Infrastructure Standard for Data Centers

ANSI/TIA-607-C, Generic Telecommunications Bonding and Grounding (Earthing) for customer Premises

T-526-14-C, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant

TIA-598-D, Optical Fiber Cable Color Coding

TIA-604.3-B, FOCIS 3—Fiber Optic Connector Intermateablility Standard, Type SC

TIA-604.10-B, FOCIS 10—Fiber Optic Connector Intermateablility Standard, Type LC

TIA TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning

TIA-758-B, Customer-owned Outside Plant Telecommunications Infrastructure Standard

TSB-155-A, Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T

5 Other Reference Materials

ANSI/NECA/BICSI-568-2006, Standard, Installing Commercial Building Telecommunications Cabling

BICSI Outside Plant Design Reference Manual (COOSP), current edition.

BICSI Electronic Safety and Security Reference Manual (ESSDRM), current edition

BICSI Information Transport Systems Installation Methods Manual (ITSIM), current edition

BICSI Network Design Reference Manual (NDRM), current edition

BICSI Telecommunications Distribution Methods Manual (TDMM), current edition

BICSI Wireless Design Reference Manual (WDRM), current edition

Institute of Electrical and Electronic Engineers (IEEE)

National Electrical Manufacturers Association (NEMA)

Underwriters Laboratories (UL) Cable Certification and Follow Up Program

6 The Vendor will follow the National Electric Code (NEC), the National Electric Safety Code (NESC), and any applicable State of Texas code, and local codes

END OF SECTION

7

Division 27 – Data and Communications

PART 1 - GENERAL REQUIREMENTS

The primary scope of work is to provide a complete, "turnkey" structured cable infrastructure, if applicable, that will serve the district reliably for many years. All cabling, copper, and fiber optic must be plenum rated. Vendor is responsible for old cable removal, rack, and old network equipment, when needed.

1.1 Active network equipment (switches, network cameras, etc.) to be procured, installed, and configured by IDEA IT Department. Infrastructure components including but not limited to patch cables, patch panels, wire managers, racks, cabling, ladder, cable tray, fiber distribution panels, pig tails etc., to be provided and installed by contractor.

1.2 TECHNOLOGY SYSTEM DESIGN REQUIREMENTS

A. All data and communications cabling, voice, audio-video and projects are bid and contracted through the General Contractor scope of work. The structured cabling, IT rack fabrication, electrical back boxes, raceways, and conduit needed to support these systems and services are to be included in design and construction documents.

B. Communications and data and voice cabling projects are separate from audio-visual, video, security, building control systems that are not directly associated with IDEA's IP-based network and voice systems.

C. 100% Schematic Design Milestone Requirements:
1. Identify all telecommunication rooms, service entrances and all backbone pathways. Determine the room dimensions of all telecommunication rooms.
    a. Telecommunication rooms shall be positioned to be within 300 feet of horizontal distance from the farthest outlet point (using right angle measurements). Final locations of all IDFs, including the intended primary path(s) of horizontal cabling and the associated 300-foot rule must be presented to and approved by IDEA network team prior to the architectural layout being approved by IDEA IT project management.

D. 100% Design Development Milestone Requirements:
1. Finalize all telecommunication rooms, service entrances and all backbone pathways. Plans shall include schematic layouts of headend closets, legends, and details.

E. 50% Construction Document Milestone Requirements:
1. Include site and floor plans, endpoint drops/locations, cable pathways, headend room layouts, backbone schematic diagrams and telecommunication specifications.

F. 100% Construction Document Milestone Requirements:
1. Include backbone riser diagrams for all intra-building cross connects and interbuilding cross-connect locations. Also include service entrances and headend room layouts, wall elevations of all communication rooms, rack elevations, grounding busbar, termination boards, conduits, cables trays, floor penetration locations and pull boxes.
2. Detailed room layouts indicating all technology endpoint outlets with identification to determine number of drops per location/outlet and their designated telecommunication room.

3. 100% Data and voice communications specifications

G. Submittals Milestone Requirements:
   1. Follow the submittal requirements and procedure
   2. Owner to review Contractor's BOM (Bill of Materials)

H. ***The IDEA IT/Technology Department should review drawings after each design phase.***

I. At time of construction award, notice of final data cabling subcontractor selection to be made available to IDEA Technology for coordination.

J. ***The architect shall coordinate all underground conduit to be located adjacent to existing utilities entering the site.***

K. ***The architect shall coordinate location of all classroom projectors and conference room flat digital display, providing each student with proper visibility of the board.***

1.3 WORK INCLUDES

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

B. Communication Systems complete including cabling, special backboxes, hardware and all other required devices and equipment.

C. Installation of system equipment per specifications.

D. To supply in a timely manner to the electrical contractor special backboxes for installation as required.

E. Coordinate wireway, raceway, power, and outlet requirements with the builder and the electrical contractor.

F. Communication Systems Contractors shall provide and install prior to cable installation plastic snap in bushings at each box opening, passage through a metal stud, and at the end of all open conduit stubs or sleeves to protect the cabling from damage.

G. Furnishing of all required materials, equipment, tools, scaffolding, labor, and transportation necessary for the complete installation of the communication systems as shown on the drawings and as specified herein.

H. Cable pathways, conduit, and cable support systems shall be complete with bushings, de- burred, cleaned, and secure prior to installation of cable.

I. It is the intent of these specifications to provide complete installations although every item necessary may not be specifically mentioned or shown.

1.4 WORK TO BE INCLUDED BY THE ELECTRICAL CONTRACTOR IN BASE CONTRACT PROPOSAL

A. Provide utility services conduit as outlined on drawings as required.

B. All required conduit for accessibility to attic space.

C. Furnishing and installation of all required standard back boxes and conduit.

D. Installation of special back boxes supplied by the Division 27 contractor(s).

E. Furnishing and installation of all floor boxes, surface raceways, and other wireways which are detailed or specified under Division 26.

F. Provide equipment-mounting boards as outlined on drawings.

G. Provide equipment, grounding system, conductors, and bus bars and as outlined in Division 26.

H. Provide 120-volt power and hook-up to equipment provided in Division 26.

I. Coordination of requirements of Division 26 with the Builder.

1.5 WORK NOT INCLUDED

A. Contractors shall make no agreement that obligates the Owner to pay any company providing communications, monitoring, or other services. Contractors shall not make selection, purchase, or installation of interconnect instruments/equipment to be used on this project.

1.6 SUBMITTALS

A. Product Data: Include data on features, ratings, and performance for each component specified.

B. Shop Drawings: Include dimensioned plan and elevation views of components. Show access and workspace requirements.

1. System / endpoint cable identification labeling schedules, including an additional electronic copy of labeling schedules, as specified in Part 3, in software and format selected by Owner.
2. Fiber pathways and interconnects between MDF and IDF rooms
3. Total cable drop counts per IT closet (MDF/IDF) assignment
4. Cable drop counts per purpose/room/outlet
5. IT rack elevation and patch panel port assignment list – coordinate with Owner - additional details in Section 10
6. Conduit sleeves routed and penetrated to MDF/IDF rooms
7. Conduit sleeve location shown in each room connecting to corridor
8. Ground bar location and bonding to each rack and cable support system components

C. Samples: For workstation outlet connectors, jacks, jack assemblies, and faceplates for color selection and evaluation of technical features.

D. Product Certificates: Signed by manufacturers of cables, connectors, and terminal equipment certifying that products furnished comply with requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article. Provide evidence of Current COMMSCOPE certification. Contractor shall be certified under manufacture before bid date.

F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

G. Maintenance Data: For products to include in maintenance manuals specified in Division 1 found in Construction Specs document.

H. Submittal procedures shall be per Division 1 - General Requirements.

I. Provide a complete submittal for each section as specified.

J. Submit complete submittal package within 30 calendar days after award of this work for approval. Equipment is not to be ordered without approval. Partial submittals are not acceptable for review. Each submittal shall include a dated transmittal.

K. Submittal may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized including index tabs in a 3-ring black binder of sufficient size.

L. Each Product data submittal shall include:
1. A cover sheet with the name and location of the project, the name, address, and telephone number of the Contractor, and the name, address, and telephone number of the submitting subcontractor. Include on or after the cover sheet sufficient space for review stamps.
2. An indication of any deviations from Contract Document requirements, including variations and limitations. Show any revisions to equipment layout required by use of selected equipment.
3. A product data index and complete equipment list including for each product submitted for approval the manufactures name and part number, including options and selections.
4. Cut sheets or catalog data illustrating the physical appearance, size, function, compatibility, standards compliance, and other relevant characteristics of each product on the equipment list. Indicate by prominent notation (an arrow, circle, or other means) on each sheet the exact product and options being submitted.
5. Submit design data, when the scope of work requires, including calculations, schematics, risers, sequences, or other data.
6. When the contract requires extended product warranties, submit a sample of warranty language.
7. Any resubmittal shall include a complete revised equipment list and any product data that is revised.

M. Submit shop or coordination drawings, when specified or the required for the scope of work, which include information that will allow to the Contractor to coordinate interdisciplinary work and when necessary, guide the manufacturer or fabricator in producing the product. Shop or coordination drawings shall be specifically prepared to illustrate the submitted portion of work, this may require diagrams, schedules, details, and accurate to scale equipment and device layouts prepared using a CAD or BIM engineering drawing program.

N. The Engineer's review of submittals is only for confirmation of adherence to design of project and does not relieve the Contractor of final responsibility for furnishing all materials required for a complete working system and in complying with the Contract Documents in all respects.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Proposed contractors who do not currently possess the necessary qualifications, trained and experienced personnel, financial capacity, and meet the other requirements herein described will be disqualified.

2. Contractor shall have installed similar systems in at least (5) other projects in the last five years prior to this bid and be regularly engaged in the business of installation of the types of systems specified in this document. Contractor shall provide information on prior pro- jects including, but no limited to items such as name and location of project contacts and numbers, total square footage, total number of cables/drops, types of media, etc.
3. Recently formed companies are acceptable only if specific pre-approval is requested, and granted by the Architect/Engineer, based on experience of key personnel, current and completed projects, and all licensing requirements are met 10 working days prior to the contract proposal date.
4. The proposed contractor shall have an office within 150-miles of the job site, staffed with trained technicians who are qualified and licensed to supervise the installation, to be responsible that the system is installed as submitted, to conduct system start up and perform a 100 percent operational audit of all installed devices, to instruct the Owners representatives in the proper operation of the system, and to provide service throughout the warranty period. The contractor shall be capable of dispatching technicians to repair a system within six hours of a service request.
5. The proposed contractor shall be fully experienced in the design and installation of the type of system herein specified and shall furnish with the contract proposal an itemized list of the installations of the type specified herein. The list shall include the name of the project, date of completion, the amount of the contract, the name, and telephone number of a qualified person to contact for reference. This list must contain at least two (2) projects within a 150-mile radius of the proposed project to allow owner's officials to visit the job site for review of the system installation and service. Each reference project listed must utilize equipment by the same manufacturer as the proposed system.
6. An experienced installer who is a registered communication distribution designer certified by the Building Industry Consulting Service International.
7. The Contractor (Company) shall have a minimum of two full-time employees who have completed the Manufacturers Certification for the submitted product(s). Copies of Certification shall be included in the submittals.
8. The head installer should be a Registered Communication Distribution Designer (RCDD) and should follow all BICSI recommendations for Telecommunication Infrastructure Copper and Fiber installations.
9. The Contractor (Company) must be able to prove to the satisfaction of the Owner/Engineer that it has significant experience in the installation of fiber optics cable systems and communication systems. Installation must include installation of fiber optics cable, fiber termination, a knowledge of interconnect equipment, and a thorough knowledge of testing procedures.
10. The Contractor (company) shall provide current CommScope certification before bid date.
11. The Contractor shall not sub any portion of the scope of work. This scope shall be performed and certified by contractor awarded.
12. The ability of a proposed contractor to obtain plans and provide a performance bond shall not be regarded as the sole qualification of the contractors' competency and responsibility to meet the requirements and obligations of the contract.
13. The Builder shall be satisfied that a proposed Contractor meets all the requirements expressed herein before including the Contractor's proposal in the project.
14. The Owner may investigate, as they deem necessary to determine the ability of the proposed Contractor to perform the work. The proposed contractor shall furnish to the Owner with any information or data requested for this purpose.
15. The Owner reserves the right to reject any contract proposal if the evidence submitted, or their investigation, fails to indicate that the Contractor is qualified to fulfil any part of the contract or to complete the work contemplated therein.
16. The Owner reserves the right to reject the proposal of any contractor who has previously failed to perform properly, or complete on time, contracts of a similar nature.

B. Codes: Comply with applicable sections of the following for interior and exterior installations. Ensure you are using the latest and most current standards and regulations applicable.

1. International Building Code (IBC)
2. National Electrical Code (NEC/NFPA 70, 101, 2002)
3. National Electrical Safety Code (NES IEEE C2-1997)
4. IEEE Std. 1100-1999 Recommended Practice for Powering and Grounding Sensitive Electronic.
5. IEEE-SA 802.3, 803.11, and 803.16 series Standards for Ethernet, PoE, and Wi-Fi Information Technology.
6. Local Codes, amendments, and ordinances.
7. ANSI/TIA Standards, current revisions of 568, 569, 606, 607, 1152 standards

C. Comply with NFPA 70.

D. 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 in- tended use.

1.8 WARRANTY

A. The guarantee shall be such, that during the 25-year period, if Owner determines that any cable no longer certifies at 1Gb/sec, the contractor shall correct it within 5 working days.

1.9 COORDINATION

A. Adjust arrangements and locations of distribution frames, patch panels, and cross connects in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

B. Coordinate work of this section with IDEA IT Network Services Department for their system specifications, telephone instruments, workstations, equipment suppliers, etc.

1.10 PLANS AND SPECIFICATIONS

A. The intent of the project drawings is to establish the types of systems and functions, but not to set forth each item essential to the functioning of the system.

B. Electrical drawings are generally diagrammatic and show approximate location and extent of work.

C. Install the work complete including minor details necessary to perform the function indicated. Provide communication systems (including all hook-ups) complete in every respect and ready to operate.

D. If clarification is needed, consult the Architect/Engineer.

E. Review pertinent drawings and adjust the work to conditions shown. Where discrepancies occur between drawings, specifications, and actual field conditions, immediately notify the Architect/Engineer for his interpretation.

F. The Architect/Engineer reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.

1.11 MANUFACTURERS' INSTRUCTIONS

A. All equipment and devices shall be installed in accordance with the drawings and specifications, manufacturer's instructions, and applicable codes.

B. Where specifications call for installation of a product to be in accordance with manufacturer's instructions and/or where manufacturer's instructions are required for installation of a product, it shall be the contractor's responsibility to obtain the necessary applicable manufacturer's instructions and install the product in accordance with the manufacturer's instructions.

C. It shall be the Contractor's responsibility to install all equipment, materials, and devices shown on the plans and as called out in these specifications even if manufacturer's instructions are absolutely unattainable.

1.12 ACCEPTABLE MANUFACTURERS AND SUBSTITUTIONS

A. Descriptions and details, acceptable manufacturers' names listed, and specific manufacturer and model number items indicated in the plans and specifications shall establish a standard of quality, function, and design. Manufacturers and model numbers listed "no exceptions" shall not be substituted without specific notice in an addendum. Otherwise, where a specific manufacturer's product is indicated, products of other manufacturers listed as acceptable may be submitted for approval based on the substitute product being, in the opinion of the Engineer, of equivalent or better quality than that of the product specified.

B. Proposed contractors wishing to propose systems which differ in manufacturer, features, functions, or operating characteristics from those outlined in these specifications must do so in writing to the specifying authority at least ten (10) days prior to the proposal opening.

C. For manufacturers equipment or models other than that specified, the proposed contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. Proposals must include detailed information showing all deviations from the system as specified and include relevant technical and cost data. This shall include a complete description of the proposed substitution, drawings, catalog cuts, performance data, test data, or any other data or information necessary for evaluation.

D. The Engineer will consider all such submittals, and the Architect will issue an addendum listing items that the Engineer considers acceptable. Only such items as specified or approved as acceptable will be installed on this project.

E. Substitute products for which the proposed contractor does not obtain prior approval will not be considered acceptable for this project. Final approval of the alternate system shall be based on the decision of the Owner and Architect. Prior approval to make a proposal for this project does not automatically ensure the system will be an acceptable equivalent.

F. It is the responsibility of the Contractor to provide all features and functions as outlined in these specifications. The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.

G. The selected contractor must be a certified Integrator/Installer authorized by one of the Manufacturers listed below to provide an extended warranty to the Owner covering all network cable and connectivity hardware products comprising this installation site. All UTP cable, fiber optic

cable, and all wiring devices installed shall be products of one approved manufacturer or joint manufacturers program and approved for use in their extended warranty program. The Contractor and Manufacturer shall jointly provide the Owner an extended warranty of the installed system against defects in material or workmanship; provide a copy of contractor certification.

H. The manufacturers model numbers, functions, and features described in this specification section are those of the CommScope Uniprise with a 25-Year Extended Product Warranty and Application Assurance per District standards, no exceptions.

I. The Contractors' proposal represents that the contract proposal price is based solely upon the materials, equipment, and labor described in the Contract Proposal Documents (including addenda, if any) and that he contemplates no substitutions or extras.

J. The manufacturer of the proposed substitute unit shall provide samples for evaluation, when required, at no charge and non-returnable.

K. Requests for substitution are understood to mean that the Contractor:
1. Has personally investigated the proposed substitution and determined that it is equivalent or superior in all respects to that specified.
2. Will provide the same guarantee for the substitution that he would for that specified.
3. Will, at no cost to the Owner, replace the substitute item with the specified product if the substitute item fails to perform satisfactorily.
4. After Award of the Contract, substitutions will be considered only under one or more of the following circumstances:
    a. The substitution is required for compliance with subsequent interpretations of code or insurance requirements.
    b. The specified product is unavailable through no fault of the Contractor.
    c. The manufacturer refuses to warranty the specified products as required.
    d. Subsequent information indicates that the specified product is unable to perform properly or to fit in the designated space.
    e. In the Engineer's sole judgment, the substitution would be in the Owner's best interest.
    f. Revisions to the electrical system caused by substitutions shall be under the supervision of the Engineer, at a standard hourly rate charged by the Engineer. Charges from the Engineer, Architect, and Electrical Contractor shall be paid by the Contractor originating the changes.

1.13 FUTURE USE CABLING

A. When cabling is installed for future use, it shall be identified with a tag of sufficient durability to withstand the environment involved.

1.14 LOCATIONS AND EXISTING CONDITIONS:

A. Location and condition of any existing equipment or services, when shown, have been obtained from substantially reliable sources, are shown as a general guide only, without guarantees as to accuracy.

B. The Contractor will examine the site, verify all requirements, service points, and availability of all services required to complete this project. No consideration will be granted for any alleged misunderstanding of the materials and labor to be provided as necessitated by nature of the site including those items that may be fairly implied as essential to the execution and completion of any and all parts of this project.

1.15 PROTECTION OF EQUIPMENT AND MATERIALS

A. The Contractor shall take such precautions as may be necessary to protect his apparatus from damage.

B. This shall include the creation of all required temporary shelters to protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering.

C. Failure to comply with the above to the satisfaction of the Owner's inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by the Contractor.

1.16 CUTTING AND PATCHING

A. Notify the Builder sufficiently ahead of construction of any floors, walls, ceiling, roof, et cetera, of any openings that will be required for his work.

B. The Contractor shall see that all sleeves required for his work are set at proper times to avoid delay of the job.

C. All necessary cutting of walls, floors, partitions, ceilings, et cetera, as required for the proper installation of the work under this Contract shall be done at the Subcontractor or at the Subcontractor's expense in a neat and workmanlike manner, and as approved by the Architect/Engineer.

D. Patching of openings and/or alterations shall be provided by the communications Subcontractor or at the Subcontractor's expense in an approved manner.

E. No joists, beams, girders, or columns shall be cut by any Contractor without first obtaining written permission of the Architect/Engineer.

F. All openings in firewalls and floors shall be completely sealed after installation for a completely airtight installation. Sealing material shall be non-combustible and UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated structure to be decreased.

G. All openings in exterior walls shall be sealed watertight.

H. Seal voids around conduits penetrating fire-rated assemblies and partitions using fire stopping materials and methods in accordance with NFPA and local codes.

1.17 INSTALLATION

A. Cooperation with trades of adjacent, related or affected materials or operations, and or trades performing continuations of this work under subsequent contracts are considered a part of this work. In order to effect timely and accurate placing of work and to bring together, in the proper and correct sequence, the work of such trades, including work provided under a Division 1 allowance.

B. The Communications Contractor shall coordinate installation of the communication systems with the Builder, Electrical, Mechanical, and Plumbing Contractors to insure a complete working system for the Owner.

C. Where required for accessibility all conduit and boxes for all communication systems shall be provided by the Electrical contractor as specified, including systems in Division 27, any and all allowances shall be included. Normally low voltage wiring shall run open and supported in accessible attic space. All low voltage wiring in exposed areas such as gyms, stages, shops, and field houses shall be enclosed in conduit. Coordinate with and verify with Division 26 to provide required conduit and boxes at locations and heights as required.

D. Conduit, innerduct, track, or raceway shall conceal and protect wiring in exposed areas, within walls, through in- accessible areas, floors, chases, under slab, crawlspaces, or underground.

E. All conduit, duct, track, and raceway runs shall be spaced apart to allow for maintenance, such as the installation of couplings, without disturbing adjacent pathways.

F. All work must be performed by workers skilled in their trade. The installation must be complete whether the work is concealed or exposed.

G. Provide stainless screw/bolt hardware wherever stainless devices are used and in potentially wet areas.

H. Coordinate the actual locations of devices and outlets and equipment with building features and mechanical equipment as indicated on architectural, structural, and mechanical drawings. Review with the Architect any proposed changes in outlet or equipment location. Relocation of devices, before installation, of up to 3 feet from the position indicated, may be directed without additional cost. Remove and relocate outlets placed in an unsuitable location when so requested by the Architect.

1.18 FINAL OBSERVATION

A. It shall be the duty of the Contractor to make a careful observation trip of the entire project, assuring themselves that the work on the project is ready for final acceptance before calling upon the Architect/Engineer to make a final observation.

B. To avoid delay of final acceptance of the work, the Contractor shall have all necessary bonds, warranties, receipts, affidavits, et cetera, called for in the various articles of these specifications, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and shall deliver the same to the Architect/Engineer at or before the time of said final observation. The Contractor is cautioned to check over each bond, receipt, et cetera, before preparing for submission to verify that the terms check with the requirements of the specifications.

C. The following and other provision of Division 1 General Conditions will be required at time of final completion:
   1. Final clean up completed.
   2. All systems are fully operational, all material and devices installed.
   3. As built (as installed) drawings and operations manuals

1.19 DRAWINGS, MANUALS, AND TRAINING

A. As-built drawings and operating and maintenance manuals may be electronically transmitted in PDF file format.

B. Upon completion of the installation, and prior to final inspection, the Contractor shall furnish as-built drawings.

C. In addition, the contractor shall furnish complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets. Manuals shall include wiring diagrams to indicate internal wiring for each device and the interconnections between the items of equipment. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system. Provide a parts list with manufacturer and model number for commonly replaced parts. Include complete instructions for the inspection, testing, and maintenance of the system. Place final cable certification test results in manuals.

D. All cable paths and wiring methodology shall be documented. All cables shall have both ends labeled and included in the as-built documentation. Provide an MS Excel worksheet compatible format spreadsheet file cross referencing all cable run numbers, architectural room number, and owners room number for the origin and destination of each cable run.

E. A formal on-site training session shall be provided by the Contractor to the Owners Representative / Maintenance personnel and shall include instruction on the documentation, location, inspection, maintenance, testing, and operation of all system components. Provide a minimum of two (2) hours of documented general instruction.

1.20 QUALITY ASSURANCE

A. All Vendors must meet all applicable codes / standards defined below, and any others that may be defined.

B. The Vendor will follow the National Electric Code (NEC), the National Electric Safety Code (NESC), any applicable State of Texas code, and local codes.

C. The Vendor will provide materials and equipment that is new and will conform to the NEMA, UL, ANSI, IEEE, and IPCEA standards. All cabling will follow the BISCI standards of installation, testing and maintenance.

D. The vendor is required to provide a CommScope 25-year Extend Product Warranty and Application Assurance at job completion.

E. Standards:

1. ANSI/TIA/EIA Standards 568D - Commercial Building Telecommunications Cabling Standard
2. ANSI/TIA/EIA Standard 569 - Commercial Building Standards for Telecommunications Pathways and Spaces
3. ANSI/TIA/EIA - 606 - Administration Standard of the Infrastructure of Commercial Buildings
4. ANSI/TIA/EIA - 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
5. ANSI/TIA/EIA - 758 - Customer Owned Plant Telecommunications Cabling Standard
6. TSB-67, 95, and 72 - Testing standards and reporting

PART 2 - SCOPE OF PROJECT/SCOPE OF WORK

2.1 SCOPE OF WORK

A. The Horizontal Structured Cabling System shall consist of Category 6 and 6a cables routed and secured from the Telecommunications Room on each floor to the outlets as shown on drawings. All Category 6 outlets will terminate in the Telecommunications Room on 24-port and 48-port Category 6 patch panels. Wire management shall be used to provide cable management above, below and to each side of the patch panel.

B. All structured cabling shall be from a single manufacturer to insure optimum performance.

C. Provide a Commscope Uniprise data and telephone cable plant with a 25-Year Extended Product Warranty and Application Assurance per District standards

D. Contractor will provide all materials to place and terminate all outlet types.

E. Contractor will be responsible for supplying and coordinating the delivery of fiber and copper patch cords.
   1. Delivery date will be prior to substantial completion date and agreed upon between Owner and Contractor.
   2. A transmittal sheet showing list of parts and quantities must be signed by the Owner authorized person.

F. Owner will be responsible for fiber and copper patch cord installation.

G. Cable Routing and Installation

   1. System wiring and equipment installation shall be in accordance with good engineering practices as established by the EIA and the NEC. Wiring shall meet all state and local electrical code requirements.
   2. The cable support system shall provide a protective pathway, using J-hooks, to eliminate stress that could damage the cabling. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling. Detailed information on cable installation in Section 9.
   3. Horizontal cabling must not be fastened to electrical conduits, mechanical ductwork/piping, sprinkler pipes, or routed to obstruct access to hatches, doors, utility access panels, or service work areas. Do not route cables through fire doors, ventilation shafts, grates, or parallel with line voltage electrical conductors.
   4. For Work Area outlets/endpoints, each cable run shall include a 20-foot service loop with Velcro hook ties located above the ceiling. This is to allow for future relocation, re-termination, or repair.
   5. For each portable building, each cable run shall include a three-foot service loop with Velcro hook ties located in the ceiling above the rack. This is to allow for future re-termination or repair.

2.2 BACKBONE-FIBER

A. The Backbone Fiber Riser System shall consist of fiber cables with six (6) 50-um OM4 multimode interlocking armor cable placed from IDF modular building and terminating in the MDF, as shown on the drawings.

B. Sharp edges of interlocking armor will be terminated with MC-type connector and attached to Rack mount bracket or to Fiber shelf.

C. Interlocking armor will be bonded to ground per manufacturer's instructions.

D. All fiber terminations shall be fusion spliced pigtails with LC connectors.

E. Fiber will be terminated and routed through rack mount fiber panels.

F. 2 duplex 7' LC OM4 riser-rated patch cords will be provided for each closet.

2.3 CABLE SUPPORT

A. Conduit, duct, or track shall be used for communication cable in exposed areas.

B. Cable fill shall not exceed the manufacturers' instructions for each type of support.

C. All conduit, ducts, track, and raceways

D. Solid, ladder, or mesh cable tray/duct shall be required for narrow depth cable routes that would allow sags to rest upon the ceiling, electrical conduits, HVAC equipment, ducts, or lighting fixtures.

E. Vertical cable runs exceeding 12" in equipment closets shall require ladder or mesh type cable support tray. Attachment shall utilize appropriate mounting hardware and accessories for vertical placement and allow a minimum of 2" clearance between the wall and runway. Cable attachment shall be made by Velcro hook ties in a basket type configuration.

F. All vertical supports shall be attached to the building support structure or concrete ceiling with anchors load rated for 100-lbs. minimum. Down rods shall be a minimum of 1/4" diameter. Steel uni-strut cross supports shall be 2" minimum.

G. Cable runway or tray shall be grounded to an appropriate building ground at each end and bonded at each joint.

H. Rubber or plastic boots shall be installed at the ends of horizontal support rails to prevent cable damage or injuries to personnel.

2.4 J-HOOKS

A. The cabling from the Telecommunications Rooms will be routed to their respective outlets utilizing J-Hooks above ceiling and below floor. Cables will be bundled in groups of less than 50 and placed no more than 5' apart following the pathway from Telecommunications Room to work area outlet. J-Hooks and all mounting hardware as well as any placement of these devices are the responsibility of the contractor.

B. Attachments for cabling support shall be spaced at approximately 48 to 60 inches on center. Cable bundles shall not be allowed to sag down more than 12-inches mid-span between attachments.

C. Category 6, all attachments shall be approved for Category 6 cabling. Attachments shall be Caddy part numbers as follow, or equivalent, sized as follows:
   1. CAT16HP, 1” diameter Capacity 15 Category 6 cables.
   2. CAT21HP, 1.31” diameter Capacity 40 Category 6 cables.
   3. CAT32HP, 2” diameter Capacity 60 Category 6 cables.
   4. Split bundles greater than 2" dia. or provide cable tray.

D. Category 6A, all attachments shall be approved for Category 6A cabling. Attachments shall be Caddy part numbers as follow, or equivalent, sized as follows:
   1. CAT16HP, 1” diameter Capacity 10 Category 6A cables.
   2. CAT21HP, 1.31” diameter Capacity 12 to 24 Category 6A cables.
   3. CAT32HP, 2” diameter Capacity 25 to 35 Category 6A cables.
   4. CAT48HP, 3” diameter Capacity 48 Category 6A cables.
   5. Split bundles greater than 48 cables (maximum allowed bundle size) or provide cable tray.

E. Do not mix different signal strength cables on the same J-Hook (i.e. fire alarm with data and telephone cable). Multiple J-Hooks can be placed on the same attachment point, up to the rated weight load of the attachment device.

2.5 RACK HARDWARE

A. Rack Hardware will be utilized in each modular building to house terminated Category 6 patch panels, and network switch equipment. All rack hardware will be secured to the wall with appropriate wall-mount hardware.
B. Vertical cable management will be utilized between each rack and at the end of each rack row to manage vertical patch cables.
C. Horizontal wire management shall be provided so there will be wire management above and below each copper patch panel.
D. All rack hardware shall be grounded to an approved building ground.

2.6 CABLE TIE WRAPS (PLENUM RATED)

A. Plenum rated Velcro hook cable ties shall be furnished and installed to attach wire bundles to supports and for appropriate wire management as required. Provide and install Panduit TAK- TY HLTP series cable ties with UL 94-V2 flammability rating, or equivalent.

B. Hard plastic or metal tie wraps will not be allowed on any data cable (Category rated UTP).

2.7 MEASURING PULLING TAPE (MULE TAPE)

A. All future use innerduct and conduit cable pathways shall include a Measuring Pulling Tape (Mule Tape) made of woven Polyester, Aramid, Kevlar, or an equivalent fiber blend. Measuring Pulling Tape shall have a minimum tensile strength of 1250 lbf. or as required and shall be pre-lubricated for prevention of burn though and marked for measuring in feet.

B. Measuring Pulling Tape installed in underground pathways shall incorporate a 22-gauge minimum solid corrosion resistant copper conductor for use in radio signal locating procedures.

2.8 LADDER TRAY

A. Ladder tray shall be placed inside the IDF’s and MDF to provide a pathway into the room and routing the cables to the rack mounted termination hardware. Ladder tray will be 18” wide and mounted to

walls and racks. Ladder tray shall be mounted above racks and doors to allow a natural cable drop from the ladder tray to the rack.

B. All cable trays shall be grounded to an approved building ground.

C. Ladder type cable tray shall be routed over all floor mounted racks from wall to wall, provide all necessary hardware to attach the ladder rack to the top of the floor rack and to the walls. All field cuts shall be filed smooth, dressed square, and painted to match with CPI Part No. 25401-700 Black Touch-up Paint. Utilize tray splicing, support, and coupling hardware supplied by and installed as recommended by the manufacturer. Cable tray and rack shall be securely supported and grounded. Cable tray shall be of heavy-duty tubular steel construction with black powder coat finish, 12" wide, with cross members at 12" intervals. Chatsworth Product Inc. (CPI) Part No. 10250-712 Tubular Runway. At each ladder rack joint, provide a CPI Part No. 40164-001 Grounding Kit. Provide CPI Part No. 10642-001 fire-retardant flat black colored rubberized material end caps to cover all exposed ends of ladder rack. At the top of each rack, provide a CPI Part No. 10595-712 Rack-to-Runway Mounting Plate, CPI Part No. 10506-702 Cable Runway Elevation Kit, and CPI Part No. 12100-712 Cable Runway Radius Drop. At each wall, provide a CPI Part No. 11421-712 Horizontal Wall Angle Support. Provide CPI 12362-712 Cable Runway Center Support hanger brackets and similar and 5/8" all-thread rod hanger supports from the building structure at any span that exceeds 60" from other support (rack and wall mounting locations), at intervals of 60" on center maximum.

2.9 FIRE-STOPPING SYSTEMS

A. Suitable fire-stopping shall be used to prevent the spread of smoke and fire throughout the building. Contractor will be responsible for installing fire-stopping system for every wall or floor penetration as required by code.

2.11 GROUNDING

A. Contractor shall provide a ground bar at each termination location (Telecommunications Rooms and Equipment Room). Contractor shall provide a #6 AWG stranded copper wire cable between ground bars located at each TR and ER to the building main service ground point.
B. This ground conductor shall be utilized for grounding termination equipment, equipment rack and cable tray.

PART 3 - TELECOMMUNICATION NETWORK SYSTEM REQUIREMENTS

3.1 The Structured Cabling System shall consist of any one or all of the following structured cabling elements or subsystems:

A. Work area
B. Horizontal cabling
C. Telecommunications room (or horizontal cross connect)
D. Backbone cabling

E. Equipment room
F. Entrance facility
G. All cable support structure

3.2 SUPPORTED APPLICATIONS

A. The Structured Cabling System shall be capable of supporting and/or integrating the following:
   1. Analogue and digital voice applications
   2. Data applications
   3. Local area network services
   4. Wide area network services
   5. Video /Imaging services
   6. Low voltage devices for building controls

3.3 Additional requirements

A. Categorized copper product shall be used in conjunction with an equivalent or higher Category cable as verified by ETL or TSV.

B. All structured cabling products shall be installed according to any applicable instructions.

C. All networks and other applications shall be installed per applicable standards and manufacturers' guidelines and transmitted over the appropriate minimum Category copper cable or fiber cable for which it was intended to operate on.

D. All applicable local, state, national, and federal electrical and fire safety standards shall be adhered to during and after installation.

PART 4 - WORK AREA OUTLET

4.1 The Work Area shall consist of the connectivity equipment used to connect the horizontal cabling subsystem and the equipment in the work area. The connectivity equipment shall include the following options:

A. Patch (equipment) cords
B. Faceplates

4.2 Category 6 and Category 6a Copper Outlets

A. All category 6 information outlets designed for termination of 4-pair balanced twisted-pair category 6 copper cables must possess the following characteristics at the minimum:

   1. Be able to be a gravity feed (45 degree angled) as well as flush mount utilizing the same jack.
   2. Have 110 style insulation displacement connectors with quadrant pair isolation and a pyramid wire entry system. Termination is accomplished with a single conductor impact tool.
   3. Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity.
   4. Have rear protective strain relief caps rear entry, which will be installed onto cable after termination.
   5. Support industry standards for T568A or T568B wiring options (568B wiring scheme applicable to this project) on each individual outlet.
   6. Be side-stackable for high-density solutions.

7. Provide color-coded and labeled for VOICE, DATA or Blank, Snap-In icons for circuit identification.
8. Be constructed of high impact, flame-retardant thermoplastic.
9. Must be Third Party Verified to all claims.
10. Verified to ETL TSV performance in a channel

4.3 Face/Wall plates

A. The faceplates shall support the network system by providing high-density in-wall, surface mount or modular office furniture cabling applications. The outlets consist of faceplates for flush and recessed in-wall mounting as well as mounting to the modular office furniture systems. The surface mount boxes can be mounted where in-wall applications are not possible or to support applications where surface mount is the best option.

B. Faceplates shall be available in single gang design in White and available in (1,2, or 3) port openings. They shall feature openings on both sides to allow easy identifications of the ports and accept Uniprise information outlets. They shall come equipped with mounting screws, label covers, and label cards.

1. CommScope – M13L-262 (3-port outlet)
2. CommScope – M12L-262 (2-port outlet)
3. CommScope – M10L-262 (1-port outlet)

C. Outlets at faceplate will color code according to application

1. CommScope Uniprise- UNJ600-BL (for all Data Drops)
2. CommScope Uniprise- UNJ600-VL (for all Projectors)
3. CommScope Uniprise- UNJ600-OR (for all Analog)
4. CommScope Uniprise- UNJ600-YL (for all Security Cameras)
5. CommScope Uniprise- UNJ600-262 White (for all intercom)

D. All category 6a information outlets designed for termination of 4-pair balanced twisted-pair category 6a copper cables must possess the following characteristics at the minimum:

1. Be able to be a gravity feed (45 degree angled) as well as flush mount utilizing the same jack.
2. Have 110 style insulation displacement connectors with quadrant pair isolation and a pyramid wire entry system. Termination is accomplished with a single conductor impact tool.
3. Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity.
4. Have rear protective strain relief caps rear entry, which will be installed onto cable after termination.
5. Support industry standards for T568A or T568B wiring options (568B wiring scheme applicable to this project) on each individual outlet.
6. Be side-stackable for high-density solutions.
7. Provide color-coded and labeled for VOICE, DATA or Blank, Snap-In icons for circuit identification.
8. Be constructed of high impact, flame-retardant thermoplastic.
9. Must be Third Party Verified to all claims. Verified to ETL TSV performance in a channel

E. Outlets at faceplate will color code according to application

1. CommScope Uniprise- UNJ10G-GN (for all WAP Drops)

4.4 Above Ceiling/Structure Mounted Jack Locations

1. Jack type to match colors above and shall be as follows:
2. CommScope part number M101SMB-B-262 securely mounted to structure above the finished ceiling with Category 6/6a jacks and blanks as required.

4.5 Patch Cords

A. All category 6 Patch (Work-area) Cords shall use 4-pair balanced twisted-pair category 6 23 AWG stranded twisted pair copper cable and be available in both Booted and Non-Booted options.

B. For work area data drops, we require the following length and quantity of patch cords.
1. Two (2) CAT 6 work area patch cord, 25 feet in length and Blue in color shall be provided. UC1BBB2-0ZF025
2. Two (2) CAT 6 work area patch cord, 50 feet in length and Blue in color shall be provided. UC1BBB2-0ZF050

C. For Data Drops, provide one Blue category 6 10' patch cord per drop. UC1BBB2-0ZF010

D. For Projector Drops, provide one Purple category 6 10' patch cord per drop. UC1BBB2-0LF010

E. For Analog Drops, provide one Orange category 6 10' patch cord per drop. UC1BBB2-06F010

F. For Security Camera Drops, provide one Yellow category 6 10' patch cord per drop. UC1BBB2-09F010

G. For Intercom Drops, provide one White category 6 10' patch cord per drop. UC1BBB2-08F010

H. For WAP Drops, provide one Green category 6a 10' patch cord per drop. UC1BBB2-0MF010

I. Patch cords shall be from the same manufacturer as the horizontal cabling to insure optimum performance.

PART 5 - HORIZONTAL CABLING SUBSYSTEM

5.1 The horizontal cabling system is the portion of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the horizontal cross-connect in the TC.

A. Horizontal cabling in an office should terminate in a TC located on the same floor as the work area being served

B. Horizontal cabling is installed in a star topology (home run)

C. Bridged taps and splices are not permitted as part of the copper horizontal cabling

5.2 Copper UTP Cable

A. Category 6 UTP Cable
1. * Maximum cable length is 90 meters
   a. Cat 6 - CommScope CS37P – Plenum-rated
   b. Cat 6A - CommScope CS44P – Plenum-rated (WAP cabling only – Green)

B. These requirements are for cables of four unshielded twisted pairs of 23 AWG bare copper, thermoplastic insulated solid conductors enclosed by a thermoplastic jacket. The finished cable shall exceed the requirements of ANSI/TIA/EIA-568-B.2-1 Category 6.

C. All cable shall conform to the requirements for communications circuits defined by the National Electrical Code (Article 800) and the Canadian Building Code. All cable shall be listed with an OSHA approved laboratory and carry labeling of either CMP or CMR whichever is appropriate for the installation environment.

D. The cable manufacturer shall be ISO 9001 registered.

5.3 Cabling Testing Criteria

1. Tested to 650 MHz
2. Maximum Delay Skew < or = 25 ns
3. Typical Positive Power Sum ACR ≥ 400 MHz
4. Capacitance Unbalance of 58.2 pF Max @ 23 degrees Celsius.
5. Typical PSUM NEXT & NEXT ≥ 10dB better than category 6 standard

5.4 Cable Color Scheme

A. Color scheme for cable runs and patch cables are indicated below. Selected cabling vendor should confirm quantity of each with construction and IT to ensure correct number and type of runs.

B. The color code shall be as follows:

Purpose	**Color**
Data (wall jacks)	Blue
Wireless Access Points	Green
Projectors	Purple
Analog (security/fire/elevator x-connect)	Orange
Security Cameras	Yellow
Intercom	White

5.5 Cable Run Designator Labeling Scheme

A. Each patch panel jack, wall plate jack, terminal cabinet connector, both ends of each cable run and on the ceiling grid bar at jack locations that are concealed above a drop ceiling shall be labeled with a cable scheme run designator machine printed labels installed according to EIA/TIA 606 standards. All labeling shall conform to industry standards and best practices. Labeling types and scheme shall be verified and coordinated with the Owner prior to any installation.

B. Patch panels are to be labeled based on room number (or closet number), sequential order and purpose as indicated in the below example.

C. <Room #>-<Patch Panel #><Port# on patch panel>-<Purpose>

IT Closet (Patch Panel)	***Room (Faceplate)***
RM228-A04-AP	MDF123-A04-AP
RM228-A05-P	MDF123-A05-P
RM228-A06-D	MDF123-A06-D

Note: Patch panel # is indicated by letter. (A, B, C, etc.)

D. Third Party Systems are to be terminated on the patch panel and labeled as indicated below. At the device, the cable should be labeled indicating closet and patch panel label. No devices should be connected directly into the switch and third-party vendors are expected to coordinate needed drops with the selected cabling vendor.

IT Closet (Patch Panel)	***Device***
RM123-A46-HVAC001	MDF123-A46-HVAC001
RM123-A47-LGHT001	MDF123-A47-LGHT001
RM123-A48-MRQ001	MDF123-A48-MRQ001

PART 6 – IT RACK FOR BUILDING

6.1 The IT racks for buildings includes those products that connect the networking equipment to the horizontal and backbone cabling subsystems. These products include termination hardware (connectors, patch cords, UPS unit), racks, cable management products and cable routing products.

6.2 Data / Telephone Cabling Plan

A. Provide adjacent to the equipment rack in each MDF and IDF a plan view of all building areas covered by the equipment closet meeting the following requirements:

1. Framed and secured to the wall and plan covered with clear acrylic panel.
2. Size to clearly show all required information.
3. "YOU ARE HERE" indicator with arrow.
4. Room names and numbers. Verify with Owner.
5. Show each device with symbol and identification address number as designated by owner.
6. Symbol legend.
7. True north arrow
8. Scale indicator

6.3 Cable Management

A. The Cable Management System shall be used to provide a neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures. The system shall be a complete cable management system comprised of vertical and horizontal cable managers to manage cables on both the front and rear of the rack. The system shall protect network investment by maintaining system performance, controlling cable bend radius, and providing cable strain relief.

B. Rack Systems

1. IT rack-Modular building
   a. Include one (1) per modular building, Tripp Lite SRWF4U36 Low-Profile Vertical-Mount Server-Depth Wall-Mount Rack Enclosure Cabinet
      - Wall-mount cabinet secures and organizes 4U of 19-inch rack equipment in network wiring closets and other locations with limited floor space. Houses equipment up to 36 inches deep but extends just 8 inches from wall.

- Includes additional 2U of space for patch panel

c. Include one (1) UPS Gigabit Network Card per Battery back UPS unit, Eaton Network M-2
d. Include one (1) 24-port patch panel per rack, CommScope CPP-UDDM-1U-24 Patch Panel, 24 port

C. Cable Tray

1. The Cable Tray in a Telecommunications Room / Equipment Room shall be placed to allow easy access into the room and formed as shown on drawings. Tray shall route cables from room entrance to their termination location. Tray shall use a stand-off bracket to allow cables to be routed above racks and flow easily into vertical managers.
2. All cable trays shall be grounded to ground bar located in the termination location.

D. Cable Termination Hardware

1. Each horizontal or backbone cabling run will be terminated using appropriate connectors or connecting blocks depending upon the cable type. Matching patch cords will be used to perform cross-connect activities or to connect into the networking/voice hardware.

E. U/UTP Modular Patch Panel

1. The modular patch panel must be capable of housing M-Series outlets.
2. The discrete distribution module (DDM) panels should be available in a 24, straight configuration.
3. The panel should consist of a rack mounted base unit, rear cable management hardware, and labels for port numbering.
4. Panel should mount in a 19-inch (483mm) equipment rack with universal hole spacing.
5. The modular patch panel will be installed above and below switches. 24-port patch panels shall be installed above the top switch and below the bottom switch in each rack. 48-port patch panels shall be installed between switches in each rack.
   a. CommScope CPP-UDDM-1U-24 Patch Panel, 24 port

F. Outlets installed in the Modular Patch Panel will be color-coded to match application, workstation drop, and patch cord as follows-

1. CommScope Uniprise- UNJ600-BL (for all Data Drops)
2. CommScope Uniprise- UNJ600-VL (for all Projectors)
3. CommScope Uniprise- UNJ600-OR (for all Analog)
4. CommScope Uniprise- UNJ600-YL (for all Security Cameras)
5. CommScope Uniprise- UNJ600-262 White (for all intercom)
6. CommScope Uniprise- UNJ10G-GN (for all WAP Drops)

G. Copper Patch (Equipment) Cords

1. Category 6 and Category 6a patch cords to complete closet patching shall be provided by the contractor.
2. One (1) foot patch cords are preferred in the rack to avoid the need for horizontal and vertical management of patch cords. Patch cords shall be from the same manufacturer as the horizontal cabling to ensure optimum performance and the color should match their respective cable run color and patch panel outlet.
3. Provide 1 per cable drop ran, plus an additional 3 each of each color and type.

a. Data- Blue category 6, UC1BBB2-0ZF001
b. Projectors- Purple category 6, UC1BBB2-0LF001
c. Analog- Orange category 6, UC1BBB2-06F001
d. Security Cameras- Yellow category 6, UC1BBB2-09F001
e. Intercom- White category 6, UC1BBB2-08F001
f. WAPs- Green category 6a, UC1AAA2-04F001

4. Uniprise Category 6 and Category 6a patch cords are high-performance UTP components available in a broad range of lengths and easy-to trace colors. They are designed to meet or exceed all Category 6 specifications yet are fully backward compatible with Category 5e and lower systems.
5. 23 AWG conductors are securely mated with a patented RJ45 plug design to deliver superior electrical performance with excellent repeatability. The unique anti-snagging feature simplifies removal and replacement of patch cords.

H. Fiber Termination Enclosure

1. Fiber optic vertical rack mount enclosures shall be;
   a. Commscope WB2-EMT-BK-1P-PNL or equivalent

I. Fiber Patch (Equipment) Cords

1. All fiber optic patch cords shall be duplex MM OM4 CommScope fiber patch cords. Connector type shall be CommScope LC connectors for Multi-mode applications. All fiber patch cords shall be CommScope factory assembled and tested, and supplied for each terminated fiber connection per section 7.10

J. Fiber Pigtail Kits

1. All fiber optic pigtails and connectors shall be CommScope. Connector type shall be CommScope LC connectors for Multimode applications. Multimode pigtails shall be constructed with LazrSPEED 550 OM4 fiber.
   a. CommScope FAXLCUC0C-M003 Pigtail Kit (50-um)

PART 7 - BACKBONE CABLING SYSTEM

7.1 The Backbone Cable Subsystem in a building is the part of the premises distribution system that provides connection between equipment rooms, telecommunication rooms, and telecommunications service entrance facilities. A backbone subsystem provides either intra- building connections between floors in multi-story buildings or inter-building connections in campus-like environments.

7.2 All cables shall be run using a star topology (home run) from the Main Cross-Connect (MC) in the Equipment Room to each Horizontal Cross-Connect (HC) within the Telecommunications Room. The length of each individual run of backbone fiber cable shall not exceed 2000 meters for multimode and the length of each UTP cable run for voice applications is not to exceed 800 meters (90 meters for data) as specified under TIA/EIA-568-A.

7.3 The type of backbone fiber cable shall be 50/125 m multimode fiber optic cable. The bending radius and maximum pulling tension of the cable shall be adhered to during handling and installation.

7.4 Fiber Backbone

A. The type of fiber cable used shall contain Laser Optimized 50-micron OM-4 Multimode fiber.

B. Termination enclosure will be located at the top of the rack housing the network equipment in the MDF Room.

7.5 Fiber Cable

A. Fiber Optic Backbone Cable shall be rated OFNP or OFNR per installation environment as defined by the NEC and local authority having jurisdiction.

B. Single Mode

1. Fiber construction shall be single-mode with a core/cladding size of 50/125 microns. Contractor shall purchase and install the appropriate CommScope fan out and breakout materials where dictated by the application and choice of fiber optic cable type. The maximum attenuation of the cable shall be 3.0 dB/km at 850nm and 1.0 dB/km at 1300nm. The cable shall be capable of supporting 10 Gigabit Ethernet to 550 meters.
2. Fiber Optic Cable size shall contain 6 fibers, and termination shall be as per the backbone diagram, or Customer requirements. All Fiber Optical Cable shall be constructed to the requirements listed in Fiber Cable Specifications.
    a. CommScope 50-micron OM-4, LazrSPEED 550 single-mode fiber cable P-006-DZ-5K-FSUAQ

C. All fiber links shall be tested for attenuation using a power meter and light source. The allowable attenuation for any link shall be calculated using the CommScope link loss calculator.

D. All testing shall be accomplished according to Section 11 of ANSI/TIA/EIA-568.1-D
1. CommScope 50-micron OM-4, LazrSPEED 550 Multimode fiber cable P-006-DZ-5K-FSUAQ

E. Fiber Optic Backbone Cable shall be rated OFNP or OFNR per the installation environment as defined by the NEC and local authority having jurisdiction.
1. Multi-Mode
    a. Fiber construction shall be single-mode with a core/cladding size of 50/125 microns. Contractor shall purchase and install the appropriate CommScope fan out and breakout materials where dictated by the application and choice of fiber optic cable type. The maximum attenuation of the cable shall be 3.0 dB/km at 850nm and 1.0 dB/km at 1300nm. The cable shall be capable of supporting 10 Gigabit Ethernet to 300 meters.
    b. When tested in accordance with FOTP-3, “Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components,” the average change in attenuation over the rated temperature range of the optical fiber cable shall not exceed 0.05 dB/km at 1550 nm. The magnitude of the maximum attenuation change of each individual optical fiber shall not be greater than 0.15 dB/km at 1550 nm

7.6 Fiber Cable Specifications

A. This optical fiber backbone cable shall be suitable for installation in building riser systems, in conduit, in cable tray and/or in innerduct.
1. Optical fiber cable shall be encased in an interlocking armor with an overall jacket.
    a. Optical fiber cable shall carry an OFCP (Optical Fiber Conductive Plenum) or OFCR (Optical Fiber Conductive Riser) rating, depending on installation environment.
    b. Outer Sheath: The outer sheath shall be marked with the manufacturer’s name, date of manufacture, fiber type, listing (OFCP or OFCR), manufacturer’s identification number, and sequential length markings every two feet.

2. Temperature Range:
    a. Storage: -40ºC to +70ºC (no irreversible change in attenuation).
    b. Operating: -20ºC to +70ºC.
3. Humidity Range: 0% to 100%.
4. Single Unit Cables:
    a. Maximum Tensile Strength (2 fibers).
    - During Installation: 1001 Newton (225 lb. force) (no irreversible change in attenuation).
    - Long Term: 300 N (67 lb. force).
    b. Maximum Tensile Strength (≥4 fibers):
    - During Installation: 1335 Newton (300 lb. force) (no irreversible change in attenuation).
    - Long Term: 400 N (90-lb. force).
5. Multiple Unit Cables:
    a. Maximum Tensile Strength (≤ 24 fibers).
    - During Installation: 2670 Newton (600 lb. force) (no irreversible change in attenuation).
    - Long Term: 180 N (801 lb. force).
    b. Maximum Tensile Strength (36 to 48 fibers):
    - During Installation: 3560 Newton (800 lb. force) (no irreversible change in attenuation).
    - Long Term: 1068 N (240-lb. force).
    c. Maximum Tensile Strength (≥60 fibers):
    - During Installation: 4450 Newton (1000 lb. force) (no irreversible change in attenuation).
    - Long Term: 1335 N (300-lb. force).
6. Bending Radius:
    a. During Installation: 20 times cable diameter.
    b. No Load: 10 times cable diameter.

7.7 Fiber Hardware

A. All Fiber Optic Termination Hardware shall be CommScope.

7.8 LC Connectors

A. When fusion splicing is not practical, Qwik-II connectors shall be used to terminate multimode fiber. All Fiber Optic Connectors shall be CommScope. They shall be available in LC style connectors.
    1. CommScope MFC-LCF-09-5X LC Connector for 0.9 mm Fiber (MM)

7.9 Fiber Optic Adapter Splice Cassettes

A. The splicing cassette is designed for use in the SD fiber shelf, which has a LGX/1000 style footprint. Fusion splices are utilized and managed inside the cassette after splicing. The cassettes are available with 12 fiber LC duplex connections in 50-micron Multi-mode fiber and Single mode Fiber versions. The splice cassette is provided with pigtails in the appropriate fiber type and fusion splice protection sleeves. Break out kits are not required when utilizing the splice cassette.
B. This product is intended for indoor use or can be used outdoors in a suitable protective enclosure.
    1. CommScope PNL-CS-12LCX-PT Splice Cassette (MM)

7.10 Fiber Optic Patch Cords

A. All fiber optic patch cords shall be available in LC connector type. Cords shall be available in multiple jumper lengths. CommScope's fiber optic jumpers connect the patch panel/shelf to the equipment bay.
B. Contractor will provide three (3) Duplex 5-foot per fiber enclosure.
    1. CommScope FEXLCLC42-MXF005

PART 8 – GROUNDING

8.1 ER to the building main service ground point. This ground conductor shall be utilized for equipment, termination, equipment rack, cable tray and computer equipment grounding.

8.2 All grounding and bonding shall meet the National Electrical Code (NEC) as well as local codes, which specify additional grounding and/or bonding requirements.

8.3 Bonding and Grounding

A. Communication bonding and grounding shall be in accordance with the NEC and NFPA. Horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment. When required by local code, provide a Telecommunications Bonding Backbone utilizing a #6-AWG or larger bonding conductor that provides direct bonding between equipment rooms and telecommunications closets. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure) and is independent of equipment or cable.

PART 9 – EXECUTION

9.1 CABLE ROUTING AND INSTALLATION

A. System wiring and equipment installation shall be in accordance with good engineering practices as established by the EIA and the NEC. Wiring shall meet all state and local electrical code requirements.
B. Cable pathways, conduit, and cable support systems shall be complete with bushings, de- burred, cleaned, and secure prior to installation of cable.
C. All wiring shall test free from opens, grounds, or shorts. All communications cable shall be supported from the building structure and bundled. Do not attach any supports to joist bridging or other lightweight members.
D. The support system shall provide a protective pathway to eliminate stress that could damage the cabling. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.
E. Communications cable must not be fastened to electrical conduits, mechanical ductwork/piping, sprinkler pipes, or routed to obstruct access to hatches, doors, utility access panels, or service work areas. Do not route cables through fire doors, ventilation shafts, grates, or parallel with line voltage electrical conductors.
F. Support shall be provided by mounting appropriate fasteners that may be loaded with multiple cables. Provided that the weight load is carried by the support rod or wire, the support assembly may attach to the ceiling grid for lateral stabilization. The required support wires for the ceiling grid or light fixtures shall not be utilized. Any fastener attached to the ceiling grid shall not interfere with inserting or removing ceiling tiles.
G. The cable pathway of supports must be positioned at least 12 inches above the ceiling grid. Communication cables shall not be run loose on ceiling grid or ceiling tiles.
H. Communication cables shall be run in conduits, where stubs are provided, from wall or floor jacks to accessible areas above finished ceilings. Conduit shall be required only within walls and concealed spaces to provide access.
I. Provide bushings to protect the cable from damage for conduit ends, box openings, and passage through metal studs.

J. Communication cables shall be run in bundles above accessible ceilings and supported from building structure. Cabling shall be loosely bundled with cable Velcro hook ties randomly spaced at 30 to 48 inches on center, cable ties shall not be tight enough to deform cabling and shall not be used to support the cabling.
K. For Work Area outlets/endpoints, each cable run shall include a 20-foot service loop with Velcro hook ties located above the ceiling. This is to allow for future relocation, re-termination, or repair.
L. For MDF/IDF rooms, each cable run shall include a three-foot service loop with Velcro hook ties located in the ceiling above the rack. This is to allow for future re-termination or repair.
M. All cabling shall be placed with regard to the environment, EMI/RFI interference, and its effect on communication signal transmission.
N. Non-conductive fiber optic cable is immune from EMI/RFI interference. Give priority when selecting a route to minimize exposure to possible cable damage from maintenance or service of all systems in the attic space.
O. Do not route any data cable within two feet of any light fixture, HVAC unit, service access area, electric panel, or any device containing a motor or transformer.
P. Communication cable will not be installed in the same conduit, raceway, tray, duct, or track with line voltage electrical cable without a metallic barrier meeting NEC requirements.
Q. Maximum cable pulling tension should not exceed 25 pound-force (110 N) or the manufactures recommendation, whichever is less.
R. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.
S. No terminations or splices shall be installed in or above ceilings, other than in designated end point housings.
T. Cable bends shall not be tighter that the manufacturers' suggested bend radius.
U. Mount all equipment firmly in place. Route cable in a professional, neat, and orderly installation.
V. Provide for adequate ventilation to all equipment racks and take precautions to prevent electromagnetic or electrostatic hum.

9.2 UTP CABLE TERMINATION PRACTICES

A. Insulation Displacement Contact (IDC) connectors shall be used and installed per the manufactures' recommendations.

B. Strip back only as much cable jacket as required to terminate.

C. Preserve wire-pair twists as closely as possible to point of termination (0.5" maximum) to keep signal impairment to a minimum.

D. Avoid twisting cable jacket during installation.

E. Take care to ensure all data UTP wiring devices are designed for T568B wiring, T568A devices use a different pair assignment and should not be mixed.

9.3 OPTICAL FIBER CABLE INSTALLATION AND TERMINATION PRACTICES

A. The following fiber optic connector installation methods are acceptable; fusion splice connection of factory-made pigtail connectors, epoxy/polish style connectors, or non-epoxy compression cam gel style connectors. In each case, the connector manufactures' instructions shall be followed and the recommended tools and supplies, including breakout kits when required, shall be used for termination and testing. All Fiber strands to be terminated including future use pairs.

B. As per industry standard - IEC 61300-3-35 during optical fiber connector termination, certify all terminations with a 200-power microscope (minimum). Follow all of the connector manufacturers' recommendations. Unacceptable flaws in the terminations will include, but not be limited to, scratches, full or partial cracks, bubbles, pits, or residual dirt, dust, oil, moisture, grinding or sanding debris in the connector. The acceptable final inspection shall show a connector tip that is properly aligned and free of imperfections in 100% of the core and 80% of the cladding. Any connectors that fail testing shall be inspected and re-tested after rework.

C. During installation of optical fiber cable, do not allow pulling tension to exceed cable manufacturers' specification for the cable being installed. Only the strength member of the cable shall be subjected to the pulling tension.

D. Clean all optical fiber connector tips prior to inserting them into mating receptacles or bulkheads and re-install dust covers. Clean the tester launch cord prior to each insertion, as well.

9.4 WARRANTY, SERVICE, TESTING, CERTIFICATION

A. The Contractor must provide an extended warranty that is inclusive of the Manufacturer's warranty to the Owner covering all network cable and connectivity hardware products comprising this installation site. The Contractor and Manufactured shall jointly provide the Owner an extended warranty of the installed system against defects in material or workmanship for a period of no less than twenty-five years (period as is customary for the Manufacturer) from the date of substantial completion. Any equipment or cabling shown to be defective shall be replaced, repaired, or adjusted free of charge. All labor and materials shall be provided at no expense to the Owner.

B. The System Contractor shall make a thorough inspection of the complete installation to ensure the following:
1. Complete and functional system.
2. Installed in accordance with manufacturers' instructions.
3. All cabling shall test free from all grounds, opens, and shorts.
4. A representative of the Owner shall have an opportunity to be present for all final testing. Coordinate final testing with Owner, schedule as near as possible to acceptance date.

9.5 UTP CABLES AND LINK TESTING

A. Acceptance Testing: Test each conductor of every cable on the reel to verify length and continuity. Cables that have been damaged in transit must be replaced. Installed cable that proves to be defective will be replaced at the contractor's expense.

B. Final Testing: All UTP cabling will be certified to meet and or exceed the specifications as set forth for Permanent Link Testing of all Power over Ethernet electrical parameters including alien crosstalk performance. Mechanical requirement testing and test methods shall meet ANSI/CEA S–90–661 or ANSI/CEA S–102–732. Certified cable channel performance shall meet or exceed the requirements of ANSI/TIA-568, ANSI/TIA-1152-A, and ISO/IEC 11801 Standards for Structured Telecommunications Cabling Installations in a configuration up to 100 meters at swept frequencies of:
1. 1 to 250 MHz Level III Class E for Category 6
2. 1 to 500 MHz Level IIIe Class EA for Category 6A.

C. Test alien crosstalk (near-end and far-end loss) for a cabling system using a network analyzer with 100-Ω pair terminations as follows;

1. The test device consists of two jacks; one jack is connected to a main test unit and the other to a remote test unit; the main test unit and the remote test unit are connected with a field tester communication channel (patch cord or link).
2. Six-around-one cable-bundle configuration throughout the tested length.
3. Cable ties placed 12 inches apart for the entire length of the bundle, except the last 3.2 feet from each end; no cable-tie-induced deformation of the bundle.
4. Modeling four-connector channel configurations using the worst-case maximum and minimum configurations to determine the worst-case for different parameters.
5. Long channels with 90 meters of permanent link, 5 meters between the consolidation point and the telecommunications outlet, 10 meters of patch cords used to connect active equipment and cross-connect panels.
6. Measurement of alien crosstalk (near-end and far-end loss) between all pairs of the middle-disturbed cable and each pair of all adjacent cables;
7. Measurement of power sum of all 24 adjacent pair cables.

D. The cable tester shall be ETL verified to IEC Level V accuracy or equivalent with the latest version of firmware and shall produce an electronic or printed report, noting label information, for each cable run. These reports are to be included in the close-out documentation. Testing shall be conducted with a Fluke DSX-5000 with OLTS and OTDR functions, or equivalent, permanent link adapters, high-performance channel adapters, termination plugs, 8-pin modular couplers and analysis software. Certifications shall include the following parameters for each pair of each cable installed:

1. Characteristic Impedance 100 Ω +/- 15%
2. Wire map (pin to pin and ground connectivity)
3. Cable Length Permanent Link Test, station (horizontal) cable from patch panel to jack, should not exceed 295 feet (Channel length not to exceed 328 feet)
4. DC Loop Resistance
5. DC Resistance Unbalanced (Difference in DC Resistance between conductors of the same pair)
6. DC Resistance Unbalanced (Difference in DC Resistance between conductors between pairs)
7. Return Loss
8. Insertion Loss
9. Near End Crosstalk Loss (NEXT)
10. Power Sum Near End Crosstalk Loss (PSNEXT)
11. Far End Crosstalk Loss (FEXT)
12. Attenuation Crosstalk Ratio Far End (ACRF)
13. Power Sum Attenuation Crosstalk Ration Far End (PSACRF)
14. Transverse Conversion Loss (TCL)
15. Equal Level Transverse Conversion Transfer Loss (ELTCTL)
16. Coupling Attenuation
17. Propagation Delay
18. Propagation Delay Skew
19. Power Sum Alien Near–End Crosstalk Loss (PSANEXT)
20. Average Power Sum Alien Near End Crosstalk Loss (Average PSANEXT)
21. Power Sum Alien Far–End Crosstalk Loss (PSAFEXT)
22. Power Sum Alien Attenuation to Crosstalk Ratio Far–End (PSAACRF)

9.6 OPTICAL FIBER TESTING

A. Acceptance Testing: Test each strand of every optical fiber cable on the reel with an OTDR, to verify length and continuity. Fiber cables that have been damaged in transit must be replaced. Installed fiber cable that proves to be defective will be replaced at the contractor's expense.

B. Final Testing: After termination, each individual fiber of each cable segment shall be tested bi-directionally using an OTDR, both to determine the installed length and continuity. All individual fibers of each cable segment will be tested using a power meter to determine the actual loss. These readings will be taken at the 850 nm and 1300 nm windows for Multi-mode and 1310 nm and 1550 nm windows for single-mode. Testing will be in both directions. The final readings shall be listed in the certification report. These readings must not be higher than the "Optimal Attenuation Loss." The OAL will be calculated using the manufacturers' factory certified test results, (dB/Km) converted to the actual installed lengths plus the manufacturers' best published attenuation losses for the connector and/or splice installed on this project. (0.20 for Connectors and 0.10 for splices.) The OAL shall be used for comparison with the end-to-end power loss test results prior to acceptance by the construction manager.

C. Fiber optic cable shall be subjected to bi-directional testing meeting ANSI/TIA-568 requirements. The cable tester shall produce a printed report, noting label information, for each cable run. These reports are to be included in the close-out documentation.

10 END OF SECTION

Geotechnical Engineering Report

IDEA Edinburg – Phase III
Edinburg, TX
February 12, 2019
Terracon Project No. 88195004

Prepared for:
Gomez Mendez Saenz, Inc.
Brownsville, Texas

Prepared by:
Terracon Consultants, Inc.
Pharr, Texas

February 12, 2019

Terracon GeoReport

Gomez Mendez Saenz, Inc.
1150 Paredes Line Road
Brownsville, Texas 78521

Attn: Roan G. Gomez, AIA
P: [956] 546 0110
E: rgg@gmsarchitects.com

Re: Geotechnical Engineering Report
IDEA Edinburg – Phase III
2553 Roegiers Road
Edinburg, TX
Terracon Project No. 88195004

Dear Mr. Gomez:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P88195004 dated January 14, 2019. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.
(Texas Firm Registration No.: F-3272)

for: Stephany Chacón, E.I.T.
Staff Engineer

STATE OF TEXAS
ALFONSO A. SOTO
94153
LICENSED
PROFESSIONAL ENGINEER
2/12/19

Alfonso A. Soto, P.E., D.GE
Principal

REPORT TOPICS

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Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
SITE LOCATION AND EXPLORATION PLANS
EXPLORATION RESULTS
SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents.

REPORT SUMMARY

Topic [1]	Overview Statement [2]
Project Description	The project will include the construction of a single-story building with a footprint of approximately 30,500 square feet (sf). Development will also include the construction of flexible and/or rigid pavements for the main access lanes and car parking areas.
Geotechnical Characterization	■ Groundwater was encountered at depths between 10 and 16½ feet below existing grade during drilling operations. ■ The subsurface soils at this site generally consist of Sandy Lean Clay (CL) and Fat Clay (CH).
Potential Vertical Rise (PVR)	The existing Potential Vertical Rise (PVR) of the soils within the proposed building area in present condition is about 1 to 1½ inches.
Seismic Site Classification	The subsurface conditions within the site are consistent with the characteristics of Site Class D as defined in the International Building Code (IBC) Site Classification.
Earthwork	The subgrade should be prepared as noted in **Earthwork**
Foundations	A shallow foundation system would be appropriate to support the structural loads of the proposed structure, provided the pad is prepared as recommended in this report.
Pavements	Flexible and rigid pavement systems may be considered for this project. We anticipate traffic may consist primarily of small vehicles, midsize trucks and occasional garbage trucks.
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Geotechnical Engineering Report

IDEA Edinburg – Phase III

2553 Roegiers Road

Edinburg, TX

Terracon Project No. 88195004

February 12, 2019

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed IDEA Edinburg – Phase III to be located at 2553 Roegiers Road in Edinburg, TX. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Excavation considerations
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per IBC
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of 8 test borings to depths ranging from approximately 5 to 25 feet below existing site grades.

Maps showing the site and boring locations are presented in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project site is located within the grounds of the existing IDEA Edinburg at 2553 Roegiers Road in Edinburg, TX. Boring B-1: Latitude: 26.32575° N Longitude: 98.14887° W. See **Site Location**
Existing Improvements	Undeveloped land.
Current Ground Cover	Native grasses and soils.

Item	Description
Existing Topography	Relatively flat and level.
Geology	Based on the Geologic Atlas of Texas, McAllen – Brownsville prepared by The University of Texas, the site is located on the Lissie Formation of the Pleistocene Period of the Quaternary Age. The soils are mostly composed of clay, silt, sand, gravel and caliche. The soils are gray to brown to pale yellow in color. The gravel is mainly siliceous and locally cemented by and interbedded with sandy caliche. The caliche is massive to nodular. The surface is characterized by many undrained circular to irregular depressions, by relic clay dunes, and by stabilized northwest-trending longitudinal dunes.

PROJECT DESCRIPTION

Item	Description
Information Provided	By Gomez Mendez Saenz via email on January 9, 2019.
Project Description	The project will include the construction of a single-story building with a footprint of approximately 30,500 square feet (sf). Development will also include the construction of flexible and/or rigid pavements for the main access lanes and car parking areas.
Construction Type	We anticipate that the building construction may consist of brick veneer or stucco exterior walls with steel frame supported by a shallow or deep foundation system.
Finished Floor Elevation (FFE)	Information was not provided at this time. Assumed to be about 2 feet above existing grade.
Maximum loads (assumed)	■ Columns: 85 kips ■ Walls: 3 kips per linear foot ■ Slabs: 250 pounds per square foot
Pavements	Flexible and rigid pavements may be considered for this project.
Estimated Start of Construction	Information was not provided at this time.

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs and GeoModel can be found in the **Exploration Results** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	**Sandy Clay**	Sandy Lean Clay (CL), medium stiff to hard with Fat Clay (CH) and Clayeye Sand (SC) seams
2	**Clay**	Fat Clay (CH), medium stiff to hard

Groundwater Conditions

The boreholes were observed during and after completion of drilling for the presence and level of groundwater. The water levels observed are noted on the attached boring logs, and are summarized below.

Location	Depth to groundwater (feet)		
	During drilling	15 minutes after initial groundwater reading	After boring completion
B-1	13	12½	10
B-2	16½	16	13½
B-3	13½	13	12½
B-4	13	12½	12

* Groundwater was not observed in the rest of the borings.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project. The boreholes were backfilled with on-site soil cuttings after completion of the groundwater level observations.

GEOTECHNICAL OVERVIEW

Our findings indicate the proposed building structure can be supported on a shallow foundation system. The desired foundation system may be used at this site provided the site and foundation are designed and constructed as recommended in this report.

The suitability and performance of a soil supported foundation for a structure depends on many factors including the magnitude of soil movement expected, the type of structure, the intended

use of the structure, the construction methods available to stabilize the soils, and our understanding of the owner's expectations of the completed structure's performance.

Expansive soils are present on this site. This report provides recommendations to help mitigate the effects of soil shrinkage and expansion. However, even if these procedures are followed, some movement in the structure should be anticipated. Eliminating the risk of movement may not be feasible, but it may be possible to further reduce the risk of movement if significantly more expensive measures are used during construction. We would be pleased to discuss other construction alternatives with you upon request.

Geotechnical engineering recommendations for foundation systems and other earth connected phases of the project are outlined below. The recommendations contained in this report are based upon the results of data presented herein, engineering analyses, and our current understanding of the proposed project.

The **General Comments** section provides an understanding of the report limitations.

Swell Test Results

To further evaluate the expansive characteristics of the clayey soil, one-dimensional vertical swell tests were conducted on selected specimens. The results of these tests are shown in the following table.

Swell Test Results					
Boring	**Depth (feet)**	*** Surcharge (psf)**	**Initial Moisture (%)**	**Final Moisture (%)**	**Percent Swell (%)**
B-2	4 – 6	100	20.9	23.4	0.3
B-2	4 – 6	700	21.1	23.6	0.0
B-4	2 – 4	100	24.4	26.0	0.0
B-4	2 - 4	460	25.0	25.9	0.0

* The swell test specimens were applied a surcharge pressure during testing that approximated the existing soil overburden.

The test results indicate that the onsite soils have a low swell potential in their existing condition. Also, these soils, if they were allowed to dry out, could have greater potential for volumetric changes.

EARTHWORK

Earthwork will include clearing and grubbing, excavations and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria as necessary to render the site in the state considered in our geotechnical engineering evaluation for foundations and pavements.

Site Preparation

Construction areas should be stripped of all vegetation, topsoil and other unsuitable material. Additional excavation as recommended in this report or as needed should be performed within the proposed building area. Once final subgrade elevation has been achieved, the exposed subgrade should be carefully proofrolled with a 15-ton pneumatic roller or a fully loaded dump truck to detect weak zones in the subgrade. Special care should be exercised when proofrolling the fill soils to detect soft/weak areas. Weak areas detected during proofrolling, as well as zones of fill containing organic matter and/or debris should be removed and replaced with select fill in the proposed building area. Proper site drainage should be maintained during construction, so that ponding of surface runoff does not occur and cause construction delays and/or inhibit site access.

Subsequent to proofrolling, and just prior to placement of fill, the exposed subgrade within the construction area should be evaluated for moisture and density. If the moisture, density, and/or the requirements do not meet the criteria described in the table below, the subgrade should be scarified to a minimum depth of 8 inches, moisture adjusted and compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density. Select fill should meet the following criteria.

Fill Material Types

Engineered fill should consist of approved materials, free of organic material, debris and particles larger than about 2 inches. The maximum particle size criteria may be relaxed by the geotechnical engineer of record depending on construction techniques, material gradation, allowable lift thickness and observations during fill placement. Soils for use as engineered fill material should conform to the following specifications:

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Aggregate Base Course [2]	SC, GC, Caliche, Crushed Limestone, Crushed Concrete	Top 6 inches of building pad area.

Select Fill	CL and/or SC (7≤PI≤20)	Must be used to construct the building pad, pavements and all grade adjustments within the construction area.
On-Site Soils	CL	On-site CL soils are suitable for use as fill within the building, pavement and landscaping areas as long as they are free from organics and have a PI between 7 and 20.

1. Prior to any filling operations, samples of the proposed borrow and on-site materials should be obtained for laboratory moisture-density testing. The tests will provide a basis for evaluation of fill compaction by in-place density testing. A qualified soil technician should perform sufficient in-place density tests during the filling operations to evaluate that proper levels of compaction, including dry unit weight and moisture content, are being attained.
2. Crushed limestone and crushed concrete material should meet the requirements of 2014 TxDOT Item 247, Type A, or D, Grades 1-2 and 3. The select fill materials should be free of organic material and debris, and should not contain stones larger than 2 inches in the maximum dimension. The clayey gravel and caliche materials should meet the gradation requirements of Item 247, Type B, Grades 1-2 and 3 as specified in the 2014 TxDOT Standard Specifications Manual and a Plasticity Index between 7 and 20.

Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Description
Fill Lift Thickness	The fill should be placed in thins; loose lifts of about 8 inches, with compacted thickness not exceeding 6 inches.
Compaction Requirements (on-site soils)	The on-site soils should be compacted to at least 95 percent of The Standard Effort (ASTM D698) maximum dry density within 2 percentage points of the optimum moisture content.
Compaction Requirements (select fill)	The select fill should be compacted to at least 95 percent of The Standard Effort (ASTM D698) maximum dry density within 2 percentage points of the optimum moisture content.

Wet Weather/Soft Subgrade Conditions

Construction operations may encounter difficulties due to the wet or soft surface soils becoming a general hindrance to equipment due to rutting and pumping of the soil surface, especially during and soon after periods of wet weather.

If the subgrade cannot be adequately compacted to minimum densities as described above, one of the following measures will be required: 1) removal and replacement with select fill, 2) chemical treatment of the soil to dry and increase the stability of the subgrade, or 3) drying by natural means if the schedule allows.

In our experience with similar soils in this area, chemical treatment is the most efficient and effective method to increase the supporting value of wet and weak subgrade. Terracon should be contacted for additional recommendations if chemical treatment of the soils is needed.

Prior to placing any fill, all surface vegetation, topsoil, possible fill material and any otherwise unsuitable materials should be removed from the construction areas. Wet or dry material should either be removed or moisture conditioned and recompacted. After stripping and grubbing, the subgrade should be proof-rolled where possible to aid in locating loose or soft areas. Proof-rolling can be performed with a 15-ton roller or fully loaded dump truck. Soft, dry and low-density soil should be removed or compacted in place prior to placing fill.

Grading and Drainage

Positive drainage should be provided during construction and maintained throughout the life of the development. Infiltration of water into utility trenches or foundation excavations should be prevented during construction. Planters and other surface features which could retain water in areas adjacent to the building should be sealed or eliminated. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that protective slopes be provided with a minimum grade of approximately 3 percent for at least 10 feet from perimeter walls, except in areas where ADA ramps are required, these areas should comply with state and local regulations. Backfill against exterior walls, and in utility and sprinkler line trenches, should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

Downspouts, roof drains or scuppers should discharge into extensions when the ground surface beneath such features is not protected by exterior slabs or paving. Consideration should be given to extending drainage piping to day light at the face of curbs then empty onto pavement surfaces. Sprinkler systems should not be installed within 5 feet of foundation walls. Landscaped irrigation adjacent to the foundation systems should be minimized or eliminated.

Where paving or flatwork abuts the structure, effectively seal and maintain joints to prevent surface water infiltration. The joint between the sidewalk curb and building should be sealed. The sidewalk curb along the building line is recommended to prevent water from standing over the joint between the building and sidewalk should the outside edge of the slab rise due to soil swelling at the sidewalk edge.

Utility trenches are a common source of water infiltration and migration. All utility trenches that penetrate beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the building.

We recommend constructing an effective clay “trench plug” that extends at least 5 feet out from the face of the building exterior. The plug material should consist of clay compacted at a water content at or above the soils optimum water content. The clay fill should be placed to completely surround the utility line and be compacted in accordance with recommendations in this report.

Earthwork Construction Considerations

Shallow excavations, for the proposed structure, are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of floor slabs. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over, or adjacent to construction area should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted, prior to floor slab construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, “Excavations” and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and top soil, proof-rolling and mitigation of areas delineated by the proof-roll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked as necessary until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building area and 5,000 square feet in pavement areas. One density and water content test for every 50 linear feet of compacted utility trench backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. In the event unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Slab-on-Grade Foundation

The foundation design parameters presented below are based on our evaluation using published theoretical and empirical design methods.

These were developed based on our understanding of the proposed project, our interpretation of the information and data collected as a part of this study, our area experience and the results of our evaluation. The structural engineer should select the appropriate slab design method and code for the amount of anticipated slab movement indicated.

The slab-on-grade foundation may be designed using the following parameters provided the subgrade is prepared as outlined in the **Earthwork** and **Floor Slabs** sections of this report:

Item	Description
Select Fill Pad	Minimum 1½ feet of select fill over 12 inches of moisture conditioned and compacted on-site soils.
Allowable Bearing Pressure [1] ■ **Compacted select fill**	Net Total Load – 2,500 psf
Climatic Rating	15
Design Plasticity Index	23
Soil Support Index	0.92
Estimated PVR [2]	About 1 inch or less
Approximate total settlement [3]	About 1 inch
Estimated Differential Settlement [3]	Approximately ½ of total settlement
Min. perimeter grade beam embedment [4]	18 inches below finished grade

Item	Description
1.	The net allowable bearing pressure provided above include a factor of safety of at least 2.
2.	The slab-on-grade foundation system should be designed to tolerate the anticipated soil movement and provide satisfactory support to the proposed structure. The foundation should have adequate exterior and interior grade beams to provide sufficient rigidity to the foundation system such that the slab deflections that result are considered tolerable to the supported structure.
3.	This estimated post-construction settlement is assuming proper construction practices are followed. Settlement response of a select fill supported slab is influenced more by the quality of construction than by soil-structure interaction. Therefore, it is essential that the recommendations for foundation construction be strictly followed during the construction phases of the building pad and foundation.
4.	To bear within the select fill or moisture conditioned and recompacted on-site soils. The grade beams may be thickened and widened where necessary to support column loads.

Construction Considerations for Slab-on-Grade Foundation

Excavations for grade beams should be performed with equipment capable of providing a relatively clean bearing area. The bottom 6 inches of the excavations should be completed with a smooth-mouthed bucket or by hand labor. The excavations should be neatly excavated and properly formed. Debris in the bottom of the excavation should be removed prior to reinforcing steel placement. Water should not be allowed to accumulate at the bottom of the excavation. Due to the presence of dry soils, caving of grade beam excavation may occur. Therefore, the foundation contractor should be prepared to use forms.

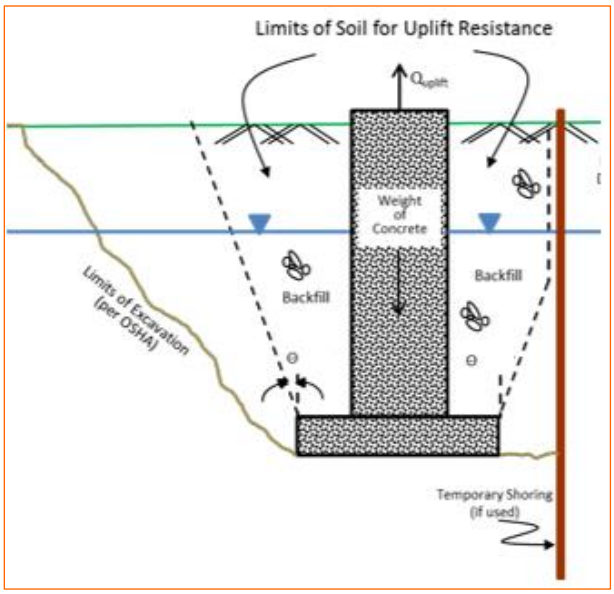
To reduce the potential for groundwater seepage into the excavations and to minimize disturbance to the bearing area, we recommend that concrete and reinforcing steel be placed as soon as possible after the excavations are completed. Excavations should not be left open for more than 36 hours. The bearing surface of the grade beams should be evaluated after excavation is completed and immediately prior to placing concrete.

Design Recommendations – Spread Footing Foundation

Spread footings may be considered in the design of the foundations to support the main column loads. Lateral loads transmitted to the footings should be resisted by a combination of soil-concrete friction on the base of the footing and passive pressure on the side of the footing. To resist lateral forces, a net allowable passive resistance may be utilized for portions of footings extending at least 30 inches below finished grade. If the footing is formed during construction, the open space between the footing and the in-situ soils should be backfilled with soils. Also, care should be taken to avoid disturbance of the footing bearing area since loose material could increase settlement and decrease resistance to lateral loading.

The spread footings can provide some uplift resistance for those structures subjected to wind or other induced structural loading.

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils. As illustrated on the subsequent figure, the effective weight of the soil prism defined by diagonal planes extending up from the top of the perimeter of the foundation to the ground surface at an angle, θ, of 20 degrees from the vertical can be included in uplift resistance. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation, divided by an appropriate factor of safety. A soil unit weight of 120 pcf should be used for the backfill. This unit weight should be reduced to 40 pcf for portions of the backfill or natural soils below the groundwater elevation.



Design values for the footings are presented below.

Item	Description
Minimum Embedment Below Finished Grade [1]	2½ feet
Net Allowable Bearing Pressure [7]	Total Load - 2,500 psf
Approximate total settlement [2]	About 1 inch
Estimated Differential Settlement [3]	Approximately ½ of total settlement
Allowable Passive Pressure [4]	700 psf (if considered)
Coefficient of Sliding Friction [5]	0.40
Uplift Resistance [6]	Foundation Weight (150 pcf) & Soil Weight (120 pcf)

Item	Description
1.	To bear within the native soils or select fill.
2.	This estimated post-construction settlement of the shallow footings is without considering the effect of stress distribution from adjacent foundations and assuming proper construction practices are followed. A clear distance between the footings of one footing size should not produce overlapping stress distributions and would essentially behave as independent foundations.
3.	Differential settlement may result from variances in subsurface conditions, loading conditions and construction procedures. The settlement response of the footings will be more dependent upon the quality of construction than upon the response of the subgrade to the foundation loads. We estimate that the differential settlement should be approximately one-half of the total settlement. Settlement of footings will be more sensitive to installation techniques than to soil-structure interaction.
4.	The passive pressure along the exterior of the footings should be neglected unless pavement is provided up to the edge of the structure. For interior footings, the allowable passive pressure may be used for the entire depth of the footing. The passive pressure provided above includes a factor of safety of at least 3.
5.	Lateral loads transmitted to the footings will be resisted by a combination of soil-concrete friction on the base of the footings and passive pressure on the side of the footings.
6.	The ultimate uplift capacity of shallow footings should be reduced by an appropriate factor of safety to compute allowable uplift capacity.
7.	The net allowable bearing pressure provided above include a factor of safety of at least 2.

Construction Considerations for Spread Footing Foundations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed. Due to the presence of dry soils, caving of excavation may occur. Therefore, the foundation contractor should be prepared to use forms.

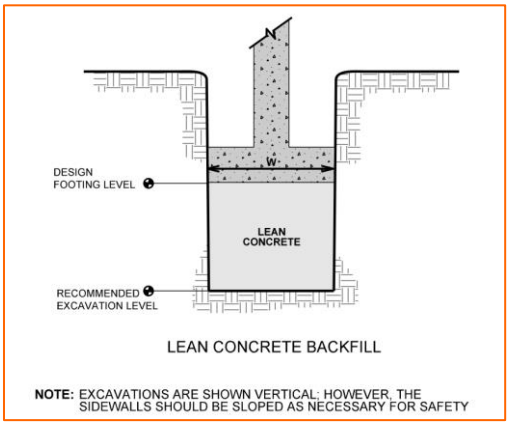
Excavation should be accomplished with a smooth-mouthed bucket. If a toothed bucket is used, excavation with this bucket should be stopped 6 inches above the final bearing surface and the excavation completed with a smooth-mouthed bucket or by hand labor.

If the footing foundations are over-excavated and formed, the backfill around the foundation sides should be achieved with compacted select fill, lean concrete, compacted cement stabilized sand (two sacks cement to one cubic yard of sand) or flowable fill. Compaction of select fill should be as described later in this section of the report.

The bearing surface should be excavated with a slight slope to create an internal sump for runoff water collection and removal. If surface runoff water in excess of 2 inches accumulates at the bottom of the excavation, it should be pumped out prior to concrete placement. Under no circumstances should water be allowed to adversely affect the quality of the bearing surface. If the spread footing is buried, backfill above the foundation may be the excavated on-site soils or

select fill soils. Backfill soils should be compacted to at least 95 percent of the maximum dry density as determined by the standard moisture/density relationship test (ASTM D 698). Moisture contents for on-site soils and imported select fill soils should be within 2 percentage points of the optimum moisture content. The backfill should be placed in thin, loose lifts of about 8 inches, with compacted thickness not to exceed 6 inches.

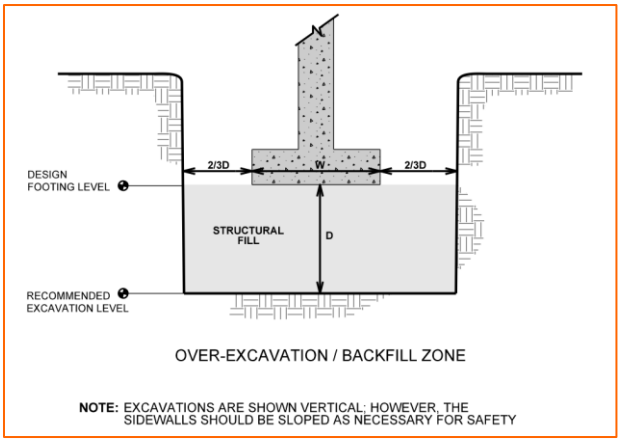
If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.



LEAN CONCRETE BACKFILL

NOTE: EXCAVATIONS ARE SHOWN VERTICAL; HOWEVER, THE SIDEWALLS SHOULD BE SLOPED AS NECESSARY FOR SAFETY

Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation, with select fill placed, as recommended in the **Earthwork** section.



OVER-EXCAVATION / BACKFILL ZONE

NOTE: EXCAVATIONS ARE SHOWN VERTICAL; HOWEVER, THE SIDEWALLS SHOULD BE SLOPED AS NECESSARY FOR SAFETY

SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties encountered at the site and as described on the exploration logs and results, it is our professional opinion that the **Seismic Site Classification is D**. Subsurface explorations at this site were extended to a maximum depth of 25 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

FLOOR SLABS

The Finished Floor Elevation (FFE) was not available at the time of this report. However, we anticipate that the FFE may be at about 2 feet above existing grade.

Floor Slab Design Parameters

The subsurface soils at this site generally exhibit moderate expansion potential. Based on the information developed from our field and laboratory programs and on method TEX-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures, we estimate that the subgrade soils at this site exhibit a Potential Vertical Rise (PVR) of about 1 to 1½ inches in present condition.

The actual movements could be greater if poor drainage, ponded water, and/or other sources of moisture are allowed to infiltrate beneath the structure after construction. We have provided recommendations to maintain / reduce the site PVR to about 1 inch or less. In addition, positive structure perimeter drainage should be carefully observed.

After site stripping and over-excavation activities as recommended, re-used on-site soil or select fill over 12 inches of moisture conditioned and compacted subgrade soils should be constructed directly below the floor slab and should also extend a minimum of 3 feet beyond the edge of the proposed building area, including any movement sensitive flatwork that abuts the structure such as sidewalks. The final exterior grade adjacent to the building should be sloped to promote positive drainage away from the structure.

The subgrade and select fill soils should be prepared as outlined in the **Earthwork** section of this report, which contains material and placement requirements for select fill, as well as other

subgrade preparation recommendations. The floor slab should be designed using the following recommendations.

Item	Description
Excavation	Minimum 12 inches.
Floor Slab Support [1]	Min. 12 inches of moisture conditioned and compacted native soils plus 1½ feet of select fill as needed to achieve Finished Building Pad Elevation. This recommendation applies to building area and flatwork that abuts the structure such as sidewalks.
Estimated Modulus of Subgrade Reaction [2]	125 pounds per square inch per inch (psi/in) for point loads.
Estimated Potential Vertical Rise (PVR)	About 1 inch or less

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Floor Slab Construction Considerations

Finished subgrade within and for at least 10 feet beyond the floor slab should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor

slabs, the affected material should be removed and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

PAVEMENTS

Both flexible and rigid pavements may be considered for this project. Pavement subgrade preparations are included in this section to limit changes in soil moisture conditions to help mitigate the effects of soil movement. However, even if these recommendations are followed some pavement distress could still occur.

General Pavement Comments

Traffic conditions and pavement life conditions were not available at the time of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

We recommend the moisture content and density of the top 6 inches of the subgrade be evaluated and the pavement subgrades be proofrolled within two days prior to commencement of actual paving operations. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and re-compacted.

Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills.

If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

Based on the subsurface conditions, we anticipate that the pavement subgrade will generally consist of the on-site soils. The top 6 inches of the finished subgrade soils directly beneath the pavements may be chemically treated. Chemical treatment will increase the supporting value of the subgrade and decrease the effect of moisture on subgrade soils. These 6 inches of treatment should be considered as required part of the pavement design and is not a part of site and

subgrade preparation for wet/soft subgrade conditions.

If chemical treatment of the subgrade is chosen, we anticipate that the on-site surficial soils should be treated with about 3 percent of lime or cement. This percentage is given as application by dry weight and is typically equivalent to about 15 pounds modifier per square yard per 6-inch depth. The recommended percentage of modifier is for estimating and planning. The actual quantity of modifier required should be determined at the time of construction by laboratory tests on bulk samples of the subgrade soils. Specifications for treated subgrade are presented later in this section. An alternative pavement section without treated subgrade is also provided.

After proofrolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified and developed as recommended in **Earthwork** section of this report to provide a uniform subgrade for pavement construction. Areas that appear severely desiccated following site stripping may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

Pavement Design Parameters

Traffic patterns and anticipated loading conditions were not available at the time that this report was prepared. However, we anticipate that traffic loads will be produced primarily by light traffic and occasional delivery and trash removal trucks. Pavement thickness can be determined using AASHTO, Asphalt Institute and/or other methods if specific wheel loads, axle configurations, frequencies, and desired pavement life are provided.

Terracon can provide thickness recommendations for pavements subjected to loads other than the above mentioned traffic if this information is provided.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to parking lots and drives should slope down from pavement edges at a minimum 2%;
- The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote proper surface drainage;
- Install pavement drainage surrounding areas anticipated for frequent wetting (e.g., garden centers, wash racks);
- Install joint sealant and seal cracks immediately;

- Seal all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils;
- Place compacted, low permeability backfill against the exterior side of curb and gutter; and,
- Place curb, gutter and/or sidewalk directly on low permeability subgrade soils rather than on unbound granular base course materials.

Pavement Section Thicknesses

As a minimum, we recommend the following typical pavement sections be considered.

Pavement Area	Traffic Design Index	Description
Automobile Parking Areas	DI-1	Light traffic (Few vehicles heavier than passenger cars, no regular use by heavily loaded two axle trucks). (EAL[(1)] < 6)
Driveways	DI-2	Light to medium traffic (Similar to DI-1 including not over 50 loaded two axle trucks or lightly loaded larger vehicles per day. No regular use by heavily loaded trucks with three or more axles). (EAL = 6-20)
Driveways for Truck Traffic Areas	DI-3	Medium to heavy traffic (Including not over 300 heavily loaded two axle trucks plus lightly loaded trucks with three or more axles and no more than 30 heavily loaded trucks with more than three axles per day). (EAL = 21-75)

1. Equivalent daily 18-kip single-axle load applications.

Listed below are pavement component thicknesses, which may be used as a guide for pavement systems at the site for the traffic classifications stated herein. These systems were derived based on general characterization of the subgrade. Specific testing (such as CBR's, resilient modulus tests, etc.) was not performed for this project to evaluate the support characteristics of the subgrade.

Minimum Recommended Flexible Pavement Section Thickness, inches		
Component	**DI-1 [1]**	**DI-2 [1]**
Hot Mix Asphaltic Concrete (HMAC) [2, 3]	2	2½
Granular Base Material [2]	6	8
Treated Subgrade [2]	6	6

1. See **Pavements** for more specifics regarding traffic classifications.

Minimum Recommended Flexible Pavement Section Thickness, inches		
Component	**DI-1** [1]	**DI-2** [1]

2. All materials should meet the current Department of Transportation (TxDOT) Standard Specifications for Highway and Bridge Construction.
3. A minimum 2-inch surface course should be used on ACC pavements.

Alternative Minimum Recommended Flexible Pavement System, inches		
Component	**DI-1** [1]	**DI-2** [1]
Hot Mix Asphaltic Concrete (HMAC) [2, 3]	2	2½
Granular Base Material [2]	8	10
Moisture Conditioned Subgrade	6	6

1. See **Pavements** for more specifics regarding traffic classifications.
2. All materials should meet the current Department of Transportation (TxDOT) Standard Specifications for Highway and Bridge Construction.
3. A minimum 2-inch surface course should be used on ACC pavements.

Minimum Recommended Rigid Pavement Section Thickness, inches			
Component	**DI-1** [1]	**DI-2** [1]	**DI-3** [1, 3]
Reinforced PC concrete [2]	5	6	7
Granular Base Material [3]	4	4	4
Moisture conditioned subgrade	6	6	6

1. See **Pavements** for more specifics regarding traffic classifications.
2. All materials should meet the current Department of Transportation (TxDOT) Standard Specifications for Highway and Bridge Construction.
3. In areas of anticipated heavy traffic, school buses, delivery trucks, or concentrated loads (e.g. dumpster pads), and areas with repeated turning or maneuvering of heavy vehicles.

The listed pavement component thicknesses should be used as a guide for pavement systems at the site for the traffic classifications stated herein. These recommendations assume a 20-year pavement design life. If pavement frequencies or loads will be different than that specified Terracon should be contacted and allowed to review these pavement sections.

We recommend a Portland Cement Concrete (PCC) pavement be utilized in the main access lanes, parking lots, dumpster pads or other areas where extensive wheel maneuvering are expected.

We recommend that waste dumpster areas be constructed of at least 7-inches of reinforced concrete pavement. The concrete pad areas should be designed so that the vehicle wheels of the collection truck are supported on the concrete while the dumpster is being lifted to support the large wheel loading imposed during waste collection.

Although not required for structural support of rigid pavement systems, a base course layer may be considered to help reduce potentials for slab curl, shrinkage cracking, and subgrade "pumping" through joints.

Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. All joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.
Presented below are our recommended material requirements for the various pavement sections.

Reinforced Concrete Pavement – The materials and properties of reinforced concrete pavement shall meet applicable requirements in the ACI Manual of Concrete Practice. The Portland cement concrete mix should have a minimum 28-day compressive strength of 4,000 psi.

Reinforcing Steel - Reinforcing steel should consist of the following:
DI-1: #3 bars spaced at 18 inches or #4 bars spaced at 24 inches on centers in both directions.
DI-2: #3 bars spaced at 12 inches or #4 bars spaced at 18 inches on centers in both directions.
DI-3: #4 bars spaced at 12 inches on centers in both directions.

Control Joint Spacing – ACI recommendations indicate that control joints should be spaced at about 30 times the thickness of the pavement. Furthermore, ACI recommends a maximum control joint spacing of 12.5 feet for 5-inch pavements and a maximum control joint spacing of 15 feet for 6-inch or thicker pavements. Saw cut control joints should be cut within 6 to 12 hours of concrete placement or as soon as it is practical.

Expansion Joint Spacing – ACI recommendations indicate that regularly spaced expansion joints may be deleted from concrete pavements. Therefore, the installation of expansion joints is optional and should be evaluated by the design team.

Dowels at Expansion Joints – The dowels at expansion joints should be spaced at 12-inch centers and consist of the following:
DI-1: 5/8-inch diameter, 12-inches long with 5-inch embedment
DI-2: 3/4-inch diameter, 14-inches long with 6-inch embedment
DI-3: 7/8-inch diameter, 14-inches long with 6-inch embedment

Hot Mix Asphaltic Concrete Surface Course – The asphaltic concrete surface course should be plant mixed, hot laid Type C or D (Fine Graded Surface Course) meeting the specifications requirements in 2014 TxDOT Standard Specifications Item 340. Specific criteria for the job specifications should include compaction to within an air void range of 5 to 9 percent calculated using the maximum theoretical gravity mix measured by TxDOT Tex-227-F. The asphalt cement content by percent of total mixture weight should be within ± 0.5 percent asphalt cement from the job mix design.

Granular Base Material: Base material should be composed of crushed limestone or crushed concrete meeting the requirements of 2014 TxDOT Standard Specifications Item 247, Type A or D, Grade 1.

As an alternate to the Type A base, treated “caliche” material meeting the requirements of 2014 TxDOT Standard Specification Manual Item 247, Type B, Grade 1 or 2 may be used.

The granular base should be compacted to at least 95 percent of the maximum dry density determined in accordance with the modified moisture-density relationship (ASTM D 1557) at moisture content within 2 percentage points of the optimum moisture content.

Treated Subgrade: The subgrade soils should be treated with lime or cement in accordance with 2014 TxDOT Standard Specifications Items 260 or 275, respectively. The recommended percentage of modifer is for estimating and planning. The actual quantity of modifer required should be determined at the time of construction by laboratory tests on bulk samples of the subgrade soils.

If chemical treatment of the subgrade is chosen, we anticipate that the on-site surficial soils be treated with about 3 percent of lime or cement. This percentage is given as application by dry weight and is typically equivalent to about 15 pounds of modifier per square yard per 6-inch depth. The subgrade should be compacted to a minimum of 95 percent of the Standard Effort (ASTM D 698) maximum dry density within 2 percentage points of the optimum moisture content. Preferably, traffic, should be kept off the treated subgrade for about 3 to 5 days to facilitate curing of the soil - chemical mixture; in addition, the subgrade is not suitable for heavy construction traffic prior to paving.

Post-construction subgrade movements and some cracking of the pavements are not uncommon for subgrade conditions such as those observed at this site. Although chemical treatment of the subgrade will help to reduce such movement/cracking, this movement/cracking cannot be economically eliminated.

Moisture Conditioned Subgrade: The subgrade should be scarified to a depth of 8 inches and moisture conditioned within 2 percentage points of the optimum moisture content. The subgrade

should then be compacted to at least 95 percent of the maximum dry density determined in accordance with ASTM D 698. This should result in a compacted, moisture conditioned layer about 6 inches thick.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

Pavement Maintenance

The pavement sections provided in this report represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program.

Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the first priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of

pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet) [1]	Location
4	25	Building Areas
4	5	Pavement Areas

1. Below ground surface

Boring Layout and Elevations: Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet).

Subsurface Exploration Procedures: We advanced the soil borings with a truck-mounted drill rig using continuous flight augers (solid stem and/or hollow stem as necessary depending on soil conditions). Five samples were obtained in the upper 10 feet of the borings and at intervals of 5 feet thereafter. Soil sampling was performed using thin-wall tube and/or split-barrel sampling procedures. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, the borings were backfilled with auger cuttings after their completion.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a geotechnical engineer. Our exploration team prepared field boring logs as part of the drilling operations. The field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field log. The final boring logs represent the geotechnical engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned various laboratory tests to better understand the engineering properties of the various soil strata as necessary for this project.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils

- ASTM D2166/D2166M Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
- ASTM D4546 Standard Test Methods for One-Dimensional Swell or Collapse of Soils

The laboratory testing program often included examination of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System (USCS).

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan
Exploration Plan

SITE LOCATION

IDEA Edinburg – Phase III ■ Edinburg, TX
February 12, 2019 ■ Terracon Project No. 88195004

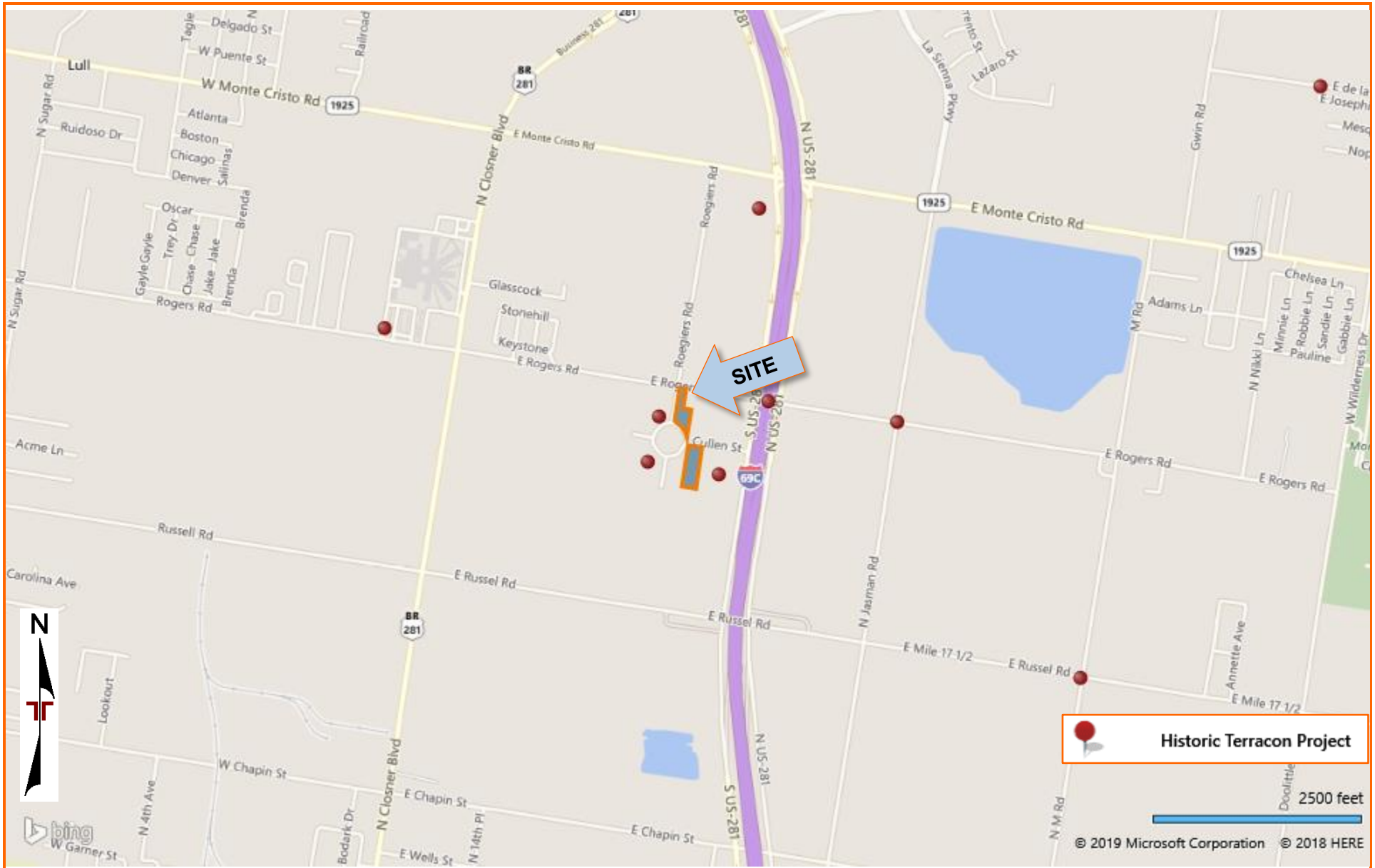


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

IDEA Edinburg – Phase III ■ Edinburg, TX
February 12, 2019 ■ Terracon Project No. 88195004

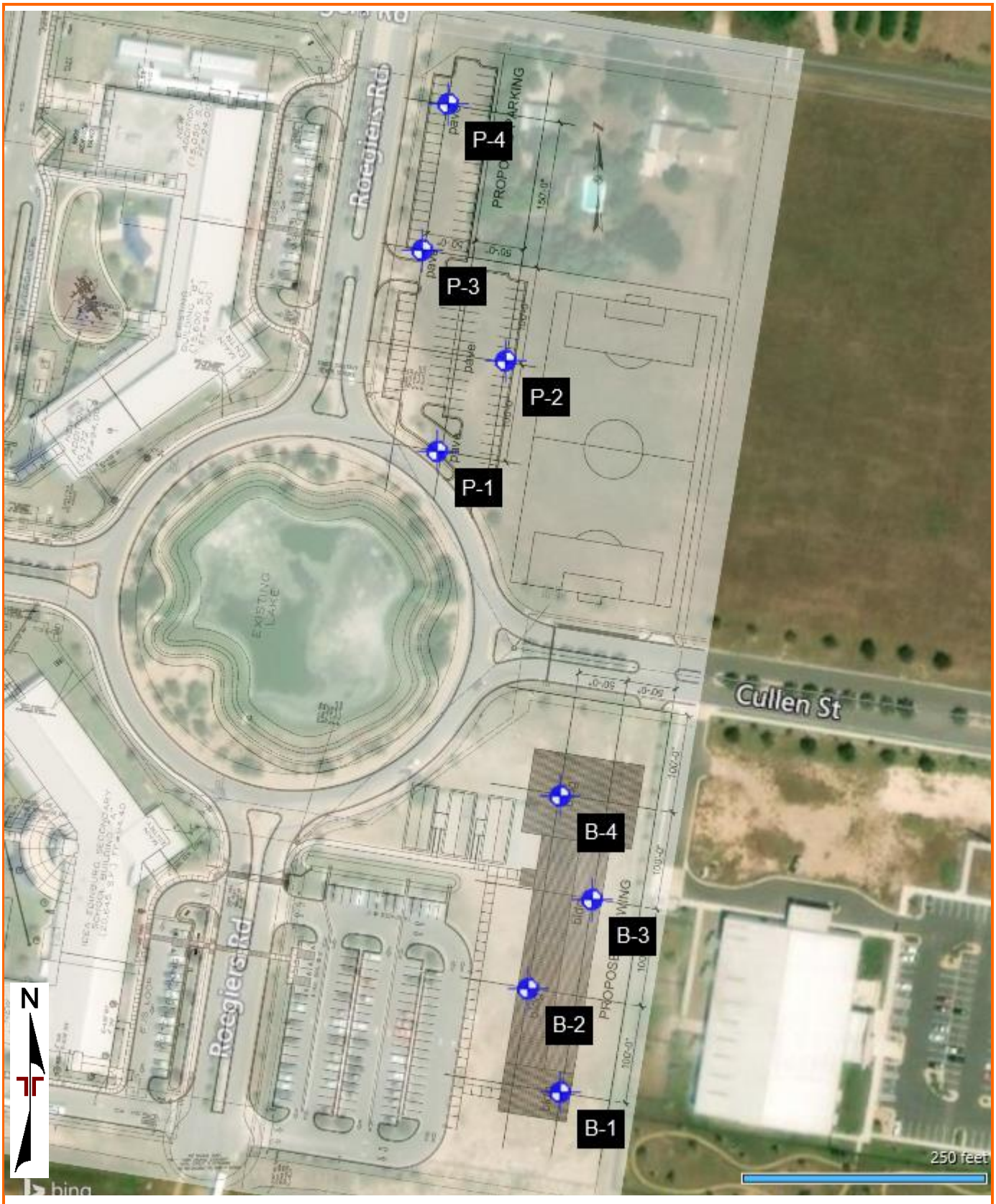


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Boring Logs
GeoModel

BORING LOG NO. B-1

PROJECT: IDEA Edinburg - Phase III

CLIENT: IDEA Public Schools
Austin, Texas

SITE: 2553 Roegiers Rd.
Edinburg, Texas

LOCATION See Exploration Plan

Latitude: 26.3258° Longitude: -98.1489°

MODEL LAYER	GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		**SANDY LEAN CLAY (CL)**, brown to light brown, medium stiff to very stiff			X	4-3-3 N=6				18		29-16-13	
					X	3-3-3 N=6				21			
		- with Fat Clay (CH) seams at 4½ feet	5		X	7-8-12 N=20				17		54-21-33	
		- with Clayey Sand (SC) seams at 6½ feet			X	9-9-10 N=19				20			44
		10.0		▼	X	4-4-3 N=7				23		38-18-20	
2		**FAT CLAY (CH)**, light brown, medium stiff to very stiff	10	▽									
			15		X	3-2-3 N=5				23			
			20		X	8-8-13 N=21				20			
		25.0	25		X	7-10-12 N=22				22			
		Boring Terminated at 25 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry augered to termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *After 15 mintues*

▼ *At completion of drilling*

Terracon
1506 Mid Cities Dr
Pharr, TX

Boring Started: 01-29-2019 | Boring Completed: 01-29-2019

Drill Rig: CME-55 | Driller: SWD

Project No.: 88195004

BORING LOG NO. B-2

PROJECT: IDEA Edinburg - Phase III

CLIENT: IDEA Public Schools
Austin, Texas

SITE: 2553 Roegiers Rd.
Edinburg, Texas

LOCATION See Exploration Plan

Latitude: 26.326° Longitude: -98.149°

MODEL LAYER	GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		**SANDY LEAN CLAY (CL)**, brown to light brown, stiff to very stiff				2.5 (HP)				15			
						1.5 (HP)				24		36-18-18	
			5			3.0 (HP)				21			
		6.0				3.5 (HP)	UC	1.60	9	21	104	62-21-41	
2		**FAT CLAY (CH)**, light brown, very stiff to hard				3.5 (HP)				22			67
			10										
				▼		4.0 (HP)				20		54-20-34	
			15	▽									
				▽									
						3.5 (HP)				23			
			20										
						4.5 (HP)				19			
		25.0	25										
		Boring Terminated at 25 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry augered to termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

- *While drilling*
- *After 15 mintues*
- *At completion of drilling*

Terracon
1506 Mid Cities Dr
Pharr, TX

Boring Started: 01-29-2019 | Boring Completed: 01-29-2019

Drill Rig: CME-55 | Driller: SWD

Project No.: 88195004

BORING LOG NO. B-3

PROJECT: IDEA Edinburg - Phase III

CLIENT: IDEA Public Schools
Austin, Texas

SITE: 2553 Roegiers Rd.
Edinburg, Texas

LOCATION See Exploration Plan

Latitude: 26.3263° Longitude: -98.1488°

MODEL LAYER	GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		**SANDY LEAN CLAY (CL)**, brown to light brown, stiff to very stiff				4-4-4 N=8				6			52
						5-4-5 N=9				19		32-16-16	
			5			4-6-7 N=13				21			68
						5-5-8 N=13				20		45-19-26	
						6-7-10 N=17				24			
			10	▼									
						7-9-12 N=21				20		47-20-27	
			15										
2		15.0 **FAT CLAY (CH)**, light brown, very stiff				9-10-10 N=20				18			
			20										
						8-11-15 N=26				18			
		25.0 ***Boring Terminated at 25 Feet***	25										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry augered to termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

- *While drilling*
- *After 15 mintues*
- *At completion of drilling*

Terracon
1506 Mid Cities Dr
Pharr, TX

Boring Started: 01-29-2019 | Boring Completed: 01-29-2019

Drill Rig: CME-55 | Driller: SWD

Project No.: 88195004

BORING LOG NO. B-4

PROJECT: IDEA Edinburg - Phase III

CLIENT: IDEA Public Schools
Austin, Texas

SITE: 2553 Roegiers Rd.
Edinburg, Texas

LOCATION See Exploration Plan

Latitude: 26.3266° Longitude: -98.1489°

MODEL LAYER	GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		**SANDY LEAN CLAY (CL)**, brown to light brown, medium stiff to hard				2-3-2 N=5				22		35-16-19	
						1.0 (HP)				26			69
			5			2.0 (HP)				24		40-18-22	
						4.5 (HP)				21			
		10.0				4.5 (HP)	UC	3.40	5.8	19	108	47-19-28	
2		**FAT CLAY (CH)**, light brown, hard	10										
						4.5 (HP)				19			
			15										
						10-15-21 N=36				19		53-21-32	
			20										
		25.0				12-17-23 N=40				19			
		Boring Terminated at 25 Feet	25										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry augered to termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

After 15 mintues

At completion of drilling

Terracon
1506 Mid Cities Dr
Pharr, TX

Boring Started: 01-29-2019 | Boring Completed: 01-29-2019

Drill Rig: CME-55 | Driller: SWD

Project No.: 88195004

BORING LOG NO. P-1

PROJECT: IDEA Edinburg - Phase III

CLIENT: IDEA Public Schools
Austin, Texas

SITE: 2553 Roegiers Rd.
Edinburg, Texas

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 26.3275° Longitude: -98.1493° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		**SANDY LEAN CLAY (CL)**, brown to light brown, stiff to medium siff				5-5-5 N=10				21		31-18-13	
						4-5-4 N=9				24			
						2-2-4 N=6				22			
		5.0	5										
		Boring Terminated at 5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry augered to termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1506 Mid Cities Dr
Pharr, TX

Boring Started: 01-29-2019 | Boring Completed: 01-29-2019

Drill Rig: CME-55 | Driller: SWD

Project No.: 88195004

BORING LOG NO. P-2

PROJECT: IDEA Edinburg - Phase III

CLIENT: IDEA Public Schools
Austin, Texas

SITE: 2553 Roegiers Rd.
Edinburg, Texas

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 26.3278° Longitude: -98.149° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		**SANDY LEAN CLAY (CL)**, brown to light brown, medium stiff				2-3-2 N=5				17			
						3-3-3 N=6				23		39-19-20	
						3-4-3 N=7				26			
		5.0	5										
		Boring Terminated at 5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry augered to termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1506 Mid Cities Dr
Pharr, TX

Boring Started: 01-29-2019 | Boring Completed: 01-29-2019

Drill Rig: CME-55 | Driller: SWD

Project No.: 88195004

BORING LOG NO. P-3

PROJECT: IDEA Edinburg - Phase III

CLIENT: IDEA Public Schools
Austin, Texas

SITE: 2553 Roegiers Rd.
Edinburg, Texas

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 26.3281° Longitude: -98.1493° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		**SANDY LEAN CLAY (CL)**, brown to light brown, stiff to medium siff				5-6-6 N=12				16		31-18-13	
						4-5-6 N=11				20			
						3-3-3 N=6				26			
		5.0	5										
		Boring Terminated at 5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry augered to termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1506 Mid Cities Dr
Pharr, TX

Boring Started: 01-29-2019 | Boring Completed: 01-29-2019

Drill Rig: CME-55 | Driller: SWD

Project No.: 88195004

BORING LOG NO. P-4

PROJECT: IDEA Edinburg - Phase III

CLIENT: IDEA Public Schools
Austin, Texas

SITE: 2553 Roegiers Rd.
Edinburg, Texas

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 26.3285° Longitude: -98.1492° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		**SANDY LEAN CLAY (CL)**, brown to light brown, stiff to medium siff				5-5-6 N=11				26			
						2-2-3 N=5				25		41-20-21	
						3-4-3 N=7				26			
		5.0	5										
		Boring Terminated at 5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry augered to termination depth.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1506 Mid Cities Dr
Pharr, TX

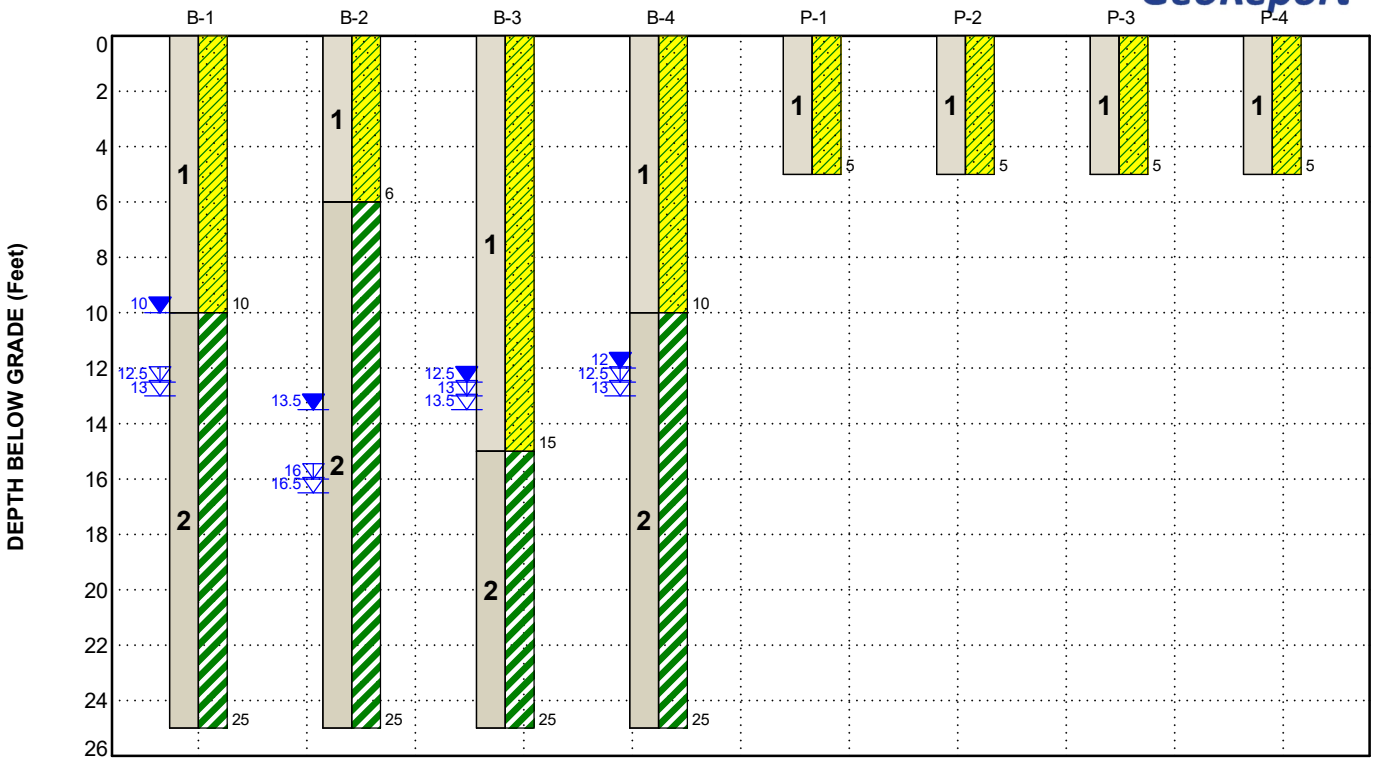
Boring Started: 01-29-2019 | Boring Completed: 01-29-2019

Drill Rig: CME-55 | Driller: SWD

Project No.: 88195004

GEOMODEL

IDEA Edinburg - Phase III ■ Edinburg, Texas
2/7/2019 ■ Terracon Project No. 88195004



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	SANDY CLAY	SANDY LEAN CLAY (CL), medium stiff to hard with Fat Clay (CH) and Clayey Sand (SC) seams
2	CLAY	FAT CLAY (CH), medium stiff to hard

LEGEND

Sandy Lean Clay

Fat Clay

First Water Observation

Second Water Observation

Third Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time. Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

SUPPORTING INFORMATION

Contents:

General Notes
Unified Soil Classification System

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING	WATER LEVEL	FIELD TESTS
Shelby Tube Split Spoon	**Water Initially Encountered** **Water Level After a Specified Period of Time** **Water Level After a Specified Period of Time** Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	**N** Standard Penetration Test Resistance (Blows/Ft.) **(HP)** Hand Penetrometer **(T)** Torvane **(DCP)** Dynamic Cone Penetrometer **UC** Unconfined Compressive Strength **(PID)** Photo-Ionization Detector **(OVA)** Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL		RELATIVE PROPORTIONS OF FINES	
Descriptive Term(s) of other constituents	Percent of Dry Weight	**Descriptive Term(s) of other constituents**	**Percent of Dry Weight**
Trace	<15	Trace	<5
With	15-29	With	5-12
Modifier	>30	Modifier	>12

GRAIN SIZE TERMINOLOGY		PLASTICITY DESCRIPTION	
Major Component of Sample	**Particle Size**	**Term**	**Plasticity Index**
Boulders	Over 12 in. (300 mm)	Non-plastic	0
Cobbles	12 in. to 3 in. (300mm to 75mm)	Low	1 - 10
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)	Medium	11 - 30
Sand	#4 to #200 sieve (4.75mm to 0.075mm	High	> 30
Silt or Clay	Passing #200 sieve (0.075mm)		

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or [$Cc<1$ or $Cc>3.0$] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or [$Cc<1$ or $Cc>3.0$] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

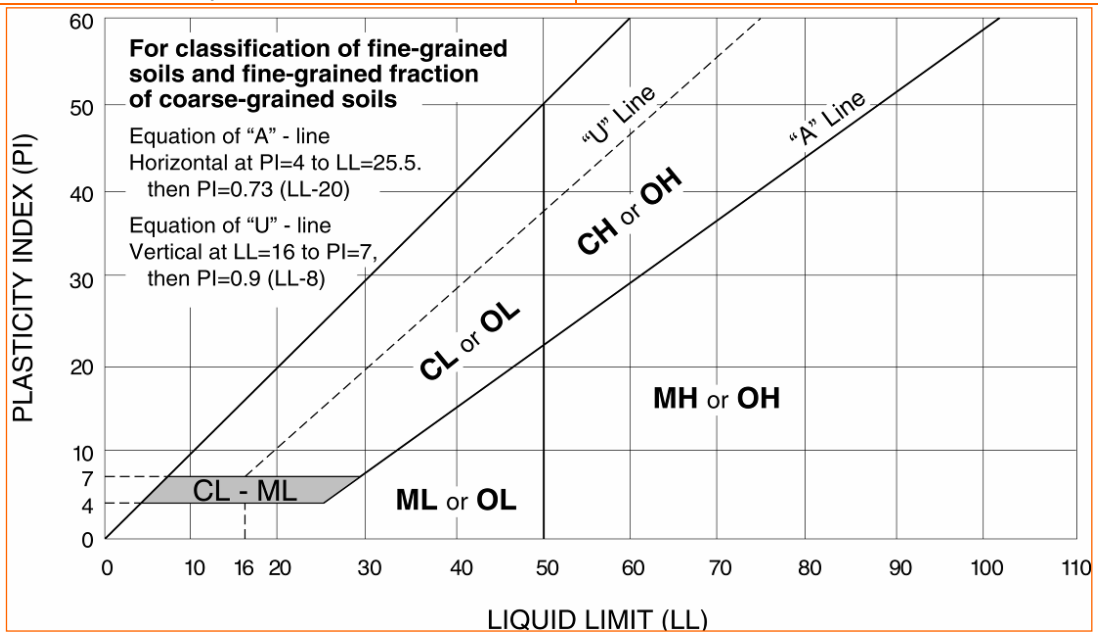
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

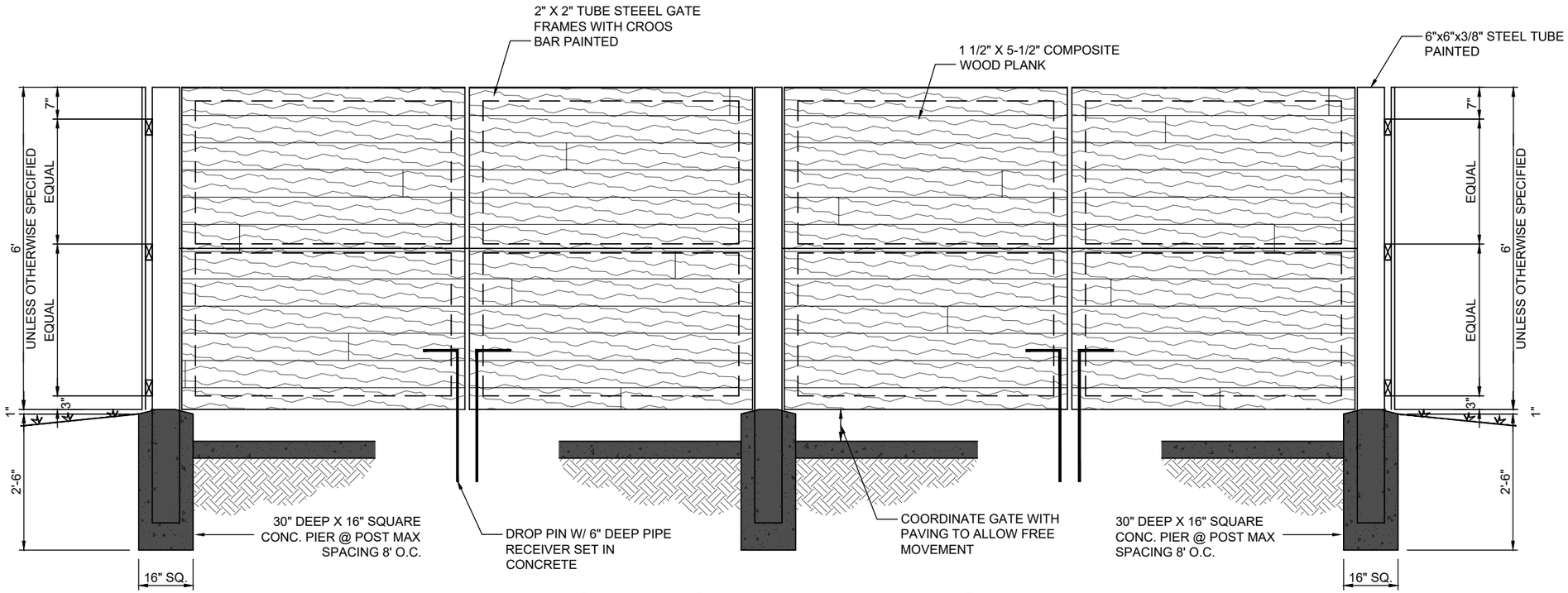
[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

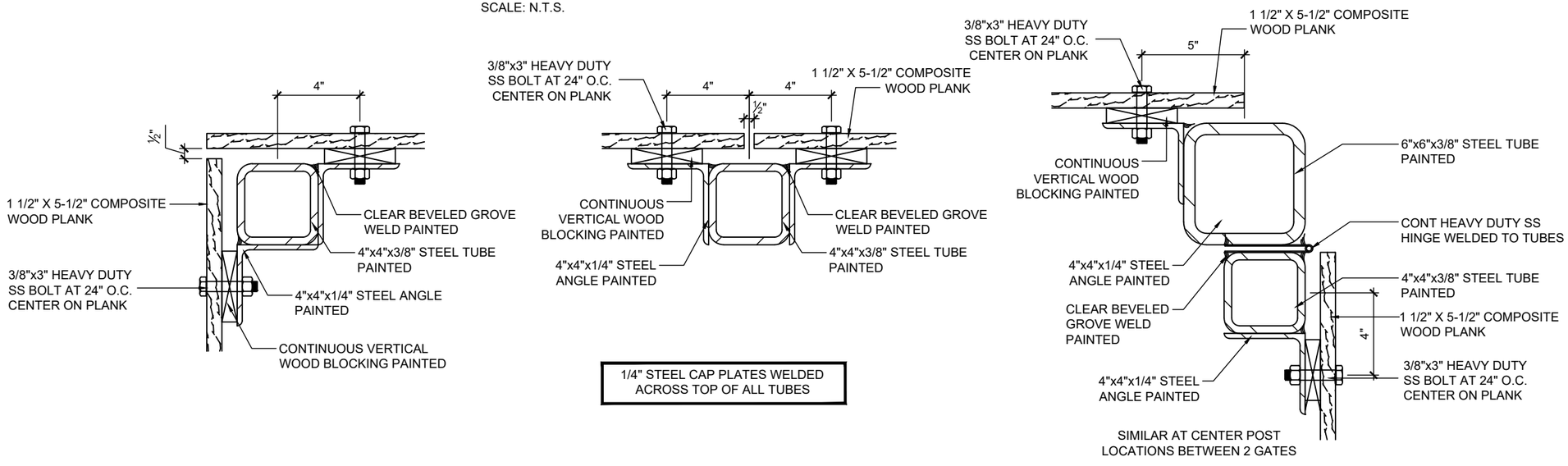
[Q] PI plots below "A" line.





07 DUMPSTER GATE ELEVATION

SCALE: N.T.S.

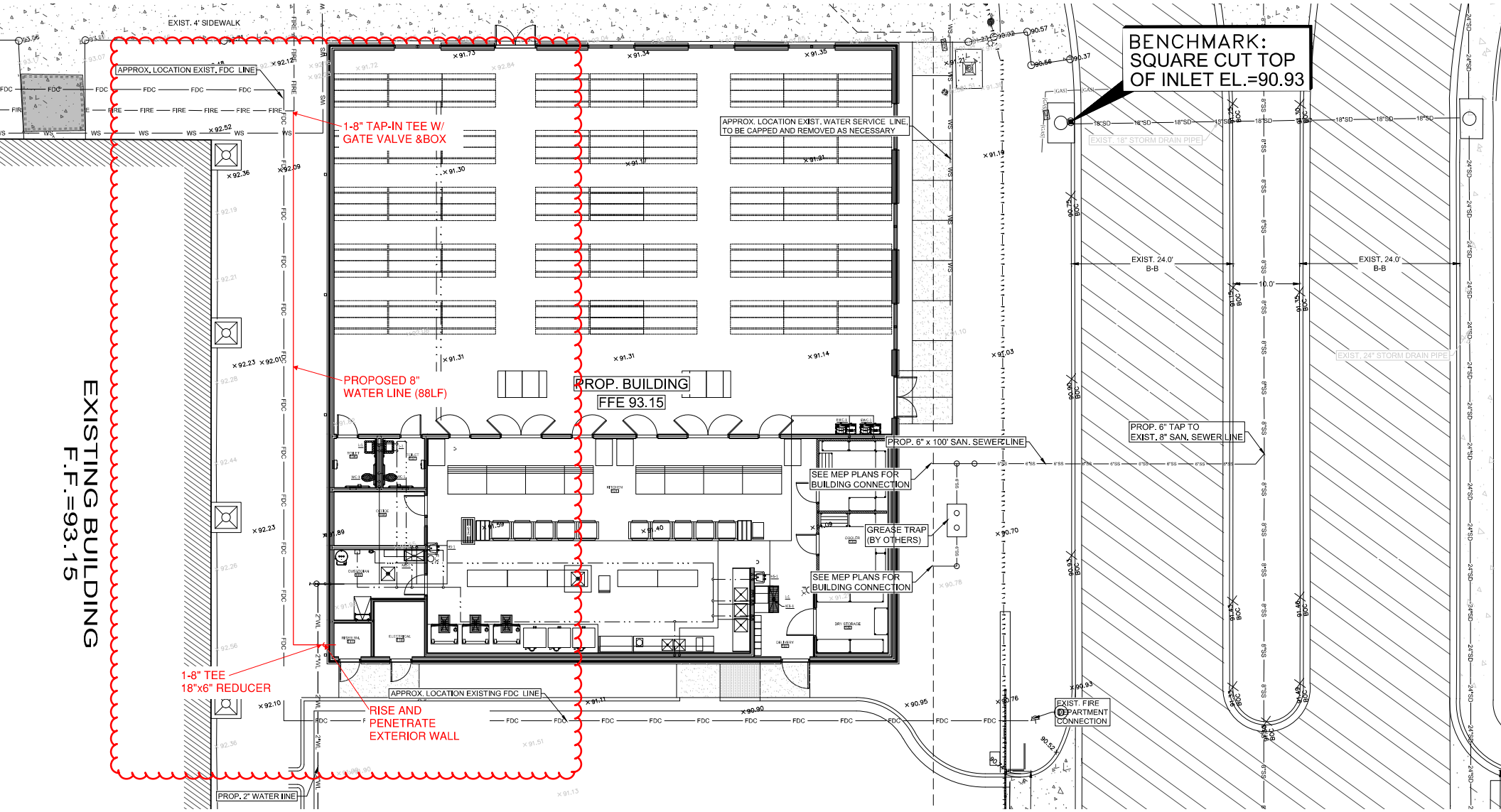


08 DUMPSTER ENCLOSURE DETAILS

SCALE: N.T.S.

WHERE NOTED, REFER TO SECTION 09900 FOR PAINT SYSTEM.

SK2.1
10/28/2024



C3 -FIRE LINE CONNECTION
SK2.2