# **Technical Specifications**

RIO GRANDE CITY, TEXAS 2022 RIO GRANDE CITY LAS BRISAS SUBDIVSION WATER LINE IMPROVEMENTS



**DECEMBER 2022** 

Prepared by:



Halff Associates, Inc. 5000 West Military Hwy, Suite 100 McAllen, Texas 78503



Project No.: 43128.002

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#### SECTION 001340 SHOP DRAWINGS, PRODUCT DATA & SAMPLES, O&M MANUALS

# PART 1 - GENERAL

#### 1.01 SUMMARY

- A. General:
  - 1. Section Addresses:
    - a. Mechanics and administration of the submittal process for shop drawings, product data, samples and operation and maintenance manuals.
  - 2. Related Sections include but are not necessarily limited to:
    - a. Division 1 General Requirements.

## 1.02 DEFINITIONS

- A. Shop Drawings:
  - 1. See Technical Specification Manual.
  - 2. Product data and samples are Shop Drawing information.
- B. Miscellaneous Submittals:
  - 1. Submittals other than Shop Drawings:
- C. Representative types of miscellaneous submittal items include but are not limited to:
  - a. Construction schedule.
  - 2. Concrete, soil compaction, and pressure test reports.
    - a. Installed equipment and systems performance test reports.
    - b. Manufacturer's installation certification letters.
    - c. Instrumentation and control commissioning reports.
    - d. Warranties.
    - e. Service agreements.
    - f. Survey data.
    - g. Cost breakdown (Schedule of Values).

# **1.03 TRANSMITTALS**

- A. Shop Drawings, Operation and Maintenance Manuals, Manufacturers and Installers Quality Control and Quality Assurance documentation:
- B. Transmit 1 electronic copy of all submittals to: Halff Associates, Inc.
   5000 W. Military Hwy, Suite 100 McAllen, Texas 78503 Attn: Kristina Leal, PE, CFM
  - (956) 445-5198
- C. Utilize a copy of attached Exhibit "A" to transmit all shop drawings, product data and samples.
- D. Utilize a copy of attached Exhibit "B" to transmit all Operation and Maintenance Manuals.
- E. All transmittals must be from Contractor and bear his approval stamp. Transmittals will not be received from or returned to subcontractors.
- F. Shop drawing transmittal stamp shall read "(Contractor's Name) represents that we have determined and verified all field dimensions and measurements, field construction criteria, materials, catalog numbers, and similar data, and that we have verified the requirements of the work and the Contract Documents."
- G. Operation and Maintenance Manual transmittal stamp may be Contractor's standard approval stamp.
- H. Provide submittal information defining specific equipment or materials utilized on the project. Generalized product information not clearly defining specific equipment or materials to be provided will be rejected.

I. Calculations required in individual specification sections are required as For-Information Only-For-Future-Use submittals. Calculations and other submittals identified as For-Information-Only-For Future-Use submittals shall be transmitted directly to the Engineer at the following address:

Halff Associates, Inc. 5000 W. Military Hwy, Suite 100 McAllen, Texas 78503 Attn: Kristina Lea, PE, CFM (956) 445-5198

- J. Submittal schedule:
  - 1. Schedule of shop drawings:
    - a. Submitted and approved within 20 days of receipt of Notice to Proceed.
  - 2. Operation and Maintenance Manuals and Equipment Record Sheets:
  - 3. Initial submittal within 60 days after date shop drawings are approved.
- K. Miscellaneous Submittals:
  - 1. Transmit under Contractor's standard letter of transmittal or letterhead.
  - 2. Submit 1 copies of all submittals to:

Halff Associates, Inc. 5000 W. Military Hwy, Suite 100 McAllen, Texas 78503 Attn: Kristina Lea, PE, CFM (956) 445-5198

# 1.04 PREPARATION OF SUBMITTALS

- A. Shop Drawings:
  - 1. Number transmittals consecutively beginning with 1.
  - 2. Number transmittals of resubmitted items with the original root number and a suffix letter starting with "A" on a new transmittal form.
  - 3. Restrict each letter of transmittal to only one Specification Section or portion thereof.
  - 4. Provide breakout of each transmittal contents on transmittal form. Each component thus defined will receive specific action by the Engineer. Define manufacturer, item, Contract Document tag number, and Contract Drawing/Specification reference.
  - 5. With prior approval of the Engineer, components of an original submittal or prior resubmittal that have not received an "R" or "E" Action may be withheld from a resubmittal. Such components shall be listed on the resubmittal transmittal form and indicated as "Outstanding To Be Resubmitted at a Later Date."
  - 6. Provide one electronic pdf copy of each page for Engineer plus the number required by the Contractor.
- B. For items not covered in above paragraphs submit one scaled pdf electronic copy.
  - 1. The Engineer will mark and return the copy to the Contractor for his reproduction and distribution.
  - 2. Contractor shall not use red color for marks on transmittals.
- C. Transmittal contents:
  - 1. Coordinate and identify shop drawing contents so that all items can be easily verified by the Engineer.
  - 2. Identify equipment or material use, tag number, drawing detail reference, weight, and other project specific information.
    - a. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
    - b. Submit items like equipment brochures, cuts of fixtures, product data sheets. Indicate exact item or model and all options proposed.
    - c. Include legible scale details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling

instructions, color charts, layout drawings, parts catalogs, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data. Arrange data and performance information in format similar to that provided in Contract Documents. Provide, at minimum, the detail provided in the Contract Documents.

- d. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet.
- D. Samples:
  - 1. Identification:
    - a. Identify sample referencing transmittal number, manufacturer, item, use, type, project designation, tag number, specification section or drawing detail reference, color, range, texture, finish and other pertinent data.
    - b. If identifying information cannot be marked directly on sample without defacing or adversely altering samples, provide a durable tag with identifying information securely attached to the sample.
  - 2. Include application specific brochures, and installation instructions.
  - 3. Provide Contractor's stamp of approval on samples or transmittal form as indication of Contractor's checking and verification of dimensions and coordination with interrelated work.
  - 4. Resubmit samples of rejected items.

# 1.05 OPERATION AND MAINTENANCE MANUALS:

- A. Number transmittals for Operation and Maintenance Manual with original root number of the approved shop drawing for the item.
  - 1. Submit one copy until approval is received.
  - 2. Identify resubmittals with the original number plus a suffix letter starting with "A."
  - 3. Submit Operation and Maintenance Manuals by pdf. Provide index for each manual.
- B. Transmittal Content:
  - 1. Submission of Operation and Maintenance Manuals is applicable but not necessarily limited to: 1) Major equipment. 2) Equipment used with electrical motor loads of 1/6 HP nameplate or greater. 3) Specialized equipment including valves and instrumentation and control system components for process systems.
  - 2. Prepare Operation and Maintenance manuals to include, but not necessarily limited to, the following detailed information, as applicable:
    - a. Equipment function, normal operating characteristics, and limiting operations.
    - b. Assembly, disassembly, installation, alignment, adjustment, and checking instructions.
    - c. Operating instructions for start-up, routine and normal operation, regulation and control, shutdown, and emergency conditions.
    - d. Lubrication and maintenance instructions.
    - e. Guide to "troubleshooting."
    - f. Parts list and predicted life of parts subject to wear.
    - g. Outline, cross-section, and assembly drawings; engineering data; and electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.
    - h. Test data and performance curves.
    - i. A list of recommended spare parts with a price list and a list of spare parts provided under these specifications.
    - j. Copies of installation instructions, parts lists or other documents packed with equipment when delivered.
    - k. Instrumentation or tag numbers relating the equipment back to the Contract Documents.
  - 3. For equipment items involving components or subunits, an Equipment Record Sheet for each operating component or subunit is required.
- C. Manufacturer's Certificates:

- 1. When specified in individual specification Sections, submit manufacturers' certificate to Engineer for review, in quantities specified for Product Data.
- 2. Indicate material or product conforms to or exceeds specified requirements. Submit supporting references date, affidavits, and certifications as appropriate.
- 3. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer.

# PART 2 - ENGINEER'S REVIEW ACTION

# 2.01 SHOP DRAWINGS AND SAMPLES:

- A. Items within transmittals will be reviewed for overall design intent and will receive one of the following actions:
  - 1. <u>**R**</u> Reviewed, No exceptions taken.
  - 2. <u>E</u> Exceptions taken, Make correction noted
  - 3. **<u>RR</u>** Revise & Resubmit
- B. Transmittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp. Drawings not stamped by the Contractor or stamped with a stamp containing language other than that specified above, will not be reviewed for technical content and will be returned without any action.
- C. Transmittals returned with Action "R" and "E" are considered ready for fabrication and installation. If for any reason a transmittal that has an "R" and "E" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "R" and "E" Action that are superseded by a resubmittal.
- D. Transmittals with Action ""R" and "E" combined with Action "RR" (Revise and Resubmit) will be individually analyzed giving consideration as follows:
- E. The portion of the transmittal given "RR" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference). One copy or the one transparency of the "RR" drawings will be marked up and returned to the Contractor. Correct and resubmit items so marked.
- F. Items marked "R" or "E" will be fully distributed.
- G. If a portion of the items or system proposed are acceptable, however, the major part of the individual drawings or documents are incomplete or require revision, the entire submittal may be given "RR" Action. This is at the sole discretion of the Engineer. In this case, some drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package." Distribution to the Owner and field will not be made (unless previously agreed to otherwise).
- H. Failure to include any specific information specified under the submittal paragraphs of the specifications will result in the transmittal being returned to the Contractor with "RR" Action.
- I. In addition to calculations stamped and returned "Engineer's Review Not Required," other transmittals such as submittals which the Engineer considers as "Not Required," submittal information which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "R" or "E" Action in a prior transmittal, will be returned with Action "Engineer's Review Not Required."
- J. Samples may be retained for comparison purposes. Remove samples when directed. Include in bid all costs of furnishing and removing samples.
- K. Approved samples submitted or constructed, constitute criteria for judging completed work. Finished work or items not equal to samples will be rejected.

# 2.02 OPERATION AND MAINTENANCE MANUALS:

- A. Engineer will review and indicate one of the following review actions:
  - 1. ACCEPTABLE.
  - 2. FURNISH AS NOTED.
  - 3. REVISE AND RESUBMIT.

- 4. REJECTED.
- B. Acceptable submittals will be retained with the transmittal form returned with a request for {five} additional copies.
- C. Deficient submittals will be returned along with the transmittal form which will be marked to indicate deficient areas.

# END OF SECTION

#### SECTION 002105 RIGHT-OF-WAY PREPARATION

#### PART 1 - GENERAL

#### 1.01 SCOPE OF WORK

A. This technical specification covers the furnishing of all labor, materials, tools, and equipment necessary for preparing the project area for the construction activities described under this contract. Included in the work is the stripping, removal, and disposal of all trees, downed timber, snags, brush, vines, rubbish, stumps, logs, topsoil, existing sidewalks, concrete steps, curbing, driveways, pavement, fencing, guiderails, signs, yard drains, pipe, light fixtures, bases, old wire, and other incidentals that interfere with the planned construction. The work includes the resetting of walls, fence fabric, and poles, relocation and/or resetting of lawn sprinklers, signs, mail boxes, etc., including the installation of temporary and construction fencing, and relocation and trimming of shrubs, trees, or other plantings to remain.

#### 1.02 SECTION INCLUDES:

- A. Preparation for work.
- B. Protection of existing features.
- C. Debris removal.
- D. Mailbox Relocations.
- E. Driveway adjustments.
- F. Fence adjustments.

#### 1.03 RELATED SECTIONS:

#### **PART 2 - EXECUTION**

#### 2.01 GENERAL:

A. The scope of work shall be as listed in Section 1.01 Scope of Work and Section 1.02 Section Includes.

#### 2.02 PREPARATION FOR WORK:

- A. Identify right-of-way limits and/or easement limits and construction limits.
- B. Verify and protect survey control.
- C. Verify that existing plant life designated to remain, if any, is tagged or identified, and protected as described in the Specifications.

#### 2.03 PROTECTION OF EXISTING FEATURES:

- A. Locate, identify, and protect from damage utilities to remain.
- B. Protect trees, plant growth, and features designated to remain.
- C. Protect bench marks and survey control from damage or displacement.

# 2.04 CLEARING AND GRUBBING:

A. See Section 311100.

#### 2.05 DEBRIS REMOVAL:

- A. Removed material shall become the property of the Contractor. Contractor shall remove debris, rock, and extracted plant life from site and legally dispose.
- B. Remove existing concrete and asphalt paving, curb, gutter, culverts, walks and other items, as needed for construction, or shown or described to be removed in the Contract Documents.

# 2.06 EXISTING FACILITIES/STRUCTURES:

A. Remove and relocate all existing sidewalks, concrete steps, curbing, driveways, pavement, fencing, guiderails, signs, yard drains, pipe, light fixtures, bases, and other incidentals that interfere with the planned construction. The work includes the resetting of walls, fence fabric, and poles, relocation and/or resetting of lawn sprinklers, signs, mail boxes, etc., including the

installation of temporary and construction fencing, and relocation and trimming of shrubs, trees, or other plantings to remain.

B. Restore all existing facilities to the preconstruction condition or better, with similar material.

# PART 3 - MEASUREMENT AND PAYMENT

## 3.01 PAYMENT:

A. No separate payment shall be made to the Contractor for the work described in this Section. Such work shall be considered incidental to the project and the payments made under specific Pay Items shall be considered as full compensation for these requirements.

# **END OF SECTION**

#### SECTION 003132 GEOTECHNICAL DATA

#### PART 1 – GENERAL

#### **GEOTECHNICAL DATA:**

- A. The below reports with it's referenced attachments is part of the Procurement and Contracting Requirements for this Project. They provide Owner's information for Bidder's convenience and are intended to supplement rather than serve in lieu of Bidders' own investigation. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. These document and it's attachments are part of the Contract Documents:
  - 1. Raba Kistner Consultants, Inc. provided supplemental recommendations for this project on November 29, 2021. This supplemental report, Raba Kistner Project No. AMA21-041-00, is included for contractor's use.

# END OF SECTION



# **GEOTECHNICAL ENGINEERING STUDY**

FOR

PROPOSED STREET REHABILITATION PROJECT RIO GRANDE CITY, STARR COUNTY, TEXAS



Raba Kistner, Inc. 800 East Hackberry McAllen, TX 78501 www.rkci.com

> P 956.682.5332 F 956.682.5487 TBPE Firm F-3257 TBAE Firm BR 3427

Project No. AMA21-041-00 January 24, 2022

Ms. Kristina Leal, P.E., CFM Business Development/Senior Engineer Halff Associates, Inc. 5000 West Military Highway, Suite 100 McAllen, Texas 78503

# RE: Geotechnical Engineering Study Proposed Street Rehabilitation Project Rio Grande City, Starr County, Texas

Dear Ms. Leal:

**RABA KISTNER Consultants, Inc. (RKCI)** is pleased to submit the report of our Geotechnical Engineering Study for the above-referenced project. This study was performed in accordance with **RKCI** Proposal No. PMA21-062-00 (Revised), dated November 29, 2021. The street segments part of the study was in accordance with an updated list of roadways received by our office, by electronic-mail transmittal, from Halff Associates, Inc. (CLIENT), on Monday, December 13, 2021. Written authorization to proceed with this study was received by our office via electronic-mail attachment on Monday, November 29, 2021. The purpose of this study was to drill borings along the proposed road alignments, to perform laboratory testing on selected samples to classify and characterize subsurface conditions, and to prepare an engineering report providing pavement design and construction guidelines for the proposed road alignments to be rehabilitated/reconstructed.

The following report contains our pavement recommendations and construction considerations based on our current understanding of the design tolerances, and pavement loads. If any of these parameters change, then there may be alternatives for value engineering of the pavement systems, and **RKCI** recommends that a meeting be held with Halff Associates, Inc. (CLIENT) and the design team to evaluate these alternatives.

O:\Active Projects\McAllen\2021\AMA21\AMA21-041-00 Prop. Rio Grande City Street Rehabilitation Project\Reporting\AMA21-041-00.doc

We appreciate the opportunity to be of professional service to you on this project. Should you have any questions about the information presented in this report, please call. We look forward to assisting Halff Associates, Inc. during the construction of the project by conducting the construction materials engineering and testing services (quality assurance program).

Very truly yours,

**RABA KISTNER CONSULTANTS, INC.** 

Adamari Davila Graduate Engineer

AD/MW

Attachments

Copies Submitted: Above (1)

Mark Wolf, P.E. **Project Engineer** 

# **GEOTECHNICAL ENGINEERING STUDY**

For

# PROPOSED STREET REHABILITATION PROJECT RIO GRANDE CITY, STARR COUNTY, TEXAS

Prepared for

HALFF ASSOCIATES, INC. McAllen, Texas

Prepared by

RABA KISTNER CONSULTANTS, INC. McAllen, Texas

PROJECT NO. AMA21-041-00

January 24, 2022

## RABAKISTNER

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#### **ATTACHMENTS**

Boring Location Map Logs of Borings Key to Terms and Symbols Results of Soil Sample Analyses Lime Series Determinations Important Information About Your Geotechnical Engineering Report

#### INTRODUCTION

**RABA KISTNER Consultants, Inc. (RKCI)** has completed the authorized subsurface exploration and pavement recommendations for the proposed road improvements in Rio Grande City, Starr County, Texas. This report briefly describes the procedures utilized during this study and presents our findings, as well as pavement design and construction guidelines.

#### **PROJECT DESCRIPTION**

We understand that the proposed project involves the assessment and preparation of design recommendations for the rehabilitation/reconstruction of the following 20 street segments in Rio Grande City, Starr County, Texas.

| Street Name   | Street                               | Limits                               | Approximate | Boring<br>Identification |  |
|---|--------------------------------------|--------------------------------------|-------------|--------------------------|--|
| Street Name   | From                                 | То                                   | Length (ft) |                          |  |
| Encino Street   | Roble Street                         | End of Street                        | 745         | P-1                      |  |
| Roble Street  | Barreta Avenue                       | End of Street                        | 875         | P-2 & P-3                |  |
| Live Oak Avenue   | River Oak Avenue                     | Plainview Drive                      | 490         | P-4                      |  |
| Live Oak Avenue   | Quito Avenue                         | Live Oak Avenue                      | 500         | P-5                      |  |
| W. Eisenhower Street  | N. Fairgrounds Road                  | N. San Antonio Street                | 3,540       | P-6 through P-9          |  |
| Columbus Street   | N. Fairgrounds Road                  | Dead End                             | 460         | P-10                     |  |
| N. Garcia Street  | W. 2 <sup>nd</sup> Street (Hwy 83)   | W. 3 <sup>rd</sup> Street            | 50          | P-11                     |  |
| N. Garcia Street  | W. 1 <sup>st</sup> Street (Loop 254) | W. 2 <sup>nd</sup> Street (Hwy 83)   | 275         | P-12                     |  |
| S. Garcia Street  | W. Water Street                      | W. 1 <sup>st</sup> Street (Loop 254) | 275         | P-13                     |  |
| Water Street  | S. Garcia Street                     | S. Shelby Street                     | 104         | P-14                     |  |
| Britton Avenue  | W. 1 <sup>st</sup> Street (Loop 254) | W. 2 <sup>nd</sup> Street (Hwy 83)   | 275         | P-15                     |  |
| Las Brisas Subdivision<br>(Including six Street Alignments) | Entire Subdivision                   | Entire Subdivision                   | 2,390       | P-16 through P-21        |  |
| E. San Benito Street  | E. US Highway 83                     | E. San Benito Street                 | 430         | P-22                     |  |
| Pine Street   | E. Olmito Street                     | E. US Highway 83                     | 325         | P-23                     |  |
| Embassy Road<br>aka Reynaldo Gomez Drive                    | E. US Highway 83                     | E. Hinojosa Street                   | 2,000       | P-24 through P-27        |  |

Further, we understand that the street alignments are located within the City of Rio Grande City and are not Texas Department of Transportation (TxDOT) street alignments. We understand that the proposed road improvements are planned to consist of flexible (asphalt) pavement systems.

#### LIMITATIONS

This engineering report has been prepared in accordance with accepted Geotechnical Engineering practices in the region of South Texas for the use of Halff Associates, Inc. (CLIENT) and its representatives for design purposes. This report may not contain sufficient information for purposes of other parties or other uses and is not intended for use in determining construction means and methods.

#### RABAKISTNER

The recommendations submitted in this report are based on the data obtained from 27 borings drilled along the proposed road alignments, our understanding of the project information provided to us by the CLIENT, and the assumption that site grading will result in only minor changes in the topography existing at the time of our study. If the project information described in this report is incorrect, is altered, or if new information is available, we should be retained to review and modify our recommendations.

This report may not reflect the actual variations of the subsurface conditions across or within the subject roads. The nature and extent of variations across or within the subject roads may not become evident until construction commences. The construction process itself may also alter subsurface conditions. If variations appear evident at the time of construction, it may be necessary to reevaluate our recommendations after performing on-site observations and tests to establish the engineering impact of the variations.

The scope of our Geotechnical Engineering Study does not include an environmental assessment of the air, soil, rock, or water conditions either on or adjacent to the road alignment. No environmental opinions are presented in this report. **RKCI**'s scope of work does not include the investigation, detection, or design related to the prevention of any biological pollutants. The term "biological pollutants" includes, but is not limited to, mold, fungi, spores, bacteria, and viruses, and the byproduct of any such biological organisms.

If final grade elevations are significantly different from the grades existing at the time of our study (more than plus or minus 1 ft), our office should be informed about these changes. If needed and/or desired, we will reexamine our analyses and make supplemental recommendations.

# **BORINGS AND LABORATORY TESTS**

Subsurface conditions along the subject road were evaluated by 27 borings (designated as "P-"), drilled from December 15, 2021 through December 18, 2021, at the locations shown on the Boring Location Map, Figures 1A through 1D. The boring locations are approximate and were located in the field by an **RKCI** representative, based on an updated street list, which specified the limits of the street segments to be rehabilitated/reconstructed, received by our office via electronic-mail attachment by the CLIENT on Monday, December 13, 2021. The borings were drilled to a depth of about 10 ft each below the ground surface elevations existing at the time of our study. The borings were drilled using a truck-mounted, rotary-drilling rig and augured utilizing straight flight augers. The upper two inches of the borings were filled with cold-mix asphalt up to the existing asphalt-paved surface level. During the drilling operations, Split-Spoon (with Standard Penetration Test, SPT) samples were collected.

The SPT samples were obtained in accordance with accepted standard practices and the penetration test results are presented as "blows per foot" on the boring logs. Representative portions of the samples were sealed in containers to reduce moisture loss, labeled, packaged, and transported to our laboratory for subsequent testing and classification.

2

In the laboratory, each sample was evaluated and visually classified by a member of our Geotechnical Engineering staff in general accordance with the Unified Soil Classification System (USCS). The geotechnical engineering properties of the strata were evaluated by the following laboratory tests: natural moisture content, Atterberg limits, sulfate content determinations, lime series determinations, and percent passing a No. 200 sieve determinations.

With the exception of the laboratory sulfate determinations and lime series tests, the results of the field and laboratory tests are presented in graphical or numerical form on the boring logs illustrated on Figures 2 through 28. A key to the classification of terms and symbols used on the logs is presented on Figure 29. The results of the laboratory and field testing are also tabulated on Figure 30 for ease of reference.

The corrosion potential of the subsurface soils to concrete and uncoated steel was preliminarily evaluated by conducting ten laboratory sulfate content tests on bulk soil samples obtained within the proposed road from an approximate depth of about 2 ft below the ground surface elevations existing at the time of our study. The laboratory test results are presented and discussed in a subsequent section of this report.

SPT results are noted as "blows per ft" on the boring logs and on Figure 30, where "blows per ft" refers to the number of blows by a falling 140-lb (pound) hammer required for 1 ft of penetration into the subsurface materials.

Samples will be retained in our laboratory for 30 days after submittal of this report. Other arrangements may be provided at the written request of the CLIENT.

#### **GENERAL SITE CONDITIONS**

#### SITE DESCRIPTION

The subject sites for the proposed pavement reconstruction are the following street alignments located within the city of Rio Grande City, Starr County, Texas.

| Street Name                       | Description   |  |  |  |  |
|-----------------------------------|---|--|--|--|--|
| Encino Stroot                     | Street segment was existing narrow 2 lane roadway aligned by residential structures and |  |  |  |  |
|                                   | vacant property.  |  |  |  |  |
| Roble Street                      | Street segment was existing narrow 2 lane roadway aligned by residential structures and |  |  |  |  |
|                                   | vacant property.  |  |  |  |  |
| Live Oak Avenue                   | Street segment was existing narrow 2 lane roadway aligned by residential structures and |  |  |  |  |
|                                   | vacant property.  |  |  |  |  |
| Live Oak Avenue                   | Street segment was existing 2 lane roadway with street parking, curb and gutter aligned |  |  |  |  |
|                                   | by residential structures.  |  |  |  |  |
| W. Eisenhower Street              | Street segment was existing 2 lane roadway aligned by residential structures and vacant |  |  |  |  |
|                                   | property.   |  |  |  |  |
| Columbus Street                   | Street segment was existing 2 lane roadway aligned by residential structures,           |  |  |  |  |
|                                   | recreational/park areas and vacant property.  |  |  |  |  |
| N. Garcia Street                  | Street segment was existing 2 lane roadway with curb and gutter aligned by              |  |  |  |  |
|                                   | commotional structures and residential structures.                                      |  |  |  |  |
| N. Garcia Street                  | Street segment was existing 2 lane roadway with curb and gutter aligned by              |  |  |  |  |
|                                   | commotional structures and graveyard.   |  |  |  |  |
| S. Garcia Street                  | Street segment was existing 2 lane roadway with curb and gutter aligned by              |  |  |  |  |
|                                   | commotional structures and residential structures.                                      |  |  |  |  |
| Water Street                      | Street segment was existing 2 lane roadway with curb and gutter aligned by              |  |  |  |  |
| Water Street                      | commotional structures and residential structures.                                      |  |  |  |  |
|                                   | Street segment was existing 2 lane roadway with north bound and south bound lanes       |  |  |  |  |
| Britton Avenue                    | separated with recreational/park area in the median. On both sides of each lane was     |  |  |  |  |
| Britton Avenue                    | street parking, curb and gutter. The street segment was aligned by commotional          |  |  |  |  |
|                                   | structures and vacant property.   |  |  |  |  |
| Las Brisas Subdivision            | Street segments were existing 2 lane roadway with street parking, curb and gutter       |  |  |  |  |
| (Including six Street Alignments) | aligned by residential structures.  |  |  |  |  |
| E San Benito Street               | Street segment was existing 2 lane roadway with wide curb lane, curb and gutter aligned |  |  |  |  |
| L. San Denito Street              | by commotional structures. Railroad crossing on southern end.                           |  |  |  |  |
| Dina Street                       | Street segment was existing 2 lane roadway with curb and gutter aligned by              |  |  |  |  |
| Fille Street                      | commotional structures. Railroad crossing on northern end.                              |  |  |  |  |
| Embassy Road aka Reynaldo         | Street segment was existing 2 lane roadway with curb and gutter aligned by              |  |  |  |  |
| Gomez Drive                       | commotional structures and residential structures. Railroad crossing on about 590 feet  |  |  |  |  |
| Gomez Drive                       | north of southern end.  |  |  |  |  |

Areas illustrated on Figure 1A through 1D

The topographies of the areas are relatively flat with a visually estimated vertical relief of less than 3 ft. Surface drainage is visually estimated to be fair.

#### SITE GEOLOGY

A cursory review of the Geologic Atlas of Texas (McAllen-Brownsville Sheet, dated 1976), published by the Bureau of Economic Geology at the University of Texas at Austin, indicates that the subject street alignments appear to be located within the following soil formations:

| Street Name  | Soil Formation   |  |
|--|--|--|
| Encino Street  | Catabaula and Frie Formation Undivided consisting  |  |
| Roble Street   | catanoula and Frio Formation Undivided consisting of   |  |
| Columbus Street                                      | the Miccone opech (Tertiary period)  |  |
| Brisas Subdivision (Including Six Street Alignments) | the Middene epoch (Tertiary period).   |  |
| Live Oak Avenue                                      |  |  |
| Live Oak Avenue                                      |  |  |
| N Garcia Street                                      |  |  |
| N Garcia Street                                      |  |  |
| S Garcia Street                                      | Flux initial towards downsite consisting of available condensite   |  |
| W Water Street                                       | and clave of the Quaternany enach (Plaietecone Poried)   |  |
| Britton Avenue                                       | and clays of the Quaternary epoch (rieistocene renou).   |  |
| E San Benito Street                                  |  |  |
| Pine Street  |  |  |
| Reynaldo Gomez Drive                                 |  |  |
| Embassy Street                                       |  |  |
| W Eisenhower Street                                  | Uvalde Gravel consisting of chert, well-rounded pebbles and cobbles of the Pilocene epoch (Tertiary period). |  |

According to the Soil Survey of Starr County, Texas, published by the United States Department of Agriculture - Soil Conservation Service, in cooperation with the Texas Agricultural Experiment Station, the proposed street alignments appear to be located within the Catarina-Copita association consisting of nearly level to undulating, deep and moderately deep, clayey and loamy soils on uplands; the Rio-Grande-Reynosa association consisting of nearly level and gently sloping, deep, loamy soils on flood plains; and the Jimenez-Quemado association consisting of undulating to hilly, very gravelly, shallow, loamy soils on ridges. The corresponding soil symbols for the subject streets appear to be the following:

| Street Name | Soil Symbol                 |
|-------------|-----------------------------|
| Cn          | Catarina clay               |
| Ср          | Copita fine sandy loam      |
| pL          | Jimenez-Quemado association |
| Мс          | McAllen fine sandy loam     |
| Zp          | Zapata soils                |
| Ra          | Ramadero loam               |
| La          | Lagloria silt loam          |
| Mm          | Matamoros silty clay        |

#### **STRATIGRAPHY**

It should be noted that the borings were drilled along the existing subject street segments. The existing hot mix asphaltic concrete (HMAC) thickness and flexible base material (FBM) thickness underlying the HMAC were measured for each boring at the time of our field operations. The boring logs should be consulted for more specific HMAC and FBM thickness information. The following table summarizes HMAC and FBM thickness for each street segment.

| Street Name   | HMAC (in.) | FBM (in.)   |
|---|------------|-------------|
| Encino Street   | 1.5        | 2.5         |
| Roble Street  | 2.5        | 4 to 6      |
| Live Oak Avenue   | 0.5        | 3           |
| Live Oak Avenue   | 0.5        | 3           |
| W. Eisenhower Street  | 2 to 3     | 10 to 16    |
| Columbus Street   | 3          | 16          |
| N. Garcia Street  | 2          | 13          |
| N. Garcia Street  | 4          | 8           |
| S. Garcia Street  | 3.5        | 3.5         |
| Water Street  | 5          | 4           |
| Britton Avenue  | 4          | 10          |
| Las Brisas Subdivision<br>(Including six Street Alignments) | 0.5 to 2   | 6 to 12*    |
| E. San Benito Street  | 3          | 0*          |
| Pine Street   | 3          | 6           |
| Embassy Road<br>aka Reynaldo Gomez Drive                    | 2 to 3**   | 9.5 to 13** |

\*No FBM was not encountered at borings P-18 and P-22

\*\* At boring P-27 HMAC and FBM was underlain by 2.5 in. of HMAC and 6 in. of FBM

The subsurface stratigraphy can generally be described as intermix layers of lean clay, lean clay with sand, sandy lean clay, fat clay, fat clay with sand, sandy fat clay, clayey sand, silty sand, sandy-silty clay, and siltyclayey sand. The depths of the individual strata and the physical characteristics vary significantly from boring to boring. Consequently, the individual boring logs should be consulted for detailed stratigraphic information at the individual boring locations. The lines designated the interfaces between strata on the boring logs represent approximate boundaries. Transitions between strata may be gradual.

#### GROUNDWATER

Groundwater was observed in the Borings P-10 and P-15, at depths of about 7-1/2 ft and 4-1/2 ft, respectively, below the ground surface elevation existing at the time of our study. Groundwater was not observed in the remaining borings, either during or immediately upon completion of the drilling operations. These borings remained dry during the field exploration phase.

It is possible for groundwater to exist beneath these sites on a transient basis following periods of precipitation. Fluctuations in groundwater levels occur due to variations in rainfall and surface water run-off. The construction process itself may also cause variations in the groundwater level. Based on the findings in the borings and on our experience in this region, we believe that groundwater seepage encountered during site earthwork activities and shallow foundation construction may be controlled using temporary earthen berm and conventional sump-and-pump dewatering methods.

# RABAKISTNER

#### **PAVEMENT RECOMMENDATIONS**

Flexible pavement recommendation for 20-year design period is presented in this report. Drainage conditions will have a significant impact on long-term performance, particularly where permeable base materials are utilized in the pavement section. Drainage considerations are discussed in more detail in a subsequent section of this report.

#### **SUBGRADE CONDITIONS**

A single generalized subgrade condition has been assumed for these sites. The predominant subgrade soils used in developing the pavement sections for this project are the non-plastic to plastic soils. On the basis of our past experience with similar subsurface conditions in these areas, design California Bearing Ratio (CBR) value of 3 was assigned to evaluate the pavement components. These design CBR value assume that the subgrades soils will be prepared in accordance with the recommendations stated in the *Subgrade Preparation* subsection of the *Pavement Construction Guidelines* section of this report.

#### SULFATE CORROSION POTENTIAL

The potential of soluble sulfates in the subgrade clay soils within the study area was preliminary evaluated by conducting ten laboratory sulfate content tests. This tests were conducted on bulk soil specimens obtained within the proposed road alignments from a depth of about 2 ft below the ground surface elevations existing at the time of our study. The laboratory test results indicate the following sulfate content values:

| Boring ID | Sulfate Content (ppm) |
|-----------|-----------------------|
| P-1       | 1,540                 |
| P-6       | 860                   |
| P-8       | 160                   |
| P-10      | 1,500                 |
| P-12      | 1,120                 |
| P-18      | 1,560                 |
| P-19      | 2,360                 |
| P-21      | 2,420                 |
| P-24      | 1,540                 |
| P-27      | 120                   |

On the basis of these sulfate content test results, the tested on-site soils do not appear to have a potential to cause sulfate-induced heave. Typically, the concentration of soluble sulfate on soils becomes a concern when the concentration reaches about 3,000 ppm and higher. The sulfate concentration in soils may vary over short distances, and as such, additional testing is recommended at the time of construction to confirm the concentration of sulfates in the exposed subgrade soils within the subject pavement areas.

#### LIME TREATMENT OF SUBGRADE

In general, the subgrade soils at these sites are non-plastic to plastic in nature. Moderately plastic to plastic soils can be difficult to work with, particularly during periods of inclement weather. The strength properties of the moderately plastic to plastic subgrade soils may be increased by treating the upper 8 inches with hydrated lime. A sufficient quantity of hydrated lime should be mixed with the subgrade soils to decrease the plasticity index of the soil-lime mixture to 18 or less and to increase the pH of the soil-lime mixture to at least 12.4. The laboratory lime series testing performed for the moderately plastic to plastic subgrade soils indicates an optimum hydrated lime content of about 2 percent (Please refer to Figures 31 and 32 of the Attachments for the lime series test results). For construction purposes, we recommend that the percent of hydrated lime treatment be determined by appropriate laboratory testing at the time of construction.

#### **DESIGN INFORMATION**

The following recommendations for the flexible pavement sections are based on the assumption that the proposed street alignments will meet the pavement thickness requirements provided on local standard design guidelines. Please refer to the table below for the required thicknesses stated in the aforementioned document.

The following table summarizes the local standard design guidelines for local and collector street sections and the corresponding estimated traffic capacity. These calculations were made following the American Association of State Highway and Transportation Officials (AASHTO). The pavement design and analyses performed are based directly on the 1993 and 1997 editions of the "Guide for the Design of Pavement Structures" by AASHTO.

| Street Classification | PS<br>(in.) | LTS<br>(in.) | FBM<br>(in.) | HMAC<br>(in.) | Estimated<br>ESAL's |
|-----------------------|-------------|--------------|--------------|---------------|---------------------|
|                       | -           | 6            | 8            | _             |                     |
| Local                 | 6           | -            | 12           | 2             | 40,000              |
|                       | -           | 6            | 10           |               |                     |
| Collector             | 6           | -            | 14           | 2.5           | 120,000             |

Where:

PS = Prepared Subgrade LTS = Lime-Treated Subgrade FBM = Flexible Base Material HMAC = Hot-Mix Asphaltic Concrete Surface Course ESAL = Equivalent Single Axel Loads

| <b>a</b>  | STREET                               |                                      |          |
|---|--------------------------------------|--------------------------------------|----------|
| Street Name   | From                                 | То                                   | Subgrade |
| Encino Street                                       | Roble Street                         | End of Street                        | LTS      |
| Roble Street  | Barreta Avenue                       | End of Street                        | LTS      |
| Live Oak Avenue                                     | River Oak Avenue                     | Plainview Drive                      | PS       |
| Live Oak Avenue                                     | Quito Avenue                         | Live Oak Avenue                      | PS       |
| W. Eisenhower Street                                | N. Fairgrounds Road                  | N. San Antonio Street                | PS       |
| Columbus Street                                     | N. Fairgrounds Road                  | Dead End                             | LTS      |
| N. Garcia Street                                    | W. 2 <sup>nd</sup> Street (Hwy 83)   | W. 3 <sup>rd</sup> Street            | LTS      |
| N. Garcia Street                                    | W. 1 <sup>st</sup> Street (Loop 254) | W. 2 <sup>nd</sup> Street (Hwy 83)   | LTS      |
| S. Garcia Street                                    | W. Water Street                      | W. 1 <sup>st</sup> Street (Loop 254) | LTS      |
| Water Street  | S. Garcia Street                     | S. Shelby Street                     | LTS      |
| Britton Avenue W. 1 <sup>st</sup> Street (Loop 254) |                                      | W. 2 <sup>nd</sup> Street (Hwy 83)   | PS       |
| Wilderness Trial<br>(Brisas Subdivision)            | Entire                               | LTS                                  |          |
| Sparrows Nest Street<br>(Brisas Subdivision)        | Entire                               | Street                               | PS       |
| Deer Run (Brisas Subdivision)                       | Entire                               | Street                               | PS       |
| Quail Run Road<br>(Brisas Subdivision)              | Entire                               | PS                                   |          |
| Whitewing Ridge Road<br>(Brisas Subdivision)        | Entire                               | LTS                                  |          |
| E. San Benito Street                                | E. US Highway 83                     | E. San Benito Street                 | PS       |
| Pine Street   | E. Olmito Street                     | E. US Highway 83                     | LTS      |
| Embassy Road<br>aka Reynaldo Gomez Drive            | E. US Highway 83                     | E. Hinojosa Street                   | LTS      |

The following table summarizes the type of subgrade required for the proposed street alignments.

Where: PS = Prepared Subgrade

LTS = Lime-Treated Subgrade

#### **PAVEMENT CONSTRUCTION CONSIDERATIONS**

#### **SUBGRADE PREPARATION**

Areas to support pavements should be stripped of all existing hot mix asphaltic concrete (HMAC), vegetation and/or organic topsoil, extending a minimum of 2 ft beyond the pavement perimeters. Upon completion of site stripping activities, the exposed subgrade should be thoroughly proofrolled in order to locate and densify any weak, compressible zones. A minimum of 5 passes of a fully-loaded dump truck or a similar heavily-loaded piece of construction equipment should be used for planning purposes. Proofrolling operations should be observed by the Geotechnical Engineer or his representative to document subgrade condition and preparation. Weak or soft areas identified during proofrolling should be removed and replaced with a suitable, compacted select fill in accordance with the recommendations

#### 9

presented under the *Select Fill* subsection of this section of the report. Proofrolling operations and any excavation/backfill activities should be observed by **RKCI** representatives to document subgrade condition and preparation.

Upon completion of the proofrolling operations and just prior to lime treatment, the exposed subgrade should be moisture-conditioned by scarifying to a minimum depth of 8 in. and recompacting to a minimum of 98 percent of the maximum dry density as determined from the American Society for Testing and Materials (ASTM) D698, Compaction Test. The moisture content of the subgrade should be maintained within the range between the optimum moisture content to three percentage points above the optimum moisture content until the final lift of fill is permanently covered.

#### **DRAINAGE CONSIDERATIONS**

As with any soil-supported structure, the satisfactory performance of a pavement system is contingent on the provision of adequate surface and subsurface drainage. Insufficient drainage which allows saturation of the pavement subgrade and/or the supporting granular pavement materials will greatly reduce the performance and service life of the pavement systems.

Surface and subsurface drainage considerations crucial to the performance of pavements at these sites include (but are not limited to) the following:

- 1) Any known natural or man-made subsurface seepage at the sites which may occur at sufficiently shallow depths as to influence moisture contents within the subgrades should be intercepted by drainage ditches or below grade French drains.
- 2) Final site grading should eliminate isolated depressions adjacent to curbs, which may allow surface water to pond and infiltrate into the underlying soils. Curbs should completely penetrate flexible base materials and should be installed to sufficient depth to reduce infiltration of water beneath the curbs.
- 3) Pavement surfaces should be maintained to help minimize surface ponding and to provide rapid sealing of any developing cracks. These measures will help reduce infiltration of surface water downward through the pavement section.

# ON-SITE CLAY/SAND FILL

The pavement recommendations presented in this report were prepared assuming that on-site soils will be used for site grading in the proposed pavement areas. If used, we recommend that on-site soils be placed in loose lifts not exceeding 8 in. in thickness and compacted to a minimum of 98 percent of the maximum dry density as determined from ASTM D698. The moisture content of the subgrade should be maintained within the range of two percentage points below the optimum moisture content to two percentage points above the optimum moisture content until permanently covered. We recommend that on-site fill materials be free of roots, vegetation, and/or other organic or degradable material. We also recommend that the maximum particle size not exceed 4 in. or one half the lift thickness, whichever is smaller.

#### LIME TREATMEMENT OF SUBGRADE

If and where implemented, lime treatment of the subgrade soils should be in accordance with the TxDOT 2014 Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, Item 260, Lime Treatment (Road Mixed). Lime-treated subgrade soils should be compacted to a minimum of 95 percent of the maximum dry density at a moisture content within the range of two percentage points below the optimum moisture content to two percentage points above the optimum moisture content as determined by ASTM D1557.

#### SELECT FILL

If and where implemented, materials used as select fill for final site grading preferably should be crushed stone or gravel aggregate. We recommend that materials specified for use as select fill meet the TxDOT 2014 Standard Specification for Construction and Maintenance of Highways, Streets, and Bridges, Item 247, Flexible Base, Type A through Type E, Grades 1, 2, 3, and 5.

Alternatively, the following soils, as classified according to the USCS, may be considered satisfactory for use as select fill materials along these sites: SC, GC, CL, and combinations of these soils. In addition to the USCS classification, alternative select fill materials shall have a maximum liquid limit of 40 percent, a plasticity index between 7 and 18 percent, and a maximum particle size not exceeding 4 inches or one-half the loose lift thickness, whichever is smaller. In addition, if these materials are utilized, grain size analyses and Atterberg Limits must be performed during placement at a minimum rate of one test each per 5,000 cubic yards of material due to the high degree of variability associated with pit-run materials.

If the above listed alternative materials are being considered for bidding purposes, the materials should be submitted to the Geotechnical Engineer for pre-approval at a minimum of 10 working days or more prior to the bid date. Failure to do so will be the responsibility of the General Contractor. The General Contractor will also be responsible for ensuring that the properties of all delivered alternate select fill materials are similar to those of the pre-approved submittal. It should also be noted that when using alternative fill materials, difficulties may be experienced with respect to moisture control during and subsequent to fill placement, as well as with erosion, particularly when exposed to inclement weather. This may result in sloughing of beam trenches and/or pumping of the fill materials.

Soils classified as CH, MH, ML, SM, GM, OH, OL, and Pt under the USCS and not meeting the alternative select fill material requirements, are **not** considered suitable for use as select fill materials at these sites.

Select fill should be placed in loose lifts **not** exceeding 8 in. in thickness and compacted to at least 98 percent of maximum dry density as determined by ASTM D698. The moisture content of the fill should be maintained within the range of two percentage points below the optimum moisture content to two percentage points above the optimum moisture content until the final lift of fill is permanently covered.

The select fill should be properly compacted in accordance with these recommendations and tested by **RKCI** personnel for compaction as specified.

#### FLEXIBLE BASE COURSE

The flexible base course should consist of material conforming to TxDOT 2014 Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Item 247, Flexible Base, Type A through Type E, Grades 1, 2, 3, and 5.

The flexible base course should be placed in lifts with a maximum compacted thickness of 8 in. and compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D1557. The moisture content of the base course materials should be maintained within the range of three percentage points below the optimum moisture content to three percentage points above the optimum moisture content until permanently covered.

If the existing asphaltic concrete surface course and flexible base materials are being considered to be reused as flexible base materials, such materials should be processed and treated in such a way as to comply with the TxDOT 2014 Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Item 251, Reworking Base Courses.

#### ASPHALTIC CONCRETE SURFACE COURSE

The asphaltic concrete surface course should conform to TxDOT 2014 Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Item 341, Dense-Graded Hot-Mix Asphalt, Type D. The asphaltic concrete should be compacted to a minimum of 92 percent of the maximum theoretical specific gravity (Rice) of the mixture determined according to Test Method Tex-227-F. Pavement specimens, which shall be either cores or sections of asphaltic pavement, will be tested according to Test Method Tex-207-F. The nuclear-density gauge or other methods which correlate satisfactorily with results obtained from project roadway specimens may be used when approved by the Engineer. Unless otherwise shown on the plans, the Contractor shall be responsible for obtaining the required roadway specimens at their expense and in a manner and at locations selected by the Engineer.

#### **EXCAVATION SLOPING AND BENCHING**

Excavations that extend to or below a depth of 5 ft below construction grade shall require the General Contractor to develop a trench safety plan to protect personnel entering the trench or trench vicinity. The collection of specific geotechnical data and the development of such a plan, which could include designs for sloping and benching or various types of temporary shoring, is beyond the scope of the current study. Any such designs and safety plans shall be developed in accordance with current Occupational Safety and Health Administration (OSHA) guidelines and other applicable industry standards.

#### **EXCAVATION EQUIPMENT**

Our boring logs are not intended for use in determining construction means and methods and may therefore be misleading if used for that purpose. We recommend that General Contractors and their subcontractors interested in bidding on the work perform their own tests in the form of test pits to

determine the quantities of the different materials to be excavated, as well as the preferred excavation methods and equipment for these sites.

#### CONSTRUCTION RELATED SERVICES

#### CONSTRUCTION MATERIALS ENGINEERING AND TESTING SERVICES

As presented in the attachment to this report, *Important Information About Your Geotechnical Engineering Report*, subsurface conditions can vary across a project sites. The conditions described in this report are based on interpolations derived from a limited number of data points. Variations will be encountered during construction, and only the geotechnical design engineer will be able to determine if these conditions are different than those assumed for design.

Construction problems resulting from variations or anomalies in subsurface conditions are among the most prevalent on construction projects and often lead to delays, changes, cost overruns, and disputes. These variations and anomalies can best be addressed if the geotechnical engineer of record, **RABA KISTNER**, is retained to perform the construction materials engineering and testing services during the construction of the project. This is because:

- **RKCI** has an intimate understanding of the geotechnical engineering report's findings and recommendations. **RKCI** understands how the report should be interpreted and can provide such interpretations on site, on the CLIENT's behalf.
- **RKCI** knows what subsurface conditions are anticipated at the sites.
- **RKCI** is familiar with the goals of the CLIENT and the project's design professionals, having worked with them in the development of the project's geotechnical workscope. This enables **RKCI** to suggest remedial measures (when needed) which help meet others' requirements.
- **RKCI** has a vested interest in client satisfaction, and thus assigns qualified personnel whose principal concern is client satisfaction. This concern is exhibited by the manner in which contractors' work is tested, evaluated and reported, and in selection of alternative approaches when such may become necessary.
- **RKCI** cannot be held accountable for problems which result due to misinterpretation of our findings or recommendations when we are not on hand to provide the interpretation which is required.

# **BUDGETING FOR CONSTRUCTION TESTING**

Appropriate budgets need to be developed for the required construction materials engineering and testing services. At the appropriate time before construction, we advise that **RKCI** and the project designers meet and jointly develop the testing budgets, as well as review the testing specifications as it pertains to this project.

Once the construction testing budget and scope of work are finalized, we encourage a preconstruction meeting with the selected General Contractor to review the scope of work to make sure it is consistent

with the construction means and methods proposed by the contractor. **RKCI** looks forward to the opportunity to provide continued support on this project, and would welcome the opportunity to meet with the Project Team to develop both a scope and budget for these services.

\* \* \* \* \* \* \* \* \* \* \* \* \* \* \* \* \*

The following figures are attached and complete this report:

| Figures 1A through 1D | Boring Location Map                        |
|-----------------------|--|
| Figures 2 through 28  | Logs of Borings                            |
| Figure 29             | Key to Terms and Symbols                   |
| Figure 30             | Results of Soil Sample Analyses            |
| Figures 31 and 32     | Lime Series Curves (Based on Laboratory pH |
|                       | Determinations)                            |

# ATTACHMENTS



ISSUE DATE: 01-21-22 DRAWN BY: DV CHECKED BY: AD REVIEWED BY: MW PROJECT No.: AMA21-041-00 DESCRIPTION FIGURE REVISIONS: No. DATE













|                  |              |         | <b>LC</b><br>Prop.<br>Rio Gr   | <b>)G OF B</b><br>. Street R<br>rande Cit | OR<br>Reha<br>y, St | ING<br>bilita<br>arr (  | NO. P-1<br>tion Project<br>county, Texas   | N E R<br>. F-3257 |
|------------------|--------------|---------|--|---|---------------------|-------------------------|--|-------------------|
| DRILL            | .ING<br>10D: | Stra    | aight Flight Auger   |   |                     |                         | LOCATION: See Figure 1                     |                   |
| <b>DEPTH, FT</b> | SYMBOL       | SAMPLES | DESCRIPTION OF MATERI  | AL  | BLOWS PER FT        | UNIT DRY<br>WEIGHT, pcf | SHEAR STRENGTH, TONS/FT <sup>2</sup>       | INDEX<br>% -200   |
|                  |              | X       | Hot-Mix Asphaltic Concrete (HMAC) -<br>in.<br>Flexible Base Material (FBM) - 2-1/2 i<br><b>CLAYEY SAND (SC)</b><br>dense, light brown, with gravel | - 1-1/2<br>in.                            | 44                  |                         | - ×× 1 1                                   | 6                 |
|                  |              | X       |  |   | 39                  |                         |  | 29                |
| - 5 -            |              | X       | SANDY FAT CLAY (CH)<br>very stiff, light brown   |   | 18                  |                         |  |                   |
|                  |              |         |  |   | 19                  |                         | - × × 3                                    | 7                 |
|                  | -            |         | Boring terminated at a depth of abou<br>NOTES:<br>Upon completion of the drilling opera<br>the boring was observed dry.                            | ut 10 ft.<br>ations,                      |                     |                         |  |                   |
|                  | -            |         |  |   |                     |                         |  |                   |
|                  | -            |         |  |   |                     |                         |  |                   |
| DEPTH            | H DRILL      | ED:     | 10.0 ft <b>DEPTH</b><br>12/16/2021 <b>DATE N</b>   | TO WATER<br>IEASURED:                     | :                   | DRY<br>12/16            | - PROJ. No.: AXA21-041-<br>/2021 FIGURE: 2 | 00                |

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT
|                  |                                      |              | <b>LOG OF</b><br>Prop. Stree<br>Rio Grande  | <b>BOF</b><br>t Reh<br>City, S | <b>RIN</b><br>abili<br>Starr | G NO. P-2<br>itation Project<br>r County, Texas  | <b>E R</b><br>257 |
|------------------|--------------------------------------|--------------|---|--------------------------------|------------------------------|--|-------------------|
| DRILL<br>METH    | .ING<br>IOD:                         | Stra         | aight Flight Auger  |                                |                              | LOCATION: See Figure 1   |                   |
| <b>DEPTH, FT</b> | SYMBOL                               | SAMPLES      | DESCRIPTION OF MATERIAL   | BLOWS PER FT                   |                              | SHEAR STRENGTH, TONS/FT <sup>2</sup> •••         •         •• | % -200            |
|                  |                                      |              | Hot-Mix Asphaltic Concrete (HMAC) - 2-1/2<br>in.<br>Flexible Base Material (FBM) - 4 in.<br>SANDY FAT CLAY (CH)<br>firm to stiff, dark brown to light brown,<br>with gravel and gypsum crystals | 5                              |                              |  | 63                |
| - ·              |                                      | $\mathbb{N}$ |   | 6                              |                              | ●★ →<br>→ - → - → → - 39   |                   |
|                  |                                      | X            |   | 9                              |                              |  | 64                |
|                  |                                      | / \          | Boring terminated at a depth of about 10 ft.<br>NOTES:<br>Upon completion of the drilling operations,<br>the boring was observed dry.   |                                |                              |  |                   |
| - ·              | -<br>-<br>-<br>-<br>-<br>-<br>-<br>- | ED:          | 10.0 ft DEPTH TO WA   | FER:                           | DRY                          | -     -     -       -     -     -       -     -     -       -     -     -       -     -     -       -     -     -       -     -     -       -     -     -       -     -     -       -     -     -       -     -     -       -     -     -       -     -     -       -     -     -       -     -     -       -     -     -  |                   |
| DATE             | DRILLE                               | D:           | 12/16/2021 DATE MEASUR  | ED:                            | 12/2                         | 16/2021         FIGURE:         3  |                   |

|                   |                       |                  |   | LOG OF I<br>Prop. Street       | BOR<br>Reha  | ING<br>bilita         | NO<br>ation   | Proj            | s<br>ect          |       |                           | т                |                  | RAB<br>KIS<br>Begistration | A<br>T N<br>n No. E-3 | E R    |
|-------------------|-----------------------|------------------|---|--------------------------------|--------------|-----------------------|---------------|-----------------|-------------------|-------|---------------------------|------------------|------------------|----------------------------|-----------------------|--------|
|                   |                       | Str/             | hight Elight Augor  |                                | ty, 51       |                       | Joun<br>Louin | су, те<br>сатіс | ->                | Sool  | Figure 1                  |                  |                  | Registration               |                       | 5257   |
|                   |                       |                  |   |                                | Ŀ            | ď,                    |               | -0              |                   |       | RENGTH                    | I, TON!<br>— —∆— | 6/FT²<br>· — —□- | _                          | >                     |        |
| <b>DEPTH</b> , F1 | SYMBOL                | SAMPLES          | DESCRIPTION OF M  | 1ATERIAL                       | OWS PER      | UNIT DRY<br>VEIGHT, p | 0             | .5 1<br>PLAS    | .0 1<br>TIC<br>IT | L.5 : | 2.0 2.<br>WATER<br>CONTEN | .5 3.0<br>T      |                  | 4.0                        | PLASTICIT             | % -200 |
|                   |                       |                  | SURFACE ELEVATION: Ex. Gra  | de, ft                         | 8            |                       | 1             | 0 2             | 0                 | 30    | <u>40 5</u>               | <u> </u>         | ×<br>70          | - 80                       |                       |        |
|                   |                       |                  | Hot-Mix Asphaltic Concrete (<br>in.   | (HMAC) - 2-1/2                 |              |                       |               |                 |                   |       |                           |                  |                  |                            |                       |        |
|                   |                       | $\left  \right $ | Flexible Base Material (FBM)<br>SILTY, CLAYEY SAND (SC-SM<br>dense to very dense, light b<br>gravel | - 6 in/<br>)<br>prown, with    | 31           |                       | -<br>•        |                 |                   |       |                           |                  |                  | -                          | -                     | 22     |
|                   |                       |                  |   |                                | 50/9"        |                       | -             |                 |                   |       |                           |                  |                  | -                          | -                     |        |
| 5                 |                       | X                |   |                                | 50/5"        |                       | •             | ×               | ×                 |       |                           |                  |                  | -                          | 6                     |        |
|                   |                       |                  |   |                                |              |                       | -             |                 |                   |       |                           |                  |                  | -                          |                       |        |
|                   |                       |                  |   |                                | 50/<br>10"   |                       | •             |                 |                   |       |                           |                  |                  | -                          |                       | 18     |
|                   |                       |                  | Boring terminated at a depth  | n of about 10 ft.              |              |                       |               |                 |                   |       |                           |                  |                  |                            |                       |        |
|                   | -                     |                  | NOTES:<br>Upon completion of the drill<br>the boring was observed                                   | ing operations,<br>dry.        |              |                       | _             |                 |                   |       |                           |                  |                  | -                          | -                     |        |
|                   | -                     |                  |   |                                |              |                       | -             |                 |                   |       |                           |                  |                  | -                          | -                     |        |
|                   | -                     |                  |   |                                |              |                       | -             |                 |                   |       |                           |                  |                  | -                          | -                     |        |
| -15-              | -                     |                  |   |                                |              |                       | -             |                 |                   |       |                           |                  |                  |                            |                       |        |
|                   |                       |                  |   |                                |              |                       | -             |                 |                   |       |                           |                  |                  | -                          |                       |        |
|                   | -                     |                  |   |                                |              |                       | -             |                 |                   |       |                           |                  |                  | -                          |                       |        |
|                   |                       |                  |   |                                |              |                       | _             |                 |                   |       |                           |                  |                  | -                          |                       |        |
|                   | -                     |                  |   |                                |              |                       | -             |                 |                   |       |                           |                  |                  | -                          | -                     |        |
| DEPTH<br>DATE     | <br>  DRILL<br>DRILLE | ED:<br>D:        | 10.0 ft<br>12/17/2021   | DEPTH TO WATE<br>DATE MEASURED | <br>R:<br>): | DRY<br>12/17          | L<br>7/202:   | 1               |                   |       | PRO<br>FIGU               | J. No.:<br>JRE:  |                  | AXA21-0<br>4               | <br>)41-00            |        |

RABA

## LOG OF BORING NO. P-3

Prop. Street Rehabilitation Project Rio Grande City, Starr County, Texas TBPE Firm Registration No. F-3257 DRILLING LOCATION: See Figure 1 **METHOD:** Straight Flight Auger SHEAR STRENGTH, TONS/FT<sup>2</sup> **BLOWS PER FT** UNIT DRY WEIGHT, pcf  $\sim$ -⊗--PLASTICITY INDEX Ē SAMPLES SYMBOL % -200 0.5 1.0 2.0 2.5 3.0 3.5 4.0 1.5 DEPTH, **DESCRIPTION OF MATERIAL** PLASTIC LIMIT WATER CONTENT LIQUID LIMIT -× 70 SURFACE ELEVATION: Ex. Grade, ft 10 30 40 50 60 80 Hot-Mix Asphaltic Concrete (HMAC) - 1/2 in. Flexible Base Material (FBM) - 3 in. **CLAYEY SAND (SC)** 14 medium dense, light brown 15 10 ×  $-\times$ 5 SANDY, SILTY CLAY (CL-CM) very stiff, light brown 22 68 • 17 7 ×--┢ -10 Boring terminated at a depth of about 10 ft. NOTES: Upon completion of the drilling operations, the boring was observed dry. -15-DEPTH DRILLED: 10.0 ft **DEPTH TO WATER:** DRY PROJ. No.: AXA21-041-00 DATE DRILLED: 12/17/2021 **DATE MEASURED:** 12/17/2021 FIGURE: 5

LOG OF BORING NO. P-4



RABA KISTNER Prop. Street Rehabilitation Project Rio Grande City, Starr County, Texas TBPE Firm Registration No. F-3257 DRILLING LOCATION: See Figure 1 **METHOD:** Straight Flight Auger SHEAR STRENGTH, TONS/FT<sup>2</sup> **BLOWS PER FT** UNIT DRY WEIGHT, pcf  $\sim$ -⊗--PLASTICITY INDEX Ē SAMPLES SYMBOL % -200 0.5 1.0 2.0 2.5 3.0 3.5 4.0 1.5 DEPTH, **DESCRIPTION OF MATERIAL** PLASTIC LIMIT WATER CONTENT LIQUID LIMIT -× 70 SURFACE ELEVATION: Ex. Grade, ft 10 20 30 40 50 60 80 Hot-Mix Asphaltic Concrete (HMAC) - 1/2 in. Flexible Base Material (FBM) - 3 in. 5 SANDY, SILTY CLAY (CL-CM) 4 Ж× soft, brown, with calcareous nodules 57 3 NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT 5 SILTY, CLAYEY SAND (SC-SM) loose to medium dense, brown 4  $\times \times$ 5 15 -10-Boring terminated at a depth of about 10 ft. NOTES: Upon completion of the drilling operations, the boring was observed dry. -15-DEPTH DRILLED: 10.0 ft **DEPTH TO WATER:** DRY PROJ. No.: AXA21-041-00 DATE DRILLED: 12/16/2021 **DATE MEASURED:** 12/16/2021 FIGURE: 6

LOG OF BORING NO. P-5

|               |                   |              | <b>L</b> (<br>Prop<br>Rio G   | <b>OG OF B</b><br>p. Street F<br>Grande Cit | <b>BOR</b><br>Reha<br>ty, St | ING<br>bilita<br>tarr ( | <b>NO. P-6</b><br>ation Project<br>County, Texas | TBPE Firm  | RABA<br>KIST<br>Registration N | A<br>N I<br>Io. F-3 | <b>E R</b><br>257 |
|---------------|-------------------|--------------|---|---|------------------------------|-------------------------|--|--|--------------------------------|---------------------|-------------------|
| DRILL<br>METH | ING<br>IOD:       | Stra         | aight Flight Auger  |   |                              |                         | LOCATION: See Figu                               | re 1   |                                |                     |                   |
| DEPTH, FT     | SYMBOL            | SAMPLES      | DESCRIPTION OF MATER  | RIAL  | BLOWS PER FT                 | UNIT DRY<br>WEIGHT, pcf | SHEAR STRENG<br>                                 | GTH, TONS/FT <sup>2</sup><br>2.5 3.0 3.5<br>TER LIQU<br>TENT LIQU<br>5.0 60 70 | -<br>4.0                       | PLASTICITY<br>INDEX | % -200            |
|               |                   |              | Hot-Mix Asphaltic Concrete (HMAC)<br>Flexible Base Material (FBM) - 16 in     | ) - 2 in                                    |                              |                         |  |  |                                |                     |                   |
|               |                   |              | dense to medium dense, brown, v<br>gravel                                     | with  | 34                           |                         | -  |  | -                              |                     | 18                |
|               |                   | X            |   |   | 28                           |                         | _ • × - ×  |  |                                | 9                   |                   |
|               |                   | X            | SILTY, CLAYEY SAND (SC-SM)<br>medium dense to dense, brown                    |   | 23                           |                         | -  |  | -                              |                     | 30                |
|               |                   | $\mathbb{N}$ |   |   | 31                           |                         | - • ×-×  |  | -                              | 7                   |                   |
| -10-          | ſ                 |              | Boring terminated at a depth of abo   | out 10 ft.                                  |                              |                         |  |  |                                |                     |                   |
|               |                   |              | NOTES:<br>Upon completion of the drilling ope<br>the boring was observed dry. | erations,                                   |                              |                         | -  |  | -                              |                     |                   |
|               | -                 |              |   |   |                              |                         | -  |  | _                              |                     |                   |
| -15-          |                   |              |   |   |                              |                         |  |  |                                |                     |                   |
|               | -                 |              |   |   |                              |                         | -  |  |                                |                     |                   |
|               | -                 |              |   |   |                              |                         |  |  |                                |                     |                   |
|               | -                 |              |   |   |                              |                         |  |  |                                |                     |                   |
| DEPTH<br>DATE | i DRILL<br>DRILLE | ED:<br>D:    | 10.0 ft         DEPTH           12/15/2021         DATE                       | I TO WATER<br>MEASURED                      | R:<br>:                      | DRY<br>12/15            | 5/2021 F   | PROJ. No.:<br>IGURE:   | AXA21-041<br>7                 | 1-00                |                   |

|                  |            |              | <b>L</b><br>Pro<br>Rio (  | <b>.OG OF B</b><br>op. Street F<br>Grande Cit | SOR<br>Reha<br>Sy, St | <b>ING</b><br>bilita<br>arr C | <b>NO</b><br>ition<br>count | <b>. P-7</b><br>Projec<br>cy, Tex | ct<br>as |                          | тв              | PE Firm Re  | A B<br>IS<br>gistration | A<br>No. F-3        | <b>E R</b><br>3257 |
|------------------|------------|--------------|---|---|-----------------------|-------------------------------|-----------------------------|-----------------------------------|----------|--------------------------|-----------------|---|-------------------------|---------------------|--------------------|
| DRILL<br>METH    | ING<br>OD: | Stra         | aight Flight Auger  |   |                       |                               | LO                          | CATION                            | : See    | e Figure 1               | L               |   |                         |                     |                    |
| <b>DEPTH, FT</b> | SYMBOL     | SAMPLES      | DESCRIPTION OF MATE   | RIAL  | BLOWS PER FT          | UNIT DRY<br>WEIGHT, pcf       | 0.                          | SH<br><br><br><br>                | IEAR ST  | 2.0 2<br>WATER<br>CONTEN | <b>1, TONS</b>  | 6/FT <sup>2</sup><br>□-<br>3.5<br>LIQUID<br>LIMIT<br>×-<br>70 | 4.0                     | PLASTICITY<br>INDEX | % -200             |
|                  |            |              | →Hot-Mix Asphaltic Concrete (HMAC<br>Elevible Base Material (EBM) - 10 ir     | C) - 2 in/                                    |                       |                               |                             |                                   |          |                          |                 |   |                         |                     |                    |
|                  |            |              | SILTY SAND (SM)<br>dense to very dense, light brown<br>gravel                 | with  | 38                    |                               |                             |                                   |          |                          |                 |   |                         |                     | 12                 |
|                  |            |              |   |   | 38                    |                               | -<br>•                      |                                   |          |                          |                 |   | _                       |                     |                    |
| - 5              |            | X            |   |   | 50/<br>10"            |                               | •                           | **                                |          |                          |                 |   |                         | 3                   |                    |
|                  |            |              |   |   |                       |                               | -                           |                                   |          |                          |                 |   | _                       |                     |                    |
|                  |            | $\mathbb{N}$ |   |   | 50/9"                 |                               | •                           |                                   |          |                          |                 |   |                         |                     | 25                 |
| —10—             |            |              | Boring terminated at a depth of ab  | oout 10 ft.                                   |                       |                               |                             |                                   |          |                          |                 |   |                         |                     |                    |
|                  |            |              | NOTES:<br>Upon completion of the drilling ope<br>the boring was observed dry. | erations,                                     |                       |                               | _                           |                                   |          |                          |                 |   | _                       |                     |                    |
|                  |            |              |   |   |                       |                               | -                           |                                   |          |                          |                 |   | _                       |                     |                    |
| 15               |            |              |   |   |                       |                               |                             |                                   |          |                          |                 |   | _                       |                     |                    |
|                  |            |              |   |   |                       |                               | _                           |                                   |          |                          |                 |   | -                       |                     |                    |
|                  |            |              |   |   |                       |                               | -                           |                                   |          |                          |                 |   | -                       |                     |                    |
|                  |            |              |   |   |                       |                               |                             |                                   |          |                          |                 |   |                         |                     |                    |
| DEPTH<br>DATE I  | DRILL      | ED:<br>D:    | 10.0 ft         DEPT           12/16/2021         DATE                        | H TO WATER                                    | k:<br>:               | DRY<br>12/16                  | /2021                       |                                   |          | PRC<br>FIG               | J. No.:<br>JRE: | A<br>8  | XA21-0                  | 41-00               |                    |

|               |              |                   | R  | Prop. Street F<br>Rio Grande Cit | Reha<br>ty, St | bilita<br>arr C | ition<br>Count | Proj<br>ty, Te | ect<br>exas | ;     |                |         | твре       | Firm Re                | IS<br>gistration | <b>Γ Ν</b><br>η Νο. F-3 | <b>E R</b><br>3257 |
|---------------|--------------|-------------------|--|----------------------------------|----------------|-----------------|----------------|----------------|-------------|-------|----------------|---------|------------|------------------------|------------------|-------------------------|--------------------|
| DRILL<br>METH | ING<br>IOD:  | Stra              | aight Flight Auger                               |                                  |                |                 | LO             | CATIC          | DN:         | See   | e Figure       | 1       |            |                        |                  |                         |                    |
|               |              |                   |  |                                  | Н              | Ŧ               |                | -6             | SHE/        | AR ST | rrengt         | Н, ТС   | )NS/F<br>^ | T <sup>2</sup><br>—□□− |                  |                         |                    |
| TH, FT        | ABOL         | APLES             | DESCRIPTION OF MA                                |                                  | S PER          | T DRY<br>HT, po | 0.             | .5 1           | .0          | 1.5   | 2.0 2          | 2,5     | 3.0        | 3.5                    | 4.0              | DEX                     | -200               |
| DEP.          | SYA          | SAN               |  |                                  | BLOW           | NIC             |                | PLAS<br>LIM    | TIC<br>IIT  |       | WATE<br>CONTEI | R<br>NT |            |                        |                  | PLAS                    | *                  |
|               |              |                   | SURFACE ELEVATION: Ex. Grade                     | e, ft                            |                |                 | 1              | <u>0 2</u>     | <u>20</u>   | 30    | 40             | 50      | 60         | 70                     | 80               |                         |                    |
|               |              |                   | ך Hot-Mix Asphaltic Concrete (HI<br>∖ in.        | MAC) - 2-1/2                     |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
|               |              |                   | _ Flexible Base Material (FBM) - :               | 10 in.                           |                |                 | _              |                |             | _     |                |         |            |                        |                  |                         |                    |
|               |              | V                 | SILTY SAND (SM)<br>very dense to dense to very d | lense, light                     | 50/            |                 |                |                |             |       |                |         |            |                        |                  | 3                       |                    |
|               |              | $\wedge$          | brown, with gravel                               |                                  | 11"            |                 | -              |                | Ĩ           |       |                |         |            |                        | -                |                         |                    |
|               |              | $\nabla$          |  |                                  |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
|               |              | X                 |  |                                  | 42             |                 | •              |                |             |       |                |         |            |                        | -                |                         | 27                 |
|               |              | $\langle \rangle$ |  |                                  |                |                 | _              |                |             |       |                |         |            |                        | -                |                         |                    |
|               |              |                   |  |                                  |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
| - 5 -         |              |                   |  |                                  |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
|               |              | X                 |  |                                  | 50/            |                 | •              |                |             |       |                |         |            |                        |                  |                         |                    |
|               |              | /                 |  |                                  | 10"            |                 | -              |                |             |       |                |         |            |                        | -                |                         |                    |
|               |              |                   |  |                                  |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
|               |              |                   |  |                                  |                |                 | _              |                |             |       |                |         |            |                        | -                |                         |                    |
|               |              |                   |  |                                  |                |                 | _              |                |             |       |                |         |            |                        | -                |                         |                    |
|               |              |                   |  |                                  |                |                 |                |                |             | _     | _              |         |            | _                      | _                |                         |                    |
|               |              | M                 | very dense, light brown, with                    | gravel                           | 50/            |                 | •              | ×              | ×           |       |                |         |            |                        | -                | 5                       |                    |
|               |              | $\land$           |  |                                  | 10"            |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
| -10-          |              |                   | Boring terminated at a depth o                   | of about 10 ft.                  |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
|               |              |                   |  |                                  |                |                 | _              |                |             |       |                |         |            |                        | -                |                         |                    |
|               |              |                   | NOTES:   | oporations                       |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
|               |              |                   | the boring was observed dry                      | y.                               |                |                 | -              |                |             |       |                |         |            |                        |                  |                         |                    |
|               |              |                   |  |                                  |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
|               |              |                   |  |                                  |                |                 | -              |                |             |       |                |         |            |                        | -                |                         |                    |
|               |              |                   |  |                                  |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
|               |              |                   |  |                                  |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
| -15-          |              |                   |  |                                  |                |                 |                |                |             |       |                |         |            |                        | _                |                         |                    |
|               |              |                   |  |                                  |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
|               |              |                   |  |                                  |                |                 | -              |                |             |       |                |         |            |                        | -                |                         |                    |
|               |              |                   |  |                                  |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
|               |              |                   |  |                                  |                |                 | _              |                |             |       |                |         |            |                        | -                |                         |                    |
|               |              |                   |  |                                  |                |                 | L              |                |             |       |                |         |            |                        | _                |                         |                    |
|               |              |                   |  |                                  |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
|               |              |                   |  |                                  |                |                 | _              |                |             |       |                |         |            |                        | -                |                         |                    |
|               |              |                   |  |                                  |                |                 |                |                |             |       |                |         |            |                        |                  |                         |                    |
| DEPTH         | i<br>I drill | ED:               | 10.0 ft D  | EPTH TO WATER                    | R:             | L<br>DRY        |                |                |             |       | PR             | UJ. N   | o.:        | A                      | XA21-0           | اـــــــا<br>41-00      |                    |
| DATE I        | DRILLE       | D:                | 12/18/2021 D                                     | ATE MEASURED                     | :              | 12/18           | /2021          |                |             |       | FIG            | URE:    |            | 9                      |                  |                         |                    |

## LOG OF BORING NO. P-8

I



|                  |             |           | Pr<br>Ric  | LOG OF B<br>rop. Street F<br>Grande Cit | OR<br>Reha<br>y, St | <b>ING</b><br>bilita<br>arr C | NO<br>ntion<br>Count | , <b>P-9</b><br>Project<br>sy, Texas     | i  |                | ТВРЕ  | Firm Regi  | A B<br>I S 1<br>stration | A<br>No. F-3        | <b>E R</b><br>3257 |
|------------------|-------------|-----------|--|---|---------------------|-------------------------------|----------------------|--|--|----------------|---|--|--------------------------|---------------------|--------------------|
| DRILL            | ING<br>IOD: | Stra      | aight Flight Auger   |   |                     |                               | LO                   | CATION:                                  | See F  | igure 1        |   |  |                          |                     |                    |
| <b>DEPTH, FT</b> | SYMBOL      | SAMPLES   | DESCRIPTION OF MAT   | ERIAL                                   | BLOWS PER FT        | UNIT DRY<br>WEIGHT, pcf       | 0.                   | SHE<br><br>5 1.0<br>PLASTIC<br>LIMIT<br> | $\begin{array}{c} \text{AR STR} \\ \hline \hline \\ 1.5 & 2 \\ \hline \\ 30 & 4 \end{array}$ | ENGTH,<br>     | <b>TONS/F</b><br>- <u>A</u> –<br>3.0<br>- <u>60</u> | T <sup>2</sup><br><br>3.5 4<br>LIQUID<br>LIMIT<br> | .0                       | PLASTICITY<br>INDEX | % -200             |
|                  |             |           | Hot-Mix Asphaltic Concrete (HMA<br>Flexible Base Material (FBM) - 10   | AC) - 3 in.                             |                     |                               | _                    |  |  |                |   |  |                          |                     |                    |
|                  |             |           | CLAYEY SAND (SC)<br>loose to medium dense to very<br>light brown, with calcareous no                             | dense,<br>odules                        | 10                  |                               | •                    | *  | -×   |                |   |  | _                        | 8                   |                    |
| <br>             |             | X         |  |   | 3                   |                               | -                    |  | •  |                |   |  | -                        |                     |                    |
|                  |             |           |  |   | 16                  |                               | -                    |  | •  |                |   |  | -                        |                     | 33                 |
|                  |             | X         |  | Ę                                       | 50/9"               |                               | -                    |  | •  |                |   |  | -                        |                     |                    |
|                  | -           |           | Boring terminated at a depth of a<br>NOTES:<br>Upon completion of the drilling o<br>the boring was observed dry. | about 10 ft.<br>operations,             |                     |                               | _                    |  |  |                |   |  | -                        |                     |                    |
|                  | -           |           |  |   |                     |                               | _                    |  |  |                |   |  | -                        |                     |                    |
| - 15-            | -           |           |  |   |                     |                               | _                    |  |  |                |   |  |                          |                     |                    |
|                  | -           |           |  |   |                     |                               | -                    |  |  |                |   |  | -                        |                     |                    |
|                  | -           |           |  |   |                     |                               | -                    |  |  |                |   |  | _                        |                     |                    |
| DEPTH<br>DATE    | I DRILL     | ED:<br>D: | 10.0 ft     DEP       12/16/2021     DAT   | PTH TO WATER                            | :                   | DRY<br>12/16                  | /2021                |  |  | PROJ.<br>FIGUR | No.:<br>E:  | AX<br>10   | A21-04                   | 41-00               |                    |

|                  |                   |           | P<br>Ri  | LOG OF B<br>Prop. Street F<br>o Grande Cit          | <b>ORI</b><br>Reha<br>zy, St | <b>NG I</b><br>bilita<br>arr C | <b>NO. P-10</b><br>tion Project<br>ounty, Texas |  |                                    | ТВРЕ                 | Firm Registrat                                       | BA<br>TN<br>ion No. F- | <b>E R</b><br>3257 |
|------------------|-------------------|-----------|--|---|------------------------------|--------------------------------|---|--|------------------------------------|----------------------|--|------------------------|--------------------|
| DRILL<br>METH    | ing<br>Iod:       | Stra      | aight Flight Auger   |   |                              |                                | LOCATION:                                       | See Fi   | gure 1                             |                      |  |                        |                    |
| <b>ДЕРТН, FT</b> | SYMBOL            | SAMPLES   | DESCRIPTION OF MAT   | rerial  | BLOWS PER FT                 | UNIT DRY<br>WEIGHT, pcf        | SHEA<br>  | $\frac{\mathbf{AR STRE}}{-\diamond -} -$ $1.5  2.$ $- \frac{-}{20}  4$ | NGTH,<br>0 2.5<br>WATER<br>CONTENT | <b>TONS/F</b><br>3.0 | T <sup>2</sup><br><br>3.5 4.0<br>LIQUID<br>LIMIT<br> | PLASTICITY<br>INDEX    | % -200             |
|                  |                   |           | - Hot-Mix Asphaltic Concrete (HM<br>Flexible Base Material (FBM) - 16  | IAC) - 3 in.<br>6 in.                               |                              |                                | -   |  |                                    |                      |  | -                      |                    |
|                  |                   |           | CLAYEY SAND (SC)<br>loose, brown<br>SANDY LEAN CLAY (CL)<br>very soft to stiff, dark brown to  | o brown   | 7                            | -                              | -   |  |                                    |                      |  | -                      | 44                 |
|                  |                   |           |  |   | 1                            | -                              | _   | -×   |                                    |                      |  | _ 12<br>               |                    |
|                  |                   |           |  |   | 5                            | -<br>-<br>-<br>-               | -   |  |                                    |                      |  | -                      | 61                 |
| - 10-            |                   | X         | Boring terminated at a depth of  | about 10 ft.  | 9                            |                                | -<br>•  |  | ×                                  |                      |  | 21                     |                    |
| <br><br><br><br> |                   |           | NOTES:<br>During the drilling operations, gr<br>was encountered at a depth of<br>ft. Upon completion of the dr<br>operations, groundwater was<br>at a depth of about 4.5 ft. | roundwater<br>of about 7.5<br>rilling<br>s measured |                              |                                |   |  |                                    |                      |  |                        |                    |
| DEPTH<br>DATE    | i Drill<br>Drille | ED:<br>D: | 10.0 ft         DE           12/16/2021         DA   | PTH TO WATER  | k:<br>:                      | 7.5 ft<br>12/16,               | /2021   | •  | PROJ.<br>FIGUI                     | No.:<br>RE:          | AXA21<br>11  | -041-00                |                    |

|                  |               |                  | Prop. Stre<br>Rio Grand                    | eet Ro<br>e City | eha<br>/, St | bilita<br>arr C       | ation Pro<br>County, | oject<br>Texas |                |                | Т                       | BPE Fir            | m Regist                | S T<br>tration | <b>N</b> o. F-3    | <b>E R</b><br>3257 |
|------------------|---------------|------------------|--|------------------|--------------|-----------------------|----------------------|----------------|----------------|----------------|-------------------------|--------------------|-------------------------|----------------|--------------------|--------------------|
| DRILL<br>METH    | ING<br>IOD:   | Stra             | aight Flight Auger                         |                  |              |                       | LOCAT                | ION:           | See F          | igure 1        | _                       |                    |                         |                |                    |                    |
| T                |               | s                |  |                  | ١Ħ           | cf ≺                  | -                    | SHEA           | R STR<br>-↔— — | ENGTH          | I, TON<br>— —☆          | <b>S/FT</b> ²<br>[ |                         |                | ۲                  |                    |
| <b>DEPTH</b> , F | SYMBOL        | SAMPLE           | DESCRIPTION OF MATERIAL                    |                  | LOWS PER     | UNIT DR'<br>WEIGHT, p | 0.5<br>PL            | 1.0 1<br>ASTIC | .5 2           | .0 2.<br>WATER | . <mark>53.</mark><br>T |                    | 5 4.0<br>2010<br>MIT    | )              | PLASTICIT<br>INDEX | % -200             |
|                  |               |                  | SURFACE ELEVATION: Ex. Grade, ft           |                  | 8            |                       | 10                   | <u>× 3</u>     | 4              | 0 5            | 0 6                     | `<br><u>`</u>      | <u>≁</u><br><u>0 80</u> | )              |                    |                    |
|                  |               |                  | Hot-Mix Asphaltic Concrete (HMAC) - 2 in.  | _/               |              |                       |                      |                |                |                |                         |                    |                         |                |                    |                    |
|                  |               |                  |  |                  |              |                       | -                    |                |                |                |                         |                    |                         |                |                    |                    |
|                  |               | $\mathbb{N}$     | medium dense, brown, with gravel           |                  |              |                       |                      |                |                |                |                         |                    |                         |                |                    |                    |
|                  |               | Ň                |  |                  | 10           |                       | -   ●                |                |                |                |                         |                    |                         | -              |                    | 29                 |
|                  |               | $\left( \right)$ |  |                  |              |                       |                      |                |                |                |                         |                    |                         | _              |                    |                    |
|                  |               | X                |  |                  | 10           |                       |                      | ×-             | $+\times$      |                |                         |                    |                         |                | 10                 |                    |
|                  |               | /                |  |                  |              |                       | -                    |                |                |                |                         |                    |                         | -              |                    |                    |
| _                |               |                  |  |                  |              |                       |                      |                |                |                |                         |                    |                         |                |                    |                    |
| - 5              |               | $\backslash$     | FAT CLAY WITH SAND (CH)                    |                  |              |                       |                      |                |                |                |                         |                    |                         |                |                    |                    |
|                  |               | X                | very stiff, brown, with calcareous noulle  | :5               | 18           |                       | _                    | •              |                |                |                         |                    |                         | _              |                    |                    |
|                  |               | $\square$        |  |                  |              |                       |                      |                |                |                |                         |                    |                         |                |                    |                    |
|                  |               |                  |  |                  |              |                       | -                    |                |                |                |                         |                    |                         | -              |                    |                    |
|                  |               |                  |  |                  |              |                       |                      |                |                |                |                         |                    |                         |                |                    |                    |
|                  |               |                  |  |                  |              |                       | -                    |                |                |                |                         |                    |                         | _              |                    |                    |
|                  | $\langle / /$ | M                |  |                  | • •          |                       | -                    |                |                |                |                         |                    |                         | _              |                    |                    |
|                  |               | Å                |  |                  | 26           |                       |                      | •              |                |                |                         |                    |                         |                |                    | 82                 |
| —10—             | ſ             |                  | Boring terminated at a depth of about 10 f | ft.              |              |                       |                      |                |                |                |                         |                    |                         |                |                    |                    |
|                  |               |                  |  |                  |              |                       |                      |                |                |                |                         |                    |                         | _              |                    |                    |
|                  |               |                  | NOTES:                                     | ,                |              |                       |                      |                |                |                |                         |                    |                         |                |                    |                    |
|                  | -             |                  | the boring was observed dry.               | ,                |              |                       | -                    |                |                |                |                         |                    |                         | -              |                    |                    |
|                  |               |                  |  |                  |              |                       |                      |                |                |                |                         |                    |                         |                |                    |                    |
|                  | 1             |                  |  |                  |              |                       |                      |                |                |                |                         |                    |                         | _              |                    |                    |
|                  | -             |                  |  |                  |              |                       | -                    |                |                |                |                         |                    |                         | _              |                    |                    |
|                  |               |                  |  |                  |              |                       |                      |                |                |                |                         |                    |                         |                |                    |                    |
|                  |               |                  |  |                  |              |                       | -                    |                |                |                |                         |                    |                         | _              |                    |                    |
|                  |               |                  |  |                  |              |                       | _                    |                |                |                |                         |                    |                         | _              |                    |                    |
|                  |               |                  |  |                  |              |                       |                      |                |                |                |                         |                    |                         |                |                    |                    |
|                  | -             |                  |  |                  |              |                       | -                    |                |                |                |                         |                    |                         | -              |                    |                    |
|                  |               |                  |  |                  |              |                       |                      |                |                |                |                         |                    |                         |                |                    |                    |
|                  |               |                  |  |                  |              |                       |                      |                |                |                |                         |                    |                         | -              |                    |                    |
|                  | -             |                  |  |                  |              |                       |                      |                |                |                |                         |                    |                         | _              |                    |                    |
|                  |               |                  |  |                  |              |                       |                      |                |                |                |                         |                    |                         |                |                    |                    |
| DEPTH            | l<br>I DRILL  | ED:              | 10.0 ft DEPTH TO W                         | ATER:            |              | L<br>DRY              |                      |                |                | PRC            | J. No.                  | :                  | <br>AXA                 | 21-04          | 1-00               |                    |
| DATE             | DRILLE        | D:               | 12/15/2021 DATE MEASU                      | JRED:            |              | 12/15                 | /2021                |                |                | FIG            | JRE:                    |                    | 12                      |                |                    |                    |

RABA

## LOG OF BORING NO. P-11

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RABA KISTNER Prop. Street Rehabilitation Project Rio Grande City, Starr County, Texas TBPE Firm Registration No. F-3257 DRILLING LOCATION: See Figure 1 **METHOD:** Straight Flight Auger SHEAR STRENGTH, TONS/FT<sup>2</sup> **BLOWS PER FT** UNIT DRY WEIGHT, pcf  $\sim$ -⊗-------^ PLASTICITY INDEX Ē SAMPLES SYMBOL % -200 0.5 1.0 2.0 2.5 3.0 3.5 4.0 1.5 DEPTH, **DESCRIPTION OF MATERIAL** PLASTIC LIMIT WATER CONTENT LIQUID LIMIT -× SURFACE ELEVATION: Ex. Grade, ft 70 10 20 30 40 50 60 80 Portland Cement Concrete (PCC) - 4 in. Ń D. ٨ Flexible Base Material (FBM) - 8 in. ٨ ٨ **CLAYEY SAND (SC)** very loose, brown 3 15  $\rightarrow$ FAT CLAY (CH) 93 6 firm to stiff, brown 14 26  $\times$ 14 • -10-Boring terminated at a depth of about 10 ft. NOTES: Upon completion of the drilling operations, the boring was observed dry. -15-DEPTH DRILLED: 10.0 ft **DEPTH TO WATER:** DRY PROJ. No.: AXA21-041-00 DATE DRILLED: 12/15/2021 **DATE MEASURED:** 12/15/2021 FIGURE: 13

LOG OF BORING NO. P-12

Prop. Street Rehabilitation Project Rio Grande City, Starr County, Texas TBPE Firm Registration No. F-3257 DRILLING LOCATION: See Figure 1 **METHOD:** Straight Flight Auger SHEAR STRENGTH, TONS/FT<sup>2</sup> **BLOWS PER FT** UNIT DRY WEIGHT, pcf  $\sim$ -⊗-------^ PLASTICITY INDEX Ē SAMPLES SYMBOL % -200 0.5 1.0 2.0 2.5 3.0 3.5 4.0 1.5 DEPTH, **DESCRIPTION OF MATERIAL** PLASTIC LIMIT WATER CONTENT LIQUID LIMIT  $\frac{\times}{20}$ -× 70 SURFACE ELEVATION: Ex. Grade, ft 10 30 40 50 60 80 -<u>~</u>`` Portland Cement Concrete (PCC) - 3-1/2 in. Flexible Base Material (FBM) - 3-1/2 in. FAT CLAY (CH) 28 stiff to very stiff to stiff, brown to dark 11  $\times$ -× brown 13 99 18 13 -10-Boring terminated at a depth of about 10 ft. NOTES: Upon completion of the drilling operations, the boring was observed dry. -15-DEPTH DRILLED: PROJ. No.: 10.0 ft **DEPTH TO WATER:** DRY AXA21-041-00 DATE DRILLED: 12/15/2021 **DATE MEASURED:** 12/15/2021 FIGURE: 14

LOG OF BORING NO. P-13



|                  |                   |           | P<br>Ric   | LOG OF BO<br>rop. Street R<br>o Grande Cit | <b>DRI</b><br>teha<br>y, St | <b>NG</b><br>bilita<br>arr C | NO.<br>Ition<br>Count | <b>P-14</b><br>Projec<br>sy, Texa       | :t<br>as                   |                          |                 | TBPE Firm | RAB<br>KIS<br>Registration | <b>A</b><br><b>T N</b><br>No. F-3 | <b>E R</b><br>3257 |
|------------------|-------------------|-----------|--|--|-----------------------------|------------------------------|-----------------------|---|----------------------------|--------------------------|-----------------|-----------|----------------------------|-----------------------------------|--------------------|
| DRILL            | .ING<br>10D:      | Stra      | aight Flight Auger   |  |                             |                              | LO                    | CATION:                                 | : See                      | e Figure                 | 1               |           |                            |                                   |                    |
| <b>DEPTH, FT</b> | SYMBOL            | SAMPLES   |  | rerial                                     | BLOWS PER FT                | UNIT DRY<br>WEIGHT, pcf      | 0.                    | SH<br><br>5 1.0<br>PLASTIC<br>LIMIT<br> | IEAR ST<br>— →<br>1,5<br>— | 2.0 2<br>WATER<br>CONTEN | H, TON          |           | - 4.0                      | PLASTICITY<br>INDEX               | % -200             |
|                  |                   |           | Portland Cement Concrete (PCC)<br>Flexible Base Material (FBM) - 4<br>FAT CLAY (CH)<br>very stiff, brown to dark brown | ) - 5 in.<br>in.                           | 19                          |                              | -                     | • ×                                     |                            |                          | ×               |           |                            | 29                                |                    |
| <br>5            |                   | X         |  |  | 23<br>25                    |                              | -                     | •                                       | ×                          |                          | -×              |           | -                          | 28                                | 99                 |
|                  |                   |           |  |  | 20                          |                              | -                     | •                                       |                            |                          |                 |           | -                          |                                   | 99                 |
| - 10-            |                   | /         | Boring terminated at a depth of a<br>NOTES:<br>Upon completion of the drilling o<br>the boring was observed dry.       | about 10 ft.<br>operations,                |                             |                              | -                     |   |                            |                          |                 |           | -                          |                                   |                    |
| <br><br>         | -                 |           |  |  |                             |                              | -                     |   |                            |                          |                 |           | -                          |                                   |                    |
| DEPTH<br>DATE    | H DRILL<br>DRILLE | ED:<br>D: | 10.0 ft DEI<br>12/15/2021 DA   | PTH TO WATER                               | :                           | DRY<br>12/15                 | /2021                 | I                                       | I                          | PR(<br>FIG               | DJ. No.<br>URE: | .:        | AXA21-0<br>15              | 41-00                             |                    |

|                  |                   |             |   | <b>LOG OF B</b><br>Prop. Street<br>Rio Grande Ci  | <b>ORI</b><br>Reha<br>ty, Si | <b>NG</b> l<br>bilita<br>tarr C | NO. P-1<br>ition Pro<br>County, T | . <b>5</b><br>ject<br>exas |                                      |  | TBPE Fir  | R /<br>K I<br>m Regis | A B<br>S T<br>stration | A<br>No. F-3        | <b>E R</b><br>3257 |
|------------------|-------------------|-------------|---|---|------------------------------|---------------------------------|-----------------------------------|----------------------------|--------------------------------------|--|---|-----------------------|------------------------|---------------------|--------------------|
| DRILL<br>METH    | ING<br>IOD:       | Stra        | aight Flight Auger  |   |                              |                                 | LOCATIO                           | ON: S                      | See Figu                             | ure 1  |   |                       |                        |                     |                    |
| <b>DEPTH, FT</b> | SYMBOL            | SAMPLES     | DESCRIPTION OF M  | 1ATERIAL<br>de, ft  | BLOWS PER FT                 | UNIT DRY<br>WEIGHT, pcf         | 0.5 1<br>PLA:<br>UIN<br>→         | SHEAR<br>                  | STREN<br>⇒<br>5 2.0<br>w,<br>cor<br> | IGTH, TC<br>⊗— — —<br>2.5<br>ATER<br>NTENT<br>●— — —<br>50 | ONS/FT <sup>2</sup><br>△<br>3.0 3.<br>LIC<br>LIC<br>LIC<br>0<br>0 7 |                       | 0                      | PLASTICITY<br>INDEX | % -200             |
|                  |                   |             | Hot-Mix Asphaltic Concrete (<br>Flexible Base Material (FBM)  | HMAC) - 4 in.<br>- 10 in.   |                              |                                 | _                                 |                            |                                      |  |   |                       |                        |                     |                    |
|                  |                   | X           | CLAYEY SAND (SC)<br>very loose to loose, brown  |   | 4                            | Ţ                               | - •                               | € -×                       |                                      |  |   |                       | -                      | 8                   |                    |
|                  |                   |             | SANDY FAT CLAY (CH)   |   | 8                            |                                 | -                                 | •                          |                                      |  |   |                       | _                      |                     | 23                 |
| <br>             |                   | $\setminus$ | very stiff, brown   |   | 18                           |                                 | -                                 | •                          | ×                                    | ×  |   |                       | _                      | 21                  |                    |
|                  |                   |             | Boring terminated at a depth<br>NOTES:<br>During the drilling operation<br>was encountered at a dep<br>ft. Upon completion of th<br>operations, the boring wa | n of about 10 ft.<br>s, groundwater<br>oth of about 4.5<br>e drilling<br>as observed dry. |                              |                                 | -                                 |                            |                                      |  |   |                       | -                      |                     |                    |
| DEPTH<br>DATE    | I DRILL<br>DRILLE | ED:<br>D:   | 10.0 ft<br>12/15/2021   | DEPTH TO WATE<br>DATE MEASURED  | R:<br>):                     | 4.5 ft<br>12/15                 | /2021                             |                            |                                      | PROJ. N<br>FIGURE:   | 0.:   | AXA<br>16             | 21-04                  | 1-00                |                    |

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|                  |                   |           | <b>LOG</b><br>Prop. S<br>Rio Gra  | <b>OF B</b><br>Street F<br>Inde Cit | <b>ORI</b><br>Reha<br>zy, St | <b>NG</b> I<br>bilita<br>arr C | NO. P-16<br>ation Project<br>County, Texas TBPE Firm Registration No. F-3257 |
|------------------|-------------------|-----------|---|-------------------------------------|------------------------------|--------------------------------|--|
| DRILL<br>METH    | ING<br>IOD:       | Stra      | aight Flight Auger  |                                     |                              |                                | LOCATION: See Figure 1   |
| <b>DEPTH, FT</b> | SYMBOL            | SAMPLES   | DESCRIPTION OF MATERIA  | L                                   | BLOWS PER FT                 | UNIT DRY<br>WEIGHT, pcf        | SHEAR STRENGTH, TONS/FT <sup>2</sup>   |
| <br><br><br><br> |                   |           | Hot-Mix Asphaltic Concrete (HMAC) - 1<br>in.<br>Flexible Base Material (FBM) - 12 in.<br>CLAYEY SAND (SC)<br>dense to loose to medium dense, ligh<br>brown, with gravel and calcareous no | nt<br>odules                        | 26<br>9<br>17                |                                | $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$                       |
|                  |                   | X         |   |                                     | 20                           |                                |  |
|                  |                   |           | Boring terminated at a depth of about<br>NOTES:<br>Upon completion of the drilling operat<br>the boring was observed dry.   | 10 ft.                              |                              |                                |  |
| DEPTH<br>DATE    | I DRILL<br>DRILLE | ED:<br>D: | 10.0 ft         DEPTH TO           12/15/2021         DATE ME   | O WATER                             | k:<br>:                      | DRY<br>12/15                   | PROJ. No.:         AXA21-041-00           FIGURE:         17                 |

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|                  |                   |           |   | LOG OF B<br>Prop. Street F<br>Rio Grande Cit   | <b>ORI</b><br>Reha<br>ty, St | <b>NG</b><br>bilita<br>tarr C | NO. P-1<br>Ition Pro<br>County, T | L <b>7</b><br>ject<br>exas |            | TBP  | Firm Reg            | AB<br>IST<br>istration I | A<br>No. F-3        | E R<br>257 |
|------------------|-------------------|-----------|---|--|------------------------------|-------------------------------|-----------------------------------|----------------------------|------------|--|---------------------|--------------------------|---------------------|------------|
| DRILL<br>METH    | ING<br>IOD:       | Stra      | aight Flight Auger  |  |                              |                               | LOCATIO                           | <b>ON:</b> Se              | e Figure 1 | L  |                     |                          |                     |            |
| <b>DEPTH, FT</b> | SYMBOL            | SAMPLES   | DESCRIPTION OF M  | ATERIAL  | BLOWS PER FT                 | UNIT DRY<br>WEIGHT, pcf       | 0.5 1<br>PLA:<br>LIN<br>→         | SHEAR S<br>                | TRENGTH    | <b>1, TONS/</b><br>— — <u>∧</u> — —<br>.5 3.0<br>T<br> | FT <sup>2</sup><br> | .0                       | PLASTICITY<br>INDEX | % -200     |
|                  |                   |           | SURFACE ELEVATION: Ex. Grad<br>Hot-Mix Asphaltic Concrete (I<br>in.<br>Flexible Base Material (FBM)<br>CLAYEY SAND (SC)<br>very loose, brown, with grav<br>SILTY, CLAYEY SAND (SC-SM)<br>medium dense to dense, br<br>gravel<br>Boring terminated at a depth<br>NOTES:<br>Upon completion of the drillin<br>the boring was observed c | de, ft<br>HMAC) - 1-3/4<br>- 12 in.<br>vel<br>own, with<br>of about 10 ft.<br>ng operations,<br>Iry. | 3<br>3<br>10<br>33           |                               |                                   |                            | ×          |  |                     |                          | 11                  | 34         |
| DEPTH<br>DATE    | I DRILL<br>DRILLE | ED:<br>D: | 10.0 ft<br>12/17/2021   | DEPTH TO WATER<br>DATE MEASURED  | R:<br>:                      | DRY<br>12/17                  | /2021                             |                            | PRC<br>FIG | )J. No.:<br>URE:                                       | AX<br>18            | A21-04                   | 1-00                |            |

**LOG OF BORING NO. P-18** Prop. Street Rehabilitation Project Rio Grande City, Starr County, Texas



| DRILL<br>METH | ing<br>Iod: | Stra        | aight Flight Auger             |                 |       |       | LC    |         | N:       | See F        | igure 1      | L        |       |          |       |       |      |
|---------------|-------------|-------------|--------------------------------|-----------------|-------|-------|-------|---------|----------|--------------|--------------|----------|-------|----------|-------|-------|------|
|               |             |             |                                |                 | F     |       |       |         | SHEA     |              | ENGTH        | I, TOP   | NS/FT | 2        |       |       |      |
| E<br>F        | ğ           | LES         |                                |                 | PER F | T, pc | C     | ).5 1.0 | 0 1      | 5 2          | .0 2         | <br>.5 3 | .0 3  | <br>.5 4 | .0    | EX    | 8    |
| EPT           | SYME        | AMF         | DESCRIPTION OF N               | IATERIAL        | SWO   | TINI  |       | PLAST   | IC       | -            | WATER        | <br>     | - u   |          |       | INDI  | % -2 |
|               |             | •           | SUBFACE FLEVATION: Ex. Gra     | de ft           | BLC   | 23    |       |         |          |              |              |          |       | $\times$ | 0     | Ч     |      |
|               |             |             | → Hot-Mix Asphaltic Concrete ( | HMAC) - 2 in. / |       |       | -     |         | ) :      | <u>so </u> 2 | + <u>0</u> 5 | 0 6      |       |          |       |       |      |
|               | X           | $\setminus$ | SANDY, SILTY CLAY (CL-CM)      | /               |       |       |       |         | -        |              |              |          |       |          |       |       |      |
|               |             | Ň           | very stiff, brown              |                 | 18    |       | -     |         | •        |              |              |          |       |          | -     |       | 56   |
|               |             | $\square$   |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
|               |             |             |                                |                 |       |       | F     |         |          |              |              |          |       |          | -     |       |      |
|               |             |             |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
|               |             | V           |                                |                 | ٩     |       | -     |         | <u> </u> |              |              |          |       |          | -     | 5     |      |
|               |             | $\wedge$    | SILTY SAND (SM)                |                 | 5     |       |       |         |          |              |              |          |       |          |       | 5     |      |
|               |             | $\square$   | loose to medium dense, br      | own             |       |       | -     |         |          |              |              |          |       |          | -     |       |      |
|               |             |             |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
| - 5           |             |             |                                |                 |       |       | -     |         |          |              |              |          |       |          |       |       |      |
|               |             | V           |                                |                 | 20    |       |       |         | •        |              |              |          |       |          |       |       |      |
|               |             | Λ           |                                |                 | 20    |       | -     |         | •        |              |              |          |       |          | -     |       |      |
|               |             | ( )         |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
|               |             |             |                                |                 |       |       | -     |         |          |              |              |          |       |          | -     |       |      |
|               |             |             |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
|               |             |             |                                |                 |       |       | -     |         |          |              |              |          |       |          | -     |       |      |
|               |             |             |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
|               |             | V           |                                |                 | 25    |       | -     |         |          |              |              |          |       |          | -     |       | 22   |
|               |             | Λ           |                                |                 | 25    |       |       |         | •        |              |              |          |       |          |       |       | 55   |
| -10-          |             | ( )         | Boring terminated at a depth   | of about 10 ft. |       |       |       |         |          |              |              |          |       |          |       |       |      |
|               |             |             |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
|               |             |             | NOTEC                          |                 |       |       | -     |         |          |              |              |          |       |          | -     |       |      |
|               |             |             | Upon completion of the drilli  | ng operations,  |       |       |       |         |          |              |              |          |       |          |       |       |      |
|               |             |             | the boring was observed of     | dry.            |       |       | -     |         |          |              |              |          |       |          | -     |       |      |
|               |             |             |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
|               |             |             |                                |                 |       |       | -     |         |          |              |              |          |       |          | -     |       |      |
|               |             |             |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
|               |             |             |                                |                 |       |       | -     |         |          |              |              |          |       |          | -     |       |      |
|               |             |             |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
| -15-          |             |             |                                |                 |       |       | -     |         |          |              |              |          |       |          | -     |       |      |
|               |             |             |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
|               |             |             |                                |                 |       |       | -     |         |          |              |              |          |       |          | -     |       |      |
|               |             |             |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
|               |             |             |                                |                 |       |       | -     |         |          |              |              |          |       |          | -     |       |      |
|               |             |             |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
| F -           | 1           |             |                                |                 |       |       | F     |         |          |              |              |          |       |          | -     |       |      |
|               |             |             |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
| F -           | 1           |             |                                |                 |       |       | F     |         |          |              |              |          |       |          | -     |       |      |
|               |             |             |                                |                 |       |       |       |         |          |              |              |          |       |          |       |       |      |
| DEPTH         | I DRILL     | ED:         | 10.0 ft                        | DEPTH TO WATER  | k:    | DRY   |       |         |          | 1            | PRC          | J. No    | .:    | AX       | A21-0 | 41-00 |      |
| DATE          | DRILLE      | D:          | 12/17/2021                     | DATE MEASURED   | :     | 12/17 | 7/202 | 1       |          |              | FIG          | JRE:     |       | 19       |       |       |      |

|                      |   |         | I  | <b>LOG OF B</b><br>Prop. Street I<br>Rio Grande Ci | <b>ORI</b><br>Reha<br>ty, St | <b>NG</b><br>bilita<br>arr C | NO.<br>ation<br>Count | <b>P-19</b><br>Proje<br>ty, Te | <b>)</b><br>ect<br>xas |              |   | TI   | BPE Firm              | RAE<br>KIS<br>Registratio | <b>A</b><br><b>T N</b><br>n No. F- | <b>E R</b><br>3257 |
|----------------------|---|---------|--|--|------------------------------|------------------------------|-----------------------|--------------------------------|------------------------|--------------|---|--|-----------------------|---------------------------|------------------------------------|--------------------|
| DRILL<br>METH        | ING<br>IOD:   | Stra    | aight Flight Auger   |  |                              |                              | LO                    | CATIO                          | N:                     | See Fi       | gure 1  |  |                       |                           |                                    |                    |
| <b>DEPTH, FT</b>     | SYMBOL  | SAMPLES | DESCRIPTION OF M   | ATERIAL<br>e, ft                                   | BLOWS PER FT                 | UNIT DRY<br>WEIGHT, pcf      | 0.                    | 5 1.0<br>PLAST<br>LIMIT        |                        | R STRI<br>-> | ENGTH<br>—⊗—<br>.0 2<br>WATER<br>CONTENT<br>— ●—<br>.0 50 | <b>1, TON</b><br>- <u>-</u> ∆-<br>5 3.(<br>-<br> | S/FT <sup>2</sup><br> | 4.0                       | PLASTICITY<br>INDEX                | % -200             |
|                      |   | X       | Hot-Mix Asphaltic Concrete (H<br>Flexible Base Material (FBM) -<br>CLAYEY SAND (SC)<br>loose to very dense, brown, | MAC) - 1/2 in. /<br>6 in. /<br>with gravel         | 8                            |                              | -                     | •                              |                        |              |   |  |                       |                           | -                                  | 31                 |
|                      |   | X       |  |  | 50/9"                        |                              | -                     |                                | •                      | *            | -×  |  |                       | -                         | 9                                  |                    |
|                      |   |         |  |  | 50/9"                        |                              | -                     |                                | •                      |              |   |  |                       | -                         | -                                  |                    |
|                      |   | X       |  |  | 50/<br>10"                   |                              | _                     |                                | •                      |              |   |  |                       | -                         | -                                  | 33                 |
| <br><br><br><br><br> | -<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>- | ED:     | NOTES:<br>Upon completion of the drillin<br>the boring was observed dr   | pepth to water                                     | R:                           | DRY                          | -                     |                                |                        |              | PRO   | J. No.:  |                       | AXA21-C                   |                                    |                    |
| DATE                 | DRILLE  | D:      | 12/17/2021   | DATE MEASURED                                      | ):                           | 12/17                        | /2021                 | -                              |                        |              | FIGU  | JRE:   |                       | 20                        |                                    |                    |

**LOG OF BORING NO. P-20** Prop. Street Rehabilitation Project Rio Grande City, Starr County, Texas



| DRILL<br>METH | ing<br>Iod: | Stra | aight Flight Auger                          |       |     |        | LO    | CATIO          | N:     | See F          | igure 1      |                      |                   |           |       |                    |       |
|---------------|-------------|------|---|-------|-----|--------|-------|----------------|--------|----------------|--------------|----------------------|-------------------|-----------|-------|--------------------|-------|
|               |             |      |   |       | F   |        |       |                | SHEA   | RSTR           | ENGTH        | I, TON               | S/FT <sup>2</sup> | _         |       |                    |       |
| Ε             | 5           | ES   |   |       | ERF | ), pcf | 0     | - <del>0</del> | 0 1    | -↔<br>.5 2     | —⊗—<br>.0 2. | — — <u>A</u><br>5 3. | 03.               | ∟–<br>54. | .0    | Ł×                 | Q     |
| E TH          | YMB         | AMP  | DESCRIPTION OF MATERIAL                     |       | WSP | INT    |       | PLAST          |        |                | WATER        |                      |                   |           | -     | ASTIC              | % -2( |
| l 🛎           | N I         | S    |   |       | BLO | ١      |       |                | т      | (              | CONTEN       | r<br>                | LI<br>            | MIT<br>X  |       | PL                 |       |
|               |             |      | SURFACE ELEVATION: Ex. Grade, ft            |       |     |        | 1     | <u>0 2</u>     | 03     | 0 4            | <u>0 5</u>   | <u>0 6(</u>          | <u> </u>          | <u> </u>  | 0     |                    |       |
|               | . ^ .       |      | Hot-Mix Asphaltic Concrete (HMAC) - 1/2 in  | ··/]  |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             | \ /  | (Flexible Base Material (FBM) - 6 in.       | _/    |     |        | _     |                |        |                |              |                      |                   |           |       |                    |       |
|               | .           | X    | dense to medium dense. light brown, with    | ,   : | 31  |        | •     |                |        |                |              |                      |                   |           | _     |                    |       |
|               |             | /    | gravel                                      |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             |      |   |       |     | -      | -     |                |        |                |              |                      |                   |           | -     |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             | V    |   | .   . | 17  | -      | -     |                | $\sim$ |                |              |                      |                   |           | -     | 6                  |       |
|               |             | Λ    |   | -     | - / |        |       |                | $\sim$ |                |              |                      |                   |           |       |                    |       |
|               |             | / )  |   |       |     | -      | -     |                |        |                |              |                      |                   |           | -     |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
| L 5 -         |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             | NA   |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             | X    |   |       | 19  |        | _     |                |        |                |              |                      |                   |           |       |                    | 37    |
|               |             | / N  |   |       |     |        |       |                |        |                |              |                      |                   |           | _     |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             |      |   |       |     | -      | -     |                |        |                |              |                      |                   |           | -     |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             |      |   |       |     | -      | -     |                |        |                |              |                      |                   |           | -     |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             | V    |   |       | 20  | -      | -     |                |        |                |              |                      |                   |           | -     |                    |       |
|               |             | Λ    |   | ·   ' | 26  |        |       |                | /      | <del>k</del> × |              |                      |                   |           |       | 4                  |       |
| -10-          |             | / \  |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             |      | Boring terminated at a depth of about 10 ft | •     |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               | -           |      |   |       |     | -      | -     |                |        |                |              |                      |                   |           | -     |                    |       |
|               |             |      | NOTES:                                      |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
| L _           |             |      | the boring was observed drv.                |       |     |        | _     |                |        |                |              |                      |                   |           | _     |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               | 1           |      |   |       |     |        | -     |                |        |                |              |                      |                   |           | _     |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             |      |   |       |     | -      | -     |                |        |                |              |                      |                   |           | -     |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
| -15-          |             |      |   |       |     | -      |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             |      |   |       |     | -      | -     |                |        |                |              |                      |                   |           | -     |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
| L -           |             |      |   |       |     | -      | -     |                |        |                |              |                      |                   |           | _     |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             |      |   |       |     |        | _     |                |        |                |              |                      |                   |           | _     |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
| F -           | 1           |      |   |       |     |        | -     |                |        |                |              |                      |                   |           | -     |                    |       |
|               |             |      |   |       |     |        |       |                |        |                |              |                      |                   |           |       |                    |       |
| DEPTH         |             | ED:  | 10.0 ft DEPTH TO WA                         | TER:  |     |        |       |                |        | I              | PRC          | J. No.               | :                 | AX        | A21-0 | اـــــــا<br>41-00 |       |
| DATE          | DRILLE      | D:   | 12/17/2021 DATE MEASU                       | RED:  |     | 12/17, | /2021 | -              |        |                | FIG          | JRE:                 |                   | 21        |       |                    |       |

|                |             |           | Pr<br>Ric   | rop. Street R<br>o Grande City | eha<br>y, St | bilita<br>arr C    | tion P<br>ounty | roject<br>, Texa     | t<br>IS |                  | тв                 | PE Firm Reg      | <b>IS</b><br>istration | No. F-3          | E R<br>3257 |
|----------------|-------------|-----------|---|--------------------------------|--------------|--------------------|-----------------|----------------------|---------|------------------|--------------------|------------------|------------------------|------------------|-------------|
| DRILL<br>METH  | ING<br>IOD: | Str       | aight Flight Auger  |                                |              |                    | LOCA            | ATION:               | See     | Figure 1         |                    |                  |                        |                  |             |
| Ħ              |             | ES        |   |                                | er ft        | RY<br>pcf          | 0.5             | SH<br>- <del>0</del> | EAR ST  | RENGTH<br>⊗      | , TONS,<br><u></u> | /FT²<br>□<br>2.5 | 0                      | È.               |             |
| <b>DEPTH</b> , | SYMBC       | SAMPL     | DESCRIPTION OF MAT  | ERIAL                          | OWS PI       | UNIT DI<br>VEIGHT, | 0.5             | PLASTIC<br>LIMIT     | 1.5     | WATER<br>CONTENT | <u> </u>           |                  | .0                     | PLASTIC<br>INDE) | % -20       |
|                |             |           | SURFACE ELEVATION: Ex. Grade, f                                 | ft                             | BL           | ^                  | 10              | <u>~~</u> -          | 30      | 40 50            | <br>) 60           | ×-<br>70 8       | 30                     | _                |             |
|                |             |           | Hot-Mix Asphaltic Concrete (HM/                                 | AC) - 1/2 in. /                |              |                    |                 |                      |         |                  |                    |                  |                        |                  |             |
|                |             |           | Flexible Base Material (FBM) - 8 i<br>CLAVEY SAND (SC)          | n                              |              |                    | -               |                      |         |                  |                    |                  | _                      |                  |             |
|                |             | X         | medium dense, light brown, wir                                  | th gravel                      | 17           |                    |                 |                      | •       |                  |                    |                  |                        |                  | 42          |
|                |             | $\square$ |   |                                |              |                    | -               |                      |         |                  |                    |                  | -                      |                  |             |
|                |             |           |   |                                |              |                    | _               |                      |         |                  |                    |                  |                        |                  |             |
|                |             | X         |   |                                | 22           |                    |                 |                      | •       | ++               |                    | *                |                        | 36               |             |
|                |             | / )       |   |                                |              |                    | -               |                      |         |                  |                    |                  | -                      |                  |             |
|                |             |           |   |                                |              |                    |                 |                      |         |                  |                    |                  |                        |                  |             |
|                |             | $\bigvee$ |   |                                |              |                    |                 |                      |         |                  |                    |                  |                        |                  |             |
|                |             | Ň         |   |                                | 15           |                    | -               |                      |         |                  |                    |                  | -                      |                  | 46          |
|                |             | $\square$ |   |                                |              |                    |                 |                      |         |                  |                    |                  |                        |                  |             |
|                |             |           |   |                                |              |                    | -               |                      |         |                  |                    |                  |                        |                  |             |
|                |             |           |   |                                |              |                    | -               |                      |         |                  |                    |                  | -                      |                  |             |
|                |             | $\square$ |   |                                |              |                    |                 |                      |         |                  |                    |                  |                        |                  |             |
|                |             | Y         |   |                                | 23           |                    | -               |                      |         | •                |                    |                  | -                      |                  |             |
| -10-           |             | /         |   |                                |              |                    |                 |                      |         |                  |                    |                  |                        |                  |             |
|                |             |           | Boring terminated at a depth of a                               | about 10 ft.                   |              |                    |                 |                      |         |                  |                    |                  |                        |                  |             |
|                |             |           | NOTES:  |                                |              |                    | -               |                      |         |                  |                    |                  | -                      |                  |             |
|                |             |           | Upon completion of the drilling of the boring was observed dry. | operations,                    |              |                    | _               |                      |         |                  |                    |                  | _                      |                  |             |
|                |             |           | , i i i i i i i i i i i i i i i i i i i                         |                                |              |                    |                 |                      |         |                  |                    |                  |                        |                  |             |
|                |             |           |   |                                |              |                    | -               |                      |         |                  |                    |                  | -                      |                  |             |
|                |             |           |   |                                |              |                    |                 |                      |         |                  |                    |                  |                        |                  |             |
|                |             |           |   |                                |              |                    |                 |                      |         |                  |                    |                  |                        |                  |             |
| -15-           |             |           |   |                                |              |                    | -               |                      |         |                  |                    |                  | -                      |                  |             |
|                |             |           |   |                                |              |                    |                 |                      |         |                  |                    |                  |                        |                  |             |
|                |             |           |   |                                |              |                    | -               |                      |         |                  |                    |                  |                        |                  |             |
|                |             |           |   |                                |              |                    | -               |                      |         |                  |                    |                  | -                      |                  |             |
|                |             |           |   |                                |              |                    |                 |                      |         |                  |                    |                  |                        |                  |             |
|                |             |           |   |                                |              |                    | -               |                      |         |                  |                    |                  |                        |                  |             |
|                |             |           |   |                                |              |                    | -               |                      |         |                  |                    |                  | _                      |                  |             |
|                |             |           |   |                                |              |                    |                 |                      |         |                  |                    |                  |                        |                  |             |
| DEPTH          | I<br>DRILL  | ED:       | 10.0 ft DEF   | PTH TO WATER                   | :            | DRY                |                 |                      |         | PRO              | J. No.:            | AX               | A21-04                 | 41-00            |             |
| DATE           | DRILLE      | D:        | 12/17/2021 <b>DA</b> T  | TE MEASURED:                   |              | 12/17,             | /2021           |                      |         | FIGU             | IRE:               | 22               |                        |                  |             |

## LOG OF BORING NO. P-21

I



|                  | LOG OF BORING NO. P-22       Prop. Street Rehabilitation Project       RABA         Prop. Street Rehabilitation Project       TBPE Firm Registration No. F-3257         DRILLING       DRILLING       Staright Flight Auger |           |  |                              |                     |                         |   |   |  |                     |        |  |  |
|------------------|---|-----------|--|------------------------------|---------------------|-------------------------|---|---|--|---------------------|--------|--|--|
| DRILL            | ING<br>OD:  | Stra      | aight Flight Auger   |                              |                     |                         | LOCATION: See Fig   | zure 1  |  |                     |        |  |  |
| <b>DEPTH, FT</b> | SYMBOL  | SAMPLES   | DESCRIPTION OF MAT   | 'ERIAL                       | <b>BLOWS PER FT</b> | UNIT DRY<br>WEIGHT, pcf | SHEAR STRE           -⊕         -           0.5         1.0         1.5         2.0           PLASTIC         V         V         V           10         20         30         40 | MGTH, TONS/F<br>→ → → → → →<br>O 2.5 3.0<br>VATER<br>DONTERT<br>→ → → → → → → → → → → → → → → → → → → | T <sup>2</sup><br>3.5 4.0<br>⊔OUID<br>LIMIT<br>70 80 | PLASTICITY<br>INDEX | % -200 |  |  |
|                  |   |           | Hot-Mix Asphaltic Concrete (HM/<br>LEAN CLAY WITH SAND (CL)<br>very stiff to soft, brown | AC) - 3 in                   | 17                  |                         | - •*-*  |   |  | 10                  |        |  |  |
| <br>- 5          |   |           |  |                              | 6                   |                         | -   |   | -  |                     | 85     |  |  |
|                  |   |           |  |                              | 3                   |                         | -   |   | -  | 8                   |        |  |  |
|                  |   |           | CLAYEY SAND (SC)<br>very loose, brown  |                              | 3                   |                         | •   |   | _  |                     |        |  |  |
|                  |   |           | Boring terminated at a depth of a  | about 10 ft.                 |                     |                         | -   |   |  |                     |        |  |  |
|                  |   |           | Upon completion of the drilling o<br>the boring was observed dry.                        | operations,                  |                     |                         |   |   | -  |                     |        |  |  |
|                  |   |           |  |                              |                     |                         | -   |   |  |                     |        |  |  |
|                  |   |           |  |                              |                     |                         | -   |   | -  |                     |        |  |  |
|                  |   |           |  |                              |                     |                         | -   |   | -  |                     |        |  |  |
| DEPTH<br>DATE I  | DRILL   | ED:<br>D: | 10.0 ft     DEP       12/17/2021     DAT   | PTH TO WATER<br>TE MEASURED: | k:<br>:             | DRY<br>12/17            | /2021   | PROJ. No.:<br>FIGURE:   | AXA21-0<br>23  | 41-00               |        |  |  |

I

LOG OF BORING NO. P-23 RABA KISTNER Prop. Street Rehabilitation Project Rio Grande City, Starr County, Texas TBPE Firm Registration No. F-3257 DRILLING LOCATION: See Figure 1 **METHOD:** Straight Flight Auger SHEAR STRENGTH, TONS/FT<sup>2</sup> **BLOWS PER FT** UNIT DRY WEIGHT, pcf  $\sim$ -⊗--Л PLASTICITY INDEX Ē SAMPLES SYMBOL % -200 0.5 1.0 2.0 2.5 3.0 3.5 4.0 1.5 DEPTH, **DESCRIPTION OF MATERIAL** PLASTIC LIMIT WATER CONTENT LIQUID LIMIT -× SURFACE ELEVATION: Ex. Grade, ft 70 10 20 30 40 50 60 80 Hot-Mix Asphaltic Concrete (HMAC) - 3 in. ٨ ٨ Flexible Base Material (FBM) - 6 in. LEAN CLAY (CL) soft, brown 95 3 3 13 × 5 SILTY, CLAYEY SAND (SC-SM) very loose, brown 3 4 7  $\vdash \rightarrow$ -10-Boring terminated at a depth of about 10 ft. NOTES: Upon completion of the drilling operations, the boring was observed dry. -15-DEPTH DRILLED: PROJ. No.: 10.0 ft **DEPTH TO WATER:** DRY AXA21-041-00 DATE DRILLED: 12/15/2021 **DATE MEASURED:** 12/15/2021 FIGURE: 24

|               |             |         | <b>L</b><br>Pro<br>Rio   | OG OF BO<br>op. Street R<br>Grande Cit | <b>DRI</b><br>leha<br>y, St | <b>NG I</b><br>bilita<br>arr C | <b>NO. P-2</b><br>Ition Proj<br>County, Te | <b>4</b><br>ect<br>exas |         |   | те                               | PE Firm   | R A<br>K I<br>n Regist | A B<br>S T<br>tration | A<br>N  <br>No. F-3 | <b>E R</b><br>8257 |
|---------------|-------------|---------|--|--|-----------------------------|--------------------------------|--|-------------------------|---------|---|----------------------------------|---|------------------------|-----------------------|---------------------|--------------------|
| DRILL<br>METH | ING<br>IOD: | Stra    | aight Flight Auger   |  |                             |                                | LOCATIC                                    | N: 5                    | See Fig | ure 1                                   |                                  |   |                        |                       |                     |                    |
| DEPTH, FT     | SYMBOL      | SAMPLES |  | RIAL                                   | BLOWS PER FT                | UNIT DRY<br>WEIGHT, pcf        | 0.5 1<br>PLAS<br>LIM                       | SHEAR<br>.0 1.          | STRE    | NGTH,<br>-⊗<br>D 2.5<br>VATER<br>DNTENT | <b>TONS</b><br><u>A</u><br>5 3.0 | , <b>/FT<sup>2</sup></b><br>− −<br>3.5<br>LIQL<br>LIN<br>− −≻ |                        | )                     | PLASTICITY<br>INDEX | % -200             |
|               |             | +       | SURFACE ELEVATION: Ex. Grade, tt   | ()-2 in /                              |                             |                                | 10 2                                       | 0 30                    | ) 40    | ) 50                                    | 60                               | <u>70</u>   | 80                     | )                     |                     |                    |
|               |             |         | Flexible Base Material (FBM) - 10 i  | n.                                     |                             |                                |  |                         |         |   |                                  |   |                        |                       |                     |                    |
|               |             |         | SANDY LEAN CLAY (CL)<br>soft to very soft, dark brown to b                   | prown                                  | 4                           |                                | -  | •                       |         |   |                                  |   |                        |                       |                     |                    |
| <br>          |             | X       |  |  | 2                           |                                | -  |                         | •       |   |                                  |   |                        | -                     |                     | 67                 |
|               |             | X       |  |  | 2                           |                                | -  |                         | ->>>    |   |                                  |   |                        | -                     | 8                   |                    |
| <br>          |             | X       |  |  | 1                           |                                | -  |                         | •       |   |                                  |   |                        | -                     |                     | 68                 |
| <br><br>      |             |         | NOTES:<br>Upon completion of the drilling op<br>the boring was observed dry. | perations,                             |                             |                                | -  |                         |         |   |                                  |   |                        | -                     |                     |                    |
| <br><br>DEPTH | I DRILL     | ED:     | 10.0 ft  | TH TO WATER                            | :                           | DRY                            | -  |                         |         | PROJ                                    | . No.:                           |   |                        |                       | 1-00                |                    |
| DATE          | DRILLE      | D:      | 12/15/2021 <b>DATE</b>   | E MEASURED:                            |                             | 12/15                          | /2021                                      |                         |         | FIGU                                    | RE:                              |   | 25                     |                       |                     |                    |

I

|                  |                   |           | <b>LOG O</b><br>Prop. Stre<br>Rio Grande                           | F BOF<br>eet Ref<br>e City, | <b>RII</b><br>nak<br>Sta | <b>NG N</b><br>bilitat<br>arr Co | IO. P-25<br>ion Projec<br>ounty, Tex | ct<br>as                  |              | TBF             | PE Firm Regi         | AB<br>IST<br>stration I | A<br>'N<br>No. F-3  | <b>E R</b><br>3257 |
|------------------|-------------------|-----------|--|-----------------------------|--------------------------|----------------------------------|--------------------------------------|---------------------------|--------------|-----------------|----------------------|-------------------------|---------------------|--------------------|
| DRILL            | ING<br>IOD:       | Str       | aight Flight Auger   |                             |                          |                                  | LOCATION                             | : See F                   | igure 1      |                 |                      |                         |                     |                    |
| <b>DEPTH, FT</b> | SYMBOL            | SAMPLES   | DESCRIPTION OF MATERIAL  | BLOWS PER FT                |                          | UNIT DRY<br>WEIGHT, pcf          | 0.5 1.0<br>PLASTIC<br>LIMIT          | IEAR STR<br><br>1.5 2<br> | ENGTH        | , <b>TONS</b> , | /FT <sup>2</sup><br> | .0                      | PLASTICITY<br>INDEX | % -200             |
|                  |                   |           | \Hot-Mix Asphaltic Concrete (HMAC) - 2 in.                         |                             | ╈                        | -                                |                                      | 30 4                      | +0 50        |                 |                      |                         |                     |                    |
|                  |                   |           | Flexible Base Material (FBM) - 13 in.                              |                             |                          | -                                |                                      |                           |              |                 |                      |                         |                     |                    |
|                  |                   | X         | loose, reddish-brown to dark brown                                 | 7                           |                          | -                                | •                                    | ×->                       |              |                 |                      | _                       | 10                  |                    |
|                  |                   |           | FAT CLAY (CH)<br>soft to stiff, dark brown                         | 3                           |                          | -                                | -                                    | •                         |              |                 |                      | -                       |                     |                    |
|                  |                   | X         |  | 5                           |                          | -                                |                                      | •                         |              |                 |                      | -                       |                     | 93                 |
|                  |                   |           |  | 9                           |                          | -                                |                                      | × <b>-</b>                |              |                 |                      | _                       | 31                  |                    |
|                  | -                 |           | Boring terminated at a depth of about 10 f                         | t.                          |                          | -                                |                                      |                           |              |                 |                      | _                       |                     |                    |
|                  | -                 |           | the boring was observed dry.                                       | ,                           |                          | -                                |                                      |                           |              |                 |                      | _                       |                     |                    |
|                  | -                 |           |  |                             |                          | -                                |                                      |                           |              |                 |                      | _                       |                     |                    |
| -15-             | -                 |           |  |                             |                          |                                  | -                                    |                           |              |                 |                      |                         |                     |                    |
|                  |                   |           |  |                             |                          |                                  |                                      |                           |              |                 |                      |                         |                     |                    |
| <br>             | -                 |           |  |                             |                          | -                                |                                      |                           |              |                 |                      | _                       |                     |                    |
|                  | -                 |           |  |                             |                          | -                                |                                      |                           |              |                 |                      | _                       |                     |                    |
| DEPTI<br>DATE    | I DRILL<br>DRILLE | ED:<br>D: | 10.0 ft         DEPTH TO W           12/16/2021         DATE MEASU | ATER:<br>RED:               | <br>[<br>1               | DRY<br>12/16/2                   | 2021                                 |                           | PROJ<br>FIGU | . No.:<br>RE:   | AX.<br>26            | A21-04                  | 1-00                |                    |

|                  |              |                        | P<br>Ri   | LOG OF B<br>Prop. Street F<br>o Grande Cit | <b>ORI</b><br>Reha<br>zy, St | <b>NG</b> I<br>bilita<br>arr C | <b>NO. P-26</b><br>ation Project<br>County, Texas | TBPE Fir  | RAB<br>KIST<br>m Registration I | A<br>' N  <br>No. F-3 | <b>E R</b><br>3257 |
|------------------|--------------|------------------------|---|--|------------------------------|--------------------------------|---|---|---------------------------------|-----------------------|--------------------|
| DRILL<br>METH    | .ING<br>IOD: | Stra                   | aight Flight Auger  |  |                              |                                | LOCATION: See Fig                                 | gure 1  |                                 |                       |                    |
| <b>DEPTH, FT</b> | SYMBOL       | SAMPLES                | DESCRIPTION OF MAT  | TERIAL<br>ft                               | BLOWS PER FT                 | UNIT DRY<br>WEIGHT, pcf        | SHEAR STRE<br>                                    | NGTH, TONS/FT <sup>2</sup> $-\otimes$ $-$ 0         2.5         3.0         3.           WATER         LIC         LIC         LIC           .00 TENT         LIC         LIC         LIC           .00 50         60         76         76 | →<br>5 4.0<br>WIT<br>★<br>0 80  | PLASTICITY<br>INDEX   | % -200             |
|                  |              |                        | Hot-Mix Asphaltic Concrete (HM<br>Flexible Base Material (FBM) - 9- | 1AC) - 3 in.<br>-1/2 in.                   |                              |                                |   |   |                                 |                       |                    |
|                  |              |                        | SANDY LEAN CLAY (CL)<br>hard to firm, light brown                   |  | 47                           |                                | _   |   | _                               |                       |                    |
| - ·              |              | X                      | <b>LEAN CLAY (CL)</b><br>firm to stiff, dark brown                  |  | 6                            |                                | - • •   |   | -                               |                       | 60                 |
|                  |              |                        |   |  | 9                            |                                | - · · · · · · · · · · · · · · · · · · ·           | -*  | -                               | 23                    |                    |
| - ·              |              | $\left  \right\rangle$ |   |  | 10                           |                                |   |   | -                               |                       | 99                 |
|                  |              |                        | Boring terminated at a depth of NOTES:                              | about 10 ft.                               |                              |                                | -   |   | -                               |                       |                    |
|                  | _            |                        | Upon completion of the drilling the boring was observed dry.        | operations,                                |                              |                                | -   |   | _                               |                       |                    |
|                  | -            |                        |   |  |                              |                                | -   |   |                                 |                       |                    |
| -15-             |              |                        |   |  |                              |                                | _   |   |                                 |                       |                    |
|                  |              |                        |   |  |                              |                                |   |   |                                 |                       |                    |
|                  | -            |                        |   |  |                              |                                |   |   |                                 |                       |                    |
|                  | -            |                        |   |  |                              |                                | -   |   | _                               |                       |                    |
| DEPTI<br>DATE    | H DRILL      | ED:<br>D:              | 10.0 ft         DE           12/16/2021         DA                  | PTH TO WATER                               | k:<br>:                      | DRY<br>12/16                   | 5/2021  | PROJ. No.:<br>FIGURE:   | AXA21-04<br>27                  | 1-00                  |                    |

|               |             |                         | <b>LOG (</b><br>Prop. Sti<br>Rio Grand  | <b>DF B</b><br>reet f<br>de Cit | <b>ORI</b><br>Reha<br>ty, St | <b>NG</b><br>Ibilita<br>tarr C | NO. P-2<br>Ition Proj<br>County, T | 2 <b>7</b><br>ject<br>exas |              |              | TBPE Fir | RAE<br>KIS<br>m Registratio | <b>3 A</b><br><b>T N</b><br>n No. F- | <b>E R</b><br>3257 |
|---------------|-------------|-------------------------|---|---------------------------------|------------------------------|--------------------------------|------------------------------------|----------------------------|--------------|--------------|----------|-----------------------------|--------------------------------------|--------------------|
| DRILL<br>METH | ING<br>IOD: | Str                     | aight Flight Auger  |                                 |                              |                                | LOCATIO                            | ON:                        | See Figure   | e 1          |          |                             |                                      |                    |
|               |             |                         |   |                                 | Ħ                            | f.                             | -6                                 | SHEAI                      | R STRENG     | ТН, ТО<br>/  |          |                             |                                      |                    |
| H, FT         | ABOL        | IPLES                   | DESCRIPTION OF MATERIAL   |                                 | S PER                        | r DRY<br>HT, po                | 0.5 1                              | 1.0 1.                     | .5 2.0       | 2.5 3        | 3.0 3.   | 5 4.0                       | EAT                                  | 500                |
| DEPI          | SYN         | SAN                     | DESCRIPTION OF MATERIAL   |                                 | SMOT                         | UNI                            | PLAS<br>LIN                        | STIC<br>AIT                | WAT<br>CONTI | ER<br>ENT    | LIC      | OUID<br>MIT                 | PLAS                                 | *                  |
|               |             |                         | SURFACE ELEVATION: Ex. Grade, ft  |                                 | ш                            |                                | 10                                 | <u> </u>                   | 0 40         | 50 (         | <u> </u> | <u>× 80</u>                 |                                      |                    |
|               |             |                         | Hot-Mix Asphaltic Concrete (HMAC) - 3 in<br>Elexible Base Material (EBM) - 5 in | <u>ı.</u>                       |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
|               |             |                         | Hot-Mix Asphaltic Concrete (HMAC) - 2-1   | /2                              |                              |                                | -                                  |                            |              |              |          |                             | 1                                    |                    |
|               |             |                         | √ in.<br>∫Elevible Base Material (EBM) - 6 in                                   | /[                              |                              |                                |                                    |                            |              |              |          |                             | 1                                    |                    |
|               |             | X                       | LEAN CLAY (CL)  | /                               | 13                           |                                | -                                  |                            |              |              |          |                             | 1                                    | 95                 |
|               |             | $\square$               | stiff to firm to stiff, dark brown  |                                 |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
|               |             | $\mathbb{N}$            |   |                                 | _                            |                                | _                                  |                            |              |              |          |                             | ]                                    |                    |
|               |             | Å                       |   |                                 | 5                            |                                | -   •                              | •×-                        |              |              |          |                             | 19                                   |                    |
|               |             | H                       |   |                                 |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
| - 5 -         |             | $\vdash$                |   |                                 |                              |                                | -                                  |                            |              |              |          | -                           | -                                    |                    |
|               |             | IV                      |   |                                 | 5                            |                                |                                    |                            |              |              |          |                             |                                      |                    |
|               |             | $\left  \right\rangle $ |   |                                 |                              |                                | -                                  |                            |              |              |          |                             |                                      |                    |
|               |             | Π                       |   |                                 |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
|               |             |                         |   |                                 |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
|               |             |                         |   |                                 |                              |                                | -                                  |                            |              |              |          |                             | 4                                    |                    |
|               |             | $\vdash$                |   |                                 |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
|               |             | 1/                      |   |                                 | 15                           |                                | -                                  |                            |              |              |          |                             | -                                    | 100                |
|               |             | $\mathbb{N}$            |   |                                 | 15                           |                                |                                    |                            |              |              |          |                             |                                      | 100                |
| -10-          | ſ           |                         | Boring terminated at a depth of about 10  | ) ft.                           |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
|               |             |                         |   |                                 |                              |                                | _                                  |                            |              |              |          |                             |                                      |                    |
|               |             |                         | NOTES:  |                                 |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
|               | -           |                         | the boring was observed dry.  | ns,                             |                              |                                | -                                  |                            |              |              |          |                             | 4                                    |                    |
|               |             |                         |   |                                 |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
|               | -           |                         |   |                                 |                              |                                | -                                  |                            |              |              |          |                             | -                                    |                    |
|               |             |                         |   |                                 |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
|               |             |                         |   |                                 |                              |                                | -                                  |                            |              |              |          |                             |                                      |                    |
| -15-          |             |                         |   |                                 |                              |                                |                                    |                            |              |              |          | _                           |                                      |                    |
|               |             |                         |   |                                 |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
|               | -           |                         |   |                                 |                              |                                | $\left  \right $                   |                            |              |              |          |                             | -                                    |                    |
|               |             |                         |   |                                 |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
| -             | -           |                         |   |                                 |                              |                                | $\vdash$                           |                            |              |              |          |                             | 1                                    |                    |
|               |             |                         |   |                                 |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
| [ -           | 1           |                         |   |                                 |                              |                                |                                    |                            |              |              |          |                             | 1                                    |                    |
| L -           | -           |                         |   |                                 |                              |                                |                                    |                            |              |              |          |                             | 4                                    |                    |
|               |             |                         |   |                                 |                              |                                |                                    |                            |              |              |          |                             |                                      |                    |
| DEPTH         | <br>  DRILI | ED:                     | 10.0 ft DEPTH TO V  | NATEF                           | ।<br>२:                      | DRY                            |                                    |                            | PF           | l<br>ROJ. No | ).:      |                             |                                      |                    |
| DATE          | DRILLE      | D:                      | 12/16/2021 DATE MEAS  | SURED                           | ):                           | 12/16                          | /2021                              |                            | FI           | GURE:        |          | 28                          |                                      |                    |

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT



FIGURE 29a

## **KEY TO TERMS AND SYMBOLS (CONT'D)**

#### TERMINOLOGY

Terms used in this report to describe soils with regard to their consistency or conditions are in general accordance with the discussion presented in Article 45 of SOILS MECHANICS IN ENGINEERING PRACTICE, Terzaghi and Peck, John Wiley & Sons, Inc., 1967, using the most reliable information available from the field and laboratory investigations. Terms used for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in American Society for Testing and Materials D2487-06 and D2488-00, Volume 04.08, Soil and Rock; Dimension Stone; Geosynthetics; 2005.

The depths shown on the boring logs are not exact, and have been estimated to the nearest half-foot. Depth measurements may be presented in a manner that implies greater precision in depth measurement, i.e 6.71 meters. The reader should understand and interpret this information only within the stated half-foot tolerance on depth measurements.

#### **RELATIVE DENSITY COHESIVE STRENGTH** PLASTICITY Penetration Resistance Relative Resistance Cohesion Plasticity Degree of Blows per ft **Density** Blows per ft Consistency TSF Index Plasticity 0 - 4 0 - 2 0 - 0.125 0 - 5 Very Loose Very Soft None 2 - 4 4 - 10 Soft 0.125 - 0.25 5 - 10 Loose Low 10 - 30 Medium Dense 4 - 8 Firm 0.25 - 0.5 10 - 20 Moderate 0.5 - 1.0 20 - 40 Plastic 30 - 50 Dense 8 - 15 Stiff > 50 Very Dense 15 - 30 Very Stiff 1.0 - 2.0 > 40 **Highly Plastic** > 30 Hard > 2.0

#### **ABBREVIATIONS**

| В    | = | Benzene                     | Qam, Qas, Qal 😑 | = | Quaternary Alluvium         | Kef =  | Eagle Ford Shale          |
|------|---|-----------------------------|-----------------|---|-----------------------------|--------|---------------------------|
| Т    | = | Toluene                     | Qat =           | = | Low Terrace Deposits        | Kbu =  | Buda Limestone            |
| E    | = | Ethylbenzene                | Qbc =           | = | Beaumont Formation          | Kdr =  | Del Rio Clay              |
| х    | = | Total Xylenes               | Qt =            | = | Fluviatile Terrace Deposits | Kft =  | Fort Terrett Member       |
| BTEX | = | Total BTEX                  | Qao =           | = | Seymour Formation           | Kgt =  | Georgetown Formation      |
| ТРН  | = | Total Petroleum Hydrocarbon | s Qle =         | = | Leona Formation             | Kep =  | Person Formation          |
| ND   | = | Not Detected                | Q-Tu =          | = | Uvalde Gravel               | Kek =  | Kainer Formation          |
| NA   | = | Not Analyzed                | Ewi =           | = | Wilcox Formation            | Kes =  | Escondido Formation       |
| NR   | = | Not Recorded/No Recovery    | Emi =           | = | Midway Group                | Kew =  | Walnut Formation          |
| OVA  | = | Organic Vapor Analyzer      | Mc =            | = | Catahoula Formation         | Kgr =  | Glen Rose Formation       |
| ppm  | = | Parts Per Million           | EI =            | = | Laredo Formation            | Kgru = | Upper Glen Rose Formation |
|      |   |                             | Kknm =          | = | Navarro Group and Marlbrook | Kgrl = | Lower Glen Rose Formation |
|      |   |                             |                 |   |                             | Kh =   | Hensell Sand              |
|      |   |                             | Kpg =           | = | Pecan Gap Chalk             |        |                           |
|      |   |                             | Kau =           | = | Austin Chalk                |        |                           |

PROJECT NO. AXA21-041-00

## **KEY TO TERMS AND SYMBOLS (CONT'D)**

## TERMINOLOGY

### SOIL STRUCTURE

| Slickensided<br>Fissured<br>Pocket<br>Parting<br>Seam<br>Layer<br>Laminated<br>Interlayered<br>Intermixed<br>Calcareous<br>Carbonate | <ul> <li>Having planes of weakness that appear slick and glossy.</li> <li>Containing shrinkage or relief cracks, often filled with fine sand or silt; usually more or less vertical.</li> <li>Inclusion of material of different texture that is smaller than the diameter of the sample.</li> <li>Inclusion less than 1/8 inch thick extending through the sample.</li> <li>Inclusion 1/8 inch to 3 inches thick extending through the sample.</li> <li>Inclusion greater than 3 inches thick extending through the sample.</li> <li>Soil sample composed of alternating partings or seams of different soil type.</li> <li>Soil sample composed of pockets of different soil type and layered or laminated structure is not evident.</li> <li>Having more than 50% carbonate content.</li> </ul> |
|--|--|
|  | SAMPLING METHODS   |
|  | RELATIVELY UNDISTURBED SAMPLING  |
| Cohesive soil san<br>for Thin-Walled<br>samplers in gene<br>D1586). Cohesiv<br>integrity and mo                                      | nples are to be collected using three-inch thin-walled tubes in general accordance with the Standard Practice<br>Tube Sampling of Soils (ASTM D1587) and granular soil samples are to be collected using two-inch split-barrel<br>ral accordance with the Standard Method for Penetration Test and Split-Barrel Sampling of Soils (ASTM<br>re soil samples may be extruded on-site when appropriate handling and storage techniques maintain sample<br>isture content.   |
|  | STANDARD PENETRATION TEST (SPT)  |
| A 2-inOD, 1-3/8<br>After the sample<br>Standard Penetra  | -inID split spoon sampler is driven 1.5 ft into undisturbed soil with a 140-pound hammer free falling 30 in.<br>r is seated 6 in. into undisturbed soil, the number of blows required to drive the sampler the last 12 in. is the<br>ation Resistance or "N" value, which is recorded as blows per foot as described below.  |
| Blows Per Foot   | SPLIT-BARREL SAMPLER DRIVING RECORD Description  |
| 25 ·····<br>50/7" ·····<br>Ref/3" ·····  | 25 blows drove sampler 12 inches, after initial 6 inches of seating.<br>50 blows drove sampler 7 inches, after initial 6 inches of seating.<br>50 blows drove sampler 3 inches during initial 6-inch seating interval.   |
| <u>NOTE:</u> T   | o avoid damage to sampling tools, driving is limited to 50 blows during or after seating interval.   |

PROJECT NO. AXA21-041-00

## **RESULTS OF SOIL SAMPLE ANALYSES**

PROJECT NAME:

Prop. Street Rehabilitation Project Rio Grande City, Starr County, Texas

#### FILE NAME: AMA21-041-00.GPJ

| FILE N        | ame: Ama                | 21-041-0        | )0.GPJ                  |                 |                  |                     |            |                             |                 | 1,                         | /24/2022         |
|---------------|-------------------------|-----------------|-------------------------|-----------------|------------------|---------------------|------------|-----------------------------|-----------------|----------------------------|------------------|
| Boring<br>No. | Sample<br>Depth<br>(ft) | Blows<br>per ft | Water<br>Content<br>(%) | Liquid<br>Limit | Plastic<br>Limit | Plasticity<br>Index | USCS       | Dry Unit<br>Weight<br>(pcf) | % -200<br>Sieve | Shear<br>Strength<br>(tsf) | Strength<br>Test |
| P-1           | 0.3 to 1.8              | 44              | 4                       | 38              | 22               | 16                  | SC         |                             |                 |                            |                  |
|               | 2.5 to 4.0              | 39              | 2                       |                 |                  |                     |            |                             | 29              |                            |                  |
|               | 5.0 to 6.5              | 18              | 19                      |                 |                  |                     |            |                             |                 |                            |                  |
|               | 8.5 to 10.0             | 19              | 28                      | 62              | 25               | 37                  | СН         |                             |                 |                            |                  |
| P-2           | 0.6 to 2.1              | 5               | 21                      |                 |                  |                     |            |                             | 63              |                            |                  |
|               | 2.5 to 4.0              | 6               | 16                      | 59              | 20               | 39                  | СН         |                             |                 |                            |                  |
|               | 5.0 to 6.5              | 9               | 20                      |                 |                  |                     |            |                             | 64              |                            |                  |
|               | 8.5 to 10.0             | 11              | 34                      |                 |                  |                     |            |                             |                 |                            |                  |
| P-3           | 0.7 to 2.2              | 31              | 3                       |                 |                  |                     |            |                             | 22              |                            |                  |
|               | 2.5 to 3.8              | 50/9"           | 4                       |                 |                  |                     |            |                             |                 |                            |                  |
|               | 5.0 to 5.9              | 50/5"           | 2                       | 22              | 16               | 6                   | SC-SM      |                             |                 |                            |                  |
|               | 8.5 to 9.8              | 50/ 10"         | 2                       |                 |                  |                     |            |                             | 18              |                            |                  |
| P-4           | 0.3 to 1.8              | 14              | 5                       |                 |                  |                     |            |                             |                 |                            |                  |
|               | 2.5 to 4.0              | 15              | 6                       | 27              | 17               | 10                  | SC         |                             |                 |                            |                  |
|               | 5.0 to 6.5              | 22              | 14                      |                 |                  |                     |            |                             | 68              |                            |                  |
|               | 8.5 to 10.0             | 17              | 7                       | 31              | 24               | 7                   | CL-ML      |                             |                 |                            |                  |
| P-5           | 0.3 to 1.8              | 4               | 10                      | 24              | 19               | 5                   | СН         |                             |                 |                            |                  |
|               | 2.5 to 4.0              | 3               | 10                      |                 |                  |                     |            |                             | 57              |                            |                  |
|               | 5.0 to 6.5              | 4               | 10                      | 22              | 17               | 5                   | CL-ML      |                             |                 |                            |                  |
|               | 8.5 to 10.0             | 15              | 2                       |                 |                  |                     |            |                             |                 |                            |                  |
| P-6           | 1.5 to 3.0              | 34              | 8                       |                 |                  |                     |            |                             | 18              |                            |                  |
|               | 3.0 to 4.5              | 28              | 7                       | 32              | 23               | 9                   | sc         |                             |                 |                            |                  |
|               | 5.0 to 6.5              | 23              | 13                      |                 |                  |                     |            |                             | 30              |                            |                  |
|               | 8.5 to 10.0             | 31              | 19                      | 38              | 31               | 7                   | SC-SM      |                             |                 |                            |                  |
| P-7           | 1.0 to 2.5              | 38              | 3                       |                 |                  |                     |            |                             | 12              |                            |                  |
|               | 2.5 to 4.0              | 38              | 3                       |                 |                  |                     |            |                             |                 |                            |                  |
|               | 5.0 to 6.3              | 50/ 10"         | 3                       | 20              | 17               | 3                   | SM         |                             |                 |                            |                  |
|               | 8.5 to 9.8              | 50/9"           | 3                       |                 |                  |                     |            |                             | 25              |                            |                  |
| P-8           | 1.0 to 2.5              | 50/ 11"         | 7                       | 24              | 21               | 3                   | SM         |                             |                 |                            |                  |
|               | 2.5 to 4.0              | 42              | 8                       |                 |                  |                     |            |                             | 27              |                            |                  |
|               | 5.0 to 6.3              | 50/ 10"         | 3                       |                 |                  |                     |            |                             |                 |                            |                  |
|               | 8.5 to 9.8              | 50/ 10"         | 5                       | 21              | 16               | 5                   | SC-SM      |                             |                 |                            |                  |
| P-9           | 1.1 to 2.6              | 10              | 3                       | 33              | 25               | 8                   | sc         |                             |                 |                            |                  |
|               | 2.6 to 4.1              | 3               | 34                      |                 |                  |                     |            |                             |                 |                            |                  |
|               | 5.0 to 6.5              | 16              | 33                      |                 |                  |                     |            |                             | 33              |                            |                  |
|               | 8.5 to 9.8              | 50/9"           | 31                      |                 |                  |                     |            |                             |                 |                            |                  |
| P-10          | 1.6 to 3.1              | 7               | 17                      |                 |                  |                     |            |                             | 44              |                            |                  |
|               | 3 1 to 4 6              | 1               | 26                      | 31              | 19               | 12                  | CL         |                             |                 |                            |                  |
|               | 5.0 to 6.5              | 5               | 21                      |                 |                  |                     |            |                             | 61              |                            |                  |
| PP = Pocł     | ket Penetrome           | eter TV =       | Torvane                 | UC = Unco       | nfined Com       | pression            | FV = Field | l<br>d Vane UU =            | Unconsolic      | i<br>lated Undrai          | l<br>ned Triaxia |
| CU = Con      | solidated Und           | rained Triaxi   | al                      | CNBD = Co       | und Not Be       | Determined          | -          | F                           | PROJECT         | NO. AXA2                   | 1-041-00         |
|               |                         |                 |                         |                 | ADAN             | SINE                | 7          |                             |                 |                            |                  |

## **RESULTS OF SOIL SAMPLE ANALYSES**

PROJECT NAME:

Prop. Street Rehabilitation Project Rio Grande City, Starr County, Texas

#### FILE NAME: AMA21-041-00.GPJ

| FILE N        | AME: AMA                | 21-041-0        | 0.GPJ                   |                 |                  |                     |   |                             |                 | 1/                         | /24/2022         |  |
|---------------|-------------------------|-----------------|-------------------------|-----------------|------------------|---------------------|---|-----------------------------|-----------------|----------------------------|------------------|--|
| Boring<br>No. | Sample<br>Depth<br>(ft) | Blows<br>per ft | Water<br>Content<br>(%) | Liquid<br>Limit | Plastic<br>Limit | Plasticity<br>Index | USCS  | Dry Unit<br>Weight<br>(pcf) | % -200<br>Sieve | Shear<br>Strength<br>(tsf) | Strength<br>Test |  |
| P-10          | 8.5 to 10.0             | 9               | 19                      | 42              | 21               | 21                  | CL  |                             |                 |                            |                  |  |
| P-11          | 1.3 to 2.8              | 10              | 15                      |                 |                  |                     |   |                             | 29              |                            |                  |  |
|               | 2.8 to 4.3              | 10              | 9                       | 34              | 24               | 10                  | SC  |                             |                 |                            |                  |  |
|               | 5.0 to 6.5              | 18              | 21                      |                 |                  |                     |   |                             |                 |                            |                  |  |
|               | 8.5 to 10.0             | 26              | 26                      |                 |                  |                     |   |                             | 82              |                            |                  |  |
| P-12          | 1.0 to 2.5              | 3               | 30                      | 45              | 30               | 15                  | SC  |                             |                 |                            |                  |  |
|               | 2.5 to 4.0              | 6               | 25                      |                 |                  |                     |   |                             | 93              |                            |                  |  |
|               | 5.0 to 6.5              | 14              | 23                      | 56              | 30               | 26                  | СН  |                             |                 |                            |                  |  |
|               | 8.5 to 10.0             | 14              | 23                      |                 |                  |                     |   |                             |                 |                            |                  |  |
| P-13          | 0.6 to 2.1              | 11              | 18                      | 56              | 28               | 28                  | СН  |                             |                 |                            |                  |  |
|               | 2.5 to 4.0              | 13              | 18                      |                 |                  |                     |   |                             |                 |                            |                  |  |
|               | 5.0 to 6.5              | 18              | 19                      |                 |                  |                     |   |                             | 99              |                            |                  |  |
|               | 8.5 to 10.0             | 13              |                         |                 |                  |                     |   |                             |                 |                            |                  |  |
| P-14          | 0.8 to 2.3              | 19              | 15                      | 51              | 22               | 29                  | СН  |                             |                 |                            |                  |  |
|               | 2 5 to 4 0              | 23              | 16                      |                 |                  |                     |   |                             | 99              |                            |                  |  |
|               | 5.0 to 6.5              | 25              | 15                      | 53              | 25               | 28                  | СН  |                             |                 |                            |                  |  |
|               | 8 5 to 10 0             | 20              | 18                      |                 |                  |                     |   |                             | 99              |                            |                  |  |
| P-15          | 1 2 to 2 7              | 4               | 17                      | 26              | 18               | 8                   | SC  |                             |                 |                            |                  |  |
|               | 27 to 42                | 3               | 21                      |                 |                  |                     | 00  |                             |                 |                            |                  |  |
|               | 5.0 to 6.5              | 8               | 20                      |                 |                  |                     |   |                             | 23              |                            |                  |  |
|               | 8.5 to 10.0             | 19              | 20                      | 53              | 32               | 21                  | CH  |                             | 20              |                            |                  |  |
| D 16          | 1.1 to 2.6              | 26              | 20                      | 55              | 52               | 21                  | CIT   |                             | 16              |                            |                  |  |
| P-10          | 1.1 to 2.0              | 20              | 22                      | 47              | 20               | 17                  | 50  |                             | 10              |                            |                  |  |
|               | 2.0104.1                | 9               | 30                      | 41              | 30               | 17                  | 30  |                             |                 |                            |                  |  |
|               | 5.0 to 6.5              | 17              | 38                      |                 |                  |                     |   |                             | 44              |                            |                  |  |
| <b>D</b> 47   | 8.5 to 10.0             | 20              | 36                      |                 | 0.5              |                     |   |                             | 41              |                            |                  |  |
| P-17          | 1.2 to 2.7              | 3               | 17                      | 30              | 25               | 11                  | SC  |                             |                 |                            |                  |  |
|               | 2.7 to 4.2              | 3               | 20                      |                 |                  | _                   |   |                             | 34              |                            |                  |  |
|               | 5.0 to 6.5              | 10              | 4                       | 28              | 23               | 5                   | SC-SM   |                             |                 |                            |                  |  |
|               | 8.5 to 10.0             | 33              | 33                      |                 |                  |                     |   |                             |                 |                            |                  |  |
| P-18          | 0.2 to 1.7              | 18              | 26                      |                 |                  |                     |   |                             | 56              |                            |                  |  |
|               | 2.5 to 4.0              | 9               | 14                      | 25              | 20               | 5                   | CL-ML   |                             |                 |                            |                  |  |
|               | 5.0 to 6.5              | 20              | 23                      |                 |                  |                     |   |                             |                 |                            |                  |  |
|               | 8.5 to 10.0             | 25              | 26                      |                 |                  |                     |   |                             | 33              |                            |                  |  |
| P-19          | 0.5 to 2.0              | 8               | 13                      |                 |                  |                     |   |                             | 31              |                            |                  |  |
|               | 2.5 to 3.8              | 50/9"           | 23                      | 44              | 35               | 9                   | SC  |                             |                 |                            |                  |  |
|               | 5.0 to 6.3              | 50/9"           | 24                      |                 |                  |                     |   |                             |                 |                            |                  |  |
|               | 8.5 to 9.8              | 50/ 10"         | 24                      |                 |                  |                     |   |                             | 33              |                            |                  |  |
| P-20          | 0.5 to 2.0              | 31              | 5                       |                 |                  |                     |   |                             |                 |                            |                  |  |
|               | 2.5 to 4.0              | 17              | 18                      | 33              | 27               | 6                   | SC-SM   |                             |                 |                            |                  |  |
| PP = Pocł     | ket Penetrome           | ter TV =        | Torvane                 | UC = Unco       | onfined Com      | pression            | FV = Field Vane UU = Unconsolidated Undrained Triaxia |                             |                 |                            |                  |  |
| CU = Con      | solidated Und           | rained Triaxi   | al                      | CNBD = Co       | und Not Be       | Determined<br>STNEI | R   | F                           | PROJECT I       | NO. AXA2                   | 1-041-00         |  |

## **RESULTS OF SOIL SAMPLE ANALYSES**

PROJECT NAME:

Prop. Street Rehabilitation Project Rio Grande City, Starr County, Texas

#### FILE NAME: AMA21-041-00.GPJ

| 3oring<br>No.<br>P-20 | Sample<br>Depth | Blows   | Water          |                 |                  | 1                   | 1          | David           |                 |                            | 1                |
|-----------------------|-----------------|---------|----------------|-----------------|------------------|---------------------|------------|-----------------|-----------------|----------------------------|------------------|
| P-20                  | (ft)            | per ft  | Content<br>(%) | Liquid<br>Limit | Plastic<br>Limit | Plasticity<br>Index | USCS       | Weight<br>(pcf) | % -200<br>Sieve | Shear<br>Strength<br>(tsf) | Strength<br>Test |
|                       | 5.0 to 6.5      | 19      | 17             |                 |                  |                     |            |                 | 37              |                            |                  |
|                       | 8.5 to 10.0     | 26      | 17             | 34              | 30               | 4                   | SM         |                 |                 |                            |                  |
| P-21                  | 0.7 to 2.2      | 17      | 32             |                 |                  |                     |            |                 | 42              |                            |                  |
|                       | 2.5 to 4.0      | 22      | 33             | 70              | 34               | 36                  | sc         |                 |                 |                            |                  |
|                       | 5.0 to 6.5      | 15      | 38             |                 |                  |                     |            |                 | 46              |                            |                  |
|                       | 8.5 to 10.0     | 23      | 41             |                 |                  |                     |            |                 |                 |                            |                  |
| P-22                  | 0.3 to 1.8      | 17      | 16             | 30              | 20               | 10                  | CL         |                 |                 |                            |                  |
|                       | 2.5 to 4.0      | 6       | 18             |                 |                  |                     |            |                 | 85              |                            |                  |
|                       | 5.0 to 6.5      | 3       | 18             | 28              | 20               | 8                   | CL         |                 |                 |                            |                  |
|                       | 8.5 to 10.0     | 3       | 23             |                 |                  |                     |            |                 |                 |                            |                  |
| P-23                  | 0.8 to 2.3      | 3       | 21             |                 |                  |                     |            |                 | 95              |                            |                  |
|                       | 2.5 to 4.0      | 3       | 20             | 34              | 21               | 13                  | CL         |                 |                 |                            |                  |
|                       | 5.0 to 6.5      | 3       | 21             |                 |                  |                     |            |                 |                 |                            |                  |
|                       | 8.5 to 10.0     | 4       | 21             | 28              | 21               | 7                   | SC-SM      |                 |                 |                            |                  |
| P-24                  | 1.0 to 2.5      | 4       | 24             |                 |                  |                     |            |                 |                 |                            |                  |
|                       | 2.5 to 4.0      | 2       | 35             |                 |                  |                     |            |                 | 67              |                            |                  |
|                       | 5.0 to 6.5      | 2       | 34             | 33              | 25               | 8                   | CL         |                 |                 |                            |                  |
|                       | 8.5 to 10.0     | 1       | 32             |                 |                  |                     |            |                 | 68              |                            |                  |
| P-25                  | 1.3 to 2.8      | 7       | 17             | 39              | 29               | 10                  | sc         |                 |                 |                            |                  |
|                       | 2.8 to 4.3      | 3       | 27             |                 |                  |                     |            |                 |                 |                            |                  |
|                       | 5.0 to 6.5      | 5       | 29             |                 |                  |                     |            |                 | 93              |                            |                  |
|                       | 8.5 to 10.0     | 9       | 30             | 59              | 28               | 31                  | СН         |                 |                 |                            |                  |
| P-26                  | 1.0 to 2.5      | 47      | 24             |                 |                  |                     |            |                 |                 |                            |                  |
|                       | 2.5 to 4.0      | 6       | 27             |                 |                  |                     |            |                 | 60              |                            |                  |
|                       | 5.0 to 6.5      | 9       | 26             | 47              | 24               | 23                  | CL         |                 |                 |                            |                  |
|                       | 8.5 to 10.0     | 10      | 25             |                 |                  |                     |            |                 | 99              |                            |                  |
| P-27                  | 1.4 to 2.9      | 13      | 18             |                 |                  |                     |            |                 | 95              |                            |                  |
|                       | 2.9 to 4.4      | 5       | 19             | 42              | 23               | 19                  | CL         |                 |                 |                            |                  |
|                       | 5.0 to 6.5      | 5       | 17             |                 |                  |                     |            |                 |                 |                            |                  |
|                       | 8.5 to 10.0     | 15      | 19             |                 |                  |                     |            |                 | 100             |                            |                  |
|                       |                 |         |                |                 |                  |                     |            |                 |                 |                            |                  |
|                       |                 |         |                |                 |                  |                     |            |                 |                 |                            |                  |
|                       |                 |         |                |                 |                  |                     |            |                 |                 |                            |                  |
|                       |                 |         |                |                 |                  |                     |            |                 |                 |                            |                  |
|                       |                 |         |                |                 |                  |                     |            |                 |                 |                            |                  |
|                       |                 |         |                |                 |                  |                     |            |                 |                 |                            |                  |
|                       |                 |         |                |                 |                  |                     |            |                 |                 |                            |                  |
|                       |                 |         |                |                 |                  |                     |            |                 |                 |                            |                  |
|                       |                 |         |                |                 |                  |                     |            |                 |                 |                            |                  |
| ' = Pocke             | t Penetromet    | er TV = | Torvane        | UC = Unco       | nfined Com       | pression            | FV = Field | I Vane UU =     | Unconsolic      | l<br>lated Undrai          | l<br>ned Tria    |
|                       |                 |         |                |                 |                  |                     |            |                 |                 |                            |                  |





# Important Information about This Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

# Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one* — *not even you* — should apply this report for any purpose or project except the one originally contemplated.

#### **Read the Full Report**

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

## Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an

assessment of their impact. *Geotechnical engineers cannot* accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

#### **Subsurface Conditions Can Change**

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

#### Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

#### A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmationdependent recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.* 

# A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

#### Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.* 

## Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, but preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/ or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. Be sure constructors have sufficient time to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

#### **Read Responsibility Provisions Closely**

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

#### **Environmental Concerns Are Not Covered**

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnicalengineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else*.

## Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the express purpose of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.

## Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.



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# **CONSULTANTS • ENVIRONMENTAL • FACILITIES • INFRASTRUCTURE**

| San Antonio, TX     |             |                    |
|---------------------|-------------|--------------------|
| Austin, TX          | Dallas , TX | McAllen, TX        |
| Brownsville, TX     | El Paso, TX | Mexico             |
| Corpus Christi , TX | Houston, TX | Salt Lake City, UT |

#### SECTION 011030 SPECIAL PROCEDURES

### PART 1 - GENERAL

### 1.01 GENERAL

- A. Consider the sequences, duration limitations, and governing factors outlined in this Section to prepare the schedule for the work.
- B. Perform the work not specifically described in this Section as required to complete the entire project within the contract time.

### 1.02 SHUT DOWNS AND PLANS OF ACTION

- A. Shut-downs of operations or equipment must be planned and scheduled.
  - 1. Submit a written plan of action for approval for shutting down essential services. These include:
    - a. Water or Wastewater service
  - 2. Describe the following in the Plan of Action:
    - a. Construction necessary
    - b. Utilities, piping, or services affected
    - c. Length of time the service or utility will be disturbed
    - d. Procedures to be used to carry out the work
    - e. Plan of Action to handle emergencies
    - f. Contingency plan that will be used if the original schedule cannot be met
  - 3. Plan must be received by the Owner two (2) weeks prior to beginning the work.
- B. The Owner has identified "Critical Operations" that must not be out of service longer than the designated maximum out of service time and/or must be performed only during the designated times.
  - 1. Work affecting "Critical Operations" is to be performed on a 24-hour a day basis until operations have been restored.
  - 2. Provide additional work force and equipment as required to complete the work affecting "Critical Operations" within the allotted time.
- C. Include the cost for work affecting "Critical Operations" in the contract proposal.

#### SECTION 012500 PRODUCT SUBSTITUTIONS

### PART 1 - GENERAL

### 1.01 SUMMARY

- A. Section Includes:
  - 1. The procedure for requesting substitution approval for a product which is specified by descriptive or performance criteria or defined by reference to one or more of the following:
    - a. Name of manufacturer.
    - b. Name of vendor.
    - c. Trade name.
    - d. Catalog number.
- B. Related Sections include but are not necessarily limited to:
  - 1. Division 1 General Requirements.
- C. Requests for Substitution General:
  - 1. Base all bids on materials, equipment, and procedures specified.
  - 2. Certain types of equipment and kinds of material are described in specifications by means of references to names of manufacturers and vendors, trade names, or catalog numbers. When this method of specifying is used, it is not intended to exclude from consideration other products bearing other manufacturer's or vendor's names, trade names, or catalog numbers, provided said products are capable of accomplishing the same tasks as the products specifically indicated.
  - 3. Other types of equipment and kinds of material may be acceptable.

### 1.02 QUALITY ASSURANCE

- A. In making request for substitution or in using an approved product, Contractor represents:
  - 1. He has investigated proposed product and has determined that it is adequate or superior in all respects to that specified, and that it will perform function for which it is intended.
  - 2. He will provide same guarantee for substitute item for product specified by Engineer.
  - 3. He will coordinate installation of accepted substitution into work, to include building modifications if necessary, making such changes as may be required for work to be complete in all respects.
  - 4. He waives all claims for additional costs related to substitution which subsequently arise.

## **1.03 PROCEDURE FOR REQUESTING SUBSTITUTION**

- A. Considered after award of Contract.
- B. Written requests through Contractor only.
- C. Transmittal Mechanics:
  - 1. Follow the transmittal mechanics prescribed for shop drawings in Section 001340. Product substitution will be treated in a manner as a deviations. List the letter describing the deviation and justifications on the transmittal form in the space provided under the column with the heading "DESCRIPTION." Include in the transmittal letter, either directly or as a clearly marked attachment, the items listed in paragraph D below.
- D. Transmittal Contents:
  - 1. Product identification:
    - a. Manufacturer's name.
    - b. Telephone number and representative contact name.
  - 2. Specification section or drawing reference of originally specified product, including discrete name or tag number assigned to original product in the Contract Documents.
  - 3. Manufacturer's literature clearly marked to show compliance of proposed product with Contract Documents.
  - 4. Itemized comparison of original and proposed product addressing product characteristics including but not necessarily limited to:
    - a. Size.

- b. Composition or materials of construction.
- c. Weight.
- d. Electrical or mechanical requirements.
- 5. Product experience:
  - a. Location of past projects utilizing product.
  - b. Name and telephone number of persons associated with referenced projects knowledgeable concerning proposed product.
  - c. Available field data and reports associated with proposed product.
- 6. Data relating to changes in construction schedule.
- 7. Data relating to changes in cost.
- 8. Samples:
  - a. At request of Engineer.
  - b. Full size if requested by Engineer.
  - c. Held until substantial completion.
  - d. Engineer not responsible for loss or damage to samples.

# 1.04 APPROVAL OR REJECTION

- A. Written approval or rejection of substitution given by the Engineer.
- B. Engineer reserves the right to require proposed product to comply with color and pattern of specified product if necessary to secure design intent.
- C. In event substitution results in a change of Contract price or time, provisions in General Conditions will be applied for adjustment.
- D. Substitutions will be rejected if:
  - 1. Submittal is not through the Contractor with his stamp of approval.
  - 2. Requests are not made in accordance with this Section.
  - 3. In the Engineer's opinion, acceptance will require substantial revision of the original design.
  - 4. In the Engineer's opinion, substitution is not equal to original product specified or will not perform adequately the function for which it was intended.

#### SECTION 013200 CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 GENERAL

## 1.01 RELATED DOCUMENTS

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

### 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Preliminary Construction Schedule.
  - 2. Contractor's Construction Schedule.
  - 3. Submittals Schedule.
  - 4. Daily construction reports.
  - 5. Material location reports.
  - 6. Field condition reports.
  - 7. Special reports.

### 1.03 DEFINITIONS

- A. Definitions in this Article have been adapted from the glossary of terms in AGC's "Construction Planning & Scheduling." For many projects, most are unnecessary and may be deleted.
- B. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical activities are activities on the critical path. They must start and finish on the a. planned early start and finish times.
    - 1) Predecessor Activity: An activity that precedes another activity in the network.
    - 2) Successor Activity: An activity that follows another activity in the network.
      - (a) Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.
      - (b) Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
      - (c) Event: The starting or ending point of an activity.
      - (d) Float: The measure of leeway in starting and completing an activity.
        - (1) Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
        - (2) Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
        - (3) Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- C. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- D. Major Area: A story of construction, a separate building, or a similar significant construction element.
  - 1. Milestone: A key or critical point in time for reference or measurement.
- E. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

## 1.04 SUBMITTALS

- A. Qualification Data: For scheduling consultant.
- B. Submittals Schedule: Submit electronic pdf copies of schedule. Arrange the following information in a tabular format:
  - 1. Scheduled date for first submittal.
  - 2. Specification Section number and title.
  - 3. Submittal category (action or informational).
  - 4. Name of subcontractor.
  - 5. Description of the Work covered.
  - 6. Scheduled date for Engineer's final release or approval.
- C. Preliminary Construction Schedule: Submit two electronic pdf copies.
  - a. Approval of cost-loaded preliminary construction schedule will not constitute approval of Schedule of Values for cost-loaded activities.
- D. Preliminary Network Diagram: two electronic pdf copies, large enough to show entire network for entire construction period. Show logic ties for activities.
- E. Contractor's Construction Schedule: Submit two electronic pdf copies of initial schedule, large enough to show entire schedule for entire construction period.
  - 1. Submit an electronic copy of schedule, using software indicated, on CD-R, and labeled to comply with requirements for submittals. Include type of schedule (Initial or Updated) and date on label.
    - a. Daily Construction Reports: Submit electronic pdf copies at monthly intervals.
- F. Material Location Reports: Submit electronic pdf copies at monthly intervals.
- G. Field Condition Reports: Submit electronic pdf at time of discovery of differing conditions.
- H. Special Reports: Submit electronic pdf at time of unusual event.

### 1.05 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from parties involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## PART 2 PRODUCTS

## 2.01 SUBMITTALS SCHEDULE

- A. Revise this Article to suit Project. If there is an office submittal review sequence policy, insert specific requirements. See Evaluations for discussion on submittal review sequence policies.
- B. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
  - 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
  - 2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
    - a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

# 2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."
- B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
  - 1. Activity Duration: Define activities so no activity is longer than 21 days, unless specifically allowed by Architect.
  - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  - 3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
  - 4. Startup and Testing Time: Include not less than 14 days for startup and testing.
  - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.
  - 1) Phasing: Arrange list of activities on schedule by phase.
  - 2) Work under More Than One Contract: Include a separate activity for each contract.
  - 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  - 3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
    - 1) Work Restrictions: Show the effect of the following items on the schedule:
      - (a) Coordination with existing construction.
      - (b) Limitations of continued occupancies.
      - (c) Uninterruptible services.
      - (d) Partial occupancy before Substantial Completion.
      - (e) Use of premises restrictions.
      - (f) Provisions for future construction.
      - (g) Seasonal variations.
      - (h) Environmental control.
  - 4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - (a) Subcontract awards.
    - (b) Submittals.
    - (c) Purchases.
    - (d) Mockups.
    - (e) Fabrication.
    - (f) Sample testing.
    - (g) Deliveries.
    - (h) Installation.
    - (i) Tests and inspections.

- (j) Adjusting.
- (k) Curing.
- (I) Startup and placement into final use and operation.
- 5. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
  - a. Structural completion.
  - b. Permanent space enclosure.
  - c. Completion of mechanical installation.
  - d. Completion of electrical installation.
  - e. Substantial Completion.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
  - a. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned
- F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

## 2.03 PRELIMINARY CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within seven days of date established for commencement of the Work.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

# 2.04 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for commencement of the Work. Base schedule on the Preliminary Construction Schedule and whatever updating, and feedback was received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
  - 1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

## 2.05 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
  - 1. List of subcontractors at Project site.
  - 2. List of separate contractors at Project site.
  - 3. Approximate count of personnel at Project site.
  - 4. Equipment at Project site.
  - 5. Material deliveries.
  - 6. High and low temperatures and general weather conditions.
  - 7. Accidents.
  - 8. Meetings and significant decisions.
  - 9. Unusual events (refer to special reports).
  - 10. Stoppages, delays, shortages, and losses.
  - 11. Meter readings and similar recordings.
  - 12. Emergency procedures.
  - 13. Orders and requests of authorities having jurisdiction.
  - 14. Change Orders received and implemented.
  - 15. Construction Change Directives received and implemented.

- 16. Services connected and disconnected.
- 17. Equipment or system tests and startups.
- 18. Partial Completions and occupancies.
- 19. Substantial Completions authorized.
- B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

### 2.06 SPECIAL REPORTS

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

### **PART 3 EXECUTION**

## 3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
  - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  - 3. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  - a. Post copies in Project meeting rooms and temporary field offices.
  - b. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

#### SECTION 013233 PHOTOGRAPHIC DOCUMENTATION

### PART 1 GENERAL

### 1.01 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Preconstruction photographs.
  - 2. Periodic construction photographs.
  - 3. Final completion construction photographs.
  - 4. Preconstruction video recordings.
  - 5. Periodic construction video recordings.

#### 1.02 MEASUREMENT AND PAYMENT

A. No separate measurement and payment are made under this section. Include cost for work under this Section in related items listed on the Unit Price Schedule.

### **1.03 INFORMATIONAL SUBMITTALS**

- A. Digital Photographs: Submit image files within three days of taking photographs.
  - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
  - 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by brief description including location.
  - 3. Identification: Provide the following information with each image description in file metadata tag:
    - a. Name of Project.
    - b. Name and contact information for photographer.
    - c. Name of Owner and Engineer.
    - d. Name of Contractor.
    - e. Date photograph was taken.
    - f. Description of vantage point, indicating location and direction (by compass point).
    - g. Unique sequential identifier.
- B. Video Recordings: Submit video recordings within seven days of recording.
  - 1. Submit video recordings by USB and/or digital video disc acceptable to the Engineer.
  - 2. Identification: With each submittal, provide the following information:
    - a. Name of Project.
    - b. Name and address of photographer.
    - c. Name of Owner and Engineer.
    - d. Name of Contractor.
    - e. Date video recording was recorded.
    - f. Description of vantage point, indicating location and direction (by compass point).
    - g. Weather conditions at time of recording.

#### 1.04 USAGE RIGHTS

A. The owner shall be given copyright usage rights for unlimited reproduction of photographic documentation.

## PART 2 PRODUCTS

#### 2.01 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.
- B. Digital Video Recordings: Provide high-resolution, in USB and/or format acceptable to Engineer.

# PART 3 EXECUTION

### 3.01 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
  - 1. Date and Time: Include date and time in file name for each image.
  - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Owner and Engineer.
- C. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Owner and Engineer.
  - 1. Flag construction limits before taking construction photographs.
  - 2. Take photographs to show existing conditions adjacent to property before starting the Work.
  - 3. Take photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
  - 4. Take photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Periodic Construction Photographs: Take coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- E. Owner and Engineer Directed Construction Photographs: From time to time, Owner and Engineer will instruct the Contractor about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.
- F. Final Completion Construction Photographs: Take color photographs after date of Substantial Completion for submission as project record documents. Owner or Engineer will inform photographer of desired vantage points.
  - 1. Do not include date stamp.
- G. Additional Photographs: Owner or Engineer may request photographs in addition to periodic photographs specified.
  - 1. Three days' notice will be given, where feasible.
  - 2. In emergency situations, take additional photographs within 24 hours of request.
  - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
    - a. Special events planned at Project site.
    - b. Immediate follow-up when on-site events result in construction damage or losses.
    - c. Photographs to be taken at fabrication locations away from Project site.
    - d. Substantial Completion of a major phase or component of the Work.
    - e. Extra record photographs at time of final acceptance.
    - f. Owner's request for special publicity photographs.

## 3.02 CONSTRUCTION VIDEO RECORDINGS

- A. Preconstruction Video Recording: Before starting construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Engineer.
  - 1. Flag construction limits before recording construction video recordings.
  - 2. Show existing conditions adjacent to Project site before starting the Work.
  - 3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of construction.
  - 4. Show protection efforts by Contractor.

B. Periodic Construction Video Recordings: Record video recording monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last video recordings were recorded.

#### SECTION 013300 SUBMITTAL PROCEDURES

#### SUBMITTAL PROCEDURES

### PART 1 - GENERAL

## 1.01 GENERAL

- A. Contractor shall submit documentation as required by the Contract Documents and as reasonably requested by the Owner and Engineer to:
- B. Record the products incorporated into the Project for the Owner.
- C. Provide information for operation and maintenance of the Project.
- D. Provide information for the administration of the Contract.
- E. Allow the Engineer to advise the Owner if products proposed for the project by the Contractor conform, in general, with the design concepts of the Contract Documents.
- F. Contractors responsibility for full compliance with the Contract Documents is not relieved by the Engineers review of submittals, Contract modifications may only be approved by Change Order or Field Directive.

### **1.02 CONTRACTORS RESPONSIBILITIES**

- A. Review all submittals prior to submission.
- B. Determine and verify:
  - 1. Field measurements.
  - 2. Field construction requirements.
  - 3. Location of all existing structures, utilities and equipment related to the submittals.
  - 4. Submittals are complete for their intended purpose.
  - 5. Conflicts between the submittals related to the various subcontractors and suppliers have been resolved.
  - 6. Quantities and dimensions shown on the submittals.
- C. Submit information per the procedures described in this section and the detailed specifications.
- D. Furnish the following submittals:
  - 1. As specified in the attached Submittal Schedule.
  - 2. Schedules, data and other documentation as described in detail in this section or referenced in the General Conditions.
  - 3. Submittals as required in the detailed specifications.
- E. Submittals not required will be returned without Engineer's review.
- F. Submit a schedule indicating the date submittals will be sent to the Engineer and proposed dates that the product will be incorporated into the project. Make submittals promptly in accordance with the schedule so as to cause no delay in the project.
  - 1. Submittals shall be sent to Engineer allowing a reasonable time for delivery, review and marking submittals. Time for review is to include time for resubmission if necessary and to allow adequate time for the ordering, fabrication, and delivery of the product.
  - 2. Schedule submittal to provide all information for interrelated work at one time. No review will be performed on submittals requiring coordination with other submittals. Engineer will return submittals for resubmission as a complete package.
- G. Installation of any products prior to the approval of shop drawings is done at the Contractors risk. Products not meeting the requirements of Contract Documents are defective and may be rejected at the Owners option.
- H. Payment will not be made for products for which submittals are required until the submittals have been approved. Payment will not be made for products for which shop drawings or samples are required until these are approved by the Engineer.

### 1.03 QUALITY ASSURANCE

- A. Submit legible, accurate, complete documents presented in a clear, easily understood manner. Submittals not meeting this criterion will be returned without review.
- B. Demonstrate that the proposed products are in full and complete compliance with the design criteria and requirements of the Contract Documents including drawings and specifications as modified by Addenda, Field Directive and Change Orders.
- C. Furnish and install products that fully comply with the information included in the submittal.
- D. Review and approve submittals prior to submitting them to the Engineer for review. Submittals will not be accepted from subcontractors, suppliers, or anyone other than the Contractor.

## 1.04 SUBMITTAL PROCEDURES

- A. Deliver submittals to the Engineer.
- B. Assign a number to the documents originated to allow tracking of the submittal during the review process.
- C. Submit all documents electronically through a pdf file.
- D. Mark submittals to reference the drawing number and/or section of the specifications, detail designation, schedule or location that corresponds with the data submitted. Other identification may also be required, such as layout drawings or schedules to allow the reviewer to determine where a particular product is to be used

# 1.05 REVIEW PROCEDURES

A. Priority submittals will be reviewed before other submittals for this project which have been received but not reviewed.

# 1.06 REQUIREMENTS

- A. Certifications. Warranties and Service Agreements include documents as specified in the detailed specifications as shown in the submittal schedule or as follows:
- B. Certified Test Reports (CTR) A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the specifications.
  - 1. Certification of Local Field Service (CLS) A certified letter stating that field service is available from a factory or supplier approved service organization located within a 300 mile radius of the project site. List names, addresses, and telephone numbers of approved service organizations on or attach to the certificate.
  - 2. Extended Warranty (EW) A guarantee of performance for the product or system beyond the normal one (1) year warranty described in the General Conditions, Issue the warranty certificate in the name of the Project Owner.
  - 3. Extended Service Agreement (ESA) A contract to provide maintenance beyond that required to fulfill requirements for warranty repairs, or to perform routine maintenance for a definite period of time beyond the warranty period. Issue the service agreement in the name of the Project Owner.
  - 4. Certification of Adequacy of Design (CAD) A certified letter from the manufacturer of the equipment stating that they have designed the equipment to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter shall state that mechanical and electrical equipment is adequately sized to be fully operational for the conditions specified or normally encountered by the product's intended use.
  - 5. Certification of Applicator/Subcontractor (CSQ) A certified letter stating that the Applicator or Subcontractor proposed to perform a specified function is duly designated as factory authorized and trained for the application of the specified product.
- C. Submit record data to provide information to allow the Owner to adequately identify the products incorporated into the project and allow replacement or repair at some future date.
- D. Provide record data for all products. Record data is not required for items for which shop drawings and/or operations and maintenance manuals are required.

- 1. Provide information only on the specified products. Submit a Contractor's Modification Request for approval of deviations or substitutions and obtain approval by Field Order or Change Order prior to submitting Record Data.
- 2. Record data will be received by the Engineer, logged, and provided to Owner for his/her record.
  - a. Record data may be reviewed to see that the information provided is adequate for the purpose intended. Inadequate drawings may be returned as unacceptable.
  - b. Record data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.

## 1.07 SUBMITTALS FOR SUBSTITUTIONS

- A. Substitutions are defined as any product that the Contractor proposes to provide for the Project in lieu of the specified product.
- B. If the Contractor desires to submit a manufacturer or product which is not specified, the Contractor must submit the following for consideration of approval of the substitution:
- C. Contractor's Modification Request for deviation from the Contract Documents
  - 1. Prove that the product is acceptable as a substitute. It is not the Engineers responsibility to prove the product is not acceptable as a substitute.
    - a. Indicate on a point by point basis for each specified feature that the product is acceptable to meet the intent of the Contract Documents requirements.
    - b. Make a direct comparison with the specified manufacturers published data sheets and available information. Provide this printed material with the submittal.
    - c. The decision of the Engineer regarding the acceptability of the proposed substituted product is final.
  - 2. Provide a typewritten certification that, in making the substitution request. The Contractor:
    - a. Has determined that the substituted product will perform in substantially the same manner and result in the same ability to meet the specified performance as the specified product.
  - 3. Will provide the same warranties and/or bonds for the substituted product as specified or as would be provided by the Manufacturer of the specified product.
    - a. Will assume all responsibility to coordinate and modifications that may be necessary to incorporate the substituted product into the project and will waive all claims for additional work which may be necessary to incorporate the substituted product into the project which may subsequently become apparent.
    - b. Will maintain the same time schedule as for the specified product.

## **1.08 GUARANTEES**

A. Warranties and guarantees shall be submitted as required by the Contract Documents and submitted with the shop drawings or record data.

#### 1.09 RESUBMISSION REQUIREMENTS

- A. Make all corrections or changes in the submittals required by the Engineer and resubmit until approved.
- B. Need for more than one resubmission or any other delay of obtaining Engineer's review of submittals, will not entitle the Contractor to an extension of Contract Time. All costs associated with such delays shall be at the Contractor's expense.

## 1.10 ENGINEER'S DUTIES

- A. Revise the submittals and return with reasonable promptness.
- B. Affix stamp, indicate approval with or without comments, rejection, and the need for resubmittal.
- C. Distribute documents.

#### SECTION 014000 QUALITY CONTROL

### PART 1 - GENERAL

### 1.01 CONTRACTOR'S RESPONSIBILITIES

- A. Control the quality of work produced and verify that the work performed meets the standards of quality established in the Contract Documents.
  - 1. Inspect the work performed by the Contractor, subcontractors and suppliers. Correct defective work.
  - 2. Inspect products to be incorporated into the project. Provide only those products that comply with the Contract Documents.
  - 3. Verify conformance of the work and products with the Contract Documents before notifying the Owner of need for testing.
  - 4. Provide consumable construction materials of adequate quality to provide a finished product that complies with the Contract Documents.
  - 5. Provide and pay for the services of an approved professional materials testing laboratory to insure that products proposed for use fully comply with the Contract Documents.
  - 6. Perform tests as indicated in this and other sections of the specifications. Schedule the time and sequence of testing with the Owner and Engineer. Testing is to be observed by the Owner, Engineer, or designated representative.
  - 7. Provide labor, materials, tools, equipment, and related items for testing by the Owner including, but not limited to temporary construction required for testing and operation of new and existing utilities.
- B. Provide Certified Test Reports on products or constructed works to be incorporated into the project. Reports are to indicate that products or constructed works are in compliance with the Contract Documents.
- C. Assist the Engineer, Owner, and Owner's testing organization to perform quality assurance activities.
  - 1. Provide access to the work and to the Manufacturer's operations at all times work is in progress.
  - 2. Cooperate fully in the performance of sampling, inspection, and testing.
  - 3. Furnish labor and facilities to:
    - a. Provide access to the work to be tested.
    - b. Obtain and handle samples for testing at the project site or at the source of the product to be tested.
    - c. Facilitate inspections and tests.
    - d. Store and cure test samples.
  - 4. Furnish copies of the tests performed on products.
  - 5. Provide adequate quantities of representative product to be tested to the laboratory at the designated location.
  - 6. Give the Owner adequate notice before proceeding with work that would interfere with testing.
  - 7. Notify the Engineer and the testing laboratory prior to the time that testing is required. Lead-time is to be adequate to allow arrangements to be made for testing.
  - 8. Do not proceed with any work until testing services have been performed and results of tests indicate that the work is acceptable.
  - 9. Provide complete access to the site and make Contract Documents available.
  - 10. Provide personnel and equipment needed to perform sampling or to assist in making the field tests.
  - 11. Testing performed by the Owner will be paid for by the Owner.

## 1.02 QUALITY ASSURANCE ACTIVITIES BY THE OWNER

A. Quality assurance activities of the Owner and Engineer through their own forces or through contracts with materials testing laboratories and survey crews are for the purpose of monitoring the results of the Contractor's work to see that it is in compliance with the requirements of the

Contract Documents.

- 1. Quality assurance activities of the Owner and Engineer in no way relieves the Contractor of the obligation to perform work and furnish products and constructed work conforming to the Contract Documents.
- 2. Failure on the part of the Owner or Engineer to perform or test products or constructed works in no way relieves the Contractor of the obligation to perform work and furnish materials conforming to the Contract Documents.

## 1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 013300 and shall include:
  - 1. The name of the proposed testing laboratory along with documentation of qualifications, a list of tests that can be performed, and a list of recent projects for which testing has been performed with references from those projects.

### 1.04 STANDARDS

- A. Provide a testing laboratory that complies with the ACIL (American Council of Independent Laboratories)
- B. Perform testing per recognized test procedures as listed in the various sections of the specifications, standards of the State Department of Highways and Public Transportation, American Society of Testing Materials (ASTM), or other testing associations. Perform tests in accordance with published procedures for testing issued by these organizations.

### 1.05 DELIVERY AND STORAGE

A. Handle and protect test specimens of products and construction materials at the construction site in accordance with recognized test procedures.

# **1.06 VERIFICATION TESTING**

- A. Provide verification testing when tests performed by the Owner indicate that materials or the results of construction activities are not in conformance with Contract Documents.
- B. Verification testing is to be provided at the Contractor's expense to verify products or constructed works are in compliance after corrections have been made.
- C. Tests must comply with recognized methods or with methods recommended by the Owner's testing laboratory and approved by the Engineer.

## 1.07 TEST REPORTS

- A. Test reports are to be prepared for all tests.
  - 1. Tests performed by testing laboratories may be submitted on their standard test report forms. These reports must include the following:
    - a. Name of the Owner, project title and number, equipment installer and general contractor.
    - b. Name of the laboratory, address, and telephone number.
    - c. Name and signature of the laboratory personnel performing the test.
    - d. Description of the product being sampled or tested.
    - e. Date and time of sampling, inspection, and testing.
    - f. Date the report was issued.
    - g. Description of the test performed.
    - h. Weather conditions and temperature at time of test or sampling.
    - i. Location at the site or structure where the test was taken.
    - j. Standard or test procedure used in making the test.
    - k. A description of the results of the test.
    - I. Statement of compliance or non-compliance with the Contract Documents.
    - m. Interpretations of test results, if appropriate.
  - 2. Submit reports on tests performed by Contractor or his suppliers or vendors.

## 1.08 NON-CONFORMING WORK

A. Immediately correct any work that is not in compliance with the Contract Documents or submit a written explanation of why the work is not to be corrected immediately and when the

corrective work will be performed.

B. Payment for non-conforming work shall be withheld until work is brought into compliance with the Contract Documents.

# 1.09 LIMITATION OF AUTHORITY OF THE TESTING LABORATORY

- A. The testing laboratory representatives are limited to providing consultation on the test performed and in an advisory capacity.
- B. The testing laboratory is not authorized to:
  - 1. Alter the requirements of the contract documents.
  - 2. Accept or reject any portion of the work.
  - 3. Perform any of the duties of the Contractor.
  - 4. Stop the work.

### PART 2 - PRODUCTS

### 2.01 TESTING APPARATUS

A. Furnish testing apparatus and related accessories necessary to perform the tests.

## PART 3 - EXECUTION

## 3.01 LEAKAGE TESTS FOR STRUCTURES

- A. Test structures that will contain water on a full time or intermittent basis for leaks. Perform tests prior to installing equipment or materials within the basins. In the event that the basins fail to pass the test, drain the basin, repair the leaks, re-fill, and re-test the basin. Repeat tests until the basin passes the test. The Owner may repeat the test at any time during the one (1) year guarantee period.
- B. Test the basin for leakage using the following procedure:
  - 1. Determine the evaporation allowance for loss of water.
  - 2. Use a standard circular pan procedure established by the U.S. Weather Bureau to measure evaporation rate.
  - 3. Calculate evaporation allowance by multiplying the evaporation rate in gallons per 24 hours per square foot of surface are by the open surface area of the water in the basin.
  - 4. Calculate the allowable leakage for the basin. Allowable leakage is calculated as 0.03 gallons per square foot of concrete area in contact with the water per 24 hours.
  - 5. Fill the basin to the overflow level with water at a rate not to exceed 2' per hour.
  - 6. Allow the basins to set for three (3) days.
  - 7. Observe the perimeter of the basins and identify all leaks.
  - 8. Repair basin walls and floors where leaks have been identified.
  - 9. Mark the water level at the basin wall. Measure the fall in water level over a 24-hour period to the nearest 1/8" at least twice a day to determine the quantity of water lost. Provide a stilling well for measurement if required to allow accurate measurement.
  - 10. Calculate the amount of water lost during this time period.
  - 11. Compare the amount of water lost to the allowable loss.
- C. Drain the basin, determine the sources of leakage and repair if the amount of water lost exceeds the allowable leakage plus the evaporation allowance.

## 3.02 PIPING SYSTEMS

- A. TEST REQUIREMENTS
  - 1. Perform test on piping systems including piping installed between or connected to existing pipe.
  - 2. Conduct tests on buried pipe to be hydrostatically tested after the trench is completely backfilled. If field conditions permit and if approved by the Engineer, partially backfill the trench and leave the joints open for inspection and conducting of the initial service leak test. Do not conduct the acceptance test until backfilling is complete.
  - 3. Pneumatically test the buried piping and expose joints of the buried piping for the acceptance test.

- 4. Conduct the test on exposed piping after the piping is completely installed, including supports, hangers, and anchors, but prior to insulation.
- 5. Do not perform testing on pipe with concrete thrust blocking until the concrete has cured at least five (5) days.
- 6. Determine and remedy the cause of the excessive leakage for any pipe failing to meet the specified requirements for water or air tightness.
- 7. Tests must be successfully completed and reports filed before piping is accepted.
- 8. Submit the plan for testing to the Engineer for review at least 10 days before starting the test.
- 9. Remove and dispose of temporary blocking material and equipment after completion and acceptance of the piping test.
- 10. Repair any damage to the pipe coating.
- 11. Clean pipelines so they are totally free flowing prior to final acceptance.
- 12. Test piping independently from tests on structures.
- 13. Test method and test pressure depend upon the application of the piping.
  - a. Pressure pipe is defined as piping that is part of a pumped or pressurized system. Perform test for pressure pipe per the procedures indicated in Paragraph B of this section.
  - b. Gravity pipe is defined as piping that depends upon the force of gravity for flow through the pipe, with the exception of process piping described in this section.
  - c. Chemical processing lines are to be tested as pressure pipe regardless of the operating conditions. The test pressure is to be 1.5 times the pressure rating of the pipe.
  - d. Process piping between hydraulic structures is to be considered as pressure pipe. Perform the test for this pipe per this section. The test pressure is to be the maximum hydrostatic head plus 10'. The maximum hydrostatic head is the difference in elevation of the pipe at it lowest point and the maximum top of the wall elevation of the hydraulic structure on the piping system.
- B. HYDROSTATIC LEAK TEST
  - 1. Perform hydrostatic leak tests after backfilling.
  - 2. The length of the pipe to be tested shall be such that the head over the crown of the upstream end is not less than 2' or 2' above the ground water level whichever is higher and the head over the downstream crown is not more than 6'.
  - 3. Plug the pipe by pneumatic bags or mechanical plugs so that the air can be released from the pipe while it is being filled with water.
  - 4. Continue the test for one (1) hour and make provisions for measuring the amount of water required to maintain the water at a constant level during this period.
  - 5. Remove the jointing material, and remake the joint if any joint shows any visible leakage or infiltration.
  - 6. Remove and replace any defective or broken pipes.
  - 7. Determine the maximum allowable leakage or infiltration by the following formula.
    - a. L = C DS 126,720
      - b. Where L = the allowable leakage in gallons per hour; S is the length of pipe tested in feet; D is the nominal diameter of the pipe in inches; C is infiltration/exfiltration rate. Use 50 for C outside of 25 year floodplain, and 10 for C within 25 year floodplain.
  - 8. Determine the rates of infiltration by means of V-Notch weirs, pipe spigot, or plugs in the end of the pipe. Methods, times, and locations are subject to the Engineer's approval.
  - 9. Pipe with visible leaks or infiltration or exceeds the maximum allowable leakage or infiltration is considered defective and must be corrected.
- C. LOW PRESSURE AIR TEST
  - 1. Use air test in lieu of the hydrostatic test if desired, or if pipeline grades do not allow filling the entire pipeline segment or manhole to the indicated depth.
  - 2. Perform low-pressure air tests, using equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. Test is to conform to procedure described in ASTM C-828, ASTM C-924 except for testing times. The following

| Pipe Diameter<br>(Inches) | Min. Time (Seconds) | Length for Min. Time<br>(Feet) | Time for Long Length<br>(Seconds) |
|---------------------------|---------------------|--------------------------------|-----------------------------------|
| 6                         | 340                 | 398                            | 0.855 (L)                         |
| 8                         | 454                 | 298                            | 1.520 (L)                         |
| 10                        | 567                 | 239                            | 2.374 (L)                         |
| 12                        | 680                 | 199                            | 3.419 (L)                         |
| 15                        | 850                 | 159                            | 5.342 (L)                         |
| 18                        | 1020                | 133                            | 7.693 (L)                         |
| 21                        | 1190                | 114                            | 10.471 (L)                        |
| 24                        | 1360                | 100                            | 13.676 (L)                        |
| 27                        | 1530                | 88                             | 17.309 (L)                        |
| 30                        | 1700                | 80                             | 21.369 (L)                        |
| 33                        | 1870                | 72                             | 25.856 (L)                        |

test times are required:

a. Provide the equipment with an air regulator valve or air safety valve set to an internal air pressure in the pipeline that cannot exceed 6 psig.

- b. Pass air through a single control panel.
- c. Provide pneumatic plugs that have a sealing length equal to or greater than the circumference of the pipe to be tested.
- d. Provide pneumatic plugs that resist internal test pressures without requiring external bracing or blocking.
- e. Provide an air compressor of adequate capacity for charging the system.
- 3. Perform air test only on lines less than 36" diameter. Air tests for pipes larger than 36" may be air tested at each joint.
- 4. Check connections for leakage with a soap solution. If leaks are found, release the air pressure, repair the leak, and retest with soap solution until results are satisfactory, before resuming air test.
- 5. Determine the maximum allowable time for the pressure to drop from 3.5 pounds per square inch to pounds per square inch.
  - a. T = 0.0850 DK/Q
  - b. T is the time for the pressure to drop 1.0 pound per square inch gauge in seconds; K is 0.000419DL, but not less than 1.0; D is the average inside diameter in inches; L is the length of line of the same pipe size in feet; Q rate of loss, shall be 0.0015 cubic feet per minute per square foot of internal surface.
- D. AIR TEST FOR INDIVIDUAL JOINTS
  - 1. Lines 36" and larger may be tested at individual joints.
  - 2. The maximum allowable time for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge is 10 seconds for all pipe sizes.
- E. DEFLECTION TESTING FOR PIPE
  - 1. Perform deflection tests on flexible and semi-rigid pipe in accordance with ASTM 3034.
    - a. The maximum allowable deflection of pipe measured as the reduction in vertical inside diameter is 5.0% unless specified otherwise.
    - b. Conduct test after the final backfill has been in place a minimum of 30 days.
    - c. Thoroughly clear the lines before testing.
  - 2. Perform test by pulling a properly sized mandrill through the line.
  - 3. Excavate and repair pipe with deflections in excess of the maximum allowable deflection.
- F. MANHOLE TESTING
  - 1. Test manholes for leakage separately and independently of the wastewater lines by hydrostatic exfiltration testing, vacuum testing or other approved methods acceptable to TCEQ. Make manhole watertight and re- test if the manhole fails the leakage test. The maximum leakage for hydrostatic testing is 0.025 gallons per foot diameter per foot of manhole depth per hour. Prepare for hydrostatic exfiltration testing by sealing all

wastewater lines coming into the manhole with an internal pipe plug, then fill the manhole with water and maintain full for at least one hour. With concrete manholes a period of 24 hours prior to testing may be used in order to allow saturation of the concrete.

- G. TESTS FOR PLUMBING DRAINAGE AND VENT SYSTEMS
  - 1. Plug openings as necessary.
  - 2. Test drainage and venting systems by filling piping with water to the level of the highest vent stack for 30 minutes.
  - 3. Make the examination for leakage at joints and connections.
  - 4. There shall be no drop in water level.

# 3.03 ELECTRICAL TESTING

A. As required by local and state codes.

#### SECTION 014200 DEFINITIONS AND TERMINOLOGY

#### PART 1 GENERAL

#### 1.01 SPECIFICATION TERMINOLOGY

- A. "Engineer" the Consulting Engineering Firm under contract with the Owner for this particular project, or its designated representative.
- B. "Furnish" means to supply, deliver and unload materials and equipment at the project site ready to install.
- C. "Install" means the operations at the project site including unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, training and similar operations required to prepare the materials and equipment for use, verify conformance with Contract Documents and prepare for acceptance and operation by the Owner.
- D. "Provide" means to furnish and install materials and equipment.
- E. "Perform" means to complete the operations necessary to comply with the Contract Documents.
- F. "Indicated" means graphic representations, notes, or schedules on drawings, or other requirements in Contract Documents. Words such as "shown", "noted", "scheduled", are used to help locate the reference. No limitation on the location is intended unless specifically noted.
- G. "Specified" means written representations in the bid documents or the technical specifications.
- H. "Regulation" means laws, statutes, ordinances, and lawful orders issued by authorities having jurisdiction, as well as, rules, conventions, and agreements within the construction industry that control performance of work, whether they are lawfully imposed by authorities having jurisdiction or not.
- I. "Installer" means an entity engaged by Contractor, either as an employee, subcontractor, or sub subcontractor to install materials and/or equipment. Installers are to have successfully completed a minimum of five projects similar in size and scope to this project, have a minimum of five years of experience in the installation of similar materials and equipment, and comply with the requirements of the authority having jurisdiction.
- J. "Manufacturer" means an entity engaged by Contractor, as a subcontractor, or sub subcontractor to furnish materials and/or equipment. Manufacturers are to have a minimum of five years' experience in the manufacture of materials and equipment similar in size, capacity and scope to the specified materials and equipment.
- K. "Project site" means the space available to perform the work, either exclusively or in conjunction with others performing construction at the project site.
- L. "Testing laboratory" means an independent entity engaged to perform specific inspections or tests, either at the project site or elsewhere, and to report and interpret the results of those inspections or tests.
- M. "Listed" means equipment is included in a list published by a nationally recognized laboratory which makes periodic inspection of production of such equipment and states that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.
- N. "Labeled" means equipment that embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc. and production is periodically inspected in accordance with nationally recognized standards or tests to determine safe use in a specified manner.
- O. "Certified" used in context with materials and equipment means the material and equipment has been tested and found by a nationally recognized testing laboratory to meet specification requirements, or nationally recognized standards if requirements are not specified, and is safe for use in the specified manner. A nationally recognized testing laboratory must periodically inspect production of the equipment and the equipment must bear a label, tag, or other record

of certification.

- P. "Certified" used in context with labor performance or ability to install materials and equipment means that the abilities of the proposed installer have been tested by a representative of the specified testing agency authorized to issue certificates of competency and has met the prescribed standards for certification.
- Q. "Certified" used in context with test reports, payment requests or other statements of fact means that the statements made on the document are a true statement as attested to by the certifying entity.

# 1.02 SPECIFICATION SENTENCE STRUCTURE

- A. Specifications are written in modified brief style. Requirements apply to all work of the same kind, class, and type even though the word "all" is not stated.
- B. Simple imperative sentence structure is used which places a verb as the first word in the sentence. It is understood that the words "furnish", "install", "provide", or similar words include the meaning of the phrase "The Contractor shall." before these words.
- C. It is understood that the words "directed", "designated", "requested", "authorized", "approved", "selected", or similar words include the meaning of the phrase "by the Engineer" after these words unless otherwise stated. Use of these words does not extend the Engineer's responsibility for construction supervision or responsibilities beyond those defined in the General Conditions.
- D. "At no additional cost to Owner", "With no extra compensation to Contractor", "At Contractor's own expense", or similar words mean that the Contractor will perform or provide specified operation of work without any increase in the Contract Amount. It is understood that the cost for performing all work is included in the amount bid and will be performed at no additional cost to the Owner unless specifically stated otherwise.

# 1.03 DOCUMENT ORGANIZATION

- A. Organization of Contract Documents is not intended to control or to lessen the responsibility of the Contractor when dividing work among subcontractors, or to establish the extent of work to be performed by any trade, subcontractor or vendor. Specification or details do not need to be indicated or specified in each specification or drawing. Items shown in the contract documents are applicable regardless of location in the Contract Documents.
- B. Standard paragraph titles and other identifications of subject matter in the specifications are intended to aid in locating and recognizing various requirements of the specifications. Titles do not define, limit, or otherwise restrict specification text.
- C. Capitalizing words in the text does not mean that these words convey special or unique meanings or have precedence over other parts of the Contract Documents. Specification text governs over titling and it is understood that the specification is to be interpreted as a whole.
- D. Drawings and specifications do not indicate or describe all of the work required to complete the project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Engineer. Provide any work, materials or equipment required for a complete and functional system even if they are not detailed or specified.

## 1.04 INTERPRETATIONS OF DOCUMENTS

- A. Comply with the most stringent requirements where compliance with two (2) or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, unless Contract Documents indicate otherwise.
  - 1. Quantity or quality level shown or indicated shall be minimum to be provided or performed in every instance.
  - 2. Actual installation may comply exactly with minimum quality indicated, or it may exceed that minimum within reasonable limits.
  - 3. In complying with these requirements, indicated numeric values are minimum or maximum values, as noted, or appropriate for context of requirements.
  - 4. Refer instances of uncertainty to the Engineer for a decision before proceeding.

B. Provide materials and equipment comparable in quality to similar materials and equipment incorporated in the project or as required to meet the minimum requirements of the application if the materials and equipment are shown in the drawings but are not included in the specifications.

# 1.05 REFERENCE STANDARDS

- A. Comply with applicable construction industry standards as if bound or copied directly into the Contract Documents regardless of lack of reference in the Contract Documents. Apply provisions of the Contract Documents where Contract Documents include more stringent requirements than the referenced standards.
  - 1. Standards referenced directly in the Contract Documents take precedence over standards that are not referenced but recognized in the construction industry as applicable.
  - 2. Comply with standards not referenced but recognized in the construction industry as applicable for performance of the work except as otherwise limited by the Contract Documents. The Engineer determines whether code or standard is applicable, or which of several are applicable.
- B. Consider a referenced standard to be the latest edition with supplements or amendments when a standard is referred to in an individual specification section but is not listed by title and date.
- C. Trade association names and title of general standards are frequently abbreviated. Acronyms or abbreviations used in the Contract Documents mean the recognized name of trade association, standards generating organization, authority having jurisdiction, or other entity applicable in the context of the Contract Documents. Refer to "Encyclopedia of Associations," published by Gale Research Company.
- D. Make copies of reference standards available as requested by Engineer or Owner.

## 1.06 SUBSTITUTIONS AND EQUAL PRODUCTS

- A. Provide materials and equipment manufactured by the entities specifically listed in each technical specification section. Submit a Contractor's Modification Request for substitution of materials and equipment of manufacturers not specifically listed or for materials and equipment that does not strictly comply with the Contract Documents.
- B. Contractor may provide "equal" products manufactured by manufacturers other than those specifically listed in the technical specification section unless it is specifically stated that only the materials and equipment of the specified manufacturers shall be provided. Provide a request for approval of proposed equals for any materials or equipment not specifically listed. Submit a Contractor's Modification Request for substitution of materials and equipment of other manufacturers or for materials and equipment that does not strictly comply with the Contract Documents. A Field Order or Change Order will be issued if the contract modification is approved.

#### SECTION 015000 TEMPORARY FACILITIES AND CONTROL

#### PART 1 - GENERAL

#### 1.01 WORK INCLUDED

- A. Furnish temporary facilities, including field offices, storage sheds, and temporary utilities needed to complete the work.
- B. Furnish, install, and maintain temporary project identification signs. Provide temporary on-site informational signs to identify key elements of the construction facilities. Do not allow other signs to be displayed.

### PART 2 - PRODUCTS

### 2.01 SIGN MATERIALS

- A. Provide new or used, wood or metal, in sound condition for structure and framing. Materials are to be structurally adequate and suitable for the indicated finish
- B. Provide 3/4" exterior grade A/D face veneer plywood with medium density overlay for sign surface.
- C. Bolts, brackets, fasteners, and other hardware are to be galvanized or stainless steel.

#### 2.02 TEMPORARY STORAGE BUILDINGS

A. Furnish storage buildings of adequate size to store any materials or equipment delivered to the site that might be affected by weather.

#### 2.03 TEMPORARY SANITARY FACILITIES

- A. Provide sanitary facilities at the job site from the commencement of the project to its conclusion. Maintain these facilities in a clean and sanitary condition at all times, and comply with the requirements of the local health authority.
- B. Contractor's workmen shall use these sanitary facilities at all times. Restrooms within existing or Owner-occupied buildings shall not be used.

#### 2.04 TEMPORARY UTILITIES

- A. Provide the temporary utilities needed by the trades during construction, including electrical power, water, and telephone.
  - 1. Provide a source of temporary electrical power of adequate size for the construction procedures.
    - a. Electrical pole and service shall comply with OSHA and other safety requirements and the requirements of the power company.
    - b. Make the electrical power available to the trades as needed.
    - c. Provide extensions to the various parts of the building as needed.
    - d. Provide junction boxes in such an arrangement that distribution boxes are available within 75' of any part of the structure.
  - 2. Provide temporary water. Extend water to the construction site and maintain source until such time that the permanent water supply can be extended to the site.
  - 3. Provide telephone service to the site and install telephones inside the Contractor's and the Engineers office.
- B. Make arrangements with the local utility company, comply with utility company's requirements and pay for the utility costs during construction.
- C. Make utilities available to the trades during construction

#### **PART 3 - EXECUTION**

### 3.01 LOCATION OF TEMPORARY FACILITIES

A. Locate all temporary facilities in an area that will not interfere with any work to be performed under this contract.

B. Construct and install signs at locations as required by applicable regulatory agencies or as selected by the Owner. Install informational signs at the height of optimum visibility, on ground-mounted poles, or attach to temporary structural surfaces.

# 3.02 REMOVAL OF TEMPORARY FACILITIES

- A. Remove temporary buildings, shed, and utilities at the conclusion of the project and restore the site to original condition or finished in accordance with the drawings.
- B. Remove informational signs upon completion of construction.
- C. Remove project identification signs, framing, supports, and foundations upon completion of the project.
- D. Furnish storage buildings of adequate size to store any materials or equipment delivered to the site that might be affected by weather.

### 3.03 TEMPORARY SANITARY FACILITIES

A. Provide sanitary facilities at the job site from the commencement of the project to its conclusion. Maintain these facilities in a clean and sanitary condition at all times, and comply with the requirements of the local health authority.

В.

Contractor's workmen shall use these sanitary facilities at all times. Rest rooms within existing or Owner-occupied buildings shall not be used.

- C. Owner-occupied buildings shall not be used.
- D. Contractor's workmen shall use these sanitary facilities at all times. Rest rooms within existing or Owner-occupied buildings shall not be used.

### 3.04 TEMPORARY UTILITIES

- A. Provide the temporary utilities needed by the trades during construction, including electrical power, water, and telephone.
- B. Provide a source of temporary electrical power of adequate size for the construction procedures.
- C. Electrical pole and service shall comply with OSHA and other safety requirements and the requirements of the power company.
- D. Provide junction boxes in such an arrangement that distribution boxes are available within 75' of any part of the structure.
- E. Provide temporary water. Extend water to the construction site and maintain source until such time
- F. Provide telephone service to the site and install telephones inside the Contractor's and the Engineers
- G. Make arrangements with the local utility company, comply with utility company's requirements and pay for the utility costs during construction.
- H. Make utilities available to the trades during construction.

#### SECTION 015600 CONSTRUCTION TRAFFIC CONTROL

### PART 1 - GENERAL

### 1.01 GENERAL DESCRIPTION OF WORK

- A. This item shall consist of the construction, manipulation, maintenance and removal, if required, of detours of the length and to the lines, grades and typical sections indicated and providing for installing, moving, replacing, maintaining, cleaning and removing upon completion of the work, as required, all detour markers, signs, barricades and other devices used in traffic control and handling at the construction site as indicated or as directed by the Engineer.
- B. This item shall also consist of providing installing, moving, replacing, maintaining, cleaning and removing temporary or permanent street closure barricades, signs or other devices required to handle the traffic in conformance with the current edition of the Texas Manual of Uniform traffic Control Devices of Street and Highways and as indicated or directed by the Engineer.

### 1.02 SUBMITTAL

- A. Conform to requirements of Section 013300, Submittal Procedures.
- B. Submit proposed traffic routing plan, in accordance with the Texas Manual on Uniform Traffic Control Devices (TxMUTCD), latest edition. or FHWA MUTCD

### **PART 2 - PRODUCTS**

# 2.01 CONSTRUCTION TRAFFIC CONTROL SIGNS

- A. Construction traffic control signs shall be constructed by plywood.
  - 1. Construction traffic control signs used herein shall be fabricated using sheeting conforming to the requirements of the manufacturer.
  - 2. The substrate for construction signs need only be sufficiently durable to last the life of the project and sufficiently rigid to hold the sheeting in a flat plan.

### 2.02 SIGN SUPPORTS

- A. Supports for construction traffic control signs shall be grade #2 fir or yellow pine, pressure treated with pentachlorophenol.
- B. Supports shall have a minimum nominal size of 4-inches x 4-inches and conform to the details shown on the plans.

### 2.03 PORTABLE SIGN SUPPORT

A. Materials for portable sign supports shall comply with the details shown on the plans. Portable sign supports other than those shown on the plans shall be submitted to the Project Manager for approval prior to use.

#### 2.04 BARRICADES

- A. Barricades shall be classified as Type I, Type II or Type III and shall comply with the details shown on the plans and the TxMUTCD.
  - 1. Barricade rails shall be fabricated using S4S Grade #2 fir or yellow pine and reflectorized sheeting conforming to the requirements.

#### 2.05 VERTICAL PANELS

A. Materials for vertical panels shall conform to the details shown on the plans. Vertical panels shall be reflectorized with orange and white reflective sheeting or tape in accordance with the requirements.

## 2.06 ABBREVIATED PAVEMENT MARKINGS FOR CONSTRUCTION

- A. The pavement-marking material shall consist of an adhesive-back reflective tape which can get applied to the pavement. Markings shall be of goof appearance, have straight, unbroken edges and have a color that complies with all federal regulations.
  - 1. Color
    - a. The markings, as well as retro reflected light from the markings, shall be white or yellow as indicated.

- 2. Visibility
  - a. The pavement markings (during daylight hours) shall be distinctively visible of ra minimum of 300 feet unless sigh distance is restricted by geometric roadway features.
  - b. The pavement markings (when illuminated by automobile low beam headlights at night) shall be distinctively visible for a minimum of 160 feet unless sight distance is restricted by geometric features.
  - c. The above day and night visibility requirements shall be met when viewed from an automobile traveling on the roadway.

# 2.07 CHANNELIZATION DEVICES

- A. Barrels
  - 1. Barrels shall be of metal or nonmetal composition approved by the Engineer and of 30 to 55-gallon capacity. Only one size may be used on the project. The barrels shall be reflectorized with orange and white reflective sheeting or tape in accordance with the requirements of TxMUTCD. The markings on the barrels shall be horizontal, circumferential, orange wide. There shall be a minimum of 55 alternating orange and white stripes on each barrel. Barrels shall also conform to the details shown on the plans.
  - 2. Type "B" barrels shall be equipped with either Type "A" low intensity or Type "C" steadyburn warning lights complying with the provisions to TMUTCD and the ITE standard for flashing and steady-burn lights. The use warning light shall be as directed by the Engineer.
- B. Traffic Cones
  - 1. Traffic cones shall conform to the details shown on the plans.
- C. Tubular Traffic Markers
  - 1. Post
    - a. The post shall be of a thermoplastic or pliable elastomer composition meeting the manufacturer's requirements.
    - b. Dimensions:
      - 1) Outside Diameter = 2.23 inches to 4 inches
      - 2) Wall Thickness = 0.125 inch minimum
      - 3) Length= 18 to 36 inches
      - 4) Color= Orange
  - 2. Base
    - a. The base shall be of thermoplastic or pliable elastomer composition meeting the manufacturer's requirements.
    - b. Dimensions:
      - 1) Height = 1.2 to 2 inches
      - 2) Outside Diameter = 7 to 12 inches
      - 3) Color = black or same color as post
  - 3. Assembly Units
    - a. Assembly units which are inherent with the particular marker shall be as per manufacturer's recommendations.
  - 4. Adhesives
    - a. Adhesive shall be epoxy type (permanent installation or butyl type (temporary installation) as per manufacturer's recommendations.
  - 5. Reflectorization
    - a. If used at night, tubular traffic markers shall have two 3-inch, circumferential reflective bands, no more than 2-inches from the top with no more than 6-inches separating the bands. Reflective material shall be SIA-250 or higher sheeting conforming to the provisions of this Section. The color of reflective material shall be as shown in the plans.

# 2.08 SEQUENTIAL ARROW DISPLAYS

A. Sequential arrow displays shall be sequentially lighted, and roof or trailer mounted. The minimum panel size shall be 30 inches high and 54-inches wide. The display shall have 22

hooded sealed beam amber lamps rated at a maximum intensity of 8800 candlepower.

- B. Light intensity shall be adjustable by dimmer switch. The operating modes shall be as follows:
  - 1. Pass Left. 3 chevrons of 5 lamps each sequence in right to left pattern 40 to 50 times per minute.
  - 2. Pass Right. 3 chevrons of 5 lamps each sequence in left to right pattern 40 to 50 times per minute.
  - 3. Pass Either Side. The two outermost chevrons on each end of the panel pointing like arrowheads and flashing 40 to 50 times per minute with crossing row of lamps burning continuously.
  - 4. Warning. 4 lamps, one at each corner of the panel, flashing 40 to 50 times per minute.

## **PART 3 - EXECUTION**

## 3.01 CONSTRUCTION TRAFFIC CONTROL SIGNS AND SIGN SUPPORTS

A. Construction traffic control signs and sign supports shall be installed at locations noted on the plans in conformance with the TMUTCD or as directed by the Engineer.

## 3.02 PORTABLE SIGN SUPPORTS

- A. Portable sign supports for traffic control devices for detours shall be furnished by the Contractor, shall be installed at the locations shown on the plans, unless otherwise shown on the plans, and shall remain the property of the Contractor.
- B. Unless otherwise specified, portable sign supports shall be of the dimensions shown on the plans.

# 3.03 BARRICADES

A. Barricades shall be installed in conformity with the details noted on the plans or as directed by the Engineer.

## 3.04 VERTICAL PANELS

A. Vertical panels shall be installed in conformity with the details noted on the plans or as directed by the Engineer.

## 3.05 ABBREVIATED PAVEMENT MARKINGS FOR CONSTRUCTION

- A. Abbreviated markings meeting all specification requirements shall be in place on all roadways on which traffic is allowed and where suitable standard pavement marking is not in place. The transverse location of the line(s) formed by the markings shall be as determined by the Engineer.
- B. Unless otherwise indicated, the abbreviated markings shall be placed as follows:

| Condition                             | Spacing       | Length of Stripe |
|---------------------------------------|---------------|------------------|
| Straight                              | 40 FT Approx. | 48-Inch          |
| Curve Greater than 2 degrees          | 20 FT. Max.   | 48-Inch          |
| Curve Less than or Equal 2<br>Degrees | 40 FT Max.    | 48-Inch          |

- C. Pavement markings shall be a minimum of 3 7/8 inches wide. Length and spacings will be in accordance with these specifications.
- D. The spacing of stripes may be modified by the Engineer. However, the maximum spacing specified above shall not be exceeded in any case.
- E. The Contractor will be responsible for maintaining the abbreviated pavement markings until standard pavement markings are in place.
- F. Abbreviated pavement markings shall be removed after all permanent markings have been in place.

## 3.06 CHANNELIZATION DEVICES

A. Type "A" Barrels

- 1. Type "A" barrels shall be used during daylight hours only and shall not be equipped with warning lights of any type.
- B. Type "B" Barrels
  - 1. Type "B" barrels shall be equipped with warning lights. Type "B" barrels shall be used during nighttime hours only, unless otherwise shown on the plans or directed by the Project Manager.
  - 2. The term "daylight hours" refers to those hours between dawn and dusk. The term "nighttime hours" refers to those hours between dusk and dawn.
- C. Traffic Cones
  - 1. Traffic cones shall be installed in conformity with the plans and the TMUTCD or as directed by the Engineer.
- D. Tubular Traffic Markers
  - 1. The metal, concrete or bituminous surface where the tubular traffic markers are to be placed shall be thoroughly cleaned.
  - 2. Metal and concrete surfaces shall be sandblasted, or wire brushed. Bituminous surfaces shall be cleaned in accordance with manufacturer's recommendations.
  - 3. All loose sand, dust and other deleterious debris from cleaned mounting surfaces shall be removed.
  - 4. Tubular traffic markers shall be installed in conformity with details and at locations shown on the plans or as directed by the Engineer and in accordance with the manufacturer's recommendation.
  - 5. In the event that removal of an installation (temporary or permanent) is affected and the metal, concrete, or bituminous surface is damaged the Contractor shall repair and otherwise restore said surface to its original condition at no additional cost to the Owner.
  - 6. All defective post(s), base(s), assembly unit(s), adhesive(s) or reflective sheeting contributing to the detriment of the intended function of the tubular traffic markers shall be replaced by the Contractor at no addition cost to the Owner.
  - 7. Channelization devices shall be and installed in accordance with the details shown on the plans, except that barrels shall be as noted herein.

## 3.07 SEQUENTIAL ARROW DISPLAY

A. Sequential arrow displays shall be used according to the requirements shown on the plans and shown in TMUTCD AND FHWA MUTCD

### 3.08 CONSTRUCTION DETOURS

A. The detours shall be constructed at the locations and to the lines and grades indicated and it shall be the entire responsibility of the Contractor to provide for the passage of traffic in comfort and safety without creating a dust problem.

### 3.09 CONSTRUCTION METHODS

- A. Prior to commencing construction, suitable "Construction Traffic Control" devices shall be installed to protect the workers and the public.
- B. The Contractor shall be responsible for installing all markers, signs and barricades conforming to the Texas Manual on Uniform Traffic Control Devices and/or as indicated. If, in the opinion of the Engineer, additional markers, signs or barricades are needed in the interest of safety, the Contractor will install such as are required or as directed by the Engineer.

#### SECTION 016000 PRODUCT REQUIREMENTS

### PART 1 GENERAL

## 1.01 RELATED DOCUMENTS

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

### 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
  - 1. Division 01 Section 017700 "Closeout Procedures" for submitting warranties for Contract closeout.
  - 2. Divisions 02 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

### **1.03 DEFINITIONS**

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

### 1.04 SUBMITTALS

- A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
  - 1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
  - 2. Form: Tabulate information for each product under the following column headings:
    - a. Specification Section number and title.
    - b. Generic name used in the Contract Documents.
    - c. Proprietary name, model number, and similar designations.
    - d. Manufacturer's name and address.
    - e. Supplier's name and address.
    - f. Installer's name and address.
    - g. Projected delivery date or time span of delivery period.

- h. Identification of items that require early submittal approval for scheduled delivery date.
- 3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
  - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
- 4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
- 5. Engineer's Action: Engineer will respond in writing to Contractor within 15 days of receipt of completed product list. Engineer's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Engineer's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents. IA Document A511 suggests adding requirements to AIA Document A201 in the Supplementary Conditions for consideration of requests received after Contract award. First paragraph and subparagraphs below expand requirements suggested by AIA Document A511.
- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use Contractor's standard form.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified material or product cannot be provided.
    - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    - e. Samples, where applicable or requested.
    - f. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners.
    - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
    - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
    - j. Cost information, including a proposal of change, if any, in the Contract Sum.
    - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
    - I. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
  - 3. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or

documentation, whichever is later.

- a. Form of Acceptance: Change Order.
- b. Use product specified if Engineer cannot make a decision on use of a proposed substitution within time allocated.
- C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
    - a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
    - b. Use product specified if Engineer cannot make a decision on use of a comparable product request within time allocated.
- D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

# 1.05 QUALITY ASSURANCE

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

## 1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
  - 1. Store products to allow for inspection and measurement of quantity or counting of units.
  - 2. Store materials in a manner that will not endanger Project structure.
  - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  - 4. Store cementitious products and materials on elevated platforms.
  - 5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
  - 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  - 7. Protect stored products from damage and liquids from freezing.
  - 8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

## 1.07 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  - 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  - 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
  - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
  - 3. Refer to Divisions 02 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

# PART 2 PRODUCTS

# 2.01 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
  - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  - 4. Where products are accompanied by the term "as selected," Engineer will make selection.
  - 5. Where products are accompanied by the term "match sample," sample to be matched is Engineer's.
  - 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
  - 7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
  - 1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
  - 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
  - 3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
  - 4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
  - 5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
  - 6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies

with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.

- 7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
- 8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
- 9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Engineer's sample. Engineer's decision will be final on whether a proposed product match.
  - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
- 10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, and textures" or a similar phrase, select a product that complies with other specified requirements.
  - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Engineer will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
  - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Engineer will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

## 2.02 PRODUCT SUBSTITUTIONS

- A. Timing: Engineer will consider requests for substitution if received within 60 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Engineer
- B. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
  - Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - 2. Requested substitution does not require extensive revisions to the Contract Documents.
  - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - 4. Substitution request is fully documented and properly submitted.
  - 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
  - 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - 7. Requested substitution is compatible with other portions of the Work.
  - 8. Requested substitution has been coordinated with other portions of the Work.
  - 9. Requested substitution provides specified warranty.
  - 10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

## 2.03 COMPARABLE PRODUCTS

- A. Conditions: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
  - 1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  - 3. Evidence that proposed product provides specified warranty.
  - 4. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners, if requested.
  - 5. Samples, if requested.
#### SECTION 017700 CLOSEOUT PROCEDURES

#### PART 1 - GENERAL

#### 1.01 WORK INCLUDED

A. Comply with requirements of the General Conditions and specified administrative procedures in closing out the Construction Contract.

#### 1.02 SUBMITTALS

A. Submit affidavits and releases.

#### 1.03 SUBSTANTIAL COMPLETION

- A. Submit written notification that the work or designated portion of the work is substantially complete to the Engineer when the work is considered to be substantially complete per the General Conditions. Include a list of the items remaining to be completed or corrected before the project will be considered complete.
- B. Engineer shall visit the project site to observe the work within a reasonable time after notification is received to determine the status of completion.
- C. Engineer shall issue notification to the Contractor that the work is either substantially complete or that

additional work must be performed before the project may be considered substantially complete.

- 1. Engineer shall notify the Contractor in writing of items that must be completed before the project can be considered substantially complete.
  - a. Correct the noted deficiencies in the work.
  - b. Issue a second written notice with a revised list of deficiencies when work has been completed.
  - c. Engineer shall revisit the site and the procedure shall begin again.
- 2. Engineer shall issue a tentative Certificate of Substantial Completion to the Project Owner when the project is considered substantially complete. Certificate shall include a tentative list of items to be corrected before final payment.
  - a. Owner will review and revise the list of items and notify the Engineer of any objections or other items that are to be included in the list.
  - b. Engineer shall prepare and send to the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be corrected or completed.
  - c. Review the list and notify the Engineer in writing of any objections within 10 days of receipt of Certificate of Substantial Completion.

## 1.04 FINAL PUNCHLIST VISIT

- A. Submit written certification when the project is complete and:
  - 1. Contract Documents have been reviewed.
  - 2. Work has been completed in compliance with the Contract Documents.
  - 3. Specified spare parts and special tools have been provided.
  - 4. Work is complete and ready for final punchlist visit.
- B. Engineer shall make an site visit with the Contractor and appropriate regulatory agencies to determine the status of completeness within a reasonable time after the receipt of the Certificate.
- C. Engineer shall issue notice that the project is complete or notify the Contractor that work is not complete or is defective.
  - 1. Submit the request for final payment with Closeout submittals if project is complete and the work is acceptable.
  - 2. Upon receipt of notification from the Engineer that work is incomplete or defective, take immediate steps to remedy the stated deficiencies. Send a second certification to the Engineer when work has been completed or corrected.
  - 3. Engineer shall re-visit the site and the procedure will begin again.

#### 1.05 RE-OBSERVATION FEES

- A. Pay fees to the Contractor to compensate the Engineer for repunchlist site visit of the work required by the failure of the work to comply with the claims of status of completion made by the Contractor.
- B. Owner may withhold the amount of these fees from the Contractor's final payment.
- C. Cost for additional observation visit will be billed to the Contractor by the Engineer for the actual hours

required for the inspection and preparation of related reports in accordance with the foll owing rates:

| Principal in Charge    | \$250.00 |
|------------------------|----------|
| Project Manager        | \$150.00 |
| Design Engineer        | \$125.00 |
| Engineering Technician | \$ 95.00 |
| Clerk                  | \$ 70.00 |

## 1.06 CLOSEOUT SUBMITTALS TO THE ENGINEER

- A. Record Drawings.
- B. Keys and keying schedule.
- C. Warranties and bonds.
- D. Evidence of payment or release of liens on the forms and as required by the General Conditions.
- E. Consent from Surety to Final Payment
- F. Record data, and other submittals as required by the Contract Documents.
- G. Specified spare parts and special tools.
- H.

Evidence of final, continuing insurance, and bond coverage as required by the Contract Documents.

I. TWDB required documents.

#### 1.07 FINAL PAYMENT REQUEST

- A. Submit a preliminary final payment request. This request is to include adjustments to the Contract Amount for:
  - 1. Approved Change Orders
  - 2. Allowances not previously adjusted by Change Order
  - 3. Unit prices
  - 4. Deductions for defective work that has been accepted by the Owner
  - 5. Penalties and bonuses
  - 6. Deductions for liquidated damages
  - 7. Deductions for reinspection payments per Paragraph 1.05
  - 8. Other adjustments
- B. Engineer shall prepare a final Change Order, reflecting the approved adjustments to the contract amount which have not been covered by previously approved Change Orders.
- C. Submit the final application for payment per the General Conditions, including the final Change Order.

#### 1.08 WARRANTIES, BONDS, AND SERVICES AGREEMENTS

- A. Provide warranties, bonds, and service agreements required by Section 01300, SUBMITTALS or by the individual sections of the specifications.
- B. The date for the start of warranties, bonds, and service agreements is established per the General Conditions.

- C. Compile warranties, bonds, and service agreements and review these documents for compliance with the Contract Documents.
  - 1. Each document is to be signed by the respective manufacturer, supplier, and subcontractor.
  - 2. Each document is to include:
    - a. The product or work item description
    - b. The firm, with the name of the principal, address, and telephone number
    - c. Scope of warranty, bond or services agreement
    - d. Date, duration and expiration date for each waranty bond and service agreement.
    - e. Procedures to be followed in the event of a failure
    - f. Specific instances that might invalidate the warranty or bond
- D. Submit two (2) copies of each document to the Engineer for review and transmittal to the Owner.
  - 1. Submit duplicate sets.
  - 2. Documents are to be submitted on 8-1/2" x 11" paper, punched for a standard threering binder.
  - 3. Submit each set in a commercial quality three-ring binder with a durable and cleanable plastic cover. The title "Warranties, Bonds, and Services Agreements", the project name and the name of the Contractor are to be typed and affixed to the cover.
- E. Submit warranties, bonds and services agreements:
  - 1. At the time of final completion and before final payment.
  - 2. Within 10 days after inspection and acceptance for equipment or components placed in service during the progress of construction.

#### 1.09 CLAIMS AND DISPUTES

A. Claims and disputes must be resolved prior to recommendations of final payment. Acceptance and final payment by the Contractor will indicate that any outstanding claims or disputed issues have been resolved to the full satisfaction of the Contractor.

#### SECTION 017823 OPERATION AND MAINTENANCE DATA

#### PART 1 - GENERAL

## 1.01 WORK INCLUDED

- A. Prepare a complete and detailed Operation and Maintenance Manual for each type and model of equipment or product furnished and installed under this contract.
- B. Prepare the manuals in the form of an instruction manual for the Owner.
- C. Provide complete and detailed information specifically for the products or systems provided for this project. Include the information required to operate and maintain the product or system.
- D. Manuals are to be in addition to any information packed with or attached to the product when delivered. This information is to be taken from the product and provided as an attachment to the manual.

#### 1.02 SUBMITTALS

A. Submit manuals in accordance with Section 013300, Submittal Procedures.

#### 1.03 GUARANTEES

A. Provide copies of the Manufacturer's warranties, guarantees, or service agreements in accordance with Section 017700, Closeout Procedures.

## PART 2 - PRODUCTS

## 2.01 MATERIALS

- A. Print manuals on heavy, first quality paper.
  - 1. Paper shall be 8-1/2" X 11" paper.
    - a. Reduce drawings and diagrams to 8-1/2" X 11" paper size.
    - b. When reduction is not practical, fold drawings and place each separately in a clear, super heavy weight, top loading polypropylene sheet protector designed for ring binder use. Provide a typed identification label on each sheet protector.
  - 2. Punch paper for standard three-ring binders.
- B. Place manuals in D-Ring Presentation Binders.
  - 1. Binders are to have clear front, back, and spine covers.
  - 2. Sheet lifters are to be provided.
  - 3. Minimum size is 2" capacity. Maximum size is 3" capacity.
- C. Provide tab indexes for each section of the manual.
- D. Provide digital pdf of all documents.

## **PART 3 - EXECUTION**

## 3.01 MANUAL ORGANIZATION AND CONTENTS

- A. Provide a Table of Contents listing each section of the manual for each product or system.
  - 1. Identify each product or system using the nomenclature shown in the Contract Documents.
  - 2. Assign a number and letter to each section in the manual.
    - a. Assign a number to each product or system. The number is to correspond to the Owner's equipment numbering system or other system designated by the Engineer.
    - b. A cross reference is to be provided for the Owner's numbering system and designations for equipment indicated in the Contract Documents.
    - c. The letter assigned will represent the part of the manual, consistent with the manual contents as required by this section.
  - 3. Provide index tabs for each section in the manual.
  - 4. The designation on each index tab is to correspond to the number and letter assigned in the Table of Contents.
- B. Include only the information that pertains to the product described. Annotate each sheet to:

- 1. Clearly identify the specific product or component installed.
- 2. Clearly identify the data applicable to the installation.
- 3. Delete reference to inapplicable information.
- C. Supplement manual information with drawings as necessary to clearly illustrate relations of component parts of equipment and systems, and control and flow diagrams.
- D. Identify each manual by placing a printed cover sheet in the front cover of the binder and as the first page in the manual. The first page is to be placed in a clear polypropylene sheet protector. The information on first page and the cover page are to include:
  - 1. Name of Owner
  - 2. Project Name
  - 3. Volume number
  - 4. The Table of Contents for that volume
- E. Insert the Table of Contents into the spine of each manual.
- F. Manuals for several products or systems may be provided in the same binder.
  - 1. Sections for each product or system must be included in the same binder.
  - 2. Sections must be in numerical order from volume to volume.
- G. Correlate the data into related groups when multiple binders are used.
- H. Fill binders to only 3/4 of its indicated capacity to allow for addition of materials to each binder by the Owner.

## 3.02 EQUIPMENT AND SYSTEMS MANUAL CONTENT

Manual shall provide the following information:

- A. A description of the unit and component parts.
- B. Operating instructions for startup, normal operations, regulation, control, shutdown, emergency conditions, and limiting operating conditions.
- C. Maintenance instructions including assembly, installation, alignment, adjustment, and checking instructions.
- D. Lubrication schedule and lubrication procedures. Include a cross reference for recommended lubrication products.
- E. Troubleshooting guide.
- F. Schedule of routine maintenance requirements.

## 3.03 DESCRIPTION OF SEQUENCE OF OPERATION BY THE CONTROL MANUFACTURER.

- A. Warnings for detrimental maintenance practices.
- B. Parts lists including:
  - 1. Part numbers for ordering new parts
  - 2. Assembly illustrations showing an exploded view of the complex parts of the product
  - 3. Predicted life of parts subject to wear
  - 4. List of the Manufacturer's recommended spare parts, current prices with effective date and number of parts recommended for storage
  - 5. Directory of a local source of supply for parts with company name, address, and telephone number
- C. Complete nomenclature and list of commercial replacement parts
- D. Outline, cross section and assembly drawings, engineering data, test data, and performance curves.
- E. Control schematics and point to point wiring diagrams prepared for field installation, including circuit directories of panel boards and terminal strips.
- F. List of identification nameplates installed on equipment and valve identification.
- G. Other information as may be required by the individual sections of the specifications.

## 3.04 ELECTRICAL AND ELECTRONICS SYSTEMS MANUAL

A. NOT USED

## 3.05 LIST OF SERVICE ORGANIZATIONS

A. Provide a directory of authorized service organizations with company name, address, telephone number, and the contact person for warranty repair.

#### SECTION 311100 CLEARING AND GRUBBING

#### PART 1 – GENERAL

#### 1.01 GENERAL DESCRIPTION OF WORK

- A. Cleaning and grubbing on project site of trees, stumps, brush, roots, vegetation, logs rubbish and other objectionable matter within limits described in specifications or as shown on plans.
- B. Cleaning and grubbing shall be in advance of grading operation except that in cuts over 3 feet in depth, grubbing may be done simultaneously with excavation, provided objectionable matter is removed as specified.
- C. Dispose of all debris resulting from clearing and grubbing work.

#### 1.02 PROTECTION OF ADJACENT WORK:

- A. Protect all areas outside indicated construction areas.
- B. Protect existing improvements, adjacent property, utilities and other facilities, and trees and plants not to be removed from injury or damage.

## PART 2 - PRODUCTS

- 2.01 MATERIALS:
  - A. Provide materials required to perform work as specified.

## PART 3 - EXECUTION

#### 3.01 CLEARING:

- A. Clear all areas covered by dikes, roads, structures and embankments within project limits unless otherwise shown in plans.
- B. Remove all saplings, brush, down-timber and debris unless shown or directed otherwise.
- C. Use tree wound paint to treat scars, gashes or limbs stubs on trees not removed.

## 3.02 GRUBBING:

- A. Trees, stumps, root systems, rocks and other obstructions shall be removed to the depths shown when they fall within the construction templates for the following items:
  - 1. Footings = 18-inches below bottom of footing.
  - 2. Sidewalks (or other types of walks) = 12-inches below bottom of walk.
  - 3. Roadways or Streets = 18-inches below bottom of subgrade
  - 4. Parking Areas = 18-inches below bottom of subgrade
  - 5. Grassed Areas = 18-inches below top soil
  - 6. Fills = 24-inches below bottom of fill
- B. Blasting not permitted.

## 3.03 REMOVAL OF DEBRIS AND CLEANUP

- A. Burning is not permitted.
- B. Dispose of all waste materials not burned by removal from site.
- C. Materials cleared and grubbed shall be the property of the Contractor and shall be his responsibility for disposal.

#### SECTION 311101 TOPSOIL

PART 1 GENERAL 1.01 SECTION INCLUDES 1.02 A. [\_\_\_\_\_]. 1.03 1.04 1.05 PART 1 MATERIALS 1.06 PART 2 PRODUCTS

#### SECTION 312200 TRENCH EXCAVATION, BACKFILL AND COMPACTION

#### PART 1 - GENERAL

#### 1.01 GENERAL DESCRIPTION OF WORK

- A. Excavation, shoring, dewatering, pipe bleeding, trench backfill, compaction, grading and cleanup of all pipeline trenching for the project.
- B. All work must be done in accordance with these specifications and the safety requirements of the State and OSHA Standards.

#### 1.02 JOB CONDITIONS

- A. Site Acceptance
  - 1. Accept site in condition existing during Contract time frame.
  - 2. Ground water/surface water found during construction are conditions of the contract and responsibility of Contractor.
- B. Adverse Weather
  - 1. Place no backfill that is excessively wet or frozen.
  - 2. Place no backfill in excessively wet or frozen trenches.

## PART 2 – PRODUCT

## 2.01 MATERIAL CLASSIFICAITONS

- A. Materials for backfill shall be classified for the purpose of quality control in accordance with the Unified Soil Classification Symbols as defined in ASTM D 2487. Material use and application is defined in utility installation specifications and Drawings either by class, as described in Paragraph 2.10B, or by product descriptions, as given in Paragraph 2.02.
- B. Class Designations Based on Laboratory Testing:
  - 1. Class I: Well-graded sands and gravels, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW,SW)
  - 2. Plasticity Index: Non-plastic
  - 3. Gradation: D60/D10 greater than 4 percent. Amount passing No.  $200 \le 5\%$ .
  - 4. Class II: Poorly-graded gravels and sands, silty sands and gravels, little to moderate fines (GM, GP, SP, and SM)
  - 5. Plasticity Index: Non-plastic to 4
  - 6. Gradation (GP, SP): Amount passing No. 200 Sieve less than 5%.
  - 7. Gradation (GM, SM): Amount passing No. 200 Sieve 12% to 50%
  - 8. Class III: Clayey gravels and sands, poorly graded mixtures of sand, gravel, and clay (GC, SC)
    - a. Plasticity Index

## 2.02 PIPE BEDDING AND BACKFILL

- A. The type of bedding shall be stated on the Plans or in the Specification. Determination of source of materials for bedding and backfill to meet the stated conditions shall be responsibility of Contractor, but use of such materials shall be subject to approval of Engineer.
- B. Excavated Material Backfill
  - 1. Excavated material may be used in the trench backfill, provided that all hard rock and stones having any dimensions greater than 6" and frozen earth debris and roots larger than 2" are removed for the initial backfill. Plasticity Index shall be less than 30. Excavated backfill material must be approved by Engineer for bedding material.
- C. Select Backfill
  - 1. Select Backfill shall be gravel, fine rock cuttings, sand, sandy loam or loam free from excessive clay. Rock cuttings shall have no dimensions greater than 2 inches. Plasticity Index shall be between 7 and 22. Select backfill must be approved by Engineer.
- D. Sand Backfill

- 1. Sand backfill shall be clean, hard, durable, uncoated grains, free from lumps and organic material. All materials must pass a No. 8 Sieve.
- E. Granular Backfill
  - 1. Granular backfill shall be free flowing, such as sand or hydraulically grade stone fines, or mixed sand and gravel, or sandy loam. The material shall be free from lumps, stones over 2 inches in diameter, clay and organic matter.
- F. Controlled Density Fill
  - 1. Use high slump mixture of portland cement, fly ash and fine aggregate formulated, licensed and marketed as K-Krete or equal. Provide mixture with minimum 28-day compressive strength of 70 psi with no measurable shrinkage or surface settlement.

## 2.03 CRADLING ROCK

A. Use crushed rock or stone with 70-100% passing 1> inch sieve and no more than 50% passing 1 inch sieve.

## 2.04 SHEETING, SHORING AND BRACING

- A. Use sound timber or structural steel.
- B. Use shapes and sizes as required.

## **PART 3 - EXECUTION**

## 3.01 GENERAL

- A. Dewatering
  - 1. Execute work "dry". No pipe or conduits shall be laid or concrete poured on excessively wet soil.
  - 2. Prevent surface water from flowing into excavation.
  - 3. Provide equipment for handling water encountered as required. Obtain approval of proposed method of dewatering.
  - 4. No Sanitary sewer shall be used for disposal of trench water.
- B. Protection of Existing Utilities:
  - 1. Notify all utilities of location and schedule of work.
  - 2. Locations and elevations of utilities shown on plans are to be considered approximate only. Notify utility and Engineer of conflicts between existing and proposed facilities.
  - 3. Repair, relay or replace existing utilities damaged, destroyed or disrupted during work. Unless specified otherwise, replacement will be at the Contractors expense.
- C. Sheeting, Shoring and Bracing
  - 1. Provide as necessary, to hold walls of excavation, prevent damage to adjacent structures, and to protect workmen and property.
  - 2. Leave Sheeting and shoring in place where removal might cause damage to work or otherwise indicated on drawings.
  - 3. When movable trench shield is used below spring line of pipe, it shall be lifted prior to any forward movement to avoid pipe displacement.
- D. Changes in Grade
  - 1. Grades may be adjusted 1.5 feet (plus or minus) from plan grades to suit unforeseen construction conflicts or conditions with approval of Engineer.
  - 2. No additional compensation will be made for such changes.

## 3.02 EXCAVATION AND TRENCHING

- A. General
  - 1. Method of excavation at Contractor's option.
  - 2. Excavate by hand under tree roots 3 inches and larger, and under and around structures and utilities.
  - 3. Stockpile and replace topsoil to a minimum of 4-inches for surface restoration in grassed or agricultural areas.
- B. Trench Characteristics

1. Depth

a. As indicated for pipe installation to lines and grades required with proper allowance for thickness of pipe and type of bedding specified or indicated.

- 2. Width
  - a. Keep width of trench as narrow as possible and yet provide adequate room for backfilling and jointing.
  - b. Maximum width as follows:

| Pipe Size | Maximum Trench        |
|-----------|-----------------------|
| Inches    | Width                 |
| 4         | 2-feet 0-inches       |
| 6         | 2-feet 0-inches       |
| 8         | 2-feet 4-inches       |
| 10        | 2-feet 4-inches       |
| 12        | 2-feet 6-inches       |
| 15        | 2-feet 9-inches       |
| 18        | 3-feet 0-inches       |
| Over 18   | Pipe O.D. + 12-inches |

- 3. Trench walls must be vertical below top of pipe and may be vertical or sloped above pipe to conform to excavating codes.
- 4. Provide bell holes for each pipe joint where pipe bears on undisturbed earth.
- 5. Trench bottom shall be free of large stones and other foreign material.

## 3.03 SOFT, SPONGY OR UNSTABLE MATERIALS

- A. Stop work and notify Engineer.
- B. Perform remedial work as directed.
- C. If material is judged unsuitable and removal is authorized, remove and replace with trench stabilizing material as directed by Engineer.

## 3.04 ROCK EXCAVATION

- A. Excavate any rock to maintain minimum 6-inch clearance around pipe.
- B. Dispose of rock material not suitable for backfill as directed by Engineer.
- C. Use of explosives not permitted without prior written authorization from owner and Engineer.
- D. Provide Special Hazard Insurance covering liability for blasting operations.

## 3.05 BEDDING

- A. Place after bottom of trench has been excavated to proper depth and grade.
- B. Place, compact and shape bedding material to conform to barrel of pipe to insure continuous firm bedding for fill length of pipe.
- C. Provide bedding as described in following table unless indicated otherwise on Plans or in Special Conditions.

| Pipe Material                       | Minimum Bedding Class |
|-------------------------------------|-----------------------|
| 1. Vitrified Clay Pipe              | Class C*              |
| 2. Non-reinforced Concrete Pipe     | Class C*              |
| 3. Reinforced Concrete Pipe         | Class D*              |
| 4. Ductiole Iron Pipe               | Class D*              |
| 5. Steel Cylinder                   | Class C*              |
| 6. Flexible or Composite Pipe (PVC) | Class 1**             |

\*Refers to standard detail, "Pipe Envelope Requirements" \*\*Refers to standard detail, "Bedding Detail"

#### 3.06 TRENCH BACKFILL

- A. Use excavated material for backfill unless otherwise specified.
- B. Use Sand Backfill for all trenches within 5 feet of buildings and beneath walks, parking areas, paved streets or existing exposed utilities, unless otherwise specified in the plans.
- C. Initial Backfill
  - 1. Place after pipe has been bedded and checked for alignment, grade and internal obstructions.
  - 2. Carry out in an orderly fashion after authorization to cover pipe has been given.
  - 3. Allow no more than 300 feet of trench to be open at one time.
  - 4. Do not backfill until concrete or mortar has sufficiently cured.
  - 5. Record location of connections and appurtenances before backfilling.
  - 6. Place by hand and hand tamp to not less than 12-inches above top of pipe, in approximately 4-inch layers.
  - 7. Backfill simultaneously on both sides of pipe to prevent displacement.
  - 8. Place cushion of 4-foot backfill above pipe envelope before using heavy compacting equipment.
- D. Subsequent Backfill
  - 1. Place backfill into trench at an angle so that impact on installed pipe is minimized.
  - 2. Compaction of all backfill material shall be performed in an manner that shall not crack, crush, and/or cause the installed pipe to be moved from the established grade and/or alignment.
  - 3. Area under or within 5-feet of pavement; and under or within 2-feet of utilities, buildings, or walks shall be mechanically compacted to the top of the subgrade in 6-inch lifts to a minimum of 95% Standard Proctor Density.
  - 4. Areas not subject to vehicular traffic shall be backfilled in layers not more than 12-inches in depth.
  - 5. Compaction method is at discretion of Contractor with following exceptions:
    - a. If in Owner's opinion compaction method presents potential damage to pipe, it will not be allowed.
    - b. Compaction of any backfill material by flooding or jetting is not allowed.
  - 6. Mound excavated materials no greater than 6-inches in open areas only.
  - 7. Fill upper portion of trench with topsoil as specified hereinbefore.
- E. Controlled Density Fill
  - 1. Use where shown on plans.
  - 2. Provide suitable forms to limit volume of control density fill material.
  - 3. Prevent flow of material into existing drain lines.
  - 4. Protect exposed utility lines during placement.
  - 5. Place material in accordance with suppliers' written recommendations unless directed otherwise by Engineer

## 3.07 EXCESS MATERIAL

3.08

- Α.
- Β.
- C.
- D.
- Ε.

3.09

- Α.
- В.

3.10

A. Waste of excess excavated material shall be the responsibility of the Contractor.

## 3.11 TESTING

- A. Unless specified elsewhere, testing will be responsibility of Contractor.
- B. Standard Proctor Density
  - 1. ASTM D698.
  - 2. One (1) required for each type of material encountered.
- C. In Place Density
  - 1. ASTM D1556 (Sand Cone)
  - 2. ASTM D2167 (Balloon)
  - 3. ASTM D3017 (Nuclear)
- D. One (1) test per each 400 cubic yards of backfill placed.

#### SECTION 312350 GROUND WATER HANDLING

#### PART 1-GENERAL

#### 1.01 SECTION INCLUDES

- A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations, and foundation beds in a stable condition, and controlling ground water conditions for tunnel excavations.
- B. Protecting work against surface runoff and rising flood waters.
- C. Disposing of removed water.

#### 1.02 REFERENCES

- A. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).
- B. Federal Register 40 CFR (Vol. 53. No. 222) Part 122, EPA Administrator permit Programs (NPDES), Para 122.26 (b)(14) Storm Water Discharge.

#### 1.03 DEFINITIONS

- A. Ground water control includes both dewatering and depressurization of water-bearing soil layers using well points, for either vacuum or educator systems, or deep wells. Use of sump pumps does not constitute ground water control.
  - 1. Dewatering is lowering the water table and intercepting seepage which would otherwise emerge from slopes or bottoms of excavations or into tunnels and shafts, and disposing of removed water.
  - 2. Depressurization is reduction of piezometric pressure within a soil strata not controlled by dewatering alone.
- B. Control of excavation drainage by sump pumping includes operating the sump pump and drainage facilities installed to collect water in the sump.
- C. Control of surface drainage is diversion of surface water away from excavations.

#### 1.04 PERFORMANCE REQUIREMENTS

- A. Conduct subsurface investigations as needed to identify ground water conditions and to provide parameters for installation and operation of ground water control systems. Perform pump tests, if necessary, to determine drawdown characteristics of water bearing layers.
- B. Develop a ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926, to produce the following results:
  - 1. Reduce hydrostatic pressure affecting excavations to the following levels as determined by piezometer observations.
    - a. For structural excavations, reduce the piezometric level to at least 3 feet below the excavation bottom elevation or within 2 feet above the top of clay layers.
    - b. Where hydrostatic pressure in a confined water-bearing layer exist below the excavation, depressurize this zone to eliminate risk of uplift or other instability of the excavation or installed works.
  - 2. Develop stable subgrade for subsequent construction operations.
  - 3. Reduce hydrostatic pressure for tunnel excavations as necessary to maintain face stability, grade control, and to control seepage into tunnel.
- C. Provide drainage of seepage water and surface water, as well as water from any other source entering the excavation. Excavation drainage may include placement of drainage materials such as crushed stone and filter fabric, together with sump pumping.
- D. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.
- E. Modify ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells, if they affect potentially contaminated areas.

## 1.05 ENVIRONMENTAL REQUIREMENTS

- A. Comply with the Texas Natural Resource Conservation Commission regulations and Texas Water Well Driller Association for development, drilling, and abandonment of wells used in dewatering system.
- B. Where potentially contaminated areas are indicated on the Drawings, monitor ground water discharge for contamination in accordance with the Project Engineer's instructions.

## PART 2-PRODUCTS

#### 2.01 EQUIPMENT AND MATERIALS

- A. Equipment and materials are at the option of Contractor as necessary to achieve desired results for ground water control. Ground water control systems may include single-stage or multiple-stage well point systems, educator and ejector-type systems, deep wells, or combinations of these equipment types. Excavation drainage and surface drainage may also include sump pumping subsidiary to bid item.
- B. Maintain equipment in good repair and operating order.
- C. Arrange for standby equipment and materials where required.

## **PART 3-EXECUTION**

## 3.01 GROUND WATER CONTROL

- A. Install, operate and maintain the ground water control system in a manner compatible with construction methods and site conditions. Notify Project Engineer in writing of any changes made to accommodate field conditions and changes to the Work.
- B. For above ground piping in ground water control system, include a length of clear transparent piping between every well point and discharge header so that discharge from each installation can be visually monitored.
- C. Replace installations that produce noticeable amounts of sediments after development.
- D. Provide additional ground water control installations, or change the methods, if the installation does not achieve satisfactory results.
- E. Do not allow piezometric pressure levels to rise until foundation concrete has achieved design strength.
- F. During backfilling, dewatering may be reduced to maintain water level a minimum of 5 feet below prevailing level of backfill. However, do not allow that water level to result in uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place.
- G. Remove ground water control installations.
  - 1. Remove pumping system components and piping when ground water control is no longer required.
  - 2. Remove monitoring wells when directed by the Project Engineer.
  - 3. Grout abandoned well.
    - a. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.

#### 3.02 MAINTENANCE AND OBSERVATION

- A. Conduct daily maintenance and observation of the ground water control systems.
- B. Replace inoperable or damaged system components as necessary to maintain operation.
- C. Keep monitoring system piping accessible for observation,

#### 3.03 MONITORING AND RECORDING

A. Observe and record elevation of water level daily as long as ground water control system is in operation. Observe levels weekly thereafter until the Work is completed or piezometers or wells are removed. Initiate more frequent observation when the Project Engineer determines that more frequent monitoring and recording are required.

## 3.04 SURFACE WATER CONTROL

- A. Intercept surface water and divert it away from excavations. This includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.
- B. Drive surface water and seepage water into sumps and pump it into drainage channels, setting basins, or storm drains.

#### SECTION 312500 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

#### PART 1-GENERAL

#### 1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment and incidentals necessary to provide erosion and sediment control for the duration of the construction period including furnishing, installing and maintaining erosion and sediment control structures and procedures and the proper removal when no longer required.
- B. The intent of this specification is to provide guidelines for the Contractor to adhere to all State, Federal, and Local environmental regulations. It is also the intent to provide preventive measures to keep sediment from entering any storm water system, including open channels. It is the Contractor's responsibility to adhere to all State, Federal and Local requirements. While the Owner may require the Contractor to install erosion control devices during construction, this will in no way relieve the Contractor of his responsibility.

#### 1.02 QUALITY ASSURANCE

- A. Comply with applicable requirements of all governing authorities having jurisdiction. The Specifications and the Plans are not represented as being comprehensive, but rather to convey the intent to provide complete slope protection and erosion control for both the Owner's and adjacent property.
- B. Erosion control measures shall be established at the beginning of construction and maintained during the entire length of construction. On-site areas which are subject to severe erosion and off-site areas which are especially vulnerable to damage from erosion and/or sedimentation are to be identified and receive additional erosion control measures as directed by the Owner or the Engineer.
- C. All land-disturbing activities shall be planned and conducted to minimize the size of the area to be exposed at any one time and to minimize the time of exposure.
- D. Surface water runoff originating upgrade of exposed area shall be controlled to reduce erosion and sediment loss during the period of exposure.
- E. When the increase in the peak rates and velocity of storm water runoff resulting from a landdisturbing activity is sufficient to cause accelerated erosion of the receiving ditch or stream, the Contractor shall install measures to control both the velocity and rate of release so as to minimize accelerated erosion and increased sedimentation of the stream as directed by the Owner or the Engineer.
- F. All land-disturbing activities shall be planned and conducted so as to minimize off-site sedimentation damage.
- G. The Contractor shall be responsible for periodically cleaning out and disposing of all sediment once the storage capacity of the drainage feature or structure receiving the sediment is reduced by one-half. The Contractor shall also be responsible for cleaning out and disposing of all sediment at the time of completion of the Work.

#### 1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00, SUBMITTALS, and shall include:
- B. Manufacturer's Literature: Descriptive data of installation methods and procedures.
- C. Certificates: Manufacturer's certification that materials meet specification requirements.

## 1.04 JOB CONDITIONS; CODES AND ORDINANCES

A. Comply with the local codes and ordinances. If local codes and ordinances require more stringent or additional erosion and sediment control measures during construction, Contractor shall provide such measures.

## PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. STRAW BALES: Straw bales shall weigh a minimum of fifty (50) pounds and shall be at least 30" in length. Bales shall be composed entirely of vegetable matter and be free of seeds. Binding shall be either wire or nylon string, jute or cotton binding is unacceptable. Bales shall be used for not more than three months before being replaced. However, if weather conditions cause biological degradation of the straw bales, they shall be replaced sooner than the three month time period to prevent a loss of structural integrity of the dike.
- B. SILT FENCE: Silt fence fabric shall be a nylon reinforced polypropylene fabric which has a built-in cord running the entire length of the top edge of the fabric. The fabric must meet the following minimum criteria:
  - 1. Tensile Strength, ASTM D4632 90 lbs.,
  - 2. Puncture Rating, ASTM D4833 60 lbs.,
  - 3. Mullen Burst Rating, ASTM D3786 200 psi,
  - 4. Apparent Opening Size, U.S. Sieve No. 40
  - 5. Silt fence shall be "Enviro Fence" preassembled silt fence, AMXCO Silt Stop prefabricated silt fence, AMOCO Style 2155 preassembled silt fence or approved equal.
- C. SILT FENCE POSTS: A minimum 2" x 2" (nominal) x 54" pressure treated wood posts of Number 2 Grade southern yellow pine or approved equal.
- D. SAND BAG: Sand bag material shall be polypropylene, polyethylene, polyamide or cotton burlap woven fabric, minimum unit weight four (4) ounces per square yard, mullen burst strength exceeding 300 psi and ultraviolet stability exceeding 70%. Length shall be 24 to 30 inches, width shall be 16 to 18 inches and thickness shall be six (6) to eight (8) inches and having an approximate weight of 40 pounds. Sand bags shall be filled with coarse grade sand, free from deleterious material. All sand shall pass through a No. 10 sieve.
- E. P.V.C. PIPE: Pipe shall be SDR-35 polyvinyl chloride having a minimum nominal internal diameter of 4". Pipes shall be sized for anticipated flows.
- F. SOIL RETENTION BLANKET: Soil retention blankets shall consist of a geocomposite of excelsior or fiber blanket with an extruded plastic net attached to the tope side. The plastic net shall be photodegradable, and the excelsior or fiber blanket shall be made smolder resistant without the use of chemicals. Soil retention blankets shall be high velocity type to resist severe runoff. The soil retention blanket shall be one (1) of the following classes and types:
  - 1. Class 1. "Slope Protection"
    - a. Type A. Slopes of 3:1 or flatter Clay soils
    - b. Type B. Slopes of 3:1 or flatter Sandy soils
    - c. Type C. Slopes steeper than 3:1 Clay soils
    - d. Type D. Slopes steeper than 3:1 Sandy soils
  - 2. Class 2. "Flexible Channel Liner"
    - a. Type E. Short-term duration (Up to 2 Years)
      - Shear Stress (tD)< 1.0 lb./sq. ft.</li>
    - b. Type F. Short-term duration (Up to 2 Years)1) Shear Stress (td) 1.0 to 2.0 lb./sq. ft.
    - c. Type G. Long-term duration (Longer than 2 Years)
      - 1) Shear Stress (td) > 2.0 to < 5.0 lb./sq. ft.
    - d. Type H. Long-term duration (Longer than 2 Years)
      - 1) Shear Stress (td) greater than 0 Equal to 5.0 lb./sq. ft.

The Contractor has the option of selecting an approved soil retention blanket provided that selection conforms to the following list of approved soil retention blankets for slope protection applications:

- 3. CLASS I. SLOPE PROTECTION
  - TYPE A: Slopes of 3:1 or Flatter-Clay Soils
    - 1) Airtrol® ANTI-WASH®/GEOJUTE® (Regular)

a.

- 2) Contech Standards®
- 3) Contech Standards Plus®
- 4) Green Triangle Regular®
- 5) Green Triangle Superior®
- 6) GREENSTREAK® PEC MAT
- 7) Curlex®
- 8) North American Green® S150
- 9) North American Green® S75
- 10) North American Green® SC150
- 11) POLYJUTEÔ 407/GT
- 12) SOIL SAVER®
- 13) TerraJute®
- 14) Verdyol® ERO-MAT®
- 15) Xcel Regular®
- 16) Xcel Superior®
- b. TYPE B: Slopes of 3:1 or Flatter-Sandy Soils
  - 1) Contech Standards®
  - 2) Contech Standards Plus®
  - 3) GEOCOIR®/DEKOWE® 700
  - 4) Green Triangle Superior®
  - 5) Green Triangle Regular®
  - 6) North American Green® S75
  - 7) North American Green® SC150
  - 8) North American Green® S150
  - 9) POLYJUTEÔ 407/GT
  - 10) TerraJute®
  - 11) Verdyol® ERO-MAT®
  - 12) Xcel Superior®
  - 13) Xcel Regular®
- c. TYPE C: Slopes Steeper than 3:1-Clay Soils
  - 1) Airtrol®
  - 2) ANTI-WASH®/GEOJUTE® (Regular)
  - 3) Contech Standards Plus®
  - 4) Curlex®
  - 5) Green Triangle Superior®
  - 6) GREENSTREAK® PEC-MAT
  - 7) North American Green® SC150
  - 8) North American Green® S150
  - 9) POLYJUTEÔ 407/GT
  - 10) SOIL SAVER®
  - 11) TerraJute®
  - 12) Xcel Superior®
- d. TYPE D: Slopes Steeper than 3:1-Sandy Soils
  - 1) Contech Standards Plus®
  - 2) GEOCOIR®/DEKOWE® 700
  - 3) Green Triangle Superior®
  - 4) North American Green® S150
  - 5) North American Green® SC150
  - 6) POLYJUTEÔ 407GT
  - 7) TerraJute®
  - 8) Xcel Superior®
- 4. CLASS II: FLEXIBLE CHANNEL LINER PROTECTION

## PART 3 - EXECUTION

## 3.01 INSTALLATION

## A. TEMPORARY STRAW BALE DIKE

- 1. Straw bales shall be embedded a minimum of 4" and securely anchored using 2" x 2" wood stakes driven through the bales into the ground a minimum of 6". Straw bales are to be placed directly adjacent to one another leaving no gap between them.
- 2. Bales shall be placed in a single row, lengthwise on proposed line, with ends of adjacent bales tightly abutting one another. In swales and ditches, the barrier shall extend to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale. Additional bales shall be placed behind the first row where the bales abut each other. The additional bale is used to prevent unfiltered runoff from escaping between the bales.
- 3. The excavated soil shall be backfilled against the barrier. Backfill shall conform to ground level on the downhill side and shall be built up to 4" above ground level on the uphill side. Loose straw shall be scattered over the area immediately uphill from a straw barrier.
- B. SILT FENCE
  - 1. The purpose of a silt fence is to intercept and detain water-borne sediment from unprotected areas to a limited extent. The Contractor shall excavate a 6" by 6" trench for site fence bedding along the lower perimeters of the site where necessary to prevent sediment from entering any drainage system. The Contractor shall install the silt fence in accordance with the manufacturer's recommendations and instructions. Silt fence is used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. This fence shall remain in place until the disturbed area is permanently stabilized. Silt fence should not be used where there is a concentration of water in a channel or drainage way or where soil conditions prevent a minimum toe-in depth of 6" or installation of support post to depth of 12". Fabric shall overlap at abutting ends a minimum of 3' and shall be jointed such that no leakage or bypass occurs. If concentrated flow occurs after installation, corrective action must be taken such as placing rock berm in the areas of concentrated flow.
- C. SAND BAG BERM
  - 1. The purpose of a sandbag berm is to intercept sediment-laden water from disturbed areas such as construction in steam beds, create a retention pond, detain sediment and release water in sheet flow.
  - 2. A temporary sand bag berm shall be installed across a channel or right of way in a developing or disturbed area and should be used when the contributing drainage area is greater than 5 acres. The berm shall be a minimum height of 18", measured from the top of the existing ground at the upslope toe to the top of the berm. The berm shall be sized to have a minimum width of 48" measured at the bottom of the berm and 18" measured at the top of the berm.
  - 3. The sand bag berm shall be inspected after each rain. The sand bags shall be reshaped or replaced as needed during inspection. Additional inspections shall be made daily by the responsible party and when the silt reaches 6", the accumulated silt shall be removed and disposed of at an approved site in a manner that will not contribute to additional siltation. The sand bag berm shall be left in place until all upstream areas are stabilized and accumulated silt removed; removal must be done by hand.
- D. SOIL RETENTION BLANKETS
  - 1. A soil retention blanket (SRB) is a geotextile or biodegradable fabric placed over disturbed areas to limit the effects of erosion due to rainfall impact and runoff across barren soil. Soil retention blankets are manufactured by a wide variety of vendors addressing a wide variety of conditions such as vegetation establishment and high velocity flow. Blankets are used in areas which are difficult to stabilize such as steep slopes, drainage swales or high pedestrian traffic areas.
  - 2. The soil retention blanket, whether installed as slope protection or as flexible channel liner, shall be placed within 24 hours after seeding or sodding operations have been

completed, or as approved by the Engineer. Prior to placing the blanket, the area to be covered shall be relatively free of all rocks or clods over 1-1/2" in maximum dimension and all sticks or other foreign material which will prevent the close contact of the blanket with the soil. The area shall be smooth and free of ruts and other depressions. If as a result of rain, the prepared bed becomes crusted or eroded or if any eroded places, ruts or depressions exist for any reason, the Contractor shall be required to rework the soil until it is smooth and to reseed or resod the area at the Contractor's expense.

- 3. Installation and anchorage of the soil retention blanket shall be in accordance with the manufacturer's recommendations.
- E. PROTECTION OF BARE AREAS
  - 1. Apply seeding and soil retention blanket to bare areas including new embankment areas, fills, stripped areas, graded areas or otherwise disturbed areas, which have a grade greater than 5% or which will be exposed for more than 30 days.
  - 2. Bare working areas on which it is not practical or desirable to install seeding and soil retention blankets, as determined by the Engineer, such as areas under proposed building slabs, shall be temporarily sloped to drain at a minimum of 0.2% and a maximum of 5% grade. These areas shall then be "trackwalked" with a crawler dozer traveling up and down the slope to form the effect of small "terraces" with the tracks of the dozer. Apply a minimum of three (3) coverages to each area with the dozer tracks.
  - 3. Route runoff from the areas through the appropriate silt fence system.
  - 4. Protect earth spoil areas by "trackwalking" and silt fences.
- F. INTERCEPTOR SWALE
  - Interceptor swales may have a v-shape or be trapezoidal with a flat bottom and side slopes of 3:1 or flatter. These are used to shorten the length of exposed slope by intercepting runoff and can also serve as perimeter swales preventing off-site runoff from entering the disturbed area or prevent sediment-laden runoff from leaving the construction site or disturbed area. The outflow from a swale must be directed to a stabilized outlet or sediment trapping device. The swales should remain in place until the disturbed area is permanently stabilized.
  - 2. Stone Stabilization shall be used when grades exceed 2% or velocities exceed 6' per second and shall consist of a layer of crushed stone 3" thick, or flexible channel liner soil retention blankets. Stabilization shall extend across the bottom of the swale and up both sides of the channel to minimum height of 3" above the design water surface elevation based on a two year storm.
  - 3. Interceptor swale shall be installed across exposed slopes during construction and should intercept no more than five (5) acres of runoff. Swales shall have a minimum bottom width of 2'-0" and a maximum depth of 1'-6" with side slopes of 3:1 or flatter. Swale must have positive drainage for its entire length to an outlet. When the slope exceeds 3%, or velocities exceed 4' per second (regardless of slope), stone stabilization is required. Check dams are also recommended to reduce velocities in the swales possibly reducing the amount of stabilization necessary. Swales should be inspected on a weekly basis during wet weather and repairs should be made promptly to maintain a consistent cross section.
  - 4. All trees, brush, stumps, obstructions and other material shall be removed and disposed of so as not to interfere with the proper functioning of the swale.
  - 5. The swale shall be excavated or shaped to line, grade, and cross-section as required to meet criteria specified herein and be free of bank projections or other irregularities which will impede normal flow.
  - 6. All earth removed and not needed in construction shall be disposed of in an approved spoils site so that it will be conveyed to a sediment trapping device.
  - 7. Diverted runoff from a disturbed or exposed upland area shall be conveyed to a sediment trapping device.
  - 8. The on-site location may need to be adjusted to meet field conditions in order to utilize the most suitable outlet.
  - 9. Minimum compaction for the swale shall be 90% standard proctor.

## G. LOCATION OF EROSION AND SEDIMENT CONTROL STRUCTURES

- 1. Locate erosion and sediment control structures as required to prevent erosion and removal of sediment from the project site. Silt fences shall be required for disturbed areas and soil stockpiles/spoil areas. Each silt fence installation shall have a minimum net length (exclusive of embedments into diversion dikes or other ineffective areas) of 25'. The runoff from a maximum of one (1) acre of disturbed area or soil stockpile/ spoil area shall be routed through any individual silt fence installation.
- 2. Install diversion dikes to divert runoff to the silt fence installation.
- 3. Install silt traps at the inlet (upstream) end of the drainage structures, including open channels, through which runoff from disturbed areas or soil stockpiles/spoil areas may drain.
- 4. Provide an overall erosion and sediment control system which protects disturbed areas and soil stockpiles/spoil areas. The system shall be modified by the Contractor from time to time to effectively control erosion and sediment during construction.

## 3.02 MAINTENANCE

- A. Maintain erosion and sediment control structures and procedures in full working order at all times during construction. This shall include any necessary repair or replacement of items which have become damaged or ineffective. Remove sediment on a regular basis which accumulates in sediment control devices and place the material in approved earth spoil areas or return the material to the area from which it eroded.
- B. Upon completion of construction, properly remove the temporary erosion and sediment control structures and complete the area as indicated.
- C. Soil retention blankets will not require removal if installed on a finished graded area specified to receive seeding.

## 3.03 FIELD QUALITY CONTROL

A. In the event of conflict between the requirements and storm water pollution control laws, rules or regulations or other Federal, State or Local agencies, the more restrictive laws, rules or regulations shall apply.

#### SECTION 315000 EXCAVATING

#### PART 1 - GENERAL

#### 1.01 GENERAL DESCRIPTION OF WORK

- A. Excavation, shoring, dewatering, pipe bedding, trench backfill, compaction, grading and cleanup of all pipeline trenching for the project.
- B. All work must be done in accordance with these specifications and the safety requirements of the State and OSHA Standards.

#### **1.02 JOB CONDITIONS**

- A. Site Acceptance
  - 1. Accept site in condition existing during Contract time frame.
  - 2. Ground water/surface water found during construction are conditions of the contract and responsibility of Contractor.
- B. Adverse Weather
  - 1. Place no backfill that is excessively wet or frozen.
  - 2. Place no backfill in excessively wet or frozen trenches.

#### 1.03 SUBMITTALS

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
  - 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
  - 2. Laboratory compaction curve according to ASTM D 698 for each on-site and borrow soil material proposed for fill and backfill.

#### PART 2 - PRODUCT

#### 2.01 MATERIAL CLASSIFICATIONS FOR PIPE BEDDING AND BACKFILL

- A. Materials for bedding and backfill shall be classified for the purpose of quality control in accordance with the Unified Soil Classification Symbols as defined in ASTM D2487 and with ASTM D2321. Material use and application is defined by class in accordance with ASTM D2321, or by product descriptions, as described below. Determination of source of materials for bedding and backfill to meet the stated conditions shall be responsibility of Contractor, but use of such materials shall be subject to approval of Engineer. Contractor shall submit characterization/sieve analysis of proposed pipe embedment material for approval prior to commencement of construction.
  - 1. Class Designations Based on Laboratory Testing (ASTM D2321):
    - a. Class IA and IB: Manufactured aggregates, open or dense graded, clean.
      - 1) Plasticity Index: Non-plastic.
      - 2) Gradation: 100% passing  $1\frac{1}{2}$ " sieve,  $\leq 50\%$  passing No. 4 sieve, and < 5% passing No. 200 sieve.
    - b. Class II: Well and poorly graded gravels and sands, clean or with little to moderate fines (GW, GP, SW, SP, and combinations of the preceding with GM, GC, SM, and SC)
      - 1) Plasticity Index: Non-plastic
      - Gravel (GW, GP) Gradation: 100% passing 1½" sieve, < 5% passing No. 200 sieve (i.e. <5% fines), and < 50% of the non-fines passing a No. 4 sieve. For pipes 15" diameter and smaller, bedding material shall be 3/4-inch maximum (i.e. 100% passing 3/4-inch sieve).</li>
      - Sand (SW, SP) Gradation: 100% passing 1½" sieve, < 5% passing No. 200 sieve (i.e. <5% fines), and > 50% of the non-fines passing a No. 4 sieve.
      - 4) Gravel, Sand W/ Fines Gradation: 100% passing 1<sup>1</sup>/<sub>2</sub>" sieve, and 5% to 12% passing No. 200 sieve (i.e. 5% to 12% fines).

- c. Class III: Silty/clayey gravels and sands, gravel-sand-silt/clay mixtures ( GM, GC, SM, SC)
  - 1) Plasticity Index: (Refer to ASTM D2321)
- 2) Gradation: 100% passing 1½" sieve, 12% to 50% passing No. 200 sieve.
- 2. Designations Based on Product Descriptions:
  - a. Excavated Material Backfill: Excavated material may be used in the trench backfill, provided that all hard rock and stones having any dimensions greater than 6" and frozen earth, debris and roots larger than 2" are removed for the initial backfill. Plasticity Index shall be less than 30. Excavated backfill material must be approved by Engineer for bedding material.
  - b. Select Backfill: Select Backfill shall be gravel, fine rock cuttings, sand, sandy loam or loam free from excessive clay. Rock cuttings shall have no dimensions greater than 2 inches. Plasticity Index shall be between 7 and 22. Select backfill must be approved by Engineer.
  - c. Sand Backfill: Sand backfill shall be clean, hard, durable, uncoated grains, free from lumps and organic material. All materials must pass a No. 8 sieve with less than 5% passing a No. 200 sieve.
  - d. Granular Backfill: Granular backfill shall be free flowing, such as sand or hydraulically graded stone fines, or mixed sand and gravel, or sandy loam. The material shall be free from lumps, stones over 2 inches in diameter, clay and organic matter.
  - e. Controlled Density Fill: Use high slump mixture of portland cement, fly ash and fine aggregate formulated, licensed and marketed as K-Krete or equal. Provide mixture with minimum 28-day compressive strength of 70 psi with no measurable shrinkage or surface settlement.

## 2.02 CRADLING ROCK

A. Use crushed rock or stone with 70-100% passing 1½ inch sieve and no more than 50% passing 1 inch sieve.

## 2.03 SHEETING, SHORING AND BRACING

- A. Use sound timber or structural steel.
- B. Use shapes and sizes as required.

## PART 3 - EXECUTION

## 3.01 GENERAL

- A. Dewatering
  - 1. Execute work "dry". No pipe or conduits shall be laid or concrete poured on wet soil.
  - 2. Prevent surface water from flowing into excavation.
  - 3. Provide equipment for handling water encountered as required. Obtain approval of proposed method of dewatering.
  - 4. No Sanitary sewer shall be used for disposal of trench water.
- B. Protection of Existing Utilities:
  - 1. Notify all utilities of location and schedule of work.
  - 2. Locations and elevations of utilities shown on plans are to be considered approximate only. Notify utility and Engineer of conflicts between existing and proposed facilities.
  - 3. Repair, relay or replace existing utilities damaged, destroyed or disrupted during work. Unless specified otherwise, replacement will be at the Contractors expense.
- C. Protection of Existing Facilities:
  - 1. Mailboxes, driveways, fences, etc., existing near excavation shall be protected from damage. If needed, facilities shall be removed during construction and replaced to before construction condition or better.
  - 2. Mail delivery service shall not be interrupted.
  - 3. Driveway access shall be maintained.
- D. Sheeting, Shoring and Bracing

- 1. All sheeting, shoring, and bracing shall be in accordance with the Excavation Safety System Plan, these specifications and the safety requirements of the State and OSHA Standards.
- 2. Provide as necessary, to hold walls of excavation, prevent damage to adjacent structures, and to protect workmen and property.
- 3. Leave Sheeting and shoring in place where removal might cause damage to work or otherwise indicated on drawings.
- 4. When movable trench shield is used below spring line of pipe, it shall be lifted prior to any forward movement to avoid pipe displacement.
- E. Changes in Grade
  - 1. Grades may be adjusted 1.5 feet (plus or minus) from plan grades to suit unforeseen construction conflicts or conditions with prior approval of Engineer.
  - 2. No additional compensation will be made for such changes.

## 3.02 EXCAVATION AND TRENCHING

- A. General
  - 1. Method of excavation at Contractor's option.
  - 2. Allow no more than 300 feet of trench to be open at one time.
  - 3. Excavate by hand under tree roots 3 inches and larger, and under and around structures and utilities.
  - 4. Stockpile and replace topsoil to a minimum of 8-inches for surface restoration in grassed or agricultural areas.
- B. Trench Characteristics
  - 1. Depth
    - a. As indicated for pipe installation to lines and grades required with proper allowance for thickness of pipe and type of bedding specified or indicated.
  - 2. Width
    - a. Minimum trench width shall be pipe O.D. plus 16 inches or pipe O.D. × 1.25 + 12 inches, whichever is greater.
    - b. Maximum width as follows:

| Pipe Size Inches | <u>Maximum Trench</u> |
|------------------|-----------------------|
| 4                | 2-feet 0-inches       |
| 6                | 2-feet 0-inches       |
| 8                | 2-feet 4-inches       |
| 10               | 2-feet 4-inches       |
| 12               | 2-feet 6-inches       |
| 15               | 2-feet 9-inches       |
| 18               | 3-feet 0-inches       |
| Over 18          | Pipe O.D. x2          |

- C. Trench walls must be vertical below top of pipe and may be vertical or sloped above pipe to conform to excavating codes.
- D. Provide bell holes for each pipe joint where pipe bears on undisturbed earth.
- E. Trench bottom shall be free of large stones and other foreign material.

# 3.03 SOFT, SPONGY OR UNSTABLE MATERIALS (E.G. PEAT, MUCK, AND HIGHLY EXPANSIVE SOILS)

- A. Stop work and notify Engineer.
- B. Perform remedial work as directed.
- C. If material is judged unsuitable and removal is authorized, remove and replace with trench stabilizing material as directed by Engineer.

## 3.04 ROCK EXCAVATION

- A. Excavate any rock to maintain minimum 6-inch clearance around pipe.
- B. Dispose of rock material not suitable for backfill as directed by Engineer.
- C. Use of explosives not permitted without prior written authorization from owner and Engineer.
- D. Provide Special Hazard Insurance covering liability for blasting operations.

## 3.05 PIPE EMBEDMENT

- A. Bedding
  - 1. Place after bottom of trench has been excavated to proper depth and grade.
  - 2. Place, compact and shape bedding material to conform to barrel of pipe and bell to insure continuous firm bedding for full length of pipe.
  - 3. Provide bedding as described in following table unless indicated otherwise on Plans or in Special Conditions.

| Pipe Material  | Minimum Bedding Class |
|--|-----------------------|
| Non-reinforced Concrete Pipe   | Class C*              |
| Reinforced Concrete Pipe   | Class D*              |
| Ductile Iron Pipe  | Class D*              |
| Steel Cylinder   | Class C*              |
| Flexible (PVC) or Composite Pipe                                       | ClassI, II, and III*  |
| *Refer to ASTM D2321 and standard pipe bedding details in the Drawings |                       |

- B. Haunching (bottom of pipe to springline)
  - 1. Haunching shall be same material used for bedding.
  - 2. Place after pipe has been bedded and checked for alignment, grade and internal obstructions.
  - 3. Do not backfill until concrete or mortar has sufficiently cured.
  - 4. Record location of connections and appurtenances before backfilling.
  - 5. Work bedding under pipe haunches and compact by hand to springline of pipe in 6-inch maximum lifts.
- C. Initial Backfill
  - 1. Initial backfill shall be same material used for bedding.
  - 2. From springline to not less than 6-inches above top of pipe, place backfill and compact in 6-inch layers using vibratory compactors.
  - 3. Backfill simultaneously on both sides of pipe to prevent displacement.

## 3.06 TRENCH BACKFILL

- A. Final Backfill
  - 1. Place backfill into trench at an angle so that impact on installed pipe is minimized.
  - 2. Compaction of all backfill material shall be performed in a manner that shall not crack, crush, and/or cause the installed pipe to be moved from the established grade and/or alignment.
  - 3. Place cushion of 4-foot compacted backfill above pipe envelope before using heavy compacting equipment.
  - 4. Use excavated material for final backfill subject to the requirements stated for Select Backfill unless otherwise specified.
  - 5. Areas under or within 5 feet of pavement, and under or within 2 feet of utilities, buildings, or walks shall be backfilled with sand and mechanically compacted to the top of the subgrade in 8 inch lifts to a minimum of 95% Standard Proctor Density.
  - 6. Areas not subject to vehicular traffic shall be backfilled in layers not more than 12-inches.
  - 7. Structural and non structural backfill shall be mechanically compacted. Compaction method is at discretion of Contractor with following exceptions:
    - a. If in Owner's opinion compaction method presents potential damage to pipe, it will not be allowed.

- b. Flooding or water jetting may be permitted only if a geotechnical report justifying the use of water jetting/puddling is submitted to the Engineer by a qualified laboratory and the Engineer approves.
- 8. Mound excavated materials no greater than 6-inches in open areas only.
- 9. Fill upper portion of trench with topsoil as specified hereinbefore.
- B. Controlled Density Fill
  - 1. Use where shown on plans.
  - 2. Provide suitable forms to limit volume of control density fill material.
  - 3. Prevent flow of material into existing drain lines.
  - 4. Protect exposed utility lines during placement.
  - 5. Place material in accordance with suppliers' written recommendations unless directed otherwise by Engineer.

## 3.07 EXCESS MATERIAL

A. Waste of excess excavated material shall be the responsibility of the Contractor.

## 3.08 TESTING

- A. Unless specified elsewhere, testing will be responsibility of Owner.
- B. Standard Proctor Density
  - 1. ASTM D698.
  - 2. One (1) required for each type of material encountered.
- C. In Place Density
  - 1. ASTM D1556 (Sand Cone)
  - 2. ASTM D2167 (Balloon)
  - 3. ASTM D3017 (Nuclear)
- D. One (1) test per 250 linear feet of trench on alternating lifts, with a minimum of three tests per visit, for non-structural areas. One (1) test per 100 linear feet of trench on alternating lifts, with a minimum of three tests per visit, for structural areas.
- E. Contractor will be responsible for any costs associated with testing performed as a result of failed tests

## PART 4 - MEASUREMENT AND PAYMENT

## 4.01 TRENCH EXCAVATION

- A. Trench excavation shall be considered incidental to pipeline installation.
- B. Payment shall be made at the contract unit price per cubic yard only if a bid item is established in the contract.

## 4.02 BACKFILL

- A. Payment for backfill shall be made at the contract unit price per cubic yard only if a separate bid item is established in the contract, otherwise it shall be considered incidental to the pipeline installation.
- B. No allowance for waste shall be made.
- C. If Engineer orders an initial backfill material other than that specified in contract, it shall be paid for as an extra in price per cubic yard as compacted in place, EXCEPT if a higher class embedment is ordered by Engineer because the Contractor has over-excavated the trench width.
- D. If the Engineer orders the excavated material to be removed and disposed of and replaced with another material and a separate bid item is not established as a bid item, the material shall be paid as an extra.
- E. If the Contractor fails to compact the backfill to the density requirements, the Engineer may order the material removed and replaced at no cost to the Owner.
- F. The disposal of rejected material shall be at no cost to the Owner.

#### SECTION 315100 TRENCH PROTECTION SYSTEM

#### PART 1 GENERAL

#### 1.01 SUMMARY

A. The general conditions, special provisions and applicable requirements of DIVISION 1 – General Requirments are hereby made a part of this section.

## 1.02 SCOPE

- A. This section covers excavation and supporting systems for trenches necessary to protect the safety of workers. This specification shall govern for construction of all types of trenches except where the requirements of this section are explicitly revised or superseded by another section. Additional requirements as set forth by federal, state, and local government regulations will be applicable and must be followed. The contractor shall be responsible for the design, placement, and inspection of all trench safety systems in conformance with the Occupational Safety and Health Administration (OSHA) standards as contained in Subpart P, Part 1926, Title 29 of the Code of Federal Regulations (29 CFR 1926). Other OSHA construction standards shall apply.
- B. No boring logs are provided in these documents for subsurface conditions at the site. It is the Contractor's responsibility to determine and evaluate soil conditions at the site and design adequate trench safety systems. The Contractor will be responsible for detecting varying soil conditions which may be hazardous and take appropriate action. The contractor, at his expense, shall be responsible for obtaining any geological data required for his design of the trench safety system.

## 1.03 APPLICABILITY

A. These specifications apply to any trench excavation which is over five (5) feet in depth from the ground surface, or trench excavations that are less than five (5) feet in depth located in areas where unstable soil conditions are present (Ref. OSHA Safety and Health Regulations, Part 1926, Subpart P, Paragraph 29 CFR 1926.652, Subparagraph (a).

#### 1.04 LIABILITY

A. It is the Contractor's responsibility that all excavation work and site conditions are within the regulations as established by OSHA. Any property damage or bodily injury (including death) that arises from use of the trench safety systems, from the Contractor's negligence in performance of the contract work, shall remain the sole responsibility and liability of the Contractor.

#### 1.05 EXISTING UNDERGROUND INSTALATIONS

A. Underground installations are shown in approximate locations on the Drawings. It is the Contractors responsibility to verify the size, locations and elevations of all existing utilities in the construction area prior to commencement of excavation operations.

#### 1.06 SURCHARGE LOADS

A. The Contractor's trench safety system shall be designed to take into account all surcharge loads including, but not limited to adjacent structures, contractor's equipment and heavily loaded truck traffic which will be routed near the work site.

#### **PART 2 MEASUREMENT & PAYMENT**

#### 2.01 MEASUREMENT

A. Trench Excavation Protection shall be measured by the lump sum for the trenching and excavations shown or implied in the plans.

#### 2.02 PAYMENT

- A. Payment for Trench Excavation Protection, measured as prescribed above, shall be made at the unit price bid for "Trench Excavation Protection".
  - 1. Payment shall include all components for design and construction of the Trench Protection System which can include, but not be limited to sloping, sheeting, trench boxes or trench

shields, sheet piling, cribbing, bracing, shoring, dewatering or diversion of water to provide adequate drainage. Payment shall also include the additional excavation and backfill required, any jacking, jack removal, and removal of the trench supports after completion.

2. Payment of all work prescribed under this item shall be full compensation for all additional excavation and backfill; for furnishing, placing and removing all shoring, sheeting, or bracing; for dewatering or diversion of water; for all jacking and jack removal; and for all other labor, materials, tools, equipment and incidentals necessary to complete the work.

#### SECTION 321313 CONCRETE PAVEMENT

#### PART 1 - GENERAL

#### 1.01 THE GENERAL CONDITIONS, SPECIAL PROVISIONS AND APPLICABLE REQUIREMENTS OF DIVISION 1 – GENERAL REQUIREMENTS ARE HEREBY MADE A PART OF THIS SECTION.

#### 1.02 SCOPE

A. This work consists of street pavement, sidewalk, curb and gutter or rip rap slope pavement composed of Portland Cement Concrete with or without reinforcement, constructed on subgrade or base courses prepared in accordance with these specifications and to the lines, grades, thicknesses and typical cross-sections shown on the plans. Reinforcement, when required, will be subsidiary to the specified Concrete Pavement.

## 1.03 SUBMITTALS SHALL BE IN ACCORDANCE WITH SECTION 01 33 00, SUBMITTALS, AND SHALL INCLUDE

- A. Manufacturer's Literature: Descriptive data of installation methods and procedures.
- B. Certificates: Manufacturer's certification that materials meet specification requirements.

#### **PART 2 - PRODUCTS**

#### 2.01 JOINT FILLER AND SEALER

A. Joint sealants and expansion joint filler materials shall conform to "Item #433, JOINT SEALANTS & FILLERS" in the 1993 edition of TXDOT Standard Specifications for Construction of Highways, Streets and Bridges.

#### 2.02 STEEL REINFORCEMENT

Reinforcing bars shall conform to the requirements of AASHTO M31 or M53, Grade
60. Fabricated bar mats may be used if they conform to the requirements of AASHTO M54.

#### 2.03 DOWELS AND TIE BARS

A. Dowels and tie bars shall conform to the requirements of AASHTO M31 or M53, Grade 60 or Grade 40, as specified on the plans. Tie bars shall be deformed meeting the requirements of AASHTO M31 or M53. Dowel and tie bars may conform to the requirements of AASHTO M31 or M53. Dowel and tie bars may conform to the requirements of AASHTO M 42, except that rail steel shall not be used for tie bars that are to be bent or restraightened during construction. Dowel bars shall be plain round bars of the size specified and the ends shall be sawed. Before delivery to the construction site, a minimum of two-thirds of the length of each dowel bar shall be painted with one coat of lead or tar paint. Prior to placement of concrete, the dowels shall be coated with grease if specified on the plans.

#### 2.04 WATER

A. Water used in mixing or curing shall be as clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product as possible. Water will be tested in accordance with the requirements of AASHTO Method T26. Water known to be of potable quality may be used without testing.

#### 2.05 CURING MATERIALS SHALL CONFORM TO ONE OF THE FOLLOWING SPECIFICATIONS:

- 1. "Sheet Materials for Curing Concrete" shall conform to AASHTO M171.
- 2. "Burlap Cloth Made from Jute or Kenat" shall conform to AASHTO M182, Class 3.
- "Liquid Membrane Forming Compounds for Curing Concrete" shall conform to AASHTO M148, Type 2 (all-resin base), or Federal Specification TT-C-800, Type 2. Liquid Membrane shall be delivered and stored in bulk. Bulk storage shall be equipped with an agitator. All membranes shall be pigmented to allow visible inspection of coverage.

#### 2.06 POZZOLANIC ADMIXTURE

A. The use of fly ash as a partial replacement for cement in pavement mix designs, at the rate specified in this paragraph will be allowed at the Contractor's option. Pozzolanic admixtures

shall be fly ash meeting the requirements of ASTM C-618; Type C except loss on ignition shall not exceed three (3) percent. When fly ash is used as a partial replacement for cement, the minimum cement content may be met by considering portland cement plus fly ash as the total cementitious component. The replacement rate should not exceed 15 percent.

#### PART 3 - EXECUTION

#### 3.01 EQUIPMENT

- A. Equipment and tools necessary for handling materials and performing all parts of the work shall be approved by the Engineer as to design, capacity, and mechanical condition. The equipment shall be at the job site before the start of construction operations for examination and approval.
- B. Batching Plant and Equipment.
  - 1. General. The batching plant shall include bins, weighing hoppers, and scales for the fine aggregate and coarse aggregate. If bulk cement is used, a bin, hopper, and a separate scale for cement shall be included. The weighing hoppers shall be properly sealed and vented to preclude dusting during operation.
  - 2. Bins and Hopper. Bins with adequate separate compartments for fine aggregate and coarse aggregate shall be provided in the batching plant. Each compartment shall discharge efficiently and freely into the weighing hopper. Means of control shall be provided so that, as the quantity desired in the weighing hopper is approached, the material may be added slowly and shut off with precision. A port or other opening for removing an overload of any one of the several materials from the hopper shall be provided. Weighing hoppers shall be constructed to eliminate accumulations of materials and to discharge fully.
  - 3. Scales. The scales for weighing aggregates and cement shall be of either the beam or the springless dial type. They shall be accurate within 0.5 percent throughout their range of use. When beam-type scales are used, provisions such as a "telltale" dial shall be made for indicating to the operator that the required load in the weighing hopper is being approached. A device on the weighing beams shall clearly indicate critical position. Poises shall be designed to be locked in any position and to prevent unauthorized change. The weight beam and "telltale" device shall be in full view of the operator while charging the hopper, and the operator shall have convenient access to all controls.
  - 4. Scales shall be inspected and sealed as often as the Engineer may deem necessary to assure their continued accuracy. The Contractor shall have on hand not less than ten 50-pound (23 kg) weights for testing of all scales when directed by the Engineer.
- C. Mixers.
  - 1. General. Concrete may be mixed at a central plant, or wholly or in part in truck mixers. Each mixer shall have attached in a prominent place a manufacturer's nameplate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.
    - a. A device accurate within 3 percent and satisfactory to the Engineer shall be provided at the mixer for determining the amount of air-entraining agent or other admixture to be added to each batch requiring such admixtures.
    - b. Mixers shall be examined daily for the accumulation of hard concrete or mortar and the wear of blades.
  - 2. Central Plant Mixer. Mixing shall be in an approved mixer capable of combining the aggregates, cement, and water into a thoroughly mixed and uniform mass within the specified mixing period, and of discharging the mixture without segregation. Central plant mixers shall be equipped with an acceptable timing device that will not permit the batch to be discharged until the specified mixing time has elapsed. The water system for a central mixer shall be either a calibrated measuring tank or a meter and shall not necessarily be an integral part of the mixer.
    - a. The mixers shall be examined daily for changes in condition due to accumulation of hard concrete or mortar or wear of blades. The pickup and throwover blades shall be replaced when they have worn down 3/4-inch (19 mm) or more. The Contractor shall have a copy of the manufacturer's design on hand showing dimensions and arrangement of blades in reference to original height and depth.

- 3. Truck Mixers and Truck Agitators. Truck mixers used for mixing and hauling concrete and truck agitators used for hauling central-mixed concrete shall conform to the requirements of ASTM C94.
- D. Finishing Equipment.
  - 1. Finishing Machine. The finishing machine shall be equipped with one or more oscillatingtype transverse screeds.
  - 2. Vibrators. For side-form construction, vibrators may be either the surface pan type for pavements less than 8 inches (20 cm) thick or the internal type with either immersed tube or multiple spuds, for the full width of the concrete slab. They may be attached to the spreader or the finishing machine, or they may be mounted on a separate carriage. They shall not come in contact with the joint, load-transfer devices, subgrade, or side forms. The frequency of the surface vibrators shall not be less than 3,500 vibrations per minute, and the frequency of the internal type shall not be less than 7,000 vibrations per minute for spud vibrators. When spud-type internal vibrators are used adjacent to the side forms, they shall have a frequency of not less than 3,500 vibrations per minute. Hand vibrators should be used to consolidate the concrete along forms and other isolated areas.
  - 3. For slip-form construction, the paver shall vibrate the concrete for the full width and depth of the strip of pavement being placed. Vibration shall be accomplished by internal vibrators with a frequency range variable between 7,000 and 12,000 vibrations per minute. The amplitude of vibration shall be between 0.025 (0.6 mm) and 0.06 (1.5 mm) inches.
  - 4. The number, spacing, frequency, and eccentric weights shall be provided as necessary to achieve an acceptable concrete density and finishing quality. Adequate power to operate all vibrators at the weight and frequency required for a satisfactory finish shall be available on the paver. The internal vibrators may be supplemented by vibrating screeds operating on the surface of the concrete. The frequency of surface vibrators shall not be less than 3,500 vibrations per minute. The Contractor shall furnish a tachometer or other suitable device for measuring the frequency of the vibrators. The vibrators and tamping elements shall be automatically controlled so that they shall be stopped as forward motion ceases. Any override switch shall be of the springloaded, momentary contact type.
  - 5. For hand placed pavement the contractor shall consolidate concrete with the use of a hand held vibrator regardless of the type of strike off machinery used. Vibration shall be done to sufficiently remove air voids and consolidate concrete around reinforcing steel and side forms. VIBRATORS SHALL NOT BE USED TO DISTRIBUTE CONCRETE. The contractor shall limit disturbances of consolidated concrete during strike-off and finishing by using adequately sized floats and straight edges as approved by the Engineer. Vibrators, floats, and finishing tools to be on job site at all times during concrete placement.
  - 6. Concrete Saw. When sawing of joints is specified, the Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions and at the required rate. The Contractor shall provide at least one standby saw in good working order. An ample supply of saw blades shall be maintained at the site of the work at all times during sawing operations. The Contractor shall provide adequate artificial lighting facilities for night sawing. All of this equipment shall be on the job both before and at all times during concrete placement.
  - 7. Forms. Straight side forms shall be made of steel having a thickness of not less than 7/32 inch (6 mm) and shall be furnished in sections not less than 10 feet (3 m) in length. Forms shall have a depth equal to the prescribed edge thickness of the concrete without horizontal joint, and a base width equal to the depth of the forms. Flexible or curved forms of proper radius shall be used for curves of 100-foot (31 m) radius or less. Flexible or curved forms shall be of a design acceptable to the Engineer. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Flange braces shall extend outward on the base not less than two-thirds the height of the form. Forms with battered top surfaces and bent, twisted, or broken forms shall be removed from the work. Repaired forms shall not be used until inspected and approved. Built-up forms shall not be used, except as approved by the Engineer. The top face of the form shall not vary from a true plane more than 1/8 inch (3 mm) in 10 feet

(3 m), and the upstanding leg shall not vary more than 1/4-inch (6 mm). The forms shall contain provisions for locking the ends of abutting sections together tightly for secure setting.

8. Slip-form Pavers. The paver shall be fully energized, self-propelled, and designed for the specific purpose of placing, consolidating, and finishing the concrete pavement, true to grade, tolerances, and cross section. It shall be of sufficient weight and power to construct the maximum specified concrete paving lane width as shown in the plans, at adequate forward speed, without transverse, longitudinal or vertical instability or without displacement. The paver shall be equipped with electronic or hydraulic horizontal and vertical control devices.

#### 3.02 FORM SETTING

- A. Forms shall be set sufficiently in advance of the concrete placement to insure continuous paving operation. After the forms have been set to correct grade, the grade shall be thoroughly tamped, either mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms shall be staked into place with not less than 3 pins for each 10-foot (3 m) section. A pin shall be placed at each side of every joint.
- B. Form sections shall be tightly locked and shall be free from play or movement in any direction. The forms shall not deviate from true line by more than 1/4-inch (6 mm) at any joint. Forms shall be so set that they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms shall be cleaned and oiled prior to the placing of concrete.
- C. The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.

## 3.03 CONDITIONING OF UNDERLYING COURSE AND REINFORCING

- A. The prepared grade shall be well moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from the concrete. Ruts or depressions in the subgrade or subbase caused by hauling or usage of other equipment shall be filled as they develop with suitable material (not with concrete or concrete aggregates) and thoroughly compacted by rolling. If damage occurs to a stabilized subbase, it shall be corrected full depth by the Contractor, or the damaged areas filled with concrete integral with the pavement. All excess material shall be removed. Low areas may be filled and compacted to a condition similar to that of the surrounding grade, or filled with concrete integral with the pavement. In cold weather, the underlying subbase shall be protected so that it will be entirely free from frost when the concrete is placed. The use of chemicals to eliminate frost in the underlying material will not be permitted. The work described under the foregoing paragraphs does not constitute a regular subgrading operation, but rather a final accurate check of the underlying course.
- B. Reinforcing steel, at the time concrete is placed, shall be free of mud, oil, or other organic matter that may adversely affect or reduce bond. Reinforcing steel with rust, mill scale, or a combination of both will be considered satisfactory, provided the minimum dimensions, weight, and tensile properties of a hand wire-brushed test specimen are not less than the applicable ASTM specification requirements and provided the rust or scale is not loose. Reinforcing bars shall be securely wired together at all intersections and splices and shall be securely wired to each dowel and load transmission unit intersected. All bars shall be installed in their required position as shown on the plans.

## 3.04 MIXING CONCRETE

A. The concrete may be mixed at the work site, in a central mix plant or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials, except water, are emptied into the drum. Ready-mixed concrete shall be mixed and delivered in accordance with the requirements of ASTM C94, except that the minimum required revolutions of the mixing speed for transit mixed concrete may be reduced to not less than that recommended by the mixer manufacturer. The number of revolutions recommended by the mixer manufacturer shall be indicated on the manufacturer's serial plate attached to the mixer.

- B. When mixed at the work site or in a central mixing plant, the mixing time shall not be less than 50 seconds nor more than 90 seconds. Mixing time ends when the discharge chute opens. Transfer time in multiple drum mixers is included in mixing time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.
- C. The mixer shall be operated at the drum speed as shown on the manufacturer's nameplate on the approved mixer. Any concrete mixed less than the specified time shall be discarded at the Contractor's expense. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in cubic feet (cubic meters), as shown on the manufacturer's standard rating plate on the mixer. An overload up to 10 percent above the mixer's nominal capacity may be permitted provided concrete test data for segregation and uniform consistency are satisfactory, and provided no spillage of concrete takes place. The batch shall be charged into the drum so that a portion of the mixing water shall enter in advance of the cement and aggregates. The flow of water shall be uniform, and all water shall be in the drum by the end of the first 15 seconds of the mixing period. The throat of the drum shall be kept free of such accumulations as may restrict the free flow of materials into the drum.
- D. Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators, or nonagitating trucks. The time elapsing from the time water is added to the mix until the concrete is deposited in place at the work site shall not exceed 30 minutes when the concrete is hauled in nonagitating trucks, nor 60 minutes when the concrete is hauled in truck mixers or truck agitators. Retempering concrete by adding water or by other means will not be permitted, except when concrete is delivered in transit mixers. With transit mixers additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements, if permitted by the Engineer. All these operations must be performed within 45 minutes after the initial mixing operations and the water-cement ratio must not be exceeded. Admixtures for increasing the workability or for accelerating the set will be permitted only when specified for in the contract.

#### 3.05 LIMITATIONS OF MIXING

- A. No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.
- B. Unless authorized in writing by the Engineer, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches 40 degrees F (4 degrees C) and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35 degrees F (2 degrees C).
- C. When concreting is authorized during cold weather, the aggregates may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might be detrimental to the materials. Unless otherwise authorized, the temperature of the mixed concrete shall not be less than 50 degrees F (10 degrees C) at the time of placement in the forms.
- D. If the air temperature is 35 degrees F (2 degrees C) or less at the time of placing concrete, the Engineer may require the water and/or the aggregates to be heated to not less than 70 degrees F (21 degrees C) nor more than 150 degrees F (66 degrees C). Concrete shall not be placed on frozen subgrade nor shall frozen aggregates be used in the concrete.
- E. During periods of warm weather when the maximum daily air temperature exceeds 85 degrees F (30 degrees C), the following precautions should be taken. The forms and/or the underlying material shall be sprinkled with water immediately before placing the concrete. The concrete shall be placed at the coolest temperature practicable, and in no case shall the temperature of the concrete when placed exceed 90 degrees F (32 degrees C). The aggregate and/or mixing water shall be cooled as necessary to maintain the concrete temperature at or not more than the specified maximum.

#### 3.06 PLACING CONCRETE

A. Side-form Method:

- B. For the side-form method, the concrete shall be deposited on the moistened grade to require as little rehandling as possible. Unless truck mixers, truck agitators, or nonagitating hauling equipment are equipped with means for discharge of concrete without segregation of the materials, the concrete shall be unloaded into an approved spreading device and mechanically spread on the grade to prevent segregation of the materials. Placing shall be continuous between transverse joints without the use of intermediate bulkheads. Necessary hand spreading shall be done with shovels -- NOT RAKES. Workmen shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with earth or foreign substances.
  - 1. Concrete for side-form construction shall be placed on cement treated base. No concrete shall be placed before the cement treated base has obtained a compressive strength specified at 7 days.
  - 2. When concrete is to be placed adjoining a previously constructed lane of pavement and when mechanical equipment will be operated upon the existing lane of pavement, the concrete shall be at least 7 days old and at a flexural strength approved by the Engineer. If only finishing equipment is carried on the existing lane, paving in adjoining lanes may be permitted after 3 days, if approved by the Engineer.
  - 3. Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than 15 seconds in any one location, nor shall the vibrators be used to move the concrete. Concrete shall be deposited as near to expansion and contraction joints as possible without disturbing them but shall not be dumped from the discharge bucket or hopper onto a joint assembly unless the hopper is well centered on the joint assembly.
  - 4. Should any concrete materials fall on or be worked into the surface of a completed slab, they shall be removed immediately by approved methods.
- C. Slip Form Method.
  - 1. For the slip-form method, the concrete shall be placed with an approved crawler-mounted, slip-form paver designed to spread, consolidate, and shape the freshly placed concrete in one
  - 2. Complete pass of the machine so that a minimum of hand finishing will be necessary to provide a dense and homogeneous pavement in conformance with requirements of the plans and specifications. The concrete should be placed directly on top of the joint assemblies to prevent them from moving when the paver moves over them. Side forms and finishing screeds shall be adjustable to the extent required to produce the specified pavement edge and surface tolerance. The side forms shall be of dimensions, shape, and strength to support the concrete laterally for a sufficient length of time so that no appreciable edge slumping will occur. Final finishing shall be accomplished while the concrete is still in the plastic state.
  - 3. Concrete for slip form construction shall be placed on cement treated base or lime stabilized subgrade. No concrete shall be placed before the cement treated base has obtained the compressive strength specified at 7 days. The Contractor shall set grade stakes and stringline for each lane placement. The stringline shall be supported at intervals of not more than 25 feet. Additional supports shall be installed to prevent sag of the stringline. The horizontal alignment of the stringline shall be within plus or minus 1/4-inch in 10 feet of true alignment. The Contractor shall provide a suitable method of securing the stringline to maintain proper grade where vertical curves are to be constructed.
- D. Hand Placement Method.
  - 1. When the hand method of striking off and consolidating is permitted, the concrete, as soon as placed, shall be approximately leveled and then truck off and screeded to such elevation above grade that, when consolidated and finished, the surface of the pavement shall be at the grade elevation shown on the plans. The entire surface shall then be tamped and the concrete consolidated so as to insure maximum compaction and a minimum of voids. For the strike off and consolidation, both a strike template and tamping

template shall be provided on the work. In operation the strike template shall be moved forward with a combined longitudinal and transverse motion and so manipulated that neither end of the template is raised from the forms during the striking-off process. A slight excess of material shall be kept in front of the cutting edge at all times. The straightedging, surfacing and joint finishing shall be as described herein.

## 3.07 STRIKE-OFF OF CONCRETE:

A. Following the placing of the concrete, it shall be struck off to conform to the cross section shown on the plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement shall be at the elevation shown on the plans. All reinforcement shall be positioned in advance of concrete placement. All reinforcing bars and bar mats shall be installed in the slab at the required depth below the finished surface and supported by chairs installed on 4-foot centers. After the reinforcing steel is securely installed above the subgrade, as specifically required by plans and as herein prescribed, there shall be no loading imposed upon (or walking upon) the bar mats or individual bars that will cause deformation of reinforcing before or during the placing or finishing of the concrete.

## 3.08 JOINTS.

- A. General:
  - Longitudinal and Transverse Joints. Longitudinal and transverse joints shall be 1. constructed as indicated on the plans and in accordance with these requirements. All joints shall be constructed true to line with their faces perpendicular to the surface of the pavement. Joints shall not vary more than 1/2-inch (13 mm) from a true line or from their designated position. The vertical surface of the pavement adjacent to all expansion joints shall be finished to a true plane and edged to a radius of 1/4-inch (6 mm) or as shown on the plans. The surface across the joints shall be tested with a 10-foot (3 m) straightedge as the joints are finished and any irregularities in excess of 1/4-inch (6 mm) shall be corrected before the concrete has hardened. Longitudinal construction joints that do not meet these requirements or which show significant cracking or planes of weakness shall be sawed-off full depth at the Contractor's expense using the minimum practical width at locations designated by the Engineer. When required, keyways shall be accurately formed with a template of metal or wood. The gauge or thickness of the material in the template shall be such that the full keyway, as specified, is formed and is in the correct location. Transverse joints shall be right
  - 2. Angles to the centerline of the pavement and shall extend the full width of the slab. All joints shall be so prepared, finished, or cut to provide a groove of the width and depth shown on the plans.
- B. Tie Bars: Tie bars shall consist of deformed bars installed principally in longitudinal joints as shown on the plans or the bars shall be extensions of the distributed reinforcing steel across the joints. Tie bars shall be placed at right angles to the centerline of the concrete slab. They shall be held in position parallel to the surface and midway between the surfaces of the slab. These bars shall not be painted, greased, or enclosed in sleeves. At all locations where tie bars are specified and where pavement is in place, the tie bars shall be inserted by drilling and grouting with approved epoxy material. Tie bars in longitudinal construction joints may be installed by bending the bars flush with a keyed joint.
- C. Dowel Bars: If used, dowel bars or other load-transfer units of an approved type shall be placed across transverse or other joints in the manner as specified on the plans. They shall be of the dimensions and spacings as shown and held rigidly in the middle of the slab depth in the proper horizontal and vertical alignment by an approved assembly device to be left permanently in place. The dowel or load-transfer and joint devices shall be rigid enough to permit complete assembly as a unit ready to be lifted and placed into position. A metal, or other type, dowel expansion cap or sleeve shall be furnished for each dowel bar used with expansion joints. These caps shall be substantial enough to prevent collapse and shall be placed on the ends of the dowels as shown on the plans. The caps or sleeves shall fit the dowel bar tightly and the closed end shall be watertight.
- D. Installation: Joints in concrete pavements shall be cut as shown on the plans. Equipment shall be as described in Paragraph 3.1. The circular cutter shall be capable of cutting a groove in a
straight line and shall produce a slot at least 1/8-inch (3 mm) wide and to the depth shown on the plans. When shown on the plans or required by the specifications, the top portion of the slot or groove shall be widened by means of a second shallower cut or by suitable and approved beveling to provide adequate space for joint sealers. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing. Sawing shall be carried on both during the day and night as required. The joints shall be sawed at the required spacing consecutively in sequence of the concrete placement, unless otherwise approved by the Engineer.

- E. Longitudinal Joints.
  - 1. Construction. Longitudinal construction joints shall be formed against suitable side forms (usually made of steel) with or without keyways. Wooden forms may be used under special conditions, when approved by the Engineer. Where butt-type joints with dowels are designated, the dowels for this type shall be painted and greased. The edges of the joint shall be finished with a grooving tool or edging tool, and a space or slot shall be formed along the joint of the dimensions, as indicated, to receive the joint sealing material. Longitudinal construction joints shall be sawed to provide a groove at the top conforming to the details and dimensions indicated on the plans. Provisions shall be made for the installation of tie bars as noted on the plans.
  - 2. Contraction or Weakened-plane type. The longitudinal groove sawed in the top of the slab shall be installed where indicated on the drawings. The groove shall be sawed with approved equipment in the hardened concrete to the dimensions required. The sawed groove shall be straight and of uniform width and depth. The groove shall be clean cut so that spalling will be avoided at intersections with transverse joints. Tie bars or distributed reinforcing steel shall be installed across these joints were indicated on the plans.
  - 3. Expansion. Longitudinal expansion joints shall be installed as indicated on the plans. The premolded filler, of the thickness as shown on the plans, shall extend for the full depth and width of the slab at the joint, except for space for sealant at the top of the slab. The filler shall be securely staked or fastened into position perpendicular to the proposed finished surface. A cap shall be provided to protect the top edge of the filler and to permit the concrete to be placed and finished. After the concrete has been placed and struck off, the cap shall be carefully withdrawn leaving the space over the premolded filler. The edges of the joint shall be finished and tooled while the concrete is still plastic.
- F. Transverse Joints.
  - 1. Expansion. Transverse expansion joints shall be installed at the locations and spacing as shown on the plans. The joints shall be installed at right angles to the centerline and perpendicular to the surface of the pavement. The joints shall be installed and finished to insure complete separation of the slabs. Expansion joints shall be of a premolded type conforming to these specifications and with the plans and shall be the full width of the pavement strip.
  - 2. All concrete shall be cleaned from the top of the joint material. Before the pavement is opened to traffic, this space shall be swept clean and filled with approved joint sealing material.
  - 3. All devices used for the installation of expansion joints shall be approved by the Engineer. They shall be easily removable without disturbing the concrete and held in proper transverse and vertical alignment. Immediately after forms are removed, any concrete bridging the joint space at the ends shall be removed for the full width and depth of the joint.
  - 4. When specified, expansion joints shall be equipped with dowels of the dimensions and at the spacing and location indicated on the plans. The dowels shall be firmly supported in place and accurately aligned parallel to the subgrade and the centerline of the pavement by means of a dowel assembly which will remain in the pavement and will ensure that the dowels are not displaced during construction.
  - 5. Other types of load-transfer devices may be used, when approved by the Engineer.
- G. Contraction. Transverse contraction joints, weakened-plane joints, or both, shall be installed at the locations and spacing as shown on the plans. These joints will be installed by sawing a groove into the concrete surface after the concrete has hardened in the same manner as

specified in Paragraph 3.8(c)(2). Dowel bar assemblies shall be installed, when required, as shown on the plans.

H. Construction. Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for more than 30 minutes or it appears that the concrete will obtain its initial set before fresh concrete arrives. When the installation of the joint can be planned in advance, it shall be located at a contraction or expansion joint. The joint shall not be allowed within 8 feet (2.4 m) of a regular spaced transverse joint. If the pouring of the concrete has been stopped, causing a joint to fall within this limit, it shall not be installed, and the fresh placed concrete shall be removed back to the 8 foot (2.4 m) limit.

## 3.09 FINAL STRIKE-OFF, CONSOLIDATION, AND FINISHING:

- A. Sequence. The sequence of operations shall be the strike-off and consolidation, floating and removal of laitance, straightedging, and final surface finish. The addition of superficial water to the surface of the concrete to assist in finishing operations generally will not be permitted. If the application of water to the surface is permitted, it shall be applied as a fog spray by means of approved spray equipment.
- B. Finishing at Joints. The concrete adjacent to joints shall be compacted or firmly placed without voids or segregation against the joint material; it shall be firmly placed without voids or segregation under and around all load-transfer devices, joint assembly units, and other features designed to extend into the pavement. Concrete adjacent to joints shall be mechanically vibrated. After the concrete has been placed and vibrated adjacent to the joints, the finishing machine shall be operated in a manner to avoid damage or misalignment of joints. If uninterrupted operations of the finishing machine, to, over, and beyond the joints, cause segregation of concrete, damage to, or misalignment of the joints, the finishing machine shall be stopped when the screed is approximately 8 inches (20 cm) from the joint. Segregated concrete shall be removed from the front of and off the joint; the screed shall be lifted and set directly on top of the joint, and the forward motion of the finishing machine shall be resumed. Thereafter, the finishing machine may run over the joint without lifting the screed, provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.
- C. Machine Finishing. The concrete shall be spread as soon as it is placed, and it shall be struck off and screeded by an approved finishing machine. The machine shall go over each area as many times and at such intervals as necessary to give the proper consolidation and to leave a surface of uniform texture. Excessive operation over a given area shall be avoided. When side forms are used, the tops of the forms shall be kept clean by an effective device attached to the machine, and the travel of the machine on the forms shall be maintained true without lift, wobbling, or other variation tending to affect the precision finish. During the first pass of the finishing machine, a uniform ridge of concrete shall be moved forward with a combined longitudinal and transverse shearing motion, always moving in the direction in which the work is progressing, and so manipulated that neither end is raised from the side forms during the striking-off process. If necessary, this shall be repeated until the surface is of uniform texture, true to grade and cross section, and free from porous areas.
- D. Hand Finishing. Hand finishing methods will not be permitted, except under the following conditions: In the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade; in areas of narrow widths or of irregular dimensions where operation of the mechanical equipment is impractical. Concrete, as soon as placed, shall be struck off and screeded. An approved portable screed shall be used.
  - 1. The screed for the surface shall be at least 2 feet (0.6 m) longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and shall be constructed either of metal or of other suitable material covered with metal. Wood will not be permitted. Consolidation shall be attained by the use of a suitable vibrator.
- E. Floating. After the concrete has been struck off and consolidated, it shall be further smoothed, trued, and consolidated by means of a longitudinal float, using one of the following methods:

- 1. Hand Method. The hand-operated longitudinal float shall not be less than 12 feet (3.6 m) in length and 6 inches (15 cm) in width, properly stiffened to prevent flexibility and warping. The longitudinal float, operated from foot bridges resting on the side forms and spanning but not touching the concrete, shall be worked with a sawing motion, while held in a floating position parallel to the slab centerline and passing gradually from one side of the slab to the other. Forward movement along the centerline of the slab shall be in successive advances of not more than one-half the length of the float. Any excess water or soup material shall be wasted over the slab edge on each pass.
- 2. Mechanical Method. The Contractor may use a machine composed of a cutting and smoothing float(s), suspended from and guided by a rigid frame. The frame shall be carried by four or more visible wheels riding on, and constantly in contact with, the side forms or pavement subgrade. If necessary, long-handled floats having blades not less than 5 feet (1.5 m) in length and 6 inches (1.5 cm) in width may be used to smooth and fill in open-textured areas in the slab. Long-handled floats shall not be used to float the entire surface of the slab in lieu of mechanical methods. After floating, any excess water and laitance shall be removed from the surface of the slab by a straightedge 10 feet (3 m) or more in length. Successive drags shall be lapped one-half the length of the blade.
- F. Straight-edge Testing and Surface Correction. After the pavement has been struck off and consolidated and while the concrete is still plastic, it shall be tested for trueness with a 16-foot (4.8 m) straightedge. For this purpose the Contractor shall furnish and use an accurate 16-foot (4.8 m) straightedge swung from handles 3 feet (0.4 m) longer than one-half the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary. Advancing shall be in successive stages of not more than one-half the length of the straightedge. Any excess water and laitance shall be removed from the surface of the pavement. Any depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness. Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straightedge and until the slab conforms to the required grade and cross section. The use of long-handled wood floats shall be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment.

## 3.10 SURFACE TEXTURE

A. A light broom drag shall be used for slab concrete pavements. The direction of the texture device shall be as directed by the Engineer. Contractor to match existing pavement finishes.

## 3.11 SURFACE TEST

- A. As soon as the concrete has hardened sufficiently, the pavement surface shall be tested with a 16-foot (5 m) straightedge or other specified device to determine its compliance with design grades. Where the departure from correct cross section exceeds ½ inch (13 mm), the pavement shall be ground down with a approved grinding machine to within 1/4 inch of tolerance or removed and replaced at the expense of the Contractor when so directed by the Engineer. Cracked or damaged slabs shall be removed and replaced at the expense of the Contractor when so directed by the Engineer.
- B. Any area or section so removed shall not be less than 20 feet (6 m) in length nor less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, and remaining portion of a slab adjacent to the joints that is less than 10 feet (3 m) in length shall also be removed and replaced.

## 3.12 CURING

A. Immediately after the finishing operations have been completed and marring of the concrete will not occur, the entire surface of the newly placed concrete shall be cured in accordance with one of the methods below. In all cases in which curing requires the use of water, the curing shall have prior right to all water supply or supplies. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of

both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than 1/2 hour during the curing period. The following are alternate approved methods for curing concrete pavements.

- Impervious Membrane Method. The entire surface of the pavement shall be sprayed uniformly B. with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. The curing compound shall not be applied during rainfall. Curing compound shall be applied by mechanical sprayers under pressure at the rate of 1 gallon (4 liters) to not more than 150 square feet (14 square meters). The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application the compound shall be stirred continuously by effective mechanical means. Hand spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. Curing compound shall not be applied to the inside faces of joints to be sealed, but approved means shall be used to insure proper curing for 72 hours. The curing compound shall be of such character that the film will harden within 30 minutes after application. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional compound. Upon removal of the side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface. For the Impervious Membrane Method, the Contractor is encouraged to include Polyethylene Film dispensing equipment in the Paving Train to provide protection to the finished work in case of rainfall.
- C. Polyethylene Films. The top surface and sides of the pavement shall be entirely covered with polyethylene sheeting. The units shall be lapped at least 18 inches (457 mm). The sheeting shall be placed and weighted to cause it to remain in contact with the surface covered. The sheeting shall have dimensions that will extend at least twice the thickness of the pavement beyond the edges of the pavement. Unless otherwise specified, the sheeting shall be maintained in place for 72 hours after the concrete has been placed.
- D. Waterproof Paper. The top surface and sides of the pavement shall be entirely covered with waterproofed paper. The units shall be lapped at least 18 inches (457 mm). The paper shall be placed and weighted to cause it to remain in contact with the surface covered. The paper shall have dimensions that will extend at least twice the thickness of the pavement beyond the edges of the slab. The surface of the pavement shall be thoroughly wetted prior to placing of the paper. Unless otherwise specified, the paper shall be maintained in place for 72 hours after the concrete has been placed.
- E. White Burlap-Polyethylene Sheets. The surface of the pavement shall be entirely covered with sheeting. The sheeting used shall be such length (or width) that it will extend at least twice the thickness of the pavement beyond the edges of the slab. The sheeting shall be placed so that the entire surface and both edges of the slab are completely covered. The sheeting shall be placed and weighted to remain in contact with the surface covered, and the covering shall be maintained fully wetted and in position for 72 hours after the concrete has been placed.
- F. Curing in Cold Weather. When the average daily temperature is below 40 degrees F (4 degrees C), curing shall consist of covering the newly laid pavement with not less than 12 inches (30 cm) of loose, dry hay or straw, or equivalent protective curing authorized by the Engineer, which shall be retained in place for 10 days. The hay or straw shall be secured to avoid being blown away. Admixture for curing or temperature control may be used only when authorized by the Engineer.
- G. When concrete is being placed and the air temperature may be expected to drop below 35 degrees F (2 degrees C), a sufficient supply of straw, hay, grass, or other suitable blanketing material such as burlap or polyethylene shall be provided along the work. Any time the temperature may be expected to reach the freezing point during the day or night, the material so provided shall be spread over the pavement to a sufficient depth to prevent freezing of the concrete. The period of time such protection shall be maintained shall not be less than 10 days. A minimum of 3 days is required when high, early strength concrete is used. The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather, and any concrete injured by frost action shall be removed and replaced at the Contractor's

expense.

#### 3.13 REMOVING FORMS

A. Unless otherwise specified, forms shall not be removed from freshly placed concrete until it has set for at least 12 hours, except where auxiliary forms are used temporarily in widened areas. Forms shall be removed carefully to avoid damage to the pavement. After the forms have been removed, the sides of the slab shall be cured as outlined in one of the methods indicated in Paragraph 3.17. Major honeycombed areas shall be considered as defective work and shall be removed and replaced. Any area or section so removed shall not be less than 20 feet (6 m) in length nor less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 10 feet (3 m) in length shall also be removed and replaced.

#### 3.14 SEALING JOINTS:

A. The joints in the pavement shall be prepared and sealed in strict accordance with the sealant manufacturer's printed recommendations.

## 3.15 PROTECTION OF PAVEMENT:

A. The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents. This shall include watchmen to direct traffic and the erection and maintenance of warning signs, lights, pavement bridges, or crossovers, etc. The plans or special provisions will indicate the location and type of device or facility required to protect the work and provide adequately for traffic. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement replaced at the Contractor's expense. In order that the concrete be properly protected against the effects of rain before the concrete is sufficiently hardened, the Contractor is encouraged to have available at all times materials for the protection of edges and surface of the unhardened concrete. Such protective materials shall consist of rolled polyethylene sheeting at least 4 mils (0.1 mm) thick of sufficient length and width to cover the plastic concrete slab and any edges. The sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the plastic concrete surface. When rain appears imminent, all paving operations shall stop and all available personnel should begin covering the surface of the unhardened concrete with the protective covering.

## 3.16 OPENING TO TRAFFIC:

A. The Engineer shall decide when the pavement shall be opened to traffic. The pavement will not be opened to traffic until test specimens molded and cured in accordance with ASTM C31 have attained a flexural strength of 550 pounds per square inch (3792 kPa) when tested in accordance with ASTM C78. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed. Prior to opening to traffic, the pavement shall be thoroughly cleaned.

## 3.17 SURFACE AND THICKNESS TOLERANCES:

- A. Extreme care must be exercised in all phases of the operation to assure the pavement will pass the specified tolerances. The following tolerances are applicable:
  - 1. Lateral deviation from established alignment of the pavement edge shall not exceed plus or minus 0.10 foot (30 mm) in any lane.
  - 2. Vertical deviation from established grade shall not exceed plus or minus 0.04 foot (12 mm) at any point.
  - 3. Surface smoothness deviations shall not exceed 3/8 inch (6 mm) from a 16-foot (5 m) straightedge placed in any direction, including placement along and spanning any pavement joint or edge.
- B. No additional payment over the contract unit price shall be made for any pavement of a thickness exceeding that required by plans.

#### 3.18 INTEGRAL CURBS:

A. Where shown on the drawings, integral curbs shall be installed to the dimension shown using identical concrete to the paving mix. Expansion and contraction joints shall extend through curb

section. Reinforcing for integral curb, when shown on the plans, shall be supported from the ground with driven stakes or as directed by the Engineer. Once the forms are removed, all voided areas shall be rubbed and filled with non-shrink grout within 24 hours. If the forms are removed within 2 days of placement, the curb shall be treated with a specified curing membrane.

## 3.19 CONCRETE CURB AND GUTTER:

A. Concrete curb and gutter shall be constructed using concrete of the type and strength specified in the plans. The placement, strike-off consolidation and finishing shall be made using applicable portions of this specification as determined by the Engineer. Contraction joints shall be placed at 20-foot centers with the use of a 1/2" deep grooving tool. Expansion joints shall be placed at a maximum spacing of 400 feet and at all radius points, curb returns and junctions with structures. For curves of 100 feet radius or less, contraction joints shall be tooled at 10-foot centers and expansion joints constructed at 50-foot centers. Expansion joints shall contain a minimum of two smooth dowels a minimum of one bar size larger than the longitudinal reinforcing and 3/4-inch thick expansion joint material of the type specified in the plans. Expansion joints shall be sealed in accordance with the plan details.

## 3.20 SIDEWALKS AND SLOPE PAVING

A. Concrete sidewalks and slope paving shall be constructed to use concrete of the type and strength specified in the plans. The placement, strike-off, consolidation and finishing shall be made using applicable portions of this specification as determined by the Engineer. Contraction joints shall be tooled at a depth of 1/2" at a spacing equal to the width of the sidewalk not to exceed six feet. For walks wider than six feet, longitudinal joints shall be tooled at equal spacing, not less than three feet. Edges shall be tooled with a 1/4-inch radius and finish slightly higher than adjacent curbs to ensure proper drainage if some settlement occurs. Expansion joints shall be placed at 100-foot intervals or at intersecting walk locations. Expansion joints shall be 3/4-inch in thickness and contain smooth dowels at not less than 12" spacing. The size of the dowels will be equal to the thickness of the sidewalk in inches. Scoring and tooling for barrier free ramps shall be made in accordance with governing City standards or as directed by the Engineer.

# 3.21 FIELD TEST SPECIMENS

- A. Concrete samples shall be furnished by the Contractor and shall be taken in the field to determine the consistency, air content, and strength of the concrete. Compressive test cylinders shall be made each day that the concrete is placed. However, at the start of paving operations and when the aggregate source, aggregate characteristics, or mix design is changed, additional groups of test cylinders may be required until the Engineer is satisfied that the concrete mixture being used complies with the strength requirements of these specifications. Test ages will be 7 days and 28 days.
- B. Test cylinders for compressive strength tests shall be taken and cured in accordance with ASTM C-31 and tested in accordance with ASTM C-39. At least four cylinders (a set) shall be made for each 1,000 cubic yards or fraction thereof placed and tested at 7 days and 28 days. No extra compensation will be allowed for materials and work involved in fulfilling these requirements. Concrete will be accepted on the basis of tests conducted on a "lot" of concrete. A lot will consist of 160 cubic yards and will be divided into four equal sublots. One set of tests will be made for each sublot. Random samples will be taken from the plastic concrete at the site in accordance with accepted statistical procedures.
- C. The concrete shall be sampled in accordance with ASTM C172.
- D. The lot will be accepted without adjustment in payment if the average 28 day compressive strength, based on four acceptance tests, indicates a strength deficiency of not less than 100 psi. The pay factor for 28-day compressive strengths showing a deficiency greater than 100 psi are listed in the table below.
  - 1. PAY FACTOR SCHEDULE FOR COMPRESSIVE STRENGTH
    - a. AT THE SPECIFIED INTERVAL

| Strength De          | ficie                                | ency         | Pay Factor<br>(Percent of Contract Unit Price)<br>psi |  |  |
|----------------------|--------------------------------------|--------------|---|--|--|
| (Based on an Average | e of∙                                | 4 Cylinders) |   |  |  |
| psi                  |                                      |              |   |  |  |
| 0                    | ÷                                    | 100          | 100   |  |  |
| 100                  | -                                    | 150          | 85  |  |  |
| 151                  | $\overline{\mathbf{u}}_{\mathbf{r}}$ | 200          | 75  |  |  |
| 201                  | -                                    | 250          | 70  |  |  |
| 251                  | $\tilde{\tau}$                       | 300          | 60  |  |  |
| 301                  | $\tilde{\tau}_{\rm eff}$             | 375          | 55  |  |  |
| 375                  | Ξ.                                   | 500          | 50  |  |  |
| >500                 |                                      |              | Reject  |  |  |

END OF SECTION

#### SECTION 321320 CONCRETE REINFORCEMENT

PART 1 - GENERAL

#### 1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Section 32 13 13, Concrete Pavement.

#### 1.02 QUALITY ASSURANCE

- A. Reference Standards:
  - 1. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
- B. ASTM A615, Specification for Deformed Billet Steel Bars for concrete.
  - 1. ASTM A185, Specifications for Welded Steel Wire Fabric for Concrete Reinforcement.
  - 2. Concrete Reinforcing Steel Institute, Manual of Standard Practice.
- C. Allowable Tolerances:
  - 1. Fabricating: (per ACI 117-90)
    - a. Saw cut length to: Plus or minus 1". (Remove all burrs).
    - b. Stirrups and ties: Plus or minus 1/2".
    - c. All other bends: Plus or minus 1".
  - 2. Placing:
  - 3. Concrete cover to formed surfaces: Plus or minus 1/4".
    - a. Minimum spacing between bars: Plus or minus 1/4".
    - b. Top bars in slabs and beams:
      - 1) Members 8" deep or less: Plus or minus 1/4".
      - 2) Members more than 8" but not over 2'-0" deep: Plus or minus 1/2".
      - 3) Members more than 2'-0" deep: Plus or minus 1".
      - 4) Crosswise of members: Space evenly within 2" of stated separation.
      - 5) Lengthwise of members: Plus or minus 2".
  - 4. Maximum bar relocation to avoid interference with other reinforcing steel, conduits, or other embedded item: 1 bar diameter.

#### 1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver reinforcement to project site in bundles marked with tags indicating bar size, length and mark.
- B. Unload reinforcing carefully to prevent damage. Store above ground in dry, well drained area; protect from mud, dirt and corrosion.

#### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Reinforcing Bars: ASTM A615, deformed billet steel bars, domestic manufacture, Grades 40 and/or 60 as indicated on structural drawings.
- B. Welded Wire Fabric Reinforcing: ASTM A185, steel wire spot welded at intersections and of size indicated.
- C. Metal Accessories: Include spacers, chairs, bolsters, ties and other devices necessary for properly placing, spacing, supporting and fastening reinforcement in place, conforming to requirements to CRSI "Manual of Standard practice for Detailing Reinforced Concrete Structures." Metal accessories shall be galvanized or plastic coated where legs will be exposed in finished concrete surfaces.
- D. Tie Wire: FS QQ-W-461, black annealed steel, 16 ga. min.

#### 2.02 FABRICATION:

A. In accordance with CRSI "Manual of Standard Practice."

# **PART 3 - EXECUTION**

#### 3.01 PREPARATION

A. Cleaning: Before placing in work, thoroughly clean reinforcement of loose rust, mill, scale, dirt, oil, and other coating which might tend to reduce bonding. Reinspect reinforcing left protruding for future bonding, or following delay in work, and reclean if necessary.

#### 3.02 INSTALLATION

- A. Bar Placement: In accordance with CRSI "Recommended Practice for Placing Reinforcing Bars" and "Recommended Practice for Placing Bar Supports."
- B. Bending: Bend bars cold; do not heat reinforcing or bend by make-shift methods. Discard bent, kinked or otherwise damaged bars.
  - 1. Splices: In accordance with ACI 315.
  - 2. Placing: Accurately position reinforcement; securely saddle tie at intersections.
  - 3. Supports: In accordance with ACI 315 for number, type, spacing and placing.

#### END OF SECTION

#### SECTION 321373 CONCRETE PAVING JOINT SEALANTS

#### PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

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

## 1.02 SUMMARY

- A. This Section includes the following:
  - 1. Expansion and contraction joints within cement concrete pavement.
  - 2. Joints between cement concrete and asphalt pavement.

#### 1.03 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- D. Qualification Data: For Installer.
- E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
  - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
  - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

## 1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
  - 1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
  - 2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
  - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
  - 5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.
  - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

## 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

## 1.06 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by jointsealant manufacturer.
  - 2. When ambient and substrate temperature conditions are outside limits permitted by jointsealant manufacturer or are below 40 deg F (4.4 deg C).
  - 3. When joint substrates are wet or covered with frost.
  - 4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## PART 2 - PRODUCTS

## 2.01 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

## 2.02 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: to match concrete color.

## 2.03 COLD-APPLIED JOINT SEALANTS

- A. Multi-component Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:
  - 1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, O.
  - 2. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and, as applicable to joint substrates indicated, O.
  - 3. Bitumen-Modified Urethane Formulation: Type M; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.
- B. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
- C. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutralcuring, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
- D. Multi-component Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.

## 2.04 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated

by joint-sealant manufacturer based on field experience and laboratory testing.

- B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
- D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

#### 2.05 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from pre-construction joint-sealant-substrate tests and field tests.

## **PART 3 - EXECUTION**

## 3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint-sealant manufacturer, based on pre-construction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

## 3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability. Do not leave gaps between ends of backer materials. Do not stretch, twist, puncture, or tear backer materials. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses provided for each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

#### 3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

# 3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

#### END OF SECTION

#### SECTION 331110 WATER TRANMISSION LINES AND/OR PRESSURE WASTEWATER LINES

## PART 1 – GENERAL

## 1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE:

- A. Trench Excavation, Backfill, and Compaction: Section312200.
- B. Water Valves: Section 331120.

## 1.02 SUBMITTALS:

- A. Conform to requirements of Section 013300. Manufacturer's Literature: Manufacturer's descriptive literature and recommended method of installation.
- B. Certificates: Manufacturer's certification that products meet specification requirements. Submit shop drawings showing design of pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fitting, flange, and special details. Show station numbers for pipe and fittings corresponding to Drawings. Production of pipe and fittings prior to review by City Engineer is at Contractor's risk.

## 1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials on manufacturer's original skids or in original unopened protective packaging. OWNER reserves the right to reject material left from another job.
- B. Store materials to prevent physical damage.
- C. Protect materials during transportation and installation to avoid physical damage.

## 1.04 GENERAL DESCRIPTION OF WORK COVERED:

A. Furnish and install all pipe, fittings, structures and accessories required for water transmission line and/or pressure wastewater lines.

## 1.05 QUALITY ASSURANCE:

- A. Comply with the latest published edition of American Water Works Association (AWWA) Standards:
  - 1. AWWA C110/A21.10 & C110a Gray Iron and Ductile-Iron Fittings, 2 inch through 48 inch for water and other liquids.
  - 2. AWWA C111/A21.11 Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings.
  - 3. AWWA C150/A21.50 Thickness Design of Ductile-Iron Pipe.
  - 4. AWWA C151/A21.51 Ductile-Iron Pipe, centrifugally cast in metal mold or sand lined molds, for water or other liquids.
  - 5. AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe 4 inch through 12 inch for water.
  - 6. AWWA C905 Polyvinyl Chloride (PVC) Pressure Pipe 14 inch through 48 inch for water.
  - 7. other liquids.
- B. Comply with the latest published editions of the American Society for Testing and Materials (ASTM) Standards:
  - 1. ASTM D2241 Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR).
  - 2. ASTM D3139 Joints for PVC Pressure Pipes using Flexible Elastomeric Seals.

## PART 2 – PRODUCTS

## 2.01 GENERAL REQUIREMENTS:

- A. Pipe furnished may be either Polyvinyl Chloride (PVC), Steel Cylinder (SCP) or Ductile Iron (DI) as specified herein for water mains unless shown otherwise on the plans or bid documents.
- B. Use PVC pipe for all pressure wastewater lines unless shown otherwise on the plans. Pressure wastewater lines shall be color coded green.
- C. All pipe shall be marked in accordance with the applicable standard specification under which the pipe is manufactured unless otherwise specified and shall be National Sanitation Foundation (NSF) approved stamped.

- D. Steel cylinder pipe manufactured shall have had a successful experience record in the design and manufacture of steel cylinder pipe with substantial footage in successful operation for at least five years.
- E. The quality of materials, the process of manufacture, and the finished pipe shall be subject to inspection and approval by the Engineer at the pipe manufacturing plant and at the project site prior to and during installation. All water distribution pipe and fittings shall be listed in the Fire Protection Equipment Directory published by the Underwriter's Laboratories, Inc. or shall be Factory Mutual approved for fire service.

## 2.02 POLYVINYL CHLORIDE PIPE (PVC):

- A. Waterlines 12" and less may be constructed of PVC water pipe, pressure pipe, in accordance with AWWA C900 (latest version) for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-inches through 12-inches, for Water Distribution. All pipe should be designed and installed with a minimum of four-foot cover.
- B. Waterlines 14 inches through 48 inches may be constructed of PVC water pipe, pressure pipe, in accordance with AWWA standard C905 (latest version) for PVC Water Transmission Pipe and Fabricated Fittings. All pipe should be designed and installed with a minimum of four-foot cover.
- C. Provide push-on joints with bell integrally cast into pipe or with coupling of same material as pipe.
- D. Use elastomeric gaskets, as provided in AWWA C900 or ASTM D3139.
- E. Provide either cast-iron or PVC 1120 fittings as indicated or required. Use long radius fittings where possible.
- F. Provide fittings with materials and pressure class equal to or greater than that specified for pipe.
- G. Provide sleeve type or anchored coupling where indicated or required to join pipe or provide restraint to offset internal or hydrostatic test pressures.
- H. Provide pipe marked to indicate the following:
  - 1. Nominal Pipe Size.
  - 2. Material Code Designation.
  - 3. Standard Dimension Ratio.
  - 4. Pressure Rating.
  - 5. Manufacturer's name or trademark.
  - 6. National Sanitation Foundation Seal.
  - 7. Appropriate ASTM designation number.

## 2.03 STEEL CYLINDER PIPE (SCP):

A. Provide pipe with a minimum working pressure of 200 psi or as shown on the plans or in the specifications.

## 2.04 DUCTILE IRON PIPE (DIP):

- A. Pipelines ranging in size from 12 inches through 36 inches in diameter shall comply with the latest published edition of AWWA as modified herein:
  - 1. AWWA C104/A21.4 ANSI Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
  - 2. AWWA C105/A21.5 ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
  - 3. AWWA C110/A21.10 ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3-inches through 48-inches (76 mm through 1,219 mm), for Water and Other Liquids
  - 4. AWWA C111/A21.11 ANSI Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
  - 5. AWWA C115/A21.15 ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

- 6. AWWA C150/A21.50 ANSI Standard Thickness Design of Ductile-Iron Pipe
- 7. AWWA C151/A21.51 ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
- 8. ANSI B 16.1 Cast Iron Pipe Flanges and Flanged Fittings.
- 9. ASTM D 1248 Polyethylene Plastics Molding and Extrusion Materials.
- 10. ASTM G 62 Test Methods for Holiday Detection in Pipeline Coatings.
- 11. AWWA C600 Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.
- 12. SSPC-SP 6 Steel Structures Painting Council, Commercial Blast Cleaning.
- 13. Ductile-iron push-on and mechanical joint pipe shall meet all requirements of standard AWWA C151/A21.51 .
- B. Joint Types include ANSI A21.11 push-on; ANSI A21.11 mechanical joint; or ANSI A21.15 flanged end. Provide push-on joints unless otherwise indicated on the Drawings or required by these specifications. For bolted joints, bolts shall conform to requirements of AWWA C111/A21.11. Threaded- or grooved-type joints which reduce pipe wall thickness below minimum required are not acceptable.
- C. Provide manufacturer's certifications that all ductile iron pipe and fittings meet provisions of this Section and have been hydrostatically tested at factory and meet requirements of ANSI A21.51.
- D. Provide certifications that all pipe joints have been tested and meet requirements of ANSI A21.11.
- E. Ductile-iron flanged pipe shall meet all requirements of standard AWWA C115/A21.15 . Barrels shall have a nominal thickness required by Table 1 of AWWA C115/A21.15 , which thickness corresponds to Special Class 53 in sizes through 54-inch, and Class 350 in 60- and 64-inch sizes. Flanges shall be ductile-iron (gray-iron is not acceptable) they shall be Class 125 flanges as shown in ANSI/ASME B16.1; and shall conform to dimensions shown in Table 2 and Figure 1 ofAWWA C115/A21.15. Flanges shall be fabricated and attached to the pipe barrels by U.S. fabricators using flanges and pipe barrels of U.S. manufacture. If fabrication is to be by other than the pipe barrel manufacturer, a complete product submittal and approval by the Water and Wastewater Utility will be required. Additionally, such fabricator shall furnish certification that each fabricated joint has been satisfactorily tested hydrostatically at a minimum pressure of 300 psi.
- F. Where ductile iron water main is cathodically protected from corrosion, bond rubber gasketed joints as shown on Drawings to provide electrical continuity along entire pipeline, except where insulating flanges are required by Drawings. Do not use polyethylene wrap with a cathodic protection system.
- G. Where restrained joints for buried service are required by Drawings, provide one of the following, or equal:
  - 1. Super-Lock Joint by Clow Corporation.
  - 2. Flex-Ring or Lok-Ring by American Cast Iron Pipe Company.
  - 3. TR-Flex Joint by U.S. Pipe and Foundry Company.
  - 4. Provide for restrained joints designed to meet test pressures required under Part 3.04 of this section.
- H. Linings and Coating: Interior surfaces of all ductile-iron water pipe shall be cement-mortar lined and seal coated as required by AWWA C104/A21.4. Pipe exteriors shall be coated as required by the applicable pipe specification. The type and brand of interior lining shall be clearly marked on the outside of the pipe and fittings. Except as authorized by the E/A, only one type and brand of pipe lining shall be used on a given project.
- I. Exterior: Prime coat and outside asphaltic coating conforming to ANSI A 21.10, ANSI A 21.15, or ANSI A 21.51 for pipe and fittings in open cut excavation and in casings. Pipe to be installed in potentially contaminated areas shall have coatings and linings recommended by the manufacturer as resistant to the contaminants identified.
- J. Except as described above for flanged pipe (Thickness Class 53) and where not otherwise indicated, ductile-iron pipe shall be minimum Pressure Class 250 as defined by AWWA

C150/A21.50; all ductile-iron pipe and flanges shall meet the following minimum physical requirements:

- 1. Grade 60-42-10:
- 2. Minimum tensile strength: 60,000 psi (414 MPa)
- 3. Minimum yield strength: 42,000 psi (290 MPa)
- 4. Minimum elongation: 10 percent
- K. The flanges for AWWA C115/A21.15 pipe may also be made from:
  - 1. Grade 70-50-05:
  - 2. Minimum tensile strength: 70,000 psi (483 MPa)
- L. Minimum yield strength: 50,000 psi (345 MPa)
  - 1. Minimum elongation: 5 percent
- M. Joint Materials:
  - 1. Gaskets for mechanical joints shall conform to ANSI/AWWA A21.11/C-111.
  - 2. Furnish, when no contaminant is identified, plain rubber (SBR) gasket material; for flanged joints 1/8-inch-thick gasket in accordance with ANSI A 21.15.
  - 3. Pipes to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed pipeline, shall have the following gasket materials for the noted contaminants:

| Contaminant                  | Gasket Material Required                  |  |  |
|------------------------------|---|--|--|
| Petroleum (diesel, gasoline) | Nitrile Rubber                            |  |  |
| Other contaminants           | As recommended by the pipe<br>manufacture |  |  |

- 4. Joining of slip joint iron pipe shall, without exception, be accomplished with the natural or synthetic rubber gaskets of the manufacturer of that particular pipe being used. A joint lubricant shall be used, and applicable recommendations of the manufacturer shall be followed.
- 5. Gaskets for flanged joints shall be continuous full-face gaskets, of 1/8-inch minimum thickness of natural or synthetic rubber, cloth reinforced rubber or neoprene material, preferably of deformed cross section deign and shall meet all applicable requirements of ANSI/AWWA A21.11/C-111 for gaskets. They shall be manufactured by, or satisfy all recommendations of, the manufacturer of the pipe/fittings being used and be fabricated for use with Class 125 ANSI B16.1 flange.
- 6. Tee-head bolts, nuts, and washers for mechanical joints shall be high strength, low alloy, corrosion resistant steel stock equal to "COR-TEN A" having UNC Class 2 rolled threads or alloyed ductile-iron conforming to ASTM A 536; either shall be fabricated in accordance with ASTM B18.2 with UNC Class 2 rolled threads.
- 7. Hex-head bolts and nuts shall satisfy the chemical and mechanical requirements of ASTM A449
- 8. SAE Grade 5 plain and shall be fabricated in accordance with ASTM B 18.2 with UNC Class 2 rolled threads.
- 9. Either Tee-head or Hex-head bolts, nuts, and washers as required, shall be protected with bonded fluoropolymer corrosion resistant coating where specifically required by the E/A.
- 10. All threaded fasteners shall be marked with a readily visible symbol cast, forged or stamped on each nut and bolt, which will identify the fastener material and grade. The producer and the supplier shall provide adequate literature to facilitate such identification; painted markings are not acceptable and the number of degrees for bends. Painted markings are not acceptable.
- 11. Use fittings of same size as pipe. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Make reductions in piping size by reducing fittings. Line and coat fittings as specified for pipe they serve.
- 12. Push-on Fittings: ANSI A 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.
- 13. Flanged Fittings: ANSI A 21.10; ANSI B 16.1 cast or ductile iron. Flanges: ANSI B 16.1, Class 125; pressure rated at 250 psig.

14. Mechanical Joint Fittings: ANSI A 21.11 (AWWA C110/A21.10 ); pressure rated at 250 psi.

# 2.05 DUCTILE IRON PIPE FITTINGS:

- A. Fittings shall be push-on, flanged, or mechanical joint as indicated or approved, with pressure rating of not less than that specified for adjacent pipe and shall meet all requirements of standards as follows:
  - 1. Sizes 4-inch and larger: AWWA C110/A21.10
  - 2. Shall be compatible with joint type of adjacent pipe.
  - 3. All specials, taps, plugs, flanges and wall fittings shall be as required.
  - 4. Interior surfaces of all iron water pipe fittings shall be lined with cement-mortar and seal coated as required by AWWA C104/A21.4. Interior surfaces of all iron wastewater and force main fittings shall be coated with a non-corrosive lining material acceptable to Owner.
  - 5. Fitting exteriors shall be coated as required by the applicable pipe specifications.

## 2.06 VALVES, HYDRANTS, METERS AND APPURTENANCES:

- A. Valve Boxes:
  - 1. Provide for all buried valves.
  - 2. Use nominal 6-inch cast-iron sliding type pipe shaft with cover and base casting.
  - 3. Set box top at finished grade.
  - 4. Furnish drop cover appropriately marked "WATER".
- B. Corporation Stops:
  - 1. Conform with AWWA C800.
  - 2. Use 3/4 inch unless indicated otherwise.
- C. Hydrants:
  - 1. Design: latest edition of AWWA C502, traffic model with break flange.
    - a. Mueller Centrurion A423
  - 2. American-Darling B-84-B
    - a. Kennedy Guardian K-81A
    - b. U.S. Pipe Metropolitan
    - c. Others as approved by OWNER in writing
  - 3. Provide 6-inch inlet, 2 2> inch hose nozzles, 1 4> inch pumper.
  - 4. Provide compression type main valve, minimum size 5< inches.
  - 5. Pentagon operating nut.
  - 6. Design to open counterclockwise.
  - 7. Provide mechanical joint bell on foot piece.
  - 8. Furnish depth as noted on plans.
  - 9. Furnish National (American) Standard Fire Hose Coupling Screw Thread (NH).
- D. Polyethylene Wrapping:
  - 1. Material: AWWA C105/A21.5.
  - 2. Thickness: 8 mils.
- E. Polyethylene Plastic Pipe (PE):
  - 1. Material: ASTM D2737.
  - 2. Fittings: ASTM D2683.
  - 3. Size: 3/4 inch unless shown otherwise on plans.
- F. Copper Pipe (CU):
  - 1. Material: seamless, Type K, ATM B88.
  - 2. Fittings: wrought copper solder joint or flared.
  - 3. Size: 3/4 inch unless shown otherwise on plans.

# PART 3 – EXECUTION

#### 3.01 GENERAL:

A. Provide all labor, equipment and materials and install all pipe fittings, special and appurtenances as indicated or specified.

#### 3.02 PIPE INSTALLATION:

- A. Handling:
  - 1. Handle in a manner to insure installation in sound and undamaged condition.
  - 2. Do not drop or bump.
  - 3. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements, and coatings.
  - 4. Ship, move, and store with provisions to prevent movement or shock contact with adjacent units.
  - 5. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.
- B. Installation:
  - 1. Utilize equipment, methods, and materials insuring installation to lines and grades as indicated.
  - 2. Do not lay on blocks unless pipe is to receive total concrete encasement.
- C. Accomplish horizontal and vertical curve alignments of ductile iron pipe with bends, bevels or deflection joints.
  - 1. Limit joint deflection with ductile iron pipe to conform with AWWA C600.
- D. Use short specials preceding curves as required.
  - 1. Obtain approval of ENGINEER of method proposed or transfer of line and grade from control to the work.
  - 2. Install pipe of size, material, strength class, and joint type with embedment as shown on plans or specified herein.
  - 3. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.
    - a. Close open ends of pipe with snug fitting closures.
    - b. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.
    - c. Remove water, sand, mud and usher undesirable materials from trench before removal of end cap.
  - 4. Pipe shall be inspected prior to installation to determine if any pipe defects are present.
  - 5. Brace or anchor as required to prevent displacement after establishing final position.
  - 6. Perform only when weather and trench conditions are suitable.
    - a. Do not lay in water.
  - 7. Observe extra precaution when hazardous atmospheres might be encountered.
  - 8. Sanitary wastewater relation to water mains:
    - a. Maintain 9 feet horizontal separation whenever possible.
    - b. When conditions prevent a lateral separation of 9 feet, wastewater may be installed closer to a water main if:
      - 1) wastewater constructed of PVC pipe meeting AWWA Specifications and having a minimum working pressure rating of 150 psi or greater and equipped with pressure type joints, and
      - 2) the wastewater line and water main are separated by a minimum vertical distance of 2 feet and a minimum horizontal distance of 4 feet, measured between the nearest outside diameters of the pipes.
    - c. When a sanitary wastewater crosses a water line and that portion of the wastewater is constructed as described in this section, the wastewater may be placed no closer than 12 inches from the water line. The separation distance must be measured between the nearest outside pipe diameters. The wastewater line shall be located at a lower elevation than the water line whenever possible and one length of the

wastewater pipe must be centered on the water line.

- 9. Separation of water mains from wastewater manholes:
  - a. No water pipe shall pass through or come in contract with any part of a wastewater manhole.
  - b. A minimum horizontal separation of 9 feet shall be maintained.
- 10. Construct service lines where shown on plans in accordance with Standard Detail Drawing. Use pipe material specified on plans or in contract documents.
- 11. Wrap pipe, fittings and tie rods with polyethylene where shown on plans in accordance with AWWA C105/A21.5.
- E. Jointing:

2.

- 1. General requirements:
  - a. Locate joint to provide for differential movement at changes in type of pipe embedment, at changes from rock to soil trench bottom, and structures.
    - 1) Not more than 18 inches from structure wall, or
    - 2) Support pipe from wall to first joint with concrete cradle structurally continuous with base slab or footing of structure.
  - b. Perform in accordance with manufacturer's recommendations.
  - c. Clean and lubricate all joint and gasket surfaces with lubricant recommended.
  - d. Utilize methods and equipment capable of fully homing or making up joints without damage.
  - e. Check joint opening and deflection for specification limits.
  - Special provisions for jointing cast-iron and ductile iron:
  - a. Conform to AWWA C600.
  - b. Visually examine while suspended and before lowering into trench.
    - 1) Paint bell, spigot, or other suspected portions with turpentine and dust with cement to check for cracks invisible to the eye.
    - 2) Remove turpentine and cement by washing when test is satisfactorily completed.
    - 3) Reject all defective pipe.
- 3. Special provisions for jointing and laying PVC pipe:
  - a. Conform to AWWA C600 and ASTM D2321
  - b. Allow pipe to reach trench soil temperature prior to installation in ditch.
- 4. Special provisions for jointing steel cylinder pipe:
  - a. Before laying each joint, the bell and spigot rings shall be cleaned by wire brush and wiped clean and dry.
  - b. Inside cement mortar joint:
    - 1) the inside joint recess shall be filled immediately prior to placing the pipe together by buttering the bell end with mortar.
    - 2) the joint mortar of pipe 18 inch diameter and smaller shall be smoothed and cleaned with a swab.
    - 3) the joint mortar of pipe diameters larger than 18 inches shall be finished off smooth by hand trowel.
  - c. Outside cement mortar joint:
    - 1) encircle joint with wrapper after joint found satisfactory.
    - 2) leave enough space between wrapper ends to allow cement mortar to be poured.
    - 3) the entire joint shall be poured with cement mortar and consolidated and rodded or agitated to eliminate voids.
- F. Cutting:

2.

- 1. Cut in neat workmanlike manner without damage to pipe.
  - Cut cast-iron with Carborumdum saw or other approved method.
  - a. Smooth cut by power grinding to remove burrs and sharp edges.
  - b. Repair lining as required and approved by ENGINEER.

- G. Closure Pieces:
  - 1. Connect two segments of pipelines or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.
  - 2. Observe specifications regarding location of joints, type of joints and pipe materials and strength classifications.
  - 3. May be accomplished with sleeve coupling for water pipe:
    - a. Of length such that gaskets are not less than 3 inches from pipe ends.
    - b. Include spacer ring identical to pipe end such that clear space does not exceed 1/4 inch.
- H. Temporary Plugs:
  - 1. Install whenever installed pipe is left unattended.
  - 2. Use water-tight plug.
- I. Cutting and Plugging Water Mains:
  - 1. Where the plans call for abandoning water mains, adhere to the following general procedure:
    - a. After constructing, disinfecting, testing, and placing the replacement main in service, and services are transferred to the replacement main, locate the main to be abandoned, trace it back to the feeder main, and at this point cut and plug it at the tee. Normally, installing a plug, clamp, and a concrete thrust block does this. In cases of 1-1/2 in. or 2 in. corporation cock or tapping sleeve and valve (TS&V) connections, remove the valve and install a cap or plug at the tee. Ensure the line to be abandoned is not valves off at the nearest valve, nor cut and plugged other than at the supply main.
    - b. Adequately plug the ends or openings in abandoned mains or cap them in an approved manner and replace excavation, backfill, and any street surfaces, to the Engineer's satisfaction. Perform this work in accordance with Excavations and Backfilling sections.
    - c. Remove surface identification, i.e., valve boxes and fire hydrants. Where valve boxes are in improved streets (other than shell), pouring valve boxes full of concrete with the cap permanently removed is permitted.
    - d. Do not remove plugs during the months of peak water demands, June, July, and August, unless otherwise approved.
- J. Wet Connections:
  - 1. Make the wet connections, as directed, in such a manner and at such hours to minimize inconvenience to the public. When the existing mains have been cut or a plug removed for a connection, pursue the work of making the connection without interruption until complete.
  - 2. If the Contractor proceeds with a wet connection without a complete shut-off, there will be no extra compensation for damages or extra work resulting from the incomplete shut-off.
  - 3. The Utility Owner will operate gate valves in the existing system and in sections of completed mains that have been placed in service. Notify the Utility Owner at least 48 hr. in advance of making connections.
  - 4. Wet connections that are 2 in. or smaller are sometimes referred to on the plans as 2 in. standard connections or gooseneck connections.
  - 5. Items that may be necessary to complete these types of wet connections include corporation cock, saddle, copper tubing, brass fittings, and 2 in. valves. Do not use these connections on or consider them as part of a 2 in. service line.
  - 6. The Utility Owner will handle, at no cost to the Contractor, operations involving opening and closing valves for wet connections.
- K. Installing Service Lines:
  - 1. For curb and gutter streets, lay copper service lines with a minimum 30 in. of cover from top of curb to the top of the service line. For crowned streets with open ditches, lay copper service lines with a minimum 30 in. of cover at the crown and with a minimum 18 in. of cover from the flow line of the ditch to the top of the service line. Ensure service line

locations are clear of proposed paving and underground work.

- 2. Exercise caution to keep the lines free of dirt and foreign matter at all times. Assemble copper lines in an entirely slack position and free of kinks. Use service lines consisting of one continuous run of copper tubing where possible. Do not use bends greater than that originally found in the coil of tubing as packaged.
- 3. For 1-1/2 in. and 2 in. copper tubing shipped in straight lengths, use the following bend criteria:
  - a. For 2 in. copper tubing, a maximum of one 45° bend may be accomplished in a 4 ft. section; for 1-1/2 in. copper tubing, a maximum of one 45° bend in a 3 ft. section. No kinks, dents, flats, or crimps will be permitted.
  - b. Locate meters, in general, 1 ft. into the street right of way. Where this is not applicable, locate meters approximately 1 ft. from the sidewalk on the curb side. If the present meter location conflicts with proposed driveway turnouts or other proposed street improvements, shift the meter to miss the obstruction and reconnect it to the customer's service line. Reset meters at positions such that the top of the meter is 4 in. to 6 in. below the finished grade.
  - c. Where the plans call for salvaging and relocating the meter, meter box, and curb stop, remove these materials with care, thoroughly clean them, and submit them for inspection by the Engineer, before installing them in the new location. If the plans call for relocating the meter (other than at some point along the existing service line), a new service line will be required.
  - d. Where it is necessary to cross a paved street, push the service line under the paving through a pre-drilled and prepared opening. Use only full lengths of copper tubing, taking care not to damage the tubing when pulling it through the prepared hole.
  - e. A compression type union is only permitted when a full 40 ft. (60 ft. for 3/4 in. to 1 in.) length of tubing cannot completely span underneath the pavement. Do not use compression type unions under the paved street.
- L. Adjusting Existing Surface Structures:
  - 1. Valve Boxes
    - a. Salvage and reuse the valve box. Remove and replace the 6 in. ductile-iron riser pipe with a suitable length for the depth of cover required to establish the adjusted elevation to accommodate the actual finished grade.
    - b. Reinstall the valve box and riser piping plumbed in a vertical position. Provide a minimum of 6 in. telescoping freeboard space between the riser pipe top butt end and the interior contact flange of the valve box, for vertical movement damping.
    - c. After setting, aligning, and adjusting the valve box so that the top lid is level with the final grade, place a 24in. by 24 in. by 8 in. thick concrete block around the valve box. Center the valve box horizontally within the concrete box.
  - 2. Meter Boxes
    - a. Salvage and reuse meter boxes when possible. Reinstall them in conformance with the manufacturer's recommendations. Repair any damage sustained by the meter box during relocation or service transfer, at no expense to the Department.
    - b. If the existing meter box requires replacement, the Contractor may obtain a new box from the Utility Owner by providing adequate documentation of the existing and proposed locations.
  - 3. Meter Vaults
    - a. Adjust meter vaults in conformance with the details shown on the plans. Salvage and reuse access covers.
- M. Removing and Salvaging Fire Hydrants and Water Meters:
  - 1. Deliver removed and salvaged fire hydrants and water meters to the Utility Owner at the location shown on the plans, or as directed.
- N. Removing Water Mains and Removing Water Mains with Casing:
  - 1. Remove water mains and water mains with casing in accordance with Item 100, or as shown on the plans. This includes removing and disposing of pipe and appurtenances as shown on the plans or as directed. Perform related excavation and backfilling, as required,

at no additional cost the Department.

## O. Thrust Blocks:

- 1. Provide for all horizontal or vertical turns utilizing fittings.
- 2. Use on all dead-end and tee fittings.
- 3. Install as indicated on Standard Detail Drawing
- 4. Construct to undisturbed edge of trench for bearing.
- 5. Provide minimum bearing area in S.F. as follows based on 150 psi test pressure and 2000 psf soil bearing:
- 6.

| Pipe | Tee /    | 11<0 | 22>0 | 450  | 900  |
|------|----------|------|------|------|------|
| Size | Deadends | Bend | Bend | Bend | Bend |
| 4"   | 1.0      | 0.5  | 0.5  | 0.8  | 1.3  |
| 6"   | 2.2      | 0.5  | 0.9  | 1.6  | 3.0  |
| 8"   | 3.8      | 0.8  | 1.5  | 2.9  | 5.3  |
| 10"  | 6.0      | 1.2  | 2.3  | 4.5  | 8.4  |
| 12"  | 8.5      | 1.7  | 3.3  | 6.5  | 12.1 |
| 14"  | 11.6     | 2.3  | 4.5  | 8.9  | 16.4 |
| 16"  | 15.2     | 3.0  | 5.9  | 11.6 | 21.4 |

7. Shall apply to all pipe materials specified.

## 3.03 VALVE AND APPURTENANCE INSTALLATION:

- A. Valves:
  - 1. Install with stems vertical when installation is horizontal.
  - 2. Set valves on concrete thrust block having four (4) square feet of bearing area on undisturbed earth.
- B. Valve Boxes:
  - 1. Center on valves.
  - 2. Carefully tamp earth around each valve box to a distance of 4 feet on all sides of box or to undisturbed trench face, if less than 4 feet.
- C. Hydrants:
  - 1. Set hydrants where shown on plans in accordance with Standard Detail Drawing.
  - 2. Install gravel, blocks and anchors in accordance with Standard Detail Drawing.
  - 3. Set reference elevation 3 inches above existing grade or to elevation established by ENGINEER (not to exceed 6 inches).
  - 4. Break-a-way flange to be either ground level where applicable or between 3 inches and 6 inches above curb as established by ENGINEER.

## 3.04 ACCEPTANCE TESTS FOR PRESSURE MAINS

- A. All testing must meet or exceed Texas Commission on Environmental Quality's current requirements.
- B. Perform hydrostatic pressure and leakage test.
  - 1. Conform to AWWA C600 procedures.
    - a. As modified herein.
    - b. Shall apply to all pipe materials specified
  - 2. Perform after backfilling.
- C. Test separately in segments between sectionalizing valves, between a sectionalizing valve and a test plug, or between test plugs.

- 1. CONTRACTOR to furnish and install test plugs, including all anchors, braces and other temporary or permanent devices to withstand hydrostatic pressure on plugs, at no additional cost to the OWNER.
- 2. CONTRACTOR responsible for any damage to public or private property caused by failure of plugs.
- D. Limit fill rate of line to available venting capacity. Fill rate shall be regulated to limit velocity in lines when flowing full to not more than 1 fps.
- E. OWNER will make water for testing available to contractor at nearest source. Valves of existing system will at all times be operated by City personnel only.
- F. Pressure test:
  - 1. Conduct at pressure at least 1.5 times than normal working pressure (not less than 150 psi test pressure).
  - 2. Maintain pressure for a minimum of two (2) hours.
  - 3. Test pressure shall not vary by more than +5 psi
- G. Leakage Test:
  - 1. Conduct concurrently with the pressure test.
  - 2. Maintain pressure for a minimum of two (2) hours.
  - 3. Acceptable when leakage does not exceed that determined by the following formula:
    - a. L = Maximum permissible leakage in gallons per hour.
    - b. N = Number of pipe joints in segment under test.
    - c. O = Nominal internal diameter of pipe being tested in inches.
    - d. P = Average actual leakage test pressure, psig.
  - 4. Repeat leakage test as necessary.
    - a. After location of leaks and repair or replacement of defective joints, pipe or fittings. Until satisfactory performance of test is at no increase in cost to the OWNER.
- H. Refit and replace all pipe not meeting the leakage or pressure requirements. Repair clamp is not permitted.
- I. Repair all visible leaks regardless of the amount of leakage.
- J. OWNER or ENGINEER will observe all tests.

# 3.05 DISINFECTION OF PIPELINES FOR CONVEYING POTABLE WATER

- A. CONTRACTOR provide all equipment and materials and perform in accordance with AWWA C601.
  - 1. As modified herein.
  - 2. Include chlorination and final flushing.
- B. Add chlorine to attain an initial concentration of 50 mg/l chlorine with 10 mg/l remaining after 24 hours.
- C. Flush main until concentration is 2 mg/l or less prior to placing main in service.
- D. Obtain approval of materials and methods proposed for use.
- E. May be conducted in conjunction with acceptance tests.
- F. Dispose of flushing water without damage to public or private property.
- G. Repeat disinfection procedure should initial treatment fail to yield satisfactory results.
  - 1. At no additional cost to the OWNER.
  - 2. OWNER will provide water under terms specified for acceptance tests.
- H. Do not exceed 500 gpm rate in flushing.
- I. Provide safe bacterial sample results before placing main into service.

## PART 4 - MEASUREMENT

## 4.01 WATER MAIN PIPE AND STEEL CASING.

A. Measured by the foot, of the various sizes and types specified. Water mains and casing will be measured along the axis of the pipe and no deductions will be made for valves or fittings. Reducers will be classed as pipe of the size of the larger end.

## 4.02 SPLIT STEEL CASING.

A. Measured by the foot, of the various sizes shown on the plans.

## 4.03 FIBERGLASS REINFORCED PLASTIC (FRP) PIPE FOR CASING.

A. Measured by the foot, of the various sizes shown on the plans.

## 4.04 JACKING, TUNNELING, BORING, OR AUGERING.

A. Jacking, Tunneling, Boring, or Augering for water mains and steel casing will be measured by the foot, of the sizes, types, and wall thickness (applicable only for casing) specified.

## 4.05 NEW COPPER SERVICE LINES.

- A. Measured by each service line installed.
- B. Short Side service line refers to service connections made to meters located on the same side of the street as the supply main is located. Long Side service line refers to service connections made to meters located on the opposite side of the street from the supply main, or from the center of the street, where the supply main is located in the center of the street.

## 4.06 GATE VALVES, TAPPING SLEEVES AND VALVES, AND BUTTERFLY VALVES.

A. Measured by each assembly installed, of the various sizes specified.

## 4.07 FIRE HYDRANTS.

- A. Measured by each assembly installed, including a 6-in. gate valve and box, regardless of depth. It is the Contractor's responsibility to install the fire hydrant assembly such that it meets the standard installation requirements of this specification and the manufacturer's specifications.
- B. Fire Hydrant Branches (Leads) are subsidiary to fire hydrant assembly.

## 4.08 METERS AND VAULTS.

A. Measured by each assembly constructed.

# 4.09 AIR RELEASE AND VACUUM RELIEF VALVES.

A. Measured by each assembly, of the various sizes, with the valve box installed.

# 4.10 PRESSURE REDUCING STATIONS.

A. Measured by the lump sum unit constructed.

# 4.11 BLOW OFF VALVES.

A. Measured by each assembly, of the various sizes and types, with the corporation stop, spool, spool piece, branch lead, and gate valve box installed.

# 4.12 REMOVING FIRE HYDRANTS.

A. Measured by each assembly removed and disposed of properly.

# 4.13 REMOVING WATER VALVES AND BOXES.

A. Measured by each assembly removed and disposed of properly.

# 4.14 REMOVING AND RELOCATING METERS AND BOXES.

A. Measured by each assembly removed, cleaned, and installed at the new location.

# 4.15 REMOVING METERS AND VAULTS.

A. Measured by each assembly removed and disposed of properly.

# 4.16 REMOVING AND SALVAGING WATER METERS.

A. Measured by each assembly removed and salvaged.

# 4.17 REMOVING AND SALVAGING FIRE HYDRANTS.

A. Measured by each assembly removed and salvaged.

# 4.18 REMOVING AND RELOCATING WATER METERS AND METER VAULTS.

A. Measured by each assembly removed and relocated.

## 4.19 ADJUSTING METER VAULTS.

A. Measured by each assembly adjusted.

## 4.20 ADJUSTING METER BOXES.

A. Measured by each assembly adjusted.

# 4.21 ADJUST OR RELOCATE WATER METER.

A. Measured by each assembly adjusted or relocated.

# 4.22 LOWERING WATER MAINS.

A. Measured by the foot, of the sizes and types of pipe lowered.

# 4.23 CUTTING AND PLUGGING WATER MAINS.

A. Measured by each location a water main is cut and plugged, of the sizes indicated.

## 4.24 REMOVING PRESSURE REDUCING STATIONS.

A. Measured by each complete pressure reducing station removed.

## 4.25 WET CONNECTIONS.

A. Measured by each connection, of the sizes specified.

## 4.26 EXTRA HAND EXCAVATION OR EXTRA MACHINE EXCAVATION.

A. Measured by the cubic yard in its original position. Excavation performed by manual labor at the locations specifically designated by the Engineer, and which is not included under or subsidiary to other bid items contained in this specification, is considered Extra Hand Excavation or Extra Machine Excavation.

## 4.27 ADJUSTING MANHOLES.

- A. Adjusted manholes will be measured as each manhole adjusted.
- B. Measured by the foot.

## 4.28 CUTTING AND CAPPING WATERLINE.

A. Measured by each waterline cut and capped of the sizes specified.

# PART 5 - PAYMENT

## 5.01 WORK

A. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit prices bid for the items of work described below. These prices are full compensation for excavation and backfill required for excavation protection; furnishing, placing, and removing shoring, sheeting or bracing; dewatering or diversion of water; jacking and jack removal, hauling, placing, and installing the materials; for inspecting and testing; and for other materials, labor, equipment, tools, and incidentals.

## 5.02 NEW

## 5.03 WATER MAIN PIPE AND STEEL CASING.

 Payment for water main pipe, and steel casing will be made at the unit prices bid for "Water Main Pipe (Cast-Iron)," "Water Main Pipe (Steel)," "Water Main Pipe (Ductile Iron)," "Water Main Pipe (Copper)," "Water Main Pipe (Polyvinyl Chloride)(PVC)," and "Casing (Steel)," of the various sizes and types specified, installed by the open-cut method. 2. Unless otherwise shown on the plans or specifications, fittings, excavating, disposing of unsuitable excavated material, backfilling, and the material for backfill, for the complete installation of the water main system, are subsidiary to this bid Item.

# B. Split Steel Casing.

1. Payment for split steel casing will be made at the unit price bid for "Split Steel Casing," of the various sizes specified, installed by the open cut method.

## C. Fiberglass Reinforced Plastic (FRP) Pipe for Casing.

1. Payment for Fiberglass Reinforced Plastic (FRP) Pipe for Casing will be made at the unit price bit for "Fiberglass Reinforced Plastic (FRP) Pipe for Casing" of the various sizes specified.

## D. Jacking, Tunneling, Boring, or Augering.

- 1. Payment for jacking, tunneling, boring, or augering water main will be made at the unit price bid for "Jacking, Tunneling, Boring, or Augering (Water Main)," of the sizes and types specified. This price includes furnishing the pipe.
- 2. Payment for jacking, tunneling, boring, or augering steel casing will be made at the unit price bid for "Jacking, Tunneling, Boring, or Augering Casing (Steel)," of the sizes, types, and wall thickness specified. This price includes the casing, casing spacers, labor, equipment, tools, and incidentals, and other materials required to place the watermain in and through the casing. Water mains placed in the casing will be paid for by the appropriate bid item.
- 3. Excavating, backfilling, backfill material, and disposing of unsuitable excavated material for jacking, tunneling, boring, or augering pits are subsidiary to these bid items.

## E. New Copper Service Lines.

 Payment for copper service lines will be made at the unit price bid for "Service Line (Short Side 5/8 in. to 1 in.)," "Service Line (Long Side 5/8 in. to 1 in.)," "Service Line (Short Side 1-1/2 in. to 2 in.)" and "Service Line (Long Side 1-1/2 in. to 2 in.)," installed. This price is full compensation for labor, materials, excavation, and backfill required to install the facility, including connection to the customer's service line.

## F. Gate Valves, Tapping Sleeves and Valves, and Butterfly Valves.

1. Payment for gate valves, tapping sleeves and valves, and butterfly valves will be made at the unit price bid for "Gate Valve," "Tapping Sleeve and Valve," and "Butterfly Valve," of the various sizes specified, with the valve box installed.

## G. Fire Hydrants.

- 1. Payment for fire hydrants will be made at the unit price bid for "Fire Hydrant Assembly," including 6 in. gate valve and box, installed regardless of barrel depth.
- 2. Fire hydrant branches (leads) are subsidiary to "Fire Hydrant Assembly" installed by the open-cut method.
- 3. Any adjustment required either in the flow line of the water main or to the barrel length of the fire hydrant is subsidiary to this bid Item.

## H. Meters and Vaults.

1. Payment for meters and vaults will be made at the unit price bid for "Meter and Vault" constructed.

## I. Air Release and Vacuum Relief Valves.

1. Payment for air release and vacuum relief valves will be made at the unit price bid for "Air Release and Vacuum Relief Valve," of the various sizes specified, with the valve box installed.

## J. Pressure Reducing Stations.

1. Payment for pressure reducing stations will be made at the unit price bid for "Pressure Reducing Station." This price is full compensation for performing the necessary excavation, backfill, finish grading, constructing the concrete structure, and furnishing and installing station appurtenances addressed under Article 2, "Materials," of this specification.

## K. Blow Off Valves.

1. Payment for blow off valves with boxes will be made at the unit price bid for "Blow Off Valve" of the various sizes and types specified, with corporation stop, spool, piece, branch lead, gate and gate valve box installed are subsidiary to this bid item.

## L. Removing Fire Hydrants.

1. Payment for removing fire hydrants will be made at the unit price bid for "Removing Fire Hydrant." This price includes removing valves from the existing location, disposing of the valves, and plugging at the tee. Excavation and backfill required for removing fire hydrants are subsidiary to this bid Item.

## M. Removing Water Valves and Boxes.

1. Payment for removing water valves and boxes will be made at the unit price bid for "Removing Water Valve and Box." Excavation and backfill required for removing water valves and boxes are subsidiary to this bid Item.

## N. Removing and Relocating Meters and Boxes.

1. Payment for removing and relocating meters and boxes will be made at the unit price bid for "Removing and Relocating Meter and Box."

## O. Removing Meters and Vaults.

1. Payment for removing meters and vaults will be made at the unit price bid for "Removing Meter and Vault." This includes salvaging the meter strainers and valves and delivering them to their owner at the location shown on the plans or as directed.

## P. Removing and Salvaging Water Meters.

1. Payment for removing and salvaging water meters will be made at the unit price bid for "Removing and Salvaging Water Meter." This price includes removing salvaged water meters from the existing locations and delivering them to the owner. Excavation, backfill, and finish grading required for removing the water meters are subsidiary to this bid Item.

## Q. Removing and Salvaging Fire Hydrants.

- 1. Payment for removing and salvaging fire hydrants will be made at the unit price bid for "Removing and Salvaging Fire Hydrant." The salvaging of fire hydrants will be a cash reimbursement to the owner by the Contractor where the fire hydrants will become the property of the Contractor or the Contractor will deliver the fire hydrants to the Utility Owner at the location shown on the plans. Excavation, backfill, and finish grading required for removing fire hydrants are subsidiary to this bid Item.
- R. **Removing and Relocating Water Meters and Meter Vaults.** Payment for removing and relocating water meters and meter vaults will be made at the unit price for "Removing and Relocating Water Meter and Meter Vault."
  - 1. Payment for removing and relocating water meters and meter vaults will be made at the unit price for "Removing and Relocating Water Meter and Meter Vault."
- S. **Adjusting Meter Vaults.** Payment for adjusting meter vaults will be made at the unit price bid for "Adjusting Meter Vault." This price is full compensation for furnishing the required materials, including backfill as required, excavation, tools, labor, equipment, and incidentals.
  - 1. Payment for adjusting meter vaults will be made at the unit price bid for "Adjusting Meter Vault." This price is full compensation for furnishing the required materials, including backfill as required, excavation, tools, labor, equipment, and incidentals.

## T. Adjusting Meter Boxes.

1. Payment for adjusting meter boxes will be made at the unit price for "Adjusting Meter Box."

## U. Adjust or Relocate Water Meter.

 Payment for adjusting or relocating water meters will be made at the unit price for "Adjusting or Relocating Water Meters." This price is full compensation for adjusting or relocating water meters. Miscellaneous fittings required to complete the work will not be paid for directly, but will be subsidiary to this Item unless otherwise shown on the plans. Water line sterilization and testing of the completed water main system is considered subsidiary to this Item.

## V. Lowering Water Mains.

1. Payment for lowering water mains will be made at the unit price bid for "Lowering Water Mains," of the sizes and types of pipe lowered. This price is full compensation for lowering and adjusting pipes, as well as any connected valves, boxes, and service lines. Excavation and backfill required for lowering water mains are subsidiary to this bid Item.

## W. Cutting and Plugging Water Mains.

1. Payment for cutting and plugging water mains will be made at the unit price bid for "Cut and Plug Water Main," of the sizes indicated. This price is full compensation for performing excavation, backfill, finish grading, and other incidental items required to abandon or cut and plug the water main as set forth this specification. Where grout is required, as shown on the plans, it is subsidiary to this bid Item.

## X. Removing Pressure Reducing Stations.

1. Payment for removing pressure reducing stations will be made at the unit price bid for "Removing Pressure Reducing Station." This price is full compensation for performing the necessary excavation, backfill, finish grading, pipe removal, structure removal, and for tools, equipment, and incidentals.

## Y. Wet Connections.

1. Payment for wet connections will be made at the unit price bid for "Wet Connections," of the sizes specified. This price is full compensation for demolition, hauling, fittings, disposal, removal of appurtenances, excavation and backfill, equipment, labor, tools and incidentals.

## Z. Extra Hand Excavation or Extra Machine Excavation.

1. Payment for extra hand excavation or extra machine excavation will be made at the unit price bid for "Extra Hand Excavation" or "Extra Machine Excavation." This price is full compensation for labor, hand tools, machines, dewatering, and handling and properly disposing of any excess excavated material not suitable for bedding or backfill for this project.

# AA. Adjusting Manholes.

- 1. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Water Main (Adj Exist Manhole)." This price is full compensation for replacement of Air Release / Vacuum Release Valve and installation of the Standard Bollards as shown on the plans; for materials including backfill as required, and for excavation, tools, equipment, labor, and incidentals.
- 2. Trench excavation protection or temporary special shoring for trenches greater than 5 ft. in depth, or sloping the sides of these trenches to preclude collapse, will be measured and paid for as required by Item 402, "Trench Excavation Protection," or Item 403, "Temporary Special Shoring."
- 3. Furnishing and placing bedding material is subsidiary to the various bid items.
- 4. Providing fittings, including necessary concrete thrust blocking, pipe clamps, nipples, pipe coatings, and lubricants, etc. is subsidiary to the water mains in which they are installed.
- 5. In addition, providing fittings required due to plan changes or alterations in line and grade, is subsidiary to the water mains in which they are installed.
- 6. Furnishing and installing taps, risers, jumpers, blind flanges, cast-iron sleeves, plugs, reducers etc., as required to disinfect and pressure test the new mains is subsidiary to the various bid items. In addition, necessary excavation and backfill, site grading, and maintenance until completion of pressure testing are subsidiary to the various bid items.
- 7. Unless otherwise shown on the plans, the work performed and materials furnished to support the pipes or conduits of public utilities are subsidiary to the various bid items.
- 8. Furnishing and installing the nonmetallic pipe detection system, as well as the labor and materials necessary for the system, is subsidiary to the various bid items. In addition, ensure that the detection system is complete, operational, and satisfactory to the Utility Owner.
- 9. Adjusting valve boxes is subsidiary to the various bid items.

## BB. Removal of Asbestos Cement Pipes.

1. The work performed in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for the Removal of Asbestos Cement Pipe. This price is full compensation for demolition plan preparation, loading, hauling, disposal, stockpiling, removal of appurtenances, excavation and backfill, equipment, labor, tools, and incidentals. All removed material is to be disposed of properly, in accordance with Federal, State, and local regulations.

## CC. Cutting and Capping Waterline.

1. Payment for Cutting and Capping waterlines will be made at the unit prices bid for "cutting and capping waterline" of the various sizes specified. This price is full compensation for demolition plan preparation, loading, hauling, disposal, stockpiling, removal of appurtenances, excavation and backfill, equipment, fittings, thrust blocks, tools, and incidentals.

## **END OF SECTION**

#### SECTION 331120 WATER VALVES

#### PART 1 - GENERAL

#### 1.01 GENERAL DESCRIPTION OF WORK

- A. This work shall consist of furnishing and installing valves as indicted on the plans or as directed by the ENGINEER in accordance with these specifications.
- B. Unless otherwise noted, all valves 4 inches and larger shall be AWWA-type valves of suitable design and fully equipped for service buried in the earth, without need for further modification and shall be wrapped with 8 mail polyethylene film with all edges and laps securely taped to provide a continuous wrap.
- C. Valve ends on Valves 4 inches and larger shall be flanged or mechanical joint. All mechanical joints shall conform to AWWA Specification C111. Flanges shall be dimensioned, faced, and drilled to the 125 pound "American Standard".
- D. Valves shall be carefully installed in their respective positions, accessible for operation and repair. Unless shown on the plans otherwise, valves shall be of the same sizes as the pipelines in which they are installed. Stems shall be installed pointing straight upward. The operating nuts of all valves or valve stem extensions shall be no deeper than 18 inches below the top of the valve box cover. Valves shall be left in satisfactory operating condition, free from all distortion and strain.
- E. All valve operators shall turn in a counterclockwise direction to open the valve.

#### 1.02 SUBMITTALS:

- A. Conform to requirements of Section 013300.
- B. Manufacturer's Literature: Manufacturer's descriptive literature and recommended method of installation.
- C. Certificates: Manufacturer's certification that products meet specification requirements.

## PART 2 - PRODUCTS

## 2.01 VALVE TYPES

- A. Gate Valves
  - 1. Gate valves shall only be used for pipe sizes of 12 inches and smaller, unless otherwise noted on the plans.
  - 2. Resilient seat gate valve shall be used and shall conform to AWWA C509. The gate valve shall be a non-rising stem type with inside screw and "O" ring seals. The valve shall have a standard hub equipped with a square operating nut. The body-to-bonnet and bonnet-to-bonnet cover shall use "O' rings as seals.
  - 3. The resilient seat shall be mechanically retained or bonded on the valve gate (wedge disc).
  - 4. The gate valve shall have protective coating inside and outside of fusion bonded epoxy approved for potable water.
  - 5. The valve stem shall comply with AWWA C509. The material for the valve stem shall be brass or bronze, and shall have minimum yield strength of 20,000 psi and minimum tensile strength of 60,000 psi. The valve stem shall be compatible and interchangeable with the equivalent sized double disc gate valve models.
  - 6. Gate valves shall have a 2 inch square operating hub nut.
  - 7. The number of turns to open the valve shall be the same or less than the equivalent sized double disc gate valve models. Maximum input torque to open and/or close the valve shall be 200 foot pounds for a 4 inch valve and 300 foot pound for a 6 inch under a working pressure of 200 psi.
  - 8. Gate valves shall be American Darling, Metroseal by U.S. Pipe, Mueller, or approved equal.
  - 9. Gate Valves 14 Inches and Larger in Diameter. AWWA C500; parallel seat double disc, or AWWA C515; reduced-wall, resilient-seated gate valves; flanged ends and nut-

operated unless otherwise specified. Provide reduced-wall resilient-seated valves with 250 psig pressure rating and manufactured by American Flow Control Series 2500, or approved equal. Provide double disc valves with 150 psig pressure rating and manufactured by American Darling 52, Clow F-6102, or approved equal. Comply with following requirements unless otherwise shown on the plans.

- B. Rubber seated Butterfly Valves
  - 1. Butterfly valves will be used in lieu of gate valves for sizes of 14 inches and larger, the butterfly valve shall be of the rubber-seated tight closing type conforming to AWWA C504.
  - 2. The valve body shall be cast iron having integral hubs for the housing shaft bearings and seals. The body ends shall be flanged per AWWA C504 with the flanges designed for installation between Class 125 cast iron flanges or mechanical joint meeting the requirements of AWWA C111/A21.11.
  - 3. The butterfly valve disc shall be cast iron.
  - 4. The seat shall be resilient new natural or synthetic rubber and shall be mechanically retained on the disc edge by means of 18-8 stainless steel bolts. Seat must also be capable of being replaced in the field without chipping, grinding, or burning out of the old seat or retaining substance. The body seat mating surface shall be 18-8 stainless steel, type 304 mechanically retained.
  - 5. Valve shafts shall be 18-8 stainless steel, type 304 and shall be securely attached to the disc by means of bolts, dowel pins, or taper pins.
  - 6. All butterfly valves shall be side operated. Valve actuator shall be integrally mounted on the valve mounting flange and shall be of the self locking traveling nut type in complete accordance with AWWA C504 requirements. Actuators shall be furnished with a standard 2 inch operating nut and must be designed to permit the adjustment of the valve disc seating without the removal of the housing cover.
  - 7. All butterfly valves shall be tested per AWWA C504
- C. Valve Stem Extensions
  - 1. Extension stems shall be provided as necessary to situate the operating nut no greater than 18 inches below the valve cover.
  - 2. Extension stems shall be equipped with stem guides affixed to the valve box at intervals not to exceed ten feet.
  - 3. Stem guides shall be considered a part of the extension. Extension stems and stem guides shall be manufactured items or approved equal.
- D. Air and Vacuum Valves
  - 1. Air and vacuum valves shall be of the type that automatically exhaust large quantities of air during the filling of a pipeline and allow air to re-enter enduring draining or when a negative pressure occurs.
  - 2. The inlet and outlet of the valve shall have the same cross-sectional area. The floats shall be guided by a stainless steel guide shaft and seat against a synthetic seat.
  - 3. Valves shall have NPT inlets and outlets.
  - 4. All air and vacuum valves shall be constructed of cast iron with stainless steel trim and buna-n seating. Valves shall be as manufactured by Val-Matic Valve & Mfg. Corp., Series 100.
- E. Fire Hydrants
  - 1. Fire hydrants and their extensions shall be in accordance withAWWA C502, traffic type. The hydrants provided shall be from the same manufacturer throughout the project. The hydrants currently approved are as follows:
    - a. Mueller Company Super Centurion 250 5-1/4 in. A423
    - b. American Darling Model B-84-B
  - 2. Fire hydrants shall have one 5 1/4 inch diameter valve opening; 6 inch mechanical joint of slip on inlet connection; two 2 1/2 inch hose nozzle connections; and one 4 1/2 inch steamer nozzle with National Standard Fire Hose Coupling Screw Threads or as specified by the OWNER.
  - 3. Fire hydrants shall have a bronze or cast iron, pentagon, operating nut, be designed for 150 psi., working pressure service, and have a normal bury of 4 to 4 1/2 feet unless field

conditions require a deeper bury, in which case extensions will be used so as to bring the bottom of the break-off flange 2 to 8 inches above the top of finish grade.

- 4. The pipe fittings and fire hydrants starting at the street main and ending at the fire hydrant itself shall be lying in a line perpendicular to the street's centerline or radially on a curvilinear installation.
- 5. Fire hydrants shall be installed in as near a vertical position as possible and shall have no more than 1/2 inch variation from a vertical line between the breakaway flange and the top of the fire hydrant.
- 6. Hydrants shall be dry barrel, post-type with compression main valve closing with pressure. They shall have a field lubrication capability, be tamper resistant, and of collision-safety construction design. Hydrants shall have a bronze seat ring threaded into a bronze drain ring or bronze or cast iron bushing.
- 7. Hydrant interior and exterior below the ground line shall be coated with asphalt varnish, and the exterior painted from the top to a point one foot below the ground level flange, consisting of one coat rust inhibitive primer.
- 8. The bottom plate of the main valve shall be epoxy coated. The shoe of the fire hydrant shall have a 6-inch mechanical joint connection. The inside shall be epoxy coated to prevent corrosion.
- 9. The nozzle shall be threaded in place and retained by stainless steel locks.
- 10. Hydrant body shall be threaded to receive the threaded nozzle. Nozzle shall be secured by a stainless steel locking device.
- 11. Fire hydrant shall contain two drain outlets. The drain outlets shall be constructed of bronze. Hydrant shall be provided with a pentagon operating nut to open counter clockwise and shall have an anti-friction washer between the hold-down nut and the operating nut.
- 12. Fire hydrant shall be installed at locations as shown on construction plans and in accordance with Standard Detail Drawings.
- 13. No project will be accepted by the OWNER until all hydrants are operational, and accessible.
- 14. Hydrants shall be limited the following unless prior written approval is provided by the ENGINEER:
  - a. Mueller Centurion A-423
  - b. American Darling B-84-B
  - c. Kennedy Guardian K-81A
  - d. U.S. Pipe Metropolitan 250
- F. Valve Boxes
  - 1. Valve boxes, rings and covers shall be the type, size and materials shown in Standard Detail drawings.
  - 2. No valve box shall be paved over without the permission of the ENGINEER. Paving material shall not remain on valve box covers overnight.
  - 3. Valve boxes shall be fabricated using 6 inch cast-iron sliding type pipe shaft with cover and base casting.
  - 4. Drop covers for vale boxes shall be marked "water" using lettering casted in the cover by the manufacturer.
  - 5. Top of valve box shall be set at finished grade unless otherwise noted.
- G. Water Valve Data Card shall be prepared for all types of valves (Gate Valves, Butterfly Valves, Air Release Valves, etc) according to the following instructions:

# END OF SECTION