NEW MEXICO

# Abandoned Mine Lands

Appendix C: Technical Specifications
for Construction of

MADRID STORMWATER AND EROSION CONTROL

Village of Madrid, New Mexico

PROJECT NO.

EMNRD-MMD-2025-02

AUTHORIZED BY:

ABANDONED MINE LAND PROGRAM
MINING and MINERALS DIVISION

STATE OF NEW MEXICO, ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

APRIL 2025

Prepared By: WESTON SOLUTIONS and RIVERBEND ENGINEERING, LLC

# TABLE OF CONTENTS

**PROJECT SPECIFICATIONS**

**Project Specifications**
Madrid Stormwater
And Erosion Control Project
**Village of Madrid, Santa Fe County, New Mexico**

**ENGINEER'S CERTIFICATE**

I, *Robert* G. *Ederer, P.E.,* hereby certify that I am a professional engineer licensed in the State of New Mexico and qualified in civil engineering; that the accompanying Project Specifications were prepared under my supervision; and that the accompanying Project Specifications are true and correct to the best of my knowledge and belief.

License Number 12467

Robert G. Ederer, P.E.

Date :

# SECTION 01 11 00
# SUMMARY OF WORK

## PART 1 GENERAL

### 1.1 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

### 1.2 WORK COVERED BY CONTRACT DOCUMENTS

#### 1.2.1 Project Description

The work, being completed for New Mexico Abandoned Mine Land Program (AMLP), includes arroyo improvement and restoration and improvement of stormwater drainage and erosion control including: regrading of roads; surfacing of roads; excavation of channels; installation of channel armoring, curb and gutter, drop inlets, culverts; construction of a detention pond and outlet structure, stormwater interceptor channels on upslope areas, boulder retaining walls; and incidental related work.

#### 1.2.2 Location

The work is located in the Village of Madrid, NM.

### 1.3 AVOIDANCE AREAS FOR PRESERVATION OF CULTURAL AND BIOLOGICAL RESOURCES

The Contractor shall avoid designated cultural and biological resources. The Contractor shall avoid any activities outside of the designated areas of disturbance. Additionally, existing mine features shall not be removed or damaged as a result of the work. Access routes and methods to construction areas shall be coordinated with the AMLP Project Manager prior to mobilizing to targeted mine features. No construction disturbances (including excavation, fill and stockpiling of construction materials) or moving of artifacts shall take place unless directly specified in design documents. Avoidance zones within the designated disturbance area shall extend to five meters (16.4 feet) from the existing mine features structures, except where construction is indicated within this zone in which case the disturbance within the avoidance zone shall be minimized as practicable. The AMLP Project Manager or may designate special avoidance areas.

Wherever the Contractor is working with equipment near designated avoidance features and avoidance areas and wherever construction access routes pass next to these features, the Contractor shall place four-foot high, temporary, high-visibility barrier fencing (Hi-Vis, ADPI, or equivalent) around the features. The Contractor shall provide a submittal for the barrier fencing to be used prior to installation. Barrier fencing shall be removed upon completion of work. An exception to this requirement may be during performing rock clearing from in front of mine entrances and clearing pedestrian approaches.

The Contractor shall bear all direct, indirect, and consequential costs of repairs due to unauthorized damage caused by the Contractor’s operations to cultural and biological resources to be avoided. These costs shall include but are not limited to fees and charges of engineers, attorneys, and other professionals, made necessary thereby.

The Contractor shall cooperate fully to preserve archaeological and historic artifacts and any threatened or endangered species found within the project area. If the Contractor encounters a previously un-inventoried archaeological site, historic site, or species listed as or proposed to be listed as threatened or endangered, the Contractor shall terminate all further operation in that immediate area until the archaeological or biological preservation agencies have had the opportunity to survey the site. This termination shall not preclude continuation of work in other areas, nor shall it entitle the Contractor to additional payment in any form, other than an extension of time, unless the Contractor is substantially precluded from working on the entire project.

If construction occurs within the migratory bird nesting season (February 15 to September 15), a preconstruction migratory bird survey will be required. If needed, the New Mexico Energy, Minerals and Natural Resources Department (EMNRD) – Abandoned Mine Land Program (AMLP) will contract an outside consulting firm to perform the bird survey within 10 days of the start of construction. The Contractor shall contact the AMLP Project Manager at least one month prior to commencement of construction to coordinate this survey or three weeks prior to Notice to Proceed. Failure by the Contractor to timely coordinate a preconstruction migratory bird survey may impact the Contractor's schedule and no additional time or compensation will be granted.

Following receipt of NTP, the Contractor shall be responsible for maintaining nest free conditions in construction-impacted areas. The Contractor shall comply with the requirements of the Migratory Bird Treaty Act (MBTA), the United States Fish and Wildlife Service (USFWS) and shall not cause harm or harassment to migratory birds. If occupied nests are found, the AMLP will coordinate with the New Mexico Game and Fish Department and USFWS to determine the appropriate exclusion buffer. This exclusion buffer will remain until after the juvenile birds have fledged (flown from the nest).

## 1.4 LOCATION OF UNDERGROUND UTILITIES

Contractor shall locate utility lines utilizing the New Mexico one call system in all work areas prior to beginning excavation (https://www.nm811.org/) prior to start of excavation and comply with installation requirements for locating and marking underground utilities. The Contractor is responsible for the location and protection of all unmapped utilities in the project area, **which may require additional location services, the cost of which shall be borne by the Contractor.**

In performing utility line locations, Contractor shall have underground utilities in work areas located by the affected utility company.

### 1.4.1 Utility Location

Locations, sizes, depths, clearances, and identification of utility lines and pipes shown on the Plans are approximate, not all inclusive, and subject to change. It is Contractor's responsibility to determine locations, sizes, depths, clearances, and identify all utility lines in the work area where intrusive work will occur. No excavation work of any kind shall be performed until all utility lines in the work area have been field verified by exploratory excavation ("pot holing")

### 1.4.1 Notification Prior to Excavation

Notify the Engineer at least 48 hours prior to starting excavation work.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

# SECTION 01 14 00
# WORK RESTRICTIONS

## PART 1 GENERAL

### 1.1 CONTRACTOR ACCESS AND USE OF PREMISES

#### 1.1.1 Activity Regulations

Ensure that Contractor personnel employed become familiar with and obey regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. Wear appropriate personal protective equipment (PPE) in designated areas. Do not enter restricted areas unless required to do so and until cleared for such entry. Ensure all Contractor equipment, include delivery vehicles, are clearly identified with their company name.

##### 1.1.1.1 Subcontractors and Personnel Contacts

Provide a list of contact personnel of the Contractor and subcontractors including physical addresses, email addresses, and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

##### 1.1.1.2 No Smoking Policy

Smoking, include vaping and use of non-tobacco smoked products, is prohibited on Site property except in designated smoking areas. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The AMLP Project Manager will identify designated smoking areas.

#### 1.1.2 Working Hours

Regular working hours will consist of a 10-hour period, between 7 a.m. and 5 p.m. Monday through Friday unless approved by the AMLP Project Manager in advance.

No work will be allowed during the following holidays or events:

- New Years Day
- Martin Luther King Day
- Memorial Day
- Independence Day
- Labor Day
- Indigenous Peoples Day
- Veterans Day
- Thanksgiving Day
- Friday After Thanksgiving
- Presidents Day
- No work between December 22, 2024 and January 2, 2025
- No work between December 21, 2025 and January 1, 2026.
- Balloon Fiesta Week - 2025 October 4$^{th}$ through 12$^{th}$ , 2025 and October 3$^{rd}$ through 11$^{th}$ , 2026
- 1$^{st}$ to 2$^{nd}$ Saturday of December.

1.1.3 Work Outside Regular Hours

Work outside regular working hours requires 7 days advance notice and AMLP approval. Make a request 5 calendar days prior to such work to allow arrangements to be made by the Engineer for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. During periods of darkness, the different parts of the work must be lighted in a manner approved by the AMLP.

1.2 AGENCY ACCESS AND USE OF PREMISES

1.2.1 New Mexico Energy, Minerals and Natural Resources Department – Abandoned Mine Land Program

The work described here-in has been approved by the New Mexico Energy, Minerals and Natural Resources Department (EMNRD) – Abandoned Mine Land Program (AMLP). The Contractor shall allow safe access by their personnel to inspect the work. The Engineer will notify the AMLP of inspections indicated in these specifications.

1.2.2 Other Government Agencies

The Contractor will notify the Engineer and AMLP of required inspections by New Mexico CID.

The NMDOT may inspect work done within the right-of-way on Highway NM-14. The Engineer or AMLP will notify the Contractor in advance.

The County of Santa Fe may inspect work done within their jurisdiction such as Madrid Arroyo or Cave Road. The Engineer or AMLP will notify the Contractor in advance.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

# SECTION 01 30 00
# ADMINISTRATIVE REQUIREMENTS

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

(2014) Safety and Health Requirements Manual EM 385-1-1
(Available at https://www.usace.army.mil/Missions/Safety-and-Occupational-Health/Safety-and-Health-Requirements-Manual/)

### 1.2 SUBMITTALS

Engineer approval is required for submittals with an "E" classification. Submittals not having an "E" classification are for information only. Submit all materials in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

### 1.3 MINIMUM INSURANCE REQUIREMENTS

Provide the minimum insurance coverage required by the STATE OF NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT CONSTRUCTION SERVICES CONTRACT (Contract) during the entire period of performance under this contract. Provide other insurance coverage as required by State law.

### 1.4 SUPERVISION

#### 1.4.1 Superintendent Qualifications

Provide Project Superintendent with a minimum of 10 years of experience in construction with at least 5 of those years as a superintendent on projects similar in size and complexity. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification and safety compliance. The individual must be capable of interpreting a critical path schedule and construction plans. The qualification requirements for the alternate superintendent are the same as for the Project Superintendent.

#### 1.4.2 Minimum Communication Requirements

Have at least one qualified superintendent, or competent alternate, capable of reading, writing, and conversing fluently in the English language, on the job-site at all times during the performance of Contract work. In addition, if a Quality Control (QC) representative is required on the Contract, then that individual must also have fluent English communication skills.

1.4.3 Duties

The Project Superintendent is primarily responsible for managing subcontractors and coordinating day-to-day production and schedule adherence on the project. The superintendent is required to attend progress meetings, and quality control meetings. The superintendent or qualified alternative must be on-site at all times during the performance of this contract until the work is completed and accepted.

1.4.4 Non-Compliance Actions

The Project Superintendent and all workers under their supervision are subject to removal by the AMLP for non-compliance with requirements specified in the contract and for failure to manage the project to ensure timely completion. Furthermore, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders is acceptable as the subject of claim for extension of time for excess costs or damages by the Contractor.

1.5 PRECONSTRUCTION MEETING

Prior to commencing work at the site, the AMLP Project Manager will select a time and place to meet for the Preconstruction Meeting. The meeting will take place within 30 calendar days after award of the contract, but prior to commencement of work at the site. The purpose of this meeting is to discuss and develop a mutual understanding of the administrative requirements of the Contract including but not limited to: daily reporting, invoicing, value engineering, safety, property-access, outage requests, hot work permits, schedule requirements, quality control, schedule of prices or earned value report, shop drawings, submittals, prosecution of the work, Engineer acceptance, final inspections and contract close-out. Contractor must present and discuss their basic approach to scheduling the construction work and required phasing.

1.5.1 Attendees

Contractor attendees must include the AMLP Project Manager, Design Engineer, Superintendent, Foremen, Site Safety and Health Officer, Quality Control Manager and major subcontractors as appropriate.

1.6 MOBILIZATION

Contractor shall mobilize to the jobsite within 30 calendar days after contract award. Mobilize is defined as having equipment AND having a physical presence of at least one person from the contractor's team on the jobsite.

PART 2 PRODUCTS

This project is subject to the federal requirements of “Buy America”. The contractor is required to provide materials that comply with 23 CFR (Code of Federal Regulations Part 635, including the Build America, Buy America Act). See https://www.ecfr.gov/current/title-23/chapter-I/subchapter-G/part-635/subpart-D/section-635.410

## PART 3 EXECUTION

Not Used

-- End of Section –

# SECTION 01 33 00
# SUBMITTAL PROCEDURES

## PART 1 GENERAL

### 1.1 DEFINITIONS

#### 1.1.1 Submittal Descriptions (SD)

Submittal requirements are specified in the technical sections. Examples and descriptions of submittals identified by the Submittal Description (SD) numbers and titles follow:

SD-01 Preconstruction Submittals

Preconstruction Submittals include schedules and a tabular list of locations, features, and other pertinent information regarding products, materials, equipment, or components to be used in the work.

Certificates Of Insurance
Surety Bonds
List Of Proposed Subcontractors
List Of Proposed Products
List of Proposed Equipment
Material Technical Data
Confirmation of Equipment Washing
Baseline Schedule
Completed Submittal Register
Schedule Of Prices or Earned Value Report
Material Technical Data
Work Plan
Quality Control (QC) plan
Environmental Protection Plan
Health and Safety Plan
Fire Prevention Plan

SD-02 Shop Drawings

Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards ensuring work can be judged. Includes assemblies or portions of assemblies that are to be incorporated into the project and those that will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. Unless specified in another section, testing must have been within three years of date of contract award for the project.

Report that includes findings of a test required to be performed on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report that includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports
Daily logs and checklists
Final acceptance test and operational test procedure

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that the product, system, or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor. The document purpose is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods, or personnel qualifications.

Confined space entry permits
Text of posted operating instructions

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, hazards, and safety precautions.

SD-10 Operation and Maintenance Data

Data provided by the manufacturer, or the system provider, including manufacturer’s help and product line documentation, necessary to maintain and install equipment, for operating and maintenance use by facility personnel.

Data required by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

Data incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism. See Section 01 78 00 CLOSEOUT SUBMITTALS.

Submittals required for third party certification.

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

1.1.2 Approving Authority

Office or designated person authorized to approve the submittal.

1.1.3 Work

As used in this section, on-site and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction. In exception, excludes work to produce SD-01 submittals.

1.2 SUBMITTALS

Engineer approval is required for submittals with an “E” classification. Submittals not having an “E” classification are for information only. When used, a code following the “E” classification identifies the office that will review the submittal for the Engineer. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES. Please use the submittal register provided on the following page:

| WESTON SOLUTIONS | SUBMITTAL REGISTER | | | | | LOCATION: Village of Madrid, New Mexico | | | | | | | PROJECT #: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PROJECT: Madrid Stormwater and Erosion Control Project | | | | | CONTRACTOR: | | | | | | | |
| NO. | Specification | Description | Classification (E, Information Only) | Supplier/Mfgr | | RECEIVED | RETURNED | RECEIVED | RETURNED | RECEIVED | RETURNED | STATUS | Notes |
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## 1.3 SUBMITTAL CLASSIFICATION

### 1.3.1 Engineer Approved (E)

Within the terms of the Contract, submittals are considered to be "shop drawings."

### 1.3.2 For Information Only

Submittals not requiring Engineer approval will be for information only. Within the terms of the Contract, they are not considered to be "shop drawings."

## 1.4 PREPARATION

### 1.4.1 Transmittal Form

Use a formal transmittal form for submittals. Properly complete this form by filling out the heading blank spaces and identifying each item submitted. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract plans pertinent to the data submitted for each item.

### 1.4.2 SUBMITTAL FORMAT

#### 1.4.2.1 Format of SD-01 Preconstruction Submittals

When the submittal includes a document that is to be used in the project, or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

#### 1.4.2.2 Format for SD-02 Shop Drawings

Provide shop drawings not less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full-size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless another form is required. Ensure drawings are suitable for reproduction and of a quality to produce clear, distinct lines and letters, with dark lines on a white background.

a. Include the nameplate data, size, and capacity on drawings. Also include applicable federal, military, industry, and technical society publication references.

b. Dimension drawings, except diagrams and schematic drawings. Prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

##### 1.4.2.2.1 Drawing Identification

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph IDENTIFYING SUBMITTALS.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location next to the title block. Place the contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space, no smaller than two inches on the right-hand side of each sheet for the Engineer disposition stamp.

1.4.2.3 Format of SD-03 Product Data

Present product data submittals for each section. Include a table of contents, listing the page and catalog item numbers for product data.

Indicate, by prominent notation, each product that is being submitted; indicate the specification section number and paragraph number to which it pertains.

1.4.2.3.1 Product Information

Supplement product data with material prepared for the project to satisfy the submittal requirements where product data does not exist. Identify this material as developed specifically for the project, with information and format as required for submission of SD-07 Certificates.

Provide product data in units used in the Contract documents. Where product data are included in preprinted catalogs with another unit, submit the dimensions in contract document units, on a separate sheet.

1.4.2.3.2 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), or American Association of State Highway and Transportation (AASHTO) submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Engineer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.4.2.3.3 Data Submission

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal that is marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of the construction effort.

Submit the manufacturer's instructions before installation.

1.4.2.4 Format of SD-04 Samples

1.4.2.4.1 Sample Characteristics

Furnish samples in the following sizes, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:

a. Sample of Equipment or Device: Full size.

b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.

c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.

d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

e. Sample Volume of Nonsolid Materials: Pint. Examples of nonsolid materials are sand and paint.

f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

g. Sample Panel: 4 by 4 feet.

h. Sample Installation: 100 square feet.

1.4.2.4.2 Sample Incorporation

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at the time of use.

Recording of Sample Installation: Note and preserve the notation of area constituting a sample installation but remove the notation at the final clean-up of the project.

1.4.2.4.3 Comparison Sample

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.4.2.5 Format of SD-05 Design Data

Provide design data and certificates on 8 1/2 by 11-inch paper.

1.4.2.6 Format of SD-06 Test Reports

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains. All tests will be performed by an appropriately accredited lab approved by the Engineer.

1.4.2.7 Format of SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11-inch paper.

1.4.2.8 Format of SD-08 Manufacturer's Instructions

Present manufacturer's instructions submittals for each section. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry, and technical-society publication references. If supplemental information is needed to clarify the manufacturer's data, submit it as specified for SD-07 Certificates.

Submit the manufacturer's instructions before installation.

1.4.2.8.1 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), American Association of State Highway and Transportation (AASHTO), or Underwriters Laboratories (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Design Engineer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.4.2.9 Format of SD-09 Manufacturer's Field Reports

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

1.4.2.10 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in each Section.

1.4.2.11 Format of SD-11 Closeout Submittals

When the submittal includes a document that is to be used in the project or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

1.4.3 Source Drawings for Shop Drawings

1.4.3.1 Source Drawings

The entire set of source drawing files (DWG) will not be provided to the Contractor. Request the specific Drawing Number for the preparation of shop drawings. Those drawings requested to prepare shop drawings will be provided. These drawings are provided only after award.

1.4.3.2 Terms and Conditions

Data contained on these digital files must not be used for purposes other than as a convenience in the preparation of construction data for the referenced project. Other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Design Engineer or AMLP. The Contractor must make no claim and waives to the fullest extent permitted by law any claim or cause of action of nature against the AMLP or Design Engineer, its agents, or its subconsultants that may arise out of or in connection with the use of these digital files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the AMLP and Design Engineer harmless against damages, liabilities, or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these digital files.

These digital source drawing files are not construction documents. Differences may exist between the source drawing files and the corresponding construction documents. The Design Engineer makes no representation regarding the accuracy or completeness of the digital source drawing files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. The Contractor is responsible for determining if conflicts exist. In the event that a conflict arises between the signed and sealed construction documents prepared by the Design Engineer and the furnished source drawing files, the signed and sealed construction documents govern. Use of these source drawing files does not relieve the Contractor of the duty to fully comply with the contract documents, including and without limitation the need to check, confirm and coordinate the work of contractors for the project. If the Contractor uses, duplicates or modifies these digital source drawing files for use in producing construction data related to this contract, remove previous indication of ownership (seals, logos, signatures, initials and dates).

1.5 QUANTITY OF SUBMITTALS

1.5.1 Number of SD-01 Preconstruction Submittal Copies

Unless otherwise specified, submit two sets of administrative submittals in digital format.

1.5.2 Number of SD-04 Samples

a. Submit two samples, or two sets of samples showing the range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in the technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of nonsolid materials.

1.6 INFORMATION ONLY SUBMITTALS

Submittals without an "E" designation must be certified by the Contractor's QC manager and submitted to the Design Engineer for information-only. Approval of the Design Engineer is not required on information only submittals. The Design Engineer will mark "receipt acknowledged" on submittals for information and will return only the transmittal cover sheet to the Contractor. Normally, submittals for

information only will not be returned. However, the Design Engineer reserves the right to return unsatisfactory submittals and requires the Contractor to resubmit items found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Design Engineer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for check testing by the Design Engineer in those instances where the technical specifications so prescribe.

## 1.7 PROJECT SUBMITTAL REGISTER

A sample Project Submittal Register showing items of equipment and materials for when submittals are required by the specifications is provided with this Specification.

### 1.7.1 Submittal Management

Prepare and maintain a submittal register, as the work progresses. Do not change data that is output in columns (c), (d), (e), and (f) as delivered by Design Engineer; retain data that is output in columns (a), (g), (h), and (i) as approved. As an attachment, provide a submittal register showing items of equipment and materials for which submittals are required by the specifications. This list may not be all-inclusive and additional submittals may be required.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD Number. and type, e.g., SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in each specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting the project requirements.

Thereafter, the Contractor is to track submittals by maintaining a complete list, including completion of data columns and dates on which submittals are received by and returned by the Design Engineer.

### 1.7.2 Preconstruction Use of Submittal Register

Submit the submittal register. Include the QC plan and the project schedule. Verify that submittals required for the project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for the approving authority to receive submittals.

Column (h) Contractor Approval Date: Date that Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

### 1.7.3 Delivery of Copies

Submit an updated digital copy of the submittal register to the Design Engineer with each invoice request. Provide an updated Submittal Register monthly regardless of whether an invoice is submitted.

## 1.8 VARIATIONS

Variations from contract requirements require Project Manager approval pursuant to Contract and will be considered where advantageous to the AMLP.

### 1.8.1 Considering Variations

Discussion of variations with the Design Engineer before submission of a variation submittal will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. For variations that include design changes or some material or product substitutions, the AMLP may require an evaluation and analysis by a licensed professional engineer hired by the contractor.

Specifically point out variations from contract requirements in a variation submittal. Failure to point out variations may cause the Design Engineer to require rejection and removal of such work at no additional cost to the AMLP.

### 1.8.2 Proposing Variations

When proposing variation, deliver a submittal, clearly marked as a "VARIATION" to the Design Engineer, with documentation illustrating the nature and features of the variation including necessary technical submittals and why the variation is desirable and beneficial to AMLP. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in documentation.

Specifically point out variations from contract requirements in a variation submittal. Failure to point out variations may cause the Design Engineer to require rejection and removal of such work at no additional cost to the AMLP.

### 1.8.3 Warranting that Variations are Compatible

When delivering a variation for approval, the Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

### 1.8.4 Review Schedule Extension

In addition to the normal submittal review period, a period of 14 days will be allowed for the Design Engineer to consider submittals with variations.

## 1.9 SCHEDULING

Schedule and submit concurrently product data and shop drawings covering component items forming a system or items that are interrelated. Submit pertinent certifications at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

a. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. The Contractor is responsible for

additional time required for Design Engineer reviews resulting from required resubmittals. The review period for each resubmittal is the same as for the initial submittal.

b. Submittals required by the contract documents are listed on the submittal register. If a submittal is listed in the submittal register but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Design Engineer does not relieve the Contractor of supplying submittals required by the contract documents but that have been omitted from the register or marked "N/A."

c. Resubmit the submittal register and annotate it monthly with actual submission and approval dates. When items on the register have been fully approved, no further resubmittal is required.

Design Engineer review will be completed within five business days after the date of submission.

## 1.10 APPROVING AUTHORITY

The approving authority is the Design Engineer, the Design Engineer will:

a. Note the date on which the submittal was received.

b. Review submittals for approval within the scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in paragraph REVIEW NOTATIONS and with comments and markings appropriate for the action indicated.

Upon completion of review of submittals requiring Design Engineer approval, stamp and date submittals. Two copies of the submittal will be retained by the Design Engineer and one copy of the submittal will be returned to the Contractor.

### 1.10.1 Review Notations

Submittals will be returned to the Contractor with the following notations:

a. Submittals marked "approved" or "accepted" authorize proceeding with the work covered.

b. Submittals marked "approved as noted" or "approved, except as noted, resubmittal not required," authorize proceeding with the work covered provided that the Contractor takes no exception to the corrections.

c. Submittals marked "not approved," "disapproved," or "revise and resubmit" indicate incomplete submittal or noncompliance with the contract requirements or design concept. Resubmit with appropriate changes. Do not proceed with work for this item until the resubmittal is approved.

d. Submittals marked "not reviewed" indicate that the submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

e. Submittals marked "receipt acknowledged" indicate that submittals have been received by the Design Engineer. This applies only to "information-only submittals" as previously defined.

## 1.11 DISAPPROVED SUBMITTALS

Make corrections required by the Design Engineer. If the Contractor considers corrections or notations on the returned submittals to constitute a change to the contract plans or specifications, give notice to the Design Engineer as required under the Contract. The Contractor is responsible for the dimensions and design of connection details and the construction of work. Failure to point out variations may cause the Design Engineer to require rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, make such revisions and resubmit in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

## 1.12 APPROVED SUBMITTALS

The Design Engineer's approval of submittals is not to be construed as a complete check, and indicates only that design, general method of construction, materials, detailing, and other information appear to meet the Solicitation and Accepted Proposal.

Approval or acceptance by the Design Engineer for a submittal does not relieve the Contractor of the responsibility for meeting the contract requirements or for errors that may exist, because under the Quality Control (QC) requirements of this contract, the Contractor is responsible for ensuring information contained within each submittal accurately conforms with the requirements of the contract documents.

After submittals have been approved or accepted by the Design Engineer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

## 1.13 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not construed to change or modify contract requirements. Before submitting samples, provide assurance that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those that may be damaged in testing, will be returned to the Contractor, at its expense, upon completion of the contract. Unapproved samples will also be returned to the Contractor at its expense, if so requested.

Failure of materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, further samples of the same brand or make as that material. The Design Engineer reserves the right to disapprove materials or equipment that has previously proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Engineer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Replace such materials or equipment to meet contract requirements.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section

# SECTION 01 40 00
# QUALITY CONTROL

## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

| | |
|---|---|
| ASTM D3740 | (2019) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction |
| ASTM E329 | (2021) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection |

### 1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program. Include associated costs in the applicable Bid Schedule item.

### 1.3 SUBMITTALS

Design Engineer approval is required for submittals with an "E" classification. Submittals not having an "E" classification are for information only. When used, a code following the "E" classification identifies the office that will review the submittal for the Design Engineer. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Contractor Quality Control (CQC) Plan
Licensed Surveyor Qualifications

SD-06 Test Reports

Verification Statement
Accreditation of Testing Laboratory

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

### 3.1 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system. QC consists of plans, procedures, and organization necessary to produce an end product which complies with the Contract requirements. The QC system covers construction operations, both onsite and offsite, and is keyed to the proposed construction sequence. The quality manager must hold a current license as a professional engineer in the State of New Mexico with experience on at least five similar projects. Evidence of extraordinary proven experience may be considered by the Design Engineer as sufficient to act as the Quality Manager.

The Project Superintendent will be held responsible for the quality of work and is subject to removal by the Design Engineer for non-compliance with the quality requirements specified in the Contract. In this context the highest-level manager responsible for the overall construction activities at the site, including quality and production, is the Project Superintendent. The Project Superintendent maintains a physical presence at the site and is responsible for construction and related activities at the site, except as otherwise acceptable to the Design Engineer.

### 3.2 SUBMITTALS AND DELIVERABLES

Submittals, if needed, have to comply with the requirements in Section 01 33 00 SUBMITTAL PROCEDURES.

### 3.3 CONTROL

CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control are required to be conducted for each definable feature of the construction work as follows:

#### 3.3.1 Preparatory Phase

This phase is performed prior to beginning work on each definable feature of work, after required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:

a. A review of each paragraph of applicable specifications, reference codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Design Engineer, government agencies, or AMLP personnel until final acceptance of the work.

b. Review of the Contract plans.

c. Check to ensure that materials and equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.

e. Examination of the work area to assure that required preliminary work has been completed and is in compliance with the Contract.

f. Examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

g. Review of the appropriate activity hazard analysis to assure safety requirements are met.

h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

i. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Design Engineer.

j. Discussion of the initial control phase.

k. The Design Engineer needs to be notified at least 48 hours in advance of beginning the preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.3.2 Initial Phase

This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:

a. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing are in compliance with the contract.

c. Establish the level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Design Engineer needs to be notified at least 48 hours in advance of beginning the initial phase for definable feature of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with follow-up phases.

g. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or when acceptable specified quality standards are not being met.

3.3.3 Follow-up Phase

Perform daily checks to assure control activities, including control testing, provide continued compliance with contract requirements, until completion of the particular feature of work. Record the checks in the

CQC documentation. Conduct final follow-up checks and correct deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work.

3.3.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.4 TESTS

3.4.1 Testing Procedure

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Design Engineer duplicate samples of test specimens for possible testing by the Design Engineer. Testing includes operation and acceptance tests when specified. Procure the services of an ASTM certified approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including test documentation requirements, have been prepared.

e. Record results of tests taken, both passing and failing, on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Design Engineer, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Design Engineer. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

3.4.2 Testing Laboratories

Testing laboratories must be validated by ASTM D3740 and approved by the NMDOT.

3.4.2.1 Capability Check

The Design Engineer reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel is required to meet criteria detailed in ASTM D3740 and ASTM E329.

## 3.5 FIELD SURVEYS FOR CONSTRUCTION STAKING

### 3.5.1 Qualifications

The Contractor shall provide experienced construction surveying subcontractors for staking grade controls. Survey and layout work performed by the subcontractor shall be performed under the supervision and direction of a New Mexico licensed land surveyor. Determination of licensing in the State of New Mexico shall be the responsibility of the Contractor.

The licensed surveyor shall have a minimum of 3 years' experience in construction surveys for construction work similar in nature to that required by the project. The subcontractor shall maintain sufficient qualified personnel to perform the required surveying work. Survey work shall be subject to review by the Design Engineer.

The subcontractor instruments and other survey equipment shall be accurate, suitable for the surveys required in accordance with recognized professional standards, and in proper condition and adjustment at all times. Equipment found to be inaccurate (beyond allowable tolerances) or defective shall immediately be repaired or removed from the job site by the subcontractor at no additional cost to the AMLP.

The Design Engineer will provide the Contractor with survey control data after contract award.

Aerial surveying methods may be restricted and subject to approval by AMLP.

### 3.5.2 Field Measurement

Field-tape measurements may be allowed to document installed quantities for use as payment application backup at the discretion of the Design Engineer.

Tolerances in survey layout of work shall not exceed the following:

| Types of Line or Mark | Horizontal Position Tolerance | Vertical Position Tolerance |
|---|---|---|
| Permanent reference points, control points, and survey control points. | 0.06 feet | 0.06 feet |
| Reference points for general excavation and earthwork grade staking. | 0.10 feet | 0.10 feet |
| Reference points for pipe inverts, floor elevations, drainage structures, etc. | 0.10 feet | 0.01 feet |

### 3.5.3 Trench and Channel Alignment Surveys

Contractor shall stake the alignment of trenches channels shown on the plans. Alignment survey shall contain, at a minimum, the following:

a. A minimum of 100-foot stationing with stationing indicated on stakes.

b. Location of direction changes where bends and tees are required.

c. Location for valve structures including gate valves.

d. Provide a minimum of one offset stake for each of the points staked above. Each offset stake shall be placed at a location where it will not be disturbed during the course of the work and shall have stationing and features (i.e., P.C., P.T., valve, A/VR) marked on it.

e. Remove and dispose of staking at end of project only after receiving written direction from Contractor.

3.5.4 Structural Features Layout

The subcontractor shall stake the layout necessary for the construction of the interceptor channels, riprap dissipater basins, culvert locations, detention pond, the NM-14 crossing, boulder retaining walls, water line/fire hydrant replacement, and areas where re-grading is occurring. Layout staking shall contain, at a minimum, the following:

a. Staking of each major corner of the feature.

b. Staking of each major grade break of the feature.

c. Provide a minimum of one offset stake for each of the points staked above. Each offset stake shall be placed at a location where it will not be disturbed during the course of the work and shall have a feature marked on it.

d. Remove and dispose of staking at end of project only after receiving written direction from Contractor.

3.5.5 Grade Finishing Stakes

a. The Contractor shall set slope stakes, and stationing at intervals no greater than 100 ft.

b. The Contractor shall set grade finishing stakes (blue tops) to establish grade elevations and horizontal alignment at the top of subgrade, subbase, and final grade. The Contractor shall set the finish stakes at intervals no more than 50 feet.

3.5.6 Survey As-Builts

Prepare survey as-builts in accordance with Section 01 78 00 (CLOSEOUT).

3.6 COMPLETION INSPECTION

3.6.1 Pre-Final (Substantial Completion) Inspection

The Design Engineer will perform the pre-final inspection to verify that the facility is complete and ready to be occupied in accordance with the Contract. An Engineer Pre-Final Punch List may be developed as a result of this inspection. Ensure that items on this list have been corrected before notifying the Design Engineer, so that a final inspection with the project owner can be scheduled. Correct items noted on the Pre-Final inspection in a timely manner. These inspections and deficiencies corrections required by this paragraph need to be accomplished within the time slated for completion of the work or particular increment of the work if the project is divided into increments by separate completion dates.

3.6.2 Final Acceptance Inspection

The Contractor's Quality Control personnel, plus the superintendent or other primary management person, and AMLP representatives are required to be in attendance at the final acceptance inspection. Additional personnel including Government agencies including, but not limited to, those from the New Mexico Department of Transportation may also be in attendance. The final acceptance inspection will be formally scheduled by the Contractor and Design Engineer based upon the results of the Pre-Final inspection. Notify the Design Engineer and the AMLP Project Manager at least 14 days prior to the final acceptance inspection and include the Contractor's assurance that specific items previously identified to the Contractor as being unacceptable, along with remaining work performed under the Contract, will be complete and acceptable by the date scheduled for the final acceptance inspection.

## 3.7 DOCUMENTATION

### 3.7.1 Quality Control Activities

Maintain current records providing factual evidence that required quality control activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

a. The name and area of responsibility of the Contractor/Subcontractor.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom.

d. Test and control activities performed with results and references to specifications/plans requirements. Identify the control phase (Initial and Final). List of deficiencies noted, along with corrective action.

e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/plans requirements.

f. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.

g. Offsite surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and specifications.

## 3.8 NOTIFICATION OF NONCOMPLIANCE

The Design Engineer will notify the Contractor of detected noncompliance with the foregoing requirements. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Design Engineer can issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claims for extension of time or for excess costs or damages by the Contractor.

-- End of Section --

# SECTION 01 78 00
# CLOSEOUT SUBMITTALS

## PART 1 GENERAL

### 1.1 DEFINITIONS

#### 1.1.1 As-Built Drawings

As-built drawings are marked-up drawings, maintained by the Contractor on-site, that depict actual conditions and deviations from the Contract Documents. These deviations and additions may result from coordination required by, but not limited to contract modifications; official responses to submitted Requests for Information (RFI's); direction from the Engineer; design that is the responsibility of the Contractor, and differing site conditions. Maintain the as-builts throughout construction as red-lined hard copies on site. These files serve as the basis for the creation of the record drawings; the Contractor is responsible for drafting the final as-builts from their hard-copy red-lined version.

#### 1.1.2 Record Drawings

The record drawings are the final compilation of actual conditions reflected in the as-built drawings.

### 1.2 SOURCE DRAWING FILES

Request the full set of digital drawings, in the source format, for Record Drawing preparation, after award and at least 30 days prior to required use.

#### 1.2.1 Terms and Conditions

Data contained on these digital files must not be used for purposes other than as a convenience in the preparation of construction drawings and data for the referenced project. Other uses or reuse shall be at the sole risk of the Contractor and without liability or legal exposure to the Design Engineer. The Contractor must make no claim and waives to the fullest extent permitted by law, any claim or cause of action of any nature against the Design Engineer, its agents or sub consultants that may arise out of or in connection with the use of these digital files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Engineer harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these digital files.

These digital CAD drawing files are not construction documents. Differences may exist between the CAD files and the corresponding construction documents. The Design Engineer makes no representation regarding the accuracy or completeness of the digital CAD files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. In the event that a conflict arises between the signed and sealed construction documents prepared by the Design Engineer and the furnished Source drawing files, the signed and sealed construction documents govern. The Contractor is responsible for determining if conflicts exist. The use of these Source Drawing files does not relieve the Contractor of duty to fully comply with the contract documents, including and without limitation, the need to check, confirm and coordinate the work of contractors for the project. If the Contractor uses, duplicates or modifies these digital source drawing files for use in producing construction drawings and data related to this contract, remove previous ownership seals, logos, signatures, initials and dates.

## 1.3 SUBMITTALS

Engineer approval is required for submittals with an "E" classification. Submittals not having an "E" classification are for information only. When used, a code following the "E" classification identifies the office that will review the submittal for the Engineer. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Warranty Tags

SD-08 Manufacturer's Instructions

None

SD-10 Operation and Maintenance Data

None

SD-11 Closeout Submittals

As-Built Drawings
Survey Drawings

## 1.4 WARRANTY MANAGEMENT

### 1.4.1 Performance Bond and Payment and Materials Bond

The Performance Bond and Payment and Materials Bond must remain effective throughout the construction and warranty period.

a. In the event the Contractor fails to commence and diligently pursue construction warranty work required, the AMLP will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Contractor while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by at the Contractor's expense, the AMLP will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the AMLP to proceed against the Contractor.

### 1.5.2 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Engineer, meet with the Engineer to develop a mutual understanding with respect to the requirements of this section. At this meeting, establish and review communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details

deemed necessary by the Engineer for the execution of the construction warranty In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact must be located within the local service area of the warranted construction, be continuously available, and be responsive to Engineer inquiry on warranty work action and status. This requirement does not relieve the Contractor of its responsibilities in connection with other portions of this provision.

## PART 2 PRODUCTS

Not used.

## PART 3 EXECUTION

### 3.1 AS-BUILT DRAWINGS

Provide and maintain two black line print copies of the PDF contract drawings for As-Built Drawings. Maintain the as-builts throughout construction as red-lined hard copies on site and red-lined PDF files. Submit As-Built Drawings 30 days submit As-Built Drawings no more than 30 days after completion of project construction.

#### 3.1.1 Markup Guidelines

Make comments and markup the drawings complete without reference to letters, memos, or materials that are not part of the As-Built drawing. Show what was changed, how it was changed, where item(s) were relocated and change related details. These working as-built markup prints must be neat, legible and accurate as follows:

a. Use base colors of red, green, and blue. Color code for changes as follows:

   1) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.

   2) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.

   3) Additions (Green) - Added items, lettering in notes and leaders.

b. Provide a legend if colors other than the "base" colors of red, green, and blue are used.

c. Add and denote additional equipment or material facilities, service lines, incorporated under As-Built Revisions if not already shown in legend.

d. Use frequent written explanations on markup drawings to describe changes. Do not totally rely on graphic means to convey the revision.

e. Use legible lettering and precise and clear digital values when marking prints. Clarify ambiguities concerning the nature and application of change involved.

f. Wherever a revision is made, also make changes to related section views, details, legend, profiles, plans and elevation views, schedules, notes and call out designations, and mark accordingly to avoid conflicting data on other sheets.

g. For deletions, cross out features, data and captions that relate to that revision.

h. For changes on small-scale drawings and in restricted areas, provide large-scale inserts, with leaders to the applicable location.

i. Indicate one of the following when attaching a print or sketch to a markup print:

1) Add an entire drawing to contract drawings

2) Change the contract drawing to show

3) Provided for reference only to further detail the initial design.

j. Incorporate shop and fabrication drawings into the markup drawings.

3.1.2 As-Built Drawings Content

Show on the as-built drawings, but not limited to, the following information:

a. The actual location, kinds and sizes of sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings.

b. The location and dimensions of changes within the structure.

c. Layout and schematic drawings of piping.

d. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if changes were made from contract plans.

e. Changes in details of design or additional information obtained from working drawings specified to be prepared or furnished by the Contractor; including but not limited to shop drawings, fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment, and foundations.

f. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

g. Changes or Revisions which result from the final inspection.

h. Where contract drawings or specifications present options, show only the option selected for construction on the working as-built markup drawings.

i. Changes in location of equipment and civil features.

j. Modifications.

k. Actual location of anchors, construction and control joints, etc., in concrete.

l. Unusual or uncharted obstructions that are encountered in the contract work area during construction.

m. Location, extent, thickness, and size of stone protection particularly where it will be normally submerged by water.

## 3.2 OPERATION AND MAINTENANCE MANUALS

None

## 3.3 CLEANUP

Leave premises clean. Clean debris from outlet tower, catwalk, intake structure, and drainage systems. Remove waste and surplus materials, rubbish, and construction facilities from the site.

-- End of Section --

# SECTION 03 30 00
# CAST-IN-PLACE CONCRETE

## PART 1 GENERAL

### 1.1 SUMMARY

Section includes reinforcing and cast-in-place concrete for the following items:

a. Drop Inlet Structures
b. Concrete Dip or Low Flow Crossings
c. Concrete Valley Gutter
d. Culvert Headwalls
e. Curb and Gutter
f. Reinforced Concrete Box Culvert
g. Concrete Road Paving
h. Concrete Grout for Large Rock Drainage Structures
i. Water Pipe Thrust Blocking and Hydrant Guard Foundations
j. Pedestrian Bridge Abutments

Note that the governing specifications for all work in the New Mexico Department of Transportation right-of-way (NM-14) shall be the Standard Specifications for Highway and Bridge Construction (2019 Edition).

### 1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

| | |
|---|---|
| ACI 117 | (2010 Errata 2015) Specifications for Tolerances for Concrete Construction and Materials and Commentary |
| ACI 121R | 2008) Guide for Concrete Construction Quality Systems in Conformance with ISO 9001 |
| ACI 213R | 2021) Guide for Structural Lightweight-Aggregate Concrete |
| ACI 301 | 2016) Specifications for Structural Concrete |
| ACI 302.1R | 2016) Guide to Concrete Floor and Slab Construction |
| ACI 304R | 2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete |
| ACI 304.2R | 2016) Guide to Placing Concrete by Pumping Methods |

| | |
|---|---|
| ACI 305R | 2016) Guide to Hot Weather Concreting |
| ACI 305.1 | 2014) Specification for Hot Weather Concreting |
| ACI 306.1 | 2002) Specification for Cold Weather Concreting |
| ACI 308.1 | 2011) Specification for Curing Concrete |
| ACI 318 | 2022) Building Code Requirements for Structural Concrete and Commentary |
| ACI 347R | 2014; Errata 1 2017) Guide to Formwork for Concrete |
| ACI 350 | 2020) Code Requirements for Environmental Engineering Concrete Structures and Commentary |
| ACI MNL-2 | 2019; Abstract: 11th Edition) ACI Manual of Concrete Inspection |
| ACI MNL-15 | 2016) Field Reference Manual: Standard Specifications for Structural Concrete ACI 301-16 with Selected ACI References |

AMERICAN WELDING SOCIETY

| | |
|---|---|
| AWS D1.4/D1.4M | 2011) Structural Welding Code - Reinforcing Steel |

ASTM INTERNATIONAL (ASTM)

| | |
|---|---|
| ASTM A184/A184M | (2019) Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement |
| ASTM A615/A615M | (2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement |
| ASTM A706/A706M | (2022) Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement |
| ASTM A934/A934M | (2016) Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars |
| ASTM A1060/A1060M | (2022) Standard Specification for Zinc-Coated (Galvanized) Steel Welded Wire Reinforcement, Plain and Deformed, for Concrete |
| ASTM A1064/A1064M | (2022) Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete |

| | |
|---|---|
| ASTM C31/C31M | (2021a) Standard Practice for Making and Curing Concrete Test Specimens in the Field |
| ASTM C33/C33M | (2018) Standard Specification for Concrete Aggregates |
| ASTM C39/C39M | (2021) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens |
| ASTM C94/C94M | (2022) Specification for Ready-Mix Concrete |
| ASTM C1293 | (2020a) Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction |
| ASTM C143/C143M | (2020) Standard Test Method for Slump of Hydraulic-Cement Concrete |
| ASTM C150/C150M | (2021) Standard Specification for Portland Cement |
| ASTM C172/C172M | (2020) Standard Practice for Sampling Freshly Mixed Concrete |
| ASTM C173/C173M | (2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method |
| ASTM C231/C231M | (2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method |
| ASTM C260/C260M | (2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete |
| ASTM C311/C311M | (2018) Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete |
| ASTM C330/C330M | (2017a) Standard Specification for Lightweight Aggregates for Structural Concrete |
| ASTM C494/C494M | (2019) Standard Specification for Chemical Admixtures for Concrete |
| ASTM C618 | (2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete |
| ASTM C873/C873M | (2016) Standard Test Method for Compressive Strength of Concrete Cylinders Case in Place in Cylindrical Molds |
| ASTM C920 | (2018) Standard Specification for Elastomeric Joint Sealants |
| ASTM C989/C989M | (2018a) Standard Specification for Slag Cement for Use in Concrete and Mortars |

| | |
|---|---|
| ASTM C1074 | (2019) Standard Practice for Estimating Concrete Strength by the Maturity Method |
| ASTM C1077 | (2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation |
| ASTM C1218/C1218M | (2020) Standard Test Method for Water-Soluble Chloride in Mortar and Concrete |
| ASTM C1240 | (2020) Standard Specification for Silica Fume Used in Cementitious Mixtures |
| ASTM C1260 | (2021) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method) |
| ASTM C1293 | (2008; R 2015) Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction |
| ASTM C1567 | (2021) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method) |
| ASTM C1602/C1602M | (2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete |
| ASTM C1778 | (2022) Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete |
| ASTM D471 | (2016a) Standard Test Method for Rubber Property - Effect of Liquids |
| ASTM D1751 | (2018) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) |
| ASTM D2628 | (1991; R 2016) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements |
| ASTM D2835 | (2012) Standard Specification for Lubricant For Installation Of Preformed Compression Seals In Concrete Pavements |
| ASTM D3042 | (2017) Standard Test Method for Insoluble Residue in Carbonate Aggregates |
| ASTM D5759 | (2012; R 2020) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses |

| | |
|---|---|
| ASTM D6690 | (2015) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements |
| ASTM E329 | (2021) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection |

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

| | |
|---|---|
| CRSI 10MSP | (2018; 29th Ed, Errata) Manual of Standard Practice |
| CRSI RB4.1 | (2022) Supports for Reinforcement Used in Concrete |

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

| | |
|---|---|
| NIST PS 1 | (2009) DOC Voluntary Product Standard PS 1-19, Structural Plywood |

NEW MEXICO DEPARTMENT OF TRANSPORTATION (NMDOT)
Standard Specifications for Highway and Bridge Construction (2019 Edition)

| | |
|---|---|
| Section 509 | Portland Cement Concrete Mix Designs |
| Section 510 | Portland Cement Concrete |
| Section 511 | Concrete Structures |
| Section 515 | Reinforced Concrete for Minor Structures |
| Section 540: | Steel Reinforcement |

U.S. ARMY CORPS OF ENGINEERS (USACE)

| | |
|---|---|
| COE CRD-C 513 | (1974) Corps of Engineers Specifications for Rubber Waterstops |
| COE CRD-C 572 | (1974) Corps of Engineers Specifications for Polyvinylchloride Waterstops |

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

| | |
|---|---|
| FS SS-S-200 | (Rev E; Am 1; Notice 1) Sealant, Joint, Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland Cement Concrete Pavement |

## 1.3 DEFINITIONS

a. "Cementitious material" as used herein must include Portland cement, pozzolan, fly ash, and slag.

b. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the structure. A public location is accessible to persons not responsible for the operation or maintenance of the structure.

c. "Chemical admixtures" are materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.

d. "Supplementary cementing materials" (SCM) include coal fly ash, slag cement, natural or calcined pozzolans, and ultra-fine coal ash when used in such proportions to replace the Portland cement that result in improvement to sustainability and durability and reduced cost.

e. "Design strength" (f'c) is the specified compressive strength of concrete at time(s) specified in this section to meet structural design criteria.

f. "Mass Concrete" is a concrete system that approaches a maximum temperature of 158 degrees F within the first 72 hours of placement. In addition, it includes concrete elements with a section thickness of 3 feet or more regardless of temperature.

g. "Mixture proportioning" is the process of designing concrete mixture proportions to enable it to meet the strength, service life and constructability requirements of the project while minimizing the initial and life-cycle cost.

h. "Mixture proportions" are the masses or volumes of individual ingredients used to make a unit measure (cubic meter or cubic yard) of concrete.

i. "Pozzolan" is a siliceous or siliceous and aluminous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.

j. "Workability (or consistence)" is the ability of a fresh (plastic) concrete mix to fill the form/mold properly with the desired work (vibration) and without reducing the concrete's quality. Workability depends on water content, chemical admixtures, aggregate (shape and size distribution), cementitious content and age (level of hydration).

## 1.4 SUBMITTALS

Engineer approval is required for submittals with an "E" classification. Submittals not having an "E" classification are for information only. When used, a code following the "E" classification identifies the office that will review the submittal for the Engineer. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Concrete Curing Plan
Laboratory Accreditation; E
Form Removal Schedule; E

SD-02 Shop Drawings

Formwork
Reinforcing Steel; E

SD-03 Product Data

Joint Sealants; E
Joint Filler; E
Formwork Materials
Recycled Aggregate Materials; E
Cementitious Materials; E
Concrete Curing Materials
Reinforcement; E
Admixtures
Waterstops
Biodegradable Form Release Agent
Pumping Concrete
Non-shrink Grout

SD-04 Samples

None

SD-05 Design Data

Concrete Mix Design, separate submittals for each type of concrete specified; E

SD-06 Test Reports

Concrete Mix Design; E
Fly Ash
Pozzolan
Slag Cement
Aggregates
Compressive Strength Tests; E
Air Content
Slump Tests
Water

SD-07 Certificates

Reinforcing Bars
Welder Qualifications
Safety Data Sheets
Field Testing Technician and Testing Agency

SD-08 Manufacturer's Instructions

Joint Sealants; E
Curing Compound

## 1.5 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Engineer.

## 1.6 DELIVERY, STORAGE, AND HANDLING

Follow ACI 301, ACI 304R and ASTM A934/A934M requirements and recommendations. Do not deliver concrete until vapor retarder, vapor barrier, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. Do not store concrete curing compounds or sealers with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store concrete curing compounds or sealers in occupied spaces.

### 1.6.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

## 1.7 QUALITY ASSURANCE

Perform the following work in accordance with ACI 301, ACI 318, and ACI 350.

Accurately record concrete dimensions and tolerances and locations of embedded utilities and components placement on as-built drawings described in Section 01 78 00 (CLOSEOUT SUBMITTALS).

### 1.7.1 Design Data

#### 1.7.1.1 Formwork Calculations

ACI 347R. Include design calculations indicating arrangement of forms, sizes and grades of supports (lumber), panels, and related components. Furnish drawings and calculations of shoring and re-shoring methods proposed for concrete members. Calculations must indicate concrete pressure with both live and dead loads, along with material types.

#### 1.7.1.2 Concrete Mix Design

Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, supplementary cementitious materials, fibers, and admixtures; and applicable reference specifications. Submit mill test and other test for cement, supplementary cementitious materials, aggregates, and admixtures. Provide documentation of maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained verses sieve size. Provide mix proportion data using at least three different water-cementitious material ratios for each type of mixture, which produce a range of strength encompassing those required for each type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Engineer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Resubmit data on concrete components if the qualities or source of components changes. For previously approved concrete mix designs used within the past

twelve months, the previous mix design may be re-submitted without further trial batch testing if accompanied by material test data conducted within the last six months. Obtain mix design approval from the Engineer prior to concrete placement.

1.7.2 Shop Drawings

1.7.2.1 Formwork

Drawings showing details of formwork including, but not limited to; joints, supports, studding and shoring, and sequence of form and shoring removal. Indicate placement schedule, construction, location and method of forming control joints. Include locations of inserts, conduit, sleeves and other embedded items. Reproductions of contract drawings are unacceptable. Submit form removal schedule indicating element and minimum length of time for form removal.

Design, fabricate, erect, support, brace, and maintain formwork so that it is able to support, without failure, vertical and lateral loads that may reasonably be anticipated to be applied to the formwork.

1.7.2.2 Reinforcing Steel

Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars. Reproductions of contract drawings are unacceptable.

1.7.3 Control Submittals

1.7.3.1 Safety Data Sheets

Submit Safety Data Sheets (SDS) for materials that are regulated for hazardous health effects. SDS must be readily accessible during each work shift to employees when they are at the construction site.

1.7.4 Test Reports

1.7.4.1 Fly Ash and Pozzolan

Submit test results in accordance with ASTM C618 for fly ash and pozzolan. Submit test results performed within 6 months of submittal date.

1.7.4.2 Slag Cement

Submit test results in accordance with ASTM C989/C989M for slag cement. Submit test results performed within 6 months of submittal date.

1.7.4.3 Aggregates

Submit test results in accordance with ASTM C33/C33M, or ASTM C330/C330M for lightweight aggregate, and ASTM C1293 or ASTM C1567 as required in the paragraph titled 2.5.2.1 ALKALI-AGGREGATE REACTION.

Do not use aggregates susceptible to alkali-carbonate reaction (ACR). Use one of the three options below for qualifying concrete mixtures to reduce the potential of alkali-silica reaction (ASR):

a. For each aggregate used in concrete, the expansion result determined in accordance with ASTM C1293 must not exceed 0.04 percent at one year.

b. For each aggregate used in concrete, the expansion result of the aggregate and cementitious materials combination determined in accordance with ASTM C1567 must not exceed 0.10 percent at an age of 16 days.

c. Alkali content in concrete (LBA) must not exceed 4 pounds per cubic yard for moderately reactive aggregate or 3 pounds per cubic yard for highly reactive aggregate. Reactivity must be determined by testing in accordance with ASTM C1293 and categorized in accordance with ASTM C1778. Alkali content is calculated as follows:

   LBA = (cement content, pounds per cubic yard) × (equivalent alkali content of Portland cement in percent/100 percent)

1.7.5 Quality Control Plan

Develop and submit for approval a concrete quality control program in accordance with the guidelines of ACI 121R and as specified herein. The plan must include approved laboratories. Provide direct oversight for the concrete qualification program inclusive of associated sampling and testing. Quality control reports must be provided to the Engineer, Quality Manager and Concrete Supplier. Maintain a copy of ACI MNL-2 and CRSI 10MSP at project site.

1.7.6 Quality Control Personnel Certifications

The Contractor must submit for approval the responsibilities of the various quality control personnel, including the names and qualifications of the individuals in those positions and a quality control organizational chart defining the quality control hierarchy and the responsibility of the various positions. Quality control personnel must be employed by the Contractor.

Submit American Concrete Institute certification for the following:

a. CQC personnel responsible for inspection of concrete operations.

b. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews.

c. Field Testing Technicians: ACI Concrete Field-Testing Technician, Grade I.

1.7.6.1 Quality Manager Qualifications

The quality manager must hold a current license as a professional engineer in the State of New Mexico with experience on at least five similar projects. Evidence of extraordinary proven experience may be considered by the Engineer as sufficient to act as the Quality Manager.

1.7.6.2 Field Testing Technician and Testing Agency

Submit data on qualifications of proposed testing agency and technicians for approval by the Engineer prior to performing testing on concrete.

a. Work on concrete under this contract must be performed by an ACI Concrete Field-Testing Technician Grade 1 qualified in accordance with Manual of Concrete Inspection, Second Edition (ACI MNL-2) or equivalent. Equivalent certification programs must include requirements for written and performance examinations as stipulated in ACI MNL-2.

b. Testing agencies that perform testing services on reinforcing steel must meet the requirements of ASTM E329.

c. Testing agencies that perform testing services on concrete materials must meet the requirements of ASTM C1077.

1.7.7 Laboratory Qualifications for Concrete Qualification Testing

The concrete testing laboratory must have the necessary equipment and experience to accomplish the required testing. The laboratory must meet the requirements of ASTM C1077 / ASTM E329 and be Cement and Concrete Reference Laboratory (CCRL) inspected.

1.7.8 Laboratory Accreditation

Laboratory and testing facilities must be provided by and at the expense of the Contractor. The laboratories performing the tests must be accredited in accordance with ASTM C1077 / ASTM E329, including ASTM C78/C78M and ASTM C1260. The accreditation must be current and must include the required test methods, as specified. Furthermore, the testing must comply with the following requirements:

a. Aggregate Testing and Mix Proportioning: Aggregate testing and mixture proportioning studies must be performed by an accredited laboratory and under the direction of a registered professional engineer in the State of New Mexico competent in concrete materials who is competent in concrete materials and must sign reports and designs.

b. Acceptance Testing: Furnish materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Furnish and maintain boxes or other facilities suitable for storing and curing the specimens at the site while in the mold within the temperature range stipulated by ASTM C31/C31M.

c. Contractor Quality Control: Sampling and testing must be performed by an approved, onsite, independent, accredited laboratory.

1.8 ENVIRONMENTAL REQUIREMENTS

Provide space ventilation according to material manufacturer recommendations, at a minimum, during and following installation of concrete curing compound and sealer. Maintain the following ventilation conditions during the curing period or for 72 hours after installation:

a. Supply 100 percent outside air 24 hours a day.

1.8.1 Submittals for Environmental Performance

a. Provide data to indicate of the percentage of post-industrial pozzolan (fly ash, slag cement) cement substitution as a percentage of the full product composite by weight.

b. Provide data indicating the percentage of post-industrial and post-consumer recycled content aggregate.

c. Provide product data indicating the percentage of post-consumer recycled steel content in each type of steel reinforcement as a percentage of the full product composite by weight.

d. Provide product data stating the location where products were manufactured.

e. For projects using Forest Stewardship Council (FSC) certified formwork, provide chain-of-custody documentation for certified wood products.

f. For projects using reusable formwork, provide data showing how formwork is reused.

g. Provide SDS product information data showing that form release agents meet environmental performance goals such as using vegetable and soy-based products.

h. Provide SDS product information data showing that concrete adhesives meet environmental performance goals including low emitting, low volatile organic compound products.

## 1.9 QUALIFICATIONS FOR WELDING WORK

Welding procedures must be in accordance with AWS D1.4/D1.4M. See Section 05 05 23.16 STRUCTURAL WELDING.

Verify that Welder qualifications are in accordance with AWS D1.4/D1.4M for welding of reinforcement or under an equivalent qualification test approved in advance. Welders are permitted to do only the type of welding for which each is specifically qualified.

# PART 2 PRODUCTS

## 2.1 FORMWORK MATERIALS

a. Form-facing material in contact with concrete must be lumber, plywood, tempered concrete-form-grade hardboard, metal, or plastic. Submit product information on proposed form-facing materials if different from that specified herein.

b. Design formwork, shores, reshores, and backshores to support loads transmitted to them and to comply with applicable building code requirements.

c. Design formwork and shoring for load redistribution resulting from stressing of post-tensioned reinforcement. Ensure that formwork allows movement resulting from application of prestressing force.

d. Design formwork to withstand pressure resulting from placement and vibration of concrete and to maintain specified tolerances.

e. Design formwork to accommodate waterstop materials in joints at locations indicated in Contract Documents.

f. Provide temporary openings in formwork if needed to facilitate cleaning and inspection.

g. Design formwork joints to inhibit leakage of mortar.

h. Limit deflection of facing materials for concrete surfaces exposed to view to 1/240 of center-to-center spacing of facing supports.

i. Do not use earth cuts as forms for vertical or sloping surfaces without approval by the Engineer.

j. Submit product information on proposed form-facing materials if different from that specified herein.

k. Submit shop drawings for formwork, shoring, reshoring, and backshoring. Shop drawings must be signed and sealed by a New Mexico licensed engineer.

l. Submit design calculations for formwork, shoring, reshoring, and backshoring. Design calculations must be signed and sealed by a New Mexico licensed engineer.

m. Submit procedure for reshoring and backshoring, including drawings signed and sealed by a New Mexico licensed engineer. Include on shop drawings the formwork removal procedure and magnitude of construction loads used for design of reshoring or backshoring system. Indicate in procedure the magnitude of live and dead loads assumed for required capacity of the structure at time of reshoring or backshoring.

n. Submit manufacturer's product data on form liner proposed for use with each formed surface.

2.1.1 Wood Forms

Provide lumber that is square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Provide plywood that complies with NIST PS 1, B-B concrete form panels or better.

2.1.1.1 Concrete Form Plywood (Standard Rough)

Provide plywood that conforms to NIST PS 1, B-B, concrete form, not less than 5/8-inch thick.

2.1.1.2 Overlaid Concrete Form Plywood (Standard Smooth)

Provide plywood that conforms to NIST PS 1, B-B, high density form overlay, not less than 5/8-inch thick.

2.1.2 Steel Forms

Provide steel form surfaces that do not contain irregularities, dents, or sags.

2.2 FORMWORK ACCESSORIES

a. Use commercially manufactured formwork accessories, including ties and hangers.

b. Form ties and accessories must not reduce the effective cover of the reinforcement.

2.2.1 Form Ties

a. Use form ties with ends or end fasteners that can be removed without damage to concrete.

b. Where indicated in Contract Documents, use form ties with integral water barrier plates or other acceptable positive water barriers in walls.

c. The breakback distance for ferrous ties must be at least 2 in. for Surface Finish-2.0 or Surface Finish-3.0, as defined in ACI 301.

d. Submit manufacturer's data sheet on form ties.

2.2.2 Waterstops

Submit manufacturer's data sheet on waterstop materials and splices.

2.2.2.1 PVC Waterstop

Polyvinylchloride waterstops must conform to COE CRD-C 572.

2.2.2.2 Rubber Waterstop

Rubber waterstops must conform to COE CRD-C 513.

2.2.2.3 Thermoplastic Elastomeric Rubber Waterstop

Thermoplastic elastomeric rubber waterstops must conform to ASTM D471.

2.2.3 Biodegradable Form Release Agent

a. Provide form release agent that is colorless, biodegradable, and water-based, with a zero VOC content.

b. Provide product that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

c. Provide form release agent that reduces formwork moisture absorption, and does not contain diesel fuel, petroleum-based lubricating oils, waxes, or kerosene. Submit documentation indicating type of biobased material in product and biobased content. Indicate relative dollar value of biobased content products to total dollar value of products included in project.

d. Submit manufacturer's product data on formwork release agent for use on each form-facing material.

2.2.4 Chamfer Materials

Use lumber materials with dimensions of 3/4 x 3/4 in.

2.2.5 Construction and movement joints

a. Submit details and locations of construction joints in accordance with the requirements herein.
b. Make construction joints perpendicular to main reinforcement.
c. Provide movement joints where indicated in the Drawings or in accepted alternate locations.
d. Submit location and detail of movement joints if different from those indicated in Contract Documents.
e. Submit manufacturer's data sheet on expansion joint materials.
f. Provide keyways where indicated in Contract Documents. Longitudinal keyways indicated in Contract Documents must be at least 1-1/2 in. deep, measured perpendicular to the plane of the joint.

2.2.6 Other Embedded items

Use sleeves, inserts, anchors, and other embedded items of material and design indicated in Contract Documents.

2.3 CONCRETE MATERIALS

2.3.1 Cementitious Materials

2.3.1.1 Portland Cement

a. Unless otherwise specified, provide cement that conforms to ASTM C150/C150M Type V.

b. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

c. Submit information along with evidence demonstrating compliance with referenced standards. Submittals must include types of cementitious materials, manufacturing locations, shipping locations, and certificates showing compliance.

d. Cementitious materials must be stored and kept dry and free from contaminants.

2.3.1.2 Fly Ash

a. ASTM C618, Class F, except that the maximum allowable loss on ignition must not exceed 3 percent.

b. If fly ash is used it shall range from 15 to 20 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Where the use of fly ash cannot meet the minimum level, it shall not be used. Report the chemical analysis of the fly ash in accordance with ASTM C311/C311M. Evaluate and classify fly ash in accordance with ASTM D5759.

2.3.2 Water

a. Water or ice must comply with the requirements of ASTM C1602/C1602M.

b. Maximum water/cement ratio shall be 0.40

c. Minimize the amount of water in the mix. Improve workability by adjusting the grading of the aggregate and using admixture rather than by adding water.

d. Water must be potable; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete.

e. Protect mixing water and ice from contamination during storage and delivery.

f. Submit test report showing water complies with ASTM C1602/C1602M.

g. When non-potable source is proposed for use, submit documentation on effects of water on strength and setting time in compliance with ASTM C1602/C1602M.

2.3.3 Aggregate

2.3.3.1 Normal-Weight Aggregate

a. Aggregates must conform to ASTM C33/C33M.

b. Aggregates used in concrete must be obtained from the same sources and have the same size range as aggregates used in concrete represented by submitted field test records or used in trial mixtures.

c. Provide sand that is at least 50 percent acid insoluble based on ASTM D3042.

d. Store and handle aggregate in a manner that will avoid segregation and prevents contamination by other materials or other sizes of aggregates. Store aggregates in locations that will permit them to drain freely. Do not use aggregates that contain frozen lumps.

e. Submit types, pit or quarry locations, producers' names, aggregate supplier statement of compliance with ASTM C33/C33M, and ASTM C1293 expansion data not more than 18 months old.

2.3.3.2 Lightweight Aggregate

Lightweight aggregate in accordance with ASTM C330/C330M.

2.3.3.3 Recycled Aggregate Materials

A minimum of 25 percent recycled aggregate may be used, depending on local availability and conforming to requirements of the mix design. Recycled aggregate to include recovered stone that meets the aggregate requirements specified. Submit recycled material request with the aggregate certification submittals and do not use until approved by the Engineer.

2.3.4 Admixtures

a. Chemical admixtures must conform to ASTM C494/C494M.

b. Air-entraining admixtures must conform to ASTM C260/C260M.

c. Chemical admixtures for use in producing flowing concrete must conform to ASTM C1017/C1017M.

d. Do not use calcium chloride admixtures

e. Admixtures used in concrete must be the same as those used in the concrete represented by submitted field test records or used in trial mixtures.

f. Protect stored admixtures against contamination, evaporation, or damage.

g. To ensure uniform distribution of constituents, provide agitating equipment for admixtures used in the form of suspensions or unstable solutions. Protect liquid admixtures from freezing and from temperature changes that would adversely affect their characteristics.

h. Submit types, brand names, producers' names, manufacturer's technical data sheets, and certificates showing compliance with standards required herein.

## 2.4 MISCELLANEOUS MATERIALS

### 2.4.1 Concrete Curing Materials

Provide concrete curing material in accordance with ACI 301 Section 5 and ACI 308.1 Section 2. Submit product data for concrete curing compounds. Submit manufactures instructions for placement of curing compound.

### 2.4.2 Nonshrink Grout

Nonshrink grout in accordance with ASTM C1107/C1107M.

### 2.4.3 Expansion/Contraction Joint Filler

ASTM D1751. Material must be 1/2 inch thick.

### 2.4.4 Joint Sealants

Submit manufacturer's product data, indicating VOC content.

#### 2.4.4.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D6690 or ASTM C920, Type M, Class 25, Use T.

#### 2.4.4.2 Vertical Surfaces Greater Than 3 Percent Slope

ASTM C920, Type M, Grade NS, Class 25, Use T NT. FS SS-S-200, no sag.

#### 2.4.4.3 Preformed Polychloroprene Elastomeric Type

ASTM D2628.

2.4.4.4 Lubricant for Preformed Compression Seals

ASTM D2835.

2.5 CONCRETE MIX DESIGN

2.5.1 Properties and Requirements

a. Use materials and material combinations listed in this section and the contract documents.

b. Cementitious material content must be adequate for concrete to satisfy the specified requirements for strength, w/cm, durability, and finishability described in this section and the contract documents.

c. Concrete shall meet 28-day unconfined compressive strength of 4,000 psi

d. Selected target slump must meet the requirements of this section, the contract documents, and must not exceed 5.5 in. for concrete not subject to freezing/thawing. Concrete must not show visible signs of segregation.

e. The target slump must be enforced for the duration of the project. Determine the slump by ASTM C143/C143M. Slump tolerances must meet the requirements of ACI 117. Tempering of concrete is not allowed.

f. The nominal maximum size of coarse aggregate for a mixture must not exceed three-fourths of the minimum clear spacing between reinforcement, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

g. Concrete must be air entrained for members assigned to Exposure Class F1, F2, or F3. The total air content must be in accordance with the requirements of the paragraph titled 2.5.2 DURABILITY.

h. Measure air content at the point of delivery in accordance with ASTM C173/C173M or ASTM C231/C231M.

i. Concrete for slabs to receive a hard-troweled finish must have a total air content greater than 3 percent.

j. Aggregates shall be measured by weight (mass) for concrete batched under the requirements of ASTM C94. Maximum size aggregate shall be 1 inch.

k. Provide concrete that meets the requirements of ASTM C94/C94M and conforms to ASTM C150/C150M Type V.

2.5.2 Durability

2.5.2.1 Alkali-Aggregate Reaction

Do not use aggregates susceptible to alkali-carbonate reaction (ACR). Use one of the three options below for qualifying concrete mixtures to reduce the potential of alkali-silica reaction (ASR):

a. For each aggregate used in concrete, the expansion result determined in accordance with ASTM C1293 must not exceed 0.04 percent at one year.

b. For each aggregate used in concrete, the expansion result of the aggregate and cementitious materials combination determined in accordance with ASTM C1567 must not exceed 0.10 percent at an age of 16 days.

c. Alkali content in concrete (LBA) must not exceed 4 pounds per cubic yard for moderately reactive aggregate or 3 pounds per cubic yard for highly reactive aggregate. Reactivity must be determined by testing in accordance with ASTM C1293 and categorized in accordance with ASTM C1778. Alkali content is calculated as follows:
LBA = (cement content, pounds per cubic yard) × (equivalent alkali content of portland cement in percent/100 percent)

2.5.2.2 Freezing and Thawing Resistance

a. Provide concrete meeting the following requirements based on exposure class assigned to members for freezing-and-thawing exposure in Contract Documents:

| Application | 28-Day Design Strength (f'c) (psi) | Slump (inches) | Air Entrainment (%) |
|---|---|---|---|
| Concrete Structures, and concrete grout for large rock drainage structures | 4,000 | 4.5-5.5 | 6.5% +/-1.5% |

b. Submit documentation verifying compliance with specified requirements.

2.5.2.3 Corrosion and Chloride Content

a. Provide concrete meeting the requirements of the following table based on the exposure class assigned to members requiring protection against reinforcement corrosion in Contract Documents.

b. Submit documentation verifying compliance with specified requirements.

c. Water-soluble chloride ion content contributed from constituents including water, aggregates, cementitious materials, and admixtures must be determined for the concrete mixture by ASTM C1218/C1218M at age between 28 and 42 days.

d. The maximum water-soluble chloride ion (Cl-) content in concrete, percent by mass of cement is as follows:

| Cementitious material | Maximum percent of total cementitious material by mass* |
|---|---|
| Fly ash or other pozzolans conforming to ASTM C618 | 25 |

| Cementitious material | Maximum percent of total cementitious material by mass* |
|---|---|
| Slag cement conforming to ASTM C989/C989M | 50 |
| Silica fume conforming to ASTM C1240 | 10 |
| Total of fly ash or other pozzolans, slag cement, and silica fume | 50* |
| Total of fly ash or other pozzolans and silica fume | 35* |

* Total cementitious material also includes ASTM C150/C150M, ASTM C595/C595M, ASTM C845/C845M, and ASTM C1157/C1157M cement. The maximum percentages above must include:

i. Fly ash or other pozzolans are present in ASTM C1157/C1157M or ASTM C595/C595M Type IP blended cement.

ii. Slag cement present in ASTM C1157/C1157M or ASTM C595/C595M Type IS blended cement.

iii. Silica fume conforming to ASTM C1240 present in ASTM C1157/C1157M or ASTM C595/C595M Type IP blended cement.

^ Fly ash or other pozzolans and silica fume must constitute no more than 25 percent and 10 percent, respectively, of the total mass of the cementitious materials.

2.5.2.4 Sulfate Resistance

a. Not used

2.5.2.5 Concrete Temperature

The temperature of concrete as delivered must not exceed 85°F. Concrete placement temperature shall be between 50°F to 85°F. Refer to 3.7.2 COLD WEATHER and 3.7.3 HOT WEATHER for hot and cold weather concrete placement.

2.5.3 Ready-Mix Concrete

Provide concrete that meets the requirements of ASTM C94/C94M and conforms to ASTM C150/C150M Type V

Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by ASTM C94/C94M:

a. Type and brand cement

b. Cement and supplementary cementitious materials content in 94-pound bags per cubic yard of concrete

c. Maximum size of aggregate

d. Amount and brand name of admixtures

e. Total water content expressed by water cementitious material ratio

2.6 REINFORCEMENT

a. Bend reinforcement cold. Fabricate reinforcement in accordance with fabricating tolerances of ACI 117.

b. When handling and storing coated reinforcement, use equipment and methods that do not damage the coating. If stored outdoors for more than 2 months, cover coated reinforcement with opaque protective material.

c. Submit manufacturer's certified test report for reinforcement.

d. Submit placing drawings showing fabrication dimensions and placement locations of reinforcement and reinforcement supports. Placing drawings must indicate locations of splices, lengths of lap splices, and details of mechanical and welded splices.

e. Submit request with locations and details of splices not indicated in Contract Documents.

f. Submit request to place column dowels without using templates.

g. Submit request for field cutting, including location and type of bar to be cut and reason field cutting is required.

2.6.1 Reinforcing Bars

a. Reinforcing bars must be deformed, except spirals, load-transfer dowels, and welded wire reinforcement, which may be plain.

b. ASTM A615/A615M with the bars marked S, Grade 60; or ASTM A996/A996M with the bars marked R, Grade 60, or marked A, Grade 60.

c. Submit mill certificates for reinforcing bars.

2.6.1.1 Bar Mats

a. Bar mats must conform to ASTM A184/A184M.

2.6.2 Wire

a. Provide flat sheets of welded wire reinforcement for slabs and toppings.

b. Plain or deformed steel wire must conform to ASTM A1064/A1064M.

2.6.3 Welded wire reinforcement

a. Use welded wire reinforcement specified in Contract Documents and conforming to one or more of the specifications given herein.

b. Plain welded wire reinforcement must conform to ASTM A1064/A1064M, with welded intersections spaced no greater than 12 in. apart in direction of principal reinforcement.

c. Deformed welded wire reinforcement must conform to ASTM A1064/A1064M, with welded intersections spaced no greater than 16 in. apart in direction of principal reinforcement.

d. Zinc-coated (galvanized) welded wire reinforcement must conform to ASTM A1060/A1060M. Coating damage incurred during shipment, storage, handling, and placing of zinc-coated (galvanized) welded wire reinforcement must be repaired in accordance with ASTM A780/A780M. If damaged area exceeds 2 percent of surface area in each linear foot of each wire or welded wire reinforcement, the sheet containing the damaged area must not be used. The 2 percent limit on damaged coating area shall include repaired areas damaged before shipment as required by ASTM A1060/A1060M.

2.6.4 Reinforcing Bar Supports

a. Provide reinforcement support types within structure as required by Contract Documents. Reinforcement supports must conform to CRSI RB4.1. Submit description of reinforcement supports and materials for fastening coated reinforcement if not in conformance with CRSI RB4.1.

b. Legs of supports in contact with formwork must be hot-dip galvanized, or plastic coated after fabrication, or stainless-steel bar supports.

2.6.5 Welding

a. Provide weldable reinforcing bars that conform to ASTM A706/A706M and ASTM A615/A615M and Supplement S1, Grade 60, except that the maximum carbon content must be 0.55 percent.

b. Comply with AWS D1.4/D1.4M unless otherwise specified. Do not tack weld reinforcing bars.

c. Welded assemblies of steel reinforcement produced under factory conditions, such as welded wire reinforcement, bar mats, and deformed bar anchors, are allowed.

d. After completing welds on zinc-coated (galvanized), epoxy-coated, or zinc and epoxy dual-coated reinforcement, coat welds and repair coating damage as previously specified.

PART 3 EXECUTION

3.1 EXAMINATION

a. Do not begin installation until substrates have been properly constructed; verify that substrates are level.

b. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before processing.

c. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Engineer and wait for instructions before beginning installation.

## 3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete before the concrete is poured.

### 3.2.1 General

a. Perform Work according to ACI 301, 318, and 350. ACI 350 takes precedence.

b. Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.

c. Remove standing water without washing over freshly deposited concrete. Divert flow of water through side drains provided for such purpose.

d. Schedule concrete placement and deliveries such that cold joints do not occur.

### 3.2.2 Subgrade Under Foundations and Footings

a. When subgrade material is semi-porous and dry, sprinkle subgrade surface with water as required to eliminate suction at the time concrete is deposited, or seal subgrade surface by covering surface with specified vapor retarder.

b. When subgrade material is porous, seal subgrade surface by covering surface with specified vapor retarder.

### 3.2.3 Edge Forms and Screed Strips for Slabs

a. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment.

b. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.

### 3.2.4 Reinforcement and Other Embedded Items

a. Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.

b. When concrete is placed, reinforcement must be free of materials deleterious to bond. Reinforcement with rust, mill scale, or a combination of both will be considered satisfactory, provided minimum nominal dimensions, nominal weight, and minimum average height of deformations of a hand-wire-brushed test specimen are not less than applicable ASTM specification requirements.

## 3.3 FORMS

a. Provide forms, shoring, and scaffolding for concrete placement. Set forms mortar-tight and true to line and grade.

b. Chamfer above grade exposed joints, edges, and external corners of concrete `0.75 inch`. Place chamfer strips in corners of formwork to produce beveled edges on permanently exposed surfaces.

c. Provide formwork with clean-out openings to permit inspection and removal of debris.

d. Inspect formwork and remove foreign material before concrete is placed.

e. At construction joints, lap form-facing materials over the concrete of previous placement. Ensure formwork is placed against hardened concrete so offsets at construction joints conform to specified tolerances.

f. Provide positive means of adjustment (such as wedges or jacks) of shores and struts. Do not make adjustments in formwork after concrete has reached initial setting. Brace formwork to resist lateral deflection and lateral instability.

g. Fasten form wedges in place after final adjustment of forms and before concrete placement.

h. Provide anchoring and bracing to control upward and lateral movement of formwork system.

i. Construct formwork for openings to facilitate removal and to produce opening dimensions as specified and within tolerances.

j. Provide runways for moving equipment. Support runways directly on formwork or structural members. Do not support runways on reinforcement. Loading applied by runways must not exceed capacity of formwork or structural members.

k. Position and support expansion joint materials, waterstops, and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with removable material to prevent concrete entry into voids.

l. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign materials before concrete placement.

3.3.1 Coating

a. Cover formwork surfaces with an acceptable material that inhibits bond with concrete.

b. If formwork release agent is used, apply to formwork surfaces in accordance with manufacturer's recommendations before placing reinforcement. Remove excess release agent on formwork prior to concrete placement.

c. Do not allow formwork release agent to contact reinforcement or hardened concrete against which fresh concrete is to be placed.

3.3.2 Reuse

a. Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised.

b. Wood forms must not be clogged with paste and must be capable of absorbing high water-cementitious material ratio paste.

c. Remove leaked mortar from formwork joints before reuse.

3.3.3 Forms for Standard Rough Form Finish

Provide formwork in accordance with ACI 301 Section 5 with a surface finish, SF-1.0, for formed surfaces that are to be concealed by other construction.

3.3.4 Forms for Standard Smooth Form Finish

Provide formwork in accordance with ACI 301 Section 5 with a surface finish, SF-3.0, for formed surfaces that are exposed to view.

3.3.5 Form Ties

a. After ends or end fasteners of form ties have been removed, repair tie holes in accordance with ACI 301 Section 5 requirements.

3.3.6 Tolerances for Form Construction

a. Construct formwork so concrete surfaces conform to tolerances in ACI 117.

b. Position and secure sleeves, inserts, anchors, and other embedded items such that embedded items are positioned within ACI 117 tolerances.

c. To maintain specified elevation and thickness within tolerances, install formwork to compensate for deflection and anticipated settlement in formwork during concrete placement. Set formwork and intermediate screed strips for slabs to produce designated elevation, camber, and contour of finished surface before formwork removal. If specified finish requires use of vibrating screeds or roller pipe screeds, ensure that edge forms and screed strips are strong enough to support such equipment.

3.3.7 Removal of Forms and Supports

a. If vertical formed surfaces require finishing, remove forms as soon as removal operations will not damage concrete.

b. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform repairs and finishing operations required. If forms are removed before end of specified curing period, provide curing and protection.

c. Do not damage concrete during removal of vertical formwork for columns, walls, and sides of beams. Perform needed repair and finishing operations required on vertical surfaces. If forms are removed before end of specified curing period, provide curing and protection.

d. Leave formwork and shoring in place to support construction loads and weight of concrete in beams, slabs, and other structural members until in-place required strength of concrete is reached.

e. Form-facing material and horizontal facing support members may be removed before in-place concrete reaches specified compressive strength if shores and other supports are designed to allow facing removal without deflection of supported slab or member.

3.3.8 Strength of Concrete Required for Removal of Formwork

If removal of formwork, reshoring, or backshoring is based on concrete reaching a specified in-place strength, mold and field-cure cylinders in accordance with ASTM C31/C31M. Formwork should be in place for at least 5 days, more if for walls with a lift to be placed on top, partially for support, partially to allow proper curing. Test cylinders in accordance with ASTM C39/C39M. Alternatively, use one or more of the methods listed herein to evaluate in-place concrete strength for formwork removal.

a. Tests of cast-in-place cylinders in accordance with ASTM C873/C873M. This option is limited to slabs with concrete depths from 5 to 12 in.

b. Maturity method in accordance with ASTM C1074. Submit maturity method data using project materials and concrete mix proportions used on the project to demonstrate the correlation between maturity and compressive strength of laboratory cured test specimens to the Engineer.

3.4 WATERSTOP INSTALLATION AND SPLICES

a. Provide waterstops in construction joints as indicated.

b. Install formwork to accommodate waterstop materials. Locate waterstops in joints as indicated in Contract Documents. Minimize the number of splices in waterstop. Splice waterstops in accordance with manufacturer’s written instructions. Install factory-manufactured premolded mitered corners, intersections, changes of direction, and transitions.

c. Install waterstops to form a continuous diaphragm in each joint. Make adequate provisions to support and protect waterstops during progress of work. Protect waterstops protruding from joints from damage.

d. Waterstops are to be installed per manufacturer's recommendations; half the width of the waterstop embedded in the concrete on each side of the joint; additional vibration surrounding waterstops to ensure complete and void-free embedment; assure protruding half of waterstop is clean before placing next lift.

3.4.1 PVC Waterstop

Make splices by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. Reform waterstops at splices with a remolding iron with ribs or corrugations to match the pattern of the waterstop. The spliced area, when cooled, must show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

3.4.2 Rubber Waterstop

Not used

3.4.3 Thermoplastic Elastomeric Rubber Waterstop

Not used.

3.5 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

a. Unless otherwise specified, placing reinforcement and miscellaneous materials must be in accordance with ACI 301 and ACI 350. Provide bars, welded wire reinforcement, wire ties, supports, and other devices necessary to install and secure reinforcement.

b. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

3.5.1 General

Provide details of reinforcement that are in accordance with the Contract Documents.

3.5.2 Reinforcement Supports

Provide reinforcement support in accordance with CRSI RB4.1 and ACI 301 and ACI 350 Section 3 requirements. Supports for coated or galvanized bars must also be coated with electrically compatible material for a distance of at least 2 inches beyond the point of contact with the bars.

3.5.3 Splicing

As indicated in the Contract Documents. For splices not indicated follow ACI 301 and ACI 350. Do not splice at points of maximum stress. Overlap welded wire reinforcement the spacing of the cross wires, plus 2 inches.

3.5.4 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Provide bolt threads that match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt is installed.

3.5.5 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement and support against displacement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

3.5.6 Fabrication

Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

a. Provide fabrication tolerances that are in accordance with ACI 117.

b. Provide hooks and bends that are in accordance with the Contract Documents.

Reinforcement must be bent cold to shapes as indicated. Bending must be done in the shop. Rebending a reinforcing bar that has been bent incorrectly is not permitted. Bending must be in accordance with standard approved practice and by approved machine methods.

Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

Do not use reinforcement that has the following defects:

a. Bar lengths, depths, and bends beyond specified fabrication tolerances

b. Bends or kinks not indicated on drawings or approved shop drawings are not permitted.

c. Bars with reduced cross-section due to rusting or other cause

Replace defective reinforcement with new reinforcement having required shape, form, and cross-section area.

3.5.7 Placing Reinforcement

Place reinforcement in accordance with ACI 301 and ACI 350.

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire reinforcement on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

For slabs other than on grade, supports for which a portion is less than 1 inch from concrete surfaces that are exposed to view or to be painted must be of precast concrete units, plastic-coated steel, or stainless-steel protected bar supports. Precast concrete units must be wedge shaped, not larger than 3-1/2 by 3-1/2 inches, and of thickness equal to that indicated for concrete protection of reinforcement. Provide precast units that have cast-in galvanized tie wire hooked for anchorage and blend with concrete surfaces after finishing is completed.

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

a. Provide supports for reinforcing bars that are sufficient in number and have sufficient strength to carry the reinforcement they support, and in accordance with ACI 301, ACI 350 and CRSI 10MSP. Do not use supports to support runways for concrete conveying equipment and similar construction loads.

b. Equip supports on ground and similar surfaces with sand-plates.

c. Support welded wire reinforcement as required for reinforcing bars.

d. Secure reinforcements to supports by means of tie wire. Wire must be black, soft iron wire, not less than 16 gage.

e. Reinforcement must be accurately placed, securely tied at intersections, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to the Contract Documents.

f. Bending of reinforcing bars partially embedded in concrete is permitted only as specified in the Contract Documents.

3.5.8 Spacing of Reinforcing Bars

a. Concrete cast against and permanently exposed to the ground or concrete exposed to the ground or weather shall have a minimum cover of 3".

b. Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If a reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to preapproval by the Engineer.

3.5.9 Concrete Protection for Reinforcement

Additional concrete protection must be in accordance with the Contract Documents.

3.5.10 Welding

Welding must be in accordance with AWS D1.4/D1.4M. See Section 05 05 23.16 (STRUCTURAL WELDING).

3.6 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

In accordance with ASTM C94/C94M, ACI 301, ACI 302.1R and ACI 304R, except as modified herein. Batching equipment must be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

3.6.1 Measuring

Make measurements at intervals as specified in paragraphs 3.12.1 CONCRETE SAMPLING and 3.12.2 CONCRETE TESTING.

3.6.2 Mixing

a. Mix concrete in accordance with ASTM C94/C94M, ACI 301 and ACI 304R.

b. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the concrete temperature is less than 84 degrees F.

c. Place concrete within 60 minutes if the concrete temperature is greater than 84 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and submitted water-cementitious material ratio are not exceeded and the required concrete strength is still met. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required.

d. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture, within the manufacturer's recommended dosage, to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch. Do not reconstitute concrete that has begun to solidify.

### 3.6.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

## 3.7 PLACING CONCRETE

Place concrete in accordance with ACI 301 Section 5. Concrete shall be placed within 15 minutes of discharge into non-agitating equipment.

### 3.7.1 Pumping

ACI 304R and ACI 304.2R. Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed 2 inches at discharge/placement. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of course aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well-rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

#### 3.7.1.1 Pumping Lightweight Concrete

In accordance with ACI 213R unless otherwise specified. Presoak or presaturate aggregates. Cement content must be minimum of 564 pounds per cubic yard and be sufficient to accommodate a 4 to 6 inch slump.

### 3.7.2 Cold Weather

Cold weather concrete must meet the requirements of ACI 306.1 unless otherwise specified. Do not allow concrete temperature to decrease below 55 degrees F. Obtain approval prior to placing concrete when the ambient temperature is below 45 degrees F or when concrete is likely to be subjected to freezing

temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 55 degrees F minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 37 degrees F in 1 hour and 55 degrees F per 24 hours after heat application.

3.7.3 Hot Weather

Hot weather concrete must meet the requirements of ACI 305.1 unless otherwise specified. Maintain required concrete temperature using Figure 4.2 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

3.7.4 Bonding

Surfaces of set concrete at joints, must be roughened and cleaned of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, nor damaged concrete at the surface.

Obtain bonding of fresh concrete that has set as follows:

a. At joints between footings and walls or columns, between walls or columns and the beams or slabs they support, and elsewhere unless otherwise specified; roughened and cleaned surface of set concrete must be dampened, but not saturated, immediately prior to placing of fresh concrete.

b. At joints in exposed-to-view work; at vertical joints in walls; at joints near midpoint of span in girders, beams, supported slabs, other structural members; in work designed to contain liquids; the roughened and cleaned surface of set concrete must be dampened but not saturated and covered with a cement grout coating.

c. Provide cement grout that consists of equal parts of Portland cement and fine aggregate by weight with not more than 6 gallons of water per sack of cement. Apply cement grout with a stiff broom or brush to a minimum thickness of 1/16 inch. Deposit fresh concrete before cement grout has attained its initial set.

3.8 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

In accordance with ACI 301 and ACI 302.1R, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Where straightedge measurements are specified, Contractor must provide straightedge.

3.8.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the

weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater. Grate tampers ("jitterbugs") shall not be used.

3.8.1.1 Scratched

Not used.

3.8.1.2 Floated

Use for exterior slabs where not otherwise specified. Finish concrete in accordance with ACI 301 Section 5 for a floated finish

3.8.1.3 Steel Troweled

Not used.

3.8.1.4 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Finish concrete in accordance with ACI 301 Section 5 for a broomed finish.

3.8.1.5 Wood Float

Use wood floats to finish exposed concrete grout in large rock drainage structures. Grout should be placed between large rocks and consolidated with a vibrator. The finish surface of grout should match the top edges of the surrounding rock, with a smooth transition between. Excess grout should be removed from the exposed surfaces of all rocks, so that the rock faces are fully exposed and clean of grout.

3.9 JOINTS

3.9.1 Construction Joints

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Joints must be perpendicular to main reinforcement. Reinforcement must be continued and developed across construction joints. Locate construction joints as follows:

3.9.1.1 Maximum Allowable Construction Joint Spacing

a. In walls at not more than `60 feet` in any horizontal direction.

b. In slabs on ground, so as to divide slab into areas not in excess of 1,200 square feet.

3.9.1.2 Construction Joints for Constructability Purposes

a. In walls, at top of footing; at top of slabs on ground.

b. Provide keyways at least 2-inches deep in construction joints in walls and slabs and between walls and footings.

3.9.2 Isolation Joints in Slabs on Ground

a. Provide joints at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

3.9.3 Contraction Joints in Slabs on Ground

a. Provide joints to form panels as indicated.

b. Under and on exact line of each control joint, cut 50 percent of welded wire reinforcement before placing concrete.

c. Sawcut contraction joints into slab on ground in accordance with ACI 301 Section 5.

d. Joints must be 1/8-inch wide by 1/5 to 1/4 of slab depth and formed by inserting hand-pressed fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured for at least 7 days, the Contractor must remove inserts and clean groove of foreign matter and loose particles.

3.9.4 Sealing Joints in Slabs on Ground

a. Contraction and control joints which are to receive finish flooring material must be sealed with joint sealing compound after concrete curing period. Slightly underfill groove with joint sealing compound to prevent extrusion of compound. Remove excess material as soon after sealing as possible.

b. Sealed groove must be left ready to receive filling material that is provided as part of finish floor covering work.

3.10 CURING AND PROTECTION

Curing and protection in accordance with ACI 301 Section 5, unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and other activities resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on surfaces to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer, hardener, or epoxy coating. Allow curing compound/sealer installations to cure prior to the installation of materials that adsorb VOCs.

3.10.1 Requirements for Type V Portland Cement – High Sulfate Resistance

ASTM C150 dictates the curing period required for Type V Portland Cement not be less than 14 days.

3.10.2 Curing Periods

ACI 301 Section 5. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Engineer.

3.10.3 Curing Formed Surfaces

Accomplish curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, accomplish final curing of formed surfaces by the curing methods specified above, as applicable.

3.10.4 Curing Unformed Surfaces

a. Accomplish initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, by membrane curing.

b. Accomplish final curing of concrete surfaces to receive liquid floor hardener of finish flooring by moisture-retaining cover curing.

3.10.5 Temperature of Concrete During Curing

When temperature of atmosphere is 41 degrees F and below, maintain temperature of concrete at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured by maturity. When necessary, make arrangements before start of concrete placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which cause too rapid drying of concrete, make arrangements before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete must be uniform and not exceed 37 degrees F in 1 hour nor 50 degrees F in a 24-hour period.

3.10.6 Protection from Mechanical Injury

During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

3.10.7 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

3.11 FIELD QUALITY CONTROL

The Contractor will notify the Engineer 72 hours prior to concrete placement for inspection.. The Design Engineer will inspect placement of reinforcement prior to concrete pouring. Without the reinforcement inspection, the work is subject to rejection and removal at no additional cost to the AMLP.

3.11.1 Concrete Sampling

ASTM C172/C172M. Collect samples of fresh concrete to perform tests specified. ASTM C31/C31M for making test specimens.

3.11.2 Concrete Testing

3.11.2.1 Slump Tests

ASTM C143/C143M. Take concrete samples during concrete placement/discharge. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cementitious material ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch truck (minimum) or every 12 cubic yards (maximum) of concrete.

3.11.2.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 12 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

3.11.2.3 Compressive Strength Tests

ASTM C39/C39M. Make six 4 inch by 8 inch test cylinders for each set of tests in accordance with ASTM C31/C31M, ASTM C172/C172M and applicable requirements of ACI 305R and ACI 306R. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold two cylinders in reserve. Take samples for strength tests of each mix design of concrete placed each day not less than once a day, nor less than once for each 50 cubic yards of concrete. Each cylinder must be tested at 28 days for strength and must pass/meet the strength requirement or the 56 day reserve cylinder(s) are to be tested. Concrete compressive tests must meet the requirements of this section, the Contract Document, and ACI 301. Retest locations represented by erratic core strengths. Where retest does not meet concrete compressive strength requirements submit a mitigation or remediation plan for review and approval by the Engineer. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

3.11.2.4 Air Content

ASTM C173/C173M or ASTM C231/C231M for normal weight concrete. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

3.11.2.5 Strength of Concrete Structure

The strength of the concrete structure will be considered to be deficient if the following conditions are identified:

a. Failure to meet compressive strength tests as evaluated.

b. Reinforcement not conforming to requirements specified.

c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.

d. Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified.

e. Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration.

f. Poor workmanship likely to result in deficient strength.

Where the strength of the concrete structure is considered deficient submit a mitigation or remediation plan for review and approval by the Engineer.

3.11.2.6 Non-Conforming Materials

Factors that indicate that there are non-conforming materials include (but not limited to) excessive compressive strength, inadequate compressive strength, excessive slump, excessive voids and honeycombing, concrete delivery records that indicate excessive time between mixing and placement, or excessive water was added to the mixture during delivery and placement. These indicators alone are sufficient reason for the Engineer to request additional sampling and testing.

Investigations into non-conforming materials must be conducted at the Contractor's expense. The Contractor must be responsible for the investigation and must make written recommendations to adequately mitigate or remediate the non-conforming material. The Engineer may accept, accept with reduced payment, require mitigation, or require removal and replacement of non-conforming material at no additional cost to the Engineer.

3.11.2.7 Testing Concrete Structure for Strength

When there is evidence that strength of concrete structure in place does not meet specification requirements or there are non-conforming materials, make cores drilled from hardened concrete for compressive strength determination in accordance with ASTM C42/C42M, and as follows:

a. Take at least three representative cores from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by the Engineer.

b. Test cores after moisture conditioning in accordance with ASTM C42/C42M if concrete they represent is more than superficially wet under service.

c. Air dry cores, (60 to 80 degrees F with relative humidity less than 60 percent) for 7 days before test and test dry if concrete they represent is dry under service conditions.

d. Strength of cores from each member or area are considered satisfactory if each is equal to or greater than of the 28-day design compressive strength of the class of concrete.

Fill core holes solid with non-shrink grout and finish to match adjacent concrete surfaces.

Correct concrete work that is found inadequate by core tests in a manner approved by the Engineer.

## 3.12 REPAIR, REHABILITATION AND REMOVAL

Before the Engineer accepts the structure the Contractor must inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. A report documenting these defects must be prepared which includes recommendations for repair, removal or remediation must be submitted to the Engineer for approval before corrective work is accomplished.

### 3.12.1 Crack Repair

Prior to final acceptance, cracks in excess of 0.02 inches wide must be documented and repaired. The proposed method and materials to repair the cracks must be submitted to the Engineer for approval. The proposal must address the amount of movement expected in the crack due to temperature changes and loading.

### 3.12.2 Repair of Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Concrete surfaces with weak surfaces less than 1/4 inch thick must be diamond ground to remove the weak surface. Surfaces containing weak surfaces greater than 1/4 inch thick must be removed and replaced or mitigated in a manner acceptable to the Engineer.

### 3.12.3 Failure of Quality Assurance Test Results

Proposed mitigation efforts by the Contractor must be approved by the Engineer prior to proceeding.

-- End of Section --

SECTION 05 23.16

STRUCTURAL WELDING

PART 1 GENERAL

1.1 Scope

This specification covers the requirements for (1) qualifying welding procedures, welders and welding operators, and (2) the fabrication, welding and inspection of carbon steel, low alloy steel, extra-high-strength quenched and tempered low alloy steels, and austenitic stainless steel materials for structural steel structures and non-structural use. Includes: welding requirements for structural work including steel water pipe, rebar, hand railings and elsewhere when required to accomplish the work.

Related requirements:

Section 05 50 14 – STRUCTURAL METAL FABRICATIONS
Section 05 50 15 – CIVIL WORKS FABRICATIONS
Section 05 52 00 - METAL RAILINGS

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

| | |
|---|---|
| AASHTO | (2009; 2015 Revisions) LRFD Guide Specifications for the Design of Pedestrian Bridges 2nd Edition, with 2015 Interim Revisions |

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

| | |
|---|---|
| AISC 360 | (2022) Specification for Structural Steel Buildings |

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

| | |
|---|---|
| ANSI/ASNT CP-189 | (2020) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel |

AMERICAN WELDING SOCIETY (AWS)

| | |
|---|---|
| AWS A2.4 | (2012) Standard Symbols for Welding, Brazing and Nondestructive Examination |
| AWS D1.1/D1.1M | (2020) Structural Welding Code - Steel |
| AWS D1.3/D1.3M | (2018) Structural Welding Code - Sheet Steel |

| | |
|---|---|
| AWS D1.4/D1.4M | (2011) Structural Welding Code - Reinforcing Steel |
| AWS D14.4/D14.4M | (2012) Specification for Welded Joints for Machinery and Equipment |
| AWS QC1 | (2016) Specification for AWS Certification of Welding Inspectors |
| AWS Z49.1(2012) | Safety in Welding and Cutting and Allied Processes |

ASTM INTERNATIONAL (ASTM)

| | |
|---|---|
| ASTM E165/E165M | (2018) Standard Practice for Liquid Penetrant Examination for General Industry |
| ASTM E709 | (2021) Standard Guide for Magnetic Particle Testing |

## 1.3 SUBMITTALS

Engineer approval is required for submittals with an "E" classification. Submittals not having an "E" classification are for information only. When used, a code following the "E" classification identifies the office that will review the submittal for the Engineer. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

None

SD-03 Product Data

Welding Procedure Qualifications;
Welder, Welding Operator, and Tacker Qualification
Pre-Qualified Procedures;
Welding Electrodes and Rods

SD-06 Test Reports

Nondestructive Testing
Weld Inspection Log

SD-07 Certificates

Certified Welding Inspector

## 1.4 QUALITY ASSURANCE

Except for pre-qualified (in accordance with AWS D1.1/D1.1M) and previously qualified procedures, each Contractor performing welding must record in detail and qualify the welding procedure specification for welding procedures followed in the fabrication of weldments. Conform welding procedure

qualifications to AWS D1.1/D1.1M and to the specifications in this section. Submit for approval copies of the welding procedure specification and the procedure qualification records for each type of welding being performed. Submission of the welder, welding operator, or tacker qualification test records is also required. Approval of any procedure, however, does not relieve the Contractor of the sole responsibility for producing a finished structure meeting the specified requirements. Submit this information on the forms in Annex M of AWS D1.1/D1.1M. Individually identify and clearly reference on the detail drawings and erection drawings welding procedure specifications, or suitably key them to the contract drawings. In case of conflict between this specification and AWS D1.1/D1.1M, this specification governs.

1.4.1 General Requirements

Fabricate work in an AISC Certified Fabrication Plant, Category BU. Erect work by an AISC Certified Erector, Category CSE.

a. For Structural Projects, provide documentation of the following:

    1) Component Thickness 1/8 inch and greater: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.1/D1.1M.

    2) Component Thickness Less than 1/8 inch: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.3/D1.3M.

    3) Reinforcing Steel: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.4/D1.4M.

b. For other applications, provide documentation of the following:

    1) Submit two copies of the Certified Welding Procedure Specifications (WPS), Certified Brazing Procedure Specifications (BPS) and Certified Procedure Qualification Records (PQR) to the Engineer for review.

    2) Submit two copies of the Certified Welder Performance Qualifications (WPQ)and Certified Brazer Performance Qualifications (BPQ) to the Engineer for review within fifteen calendar days prior to employees welding on the project material.

    3) Machinery: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D14.4/D14.4M.

1.4.2 Previous Qualifications

Welding procedures previously qualified by test in accordance with AWS D1.1/D1.1M, may be accepted for this contract without re-qualification, upon receipt of the test results, if the following conditions are met:

a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.3.3 Pre-qualified Procedures

Welding procedures which are considered pre-qualified as specified in AWS D1.1/D1.1M will be accepted without further qualification. Submit for approval a listing or an annotated drawing to indicate the joints not pre-qualified. Procedure qualification is mandatory for these joints.

1.3.4 Welder, Welding Operator, and Tacker Qualification

Each welder, welding operator, and tacker assigned to work on this contract must be qualified in accordance with the applicable requirements of AWS D1.1/D1.1M and as specified in this section. Welders, welding operators, and tackers who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used within the applicable essential variables for welder qualification.

1.3.4.1 Previous Personnel Qualifications

At the discretion of the Engineer, welders, welding operators, and tackers qualified by test within the previous 6 months may be accepted for this contract without re-qualification if the following conditions are met:

a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder, welding operator, and tacker qualification test records are submitted and approved in accordance with the specified requirements for detail drawings.

b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.3.4.2 Certificates

Before assigning welders, welding operator, or tacker to work under this contract, submit the names and certification that each individual is qualified as specified. State in the certification the type of welding and positions for which the welder, welding operator, or tacker is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests. Keep the certification current, on file, and furnish 3 copies.

1.3.4.3 Renewal of Qualification

Re-qualification of a welder or welding operator is required under the following conditions:

a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.

b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.

c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract, and a qualification test has not been taken within the past 12 months. Submit as evidence of conformance records showing periods of employment, name of employer where welder, or welding operator, was last employed, and the process for which qualified.

d. A tacker who passes the qualification test is considered eligible to perform tack welding indefinitely in the positions and with the processes for which he/she is qualified, unless there is some specific reason to question the tacker's ability or there has been a gap greater than 6 months since he/she last used the process. In such a case, the tacker is required to pass the prescribed tack welding test.

1.3.5 Inspector Qualification

Submit certificates indicating that certified welding inspectors meet the requirements of AWS QC1. Submit qualifications for nondestructive testing personnel in accordance with the requirements of ANSI/ASNT CP-189 for Levels I or II in the applicable nondestructive testing method. Level I inspectors must have direct supervision of a Level II inspector.

1.3.6 Symbols and Safety

Use symbols in accordance with AWS A2.4, unless otherwise indicated. Follow safe welding practices and safety precautions during welding in conformance with AWS Z49.1.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Conform the design of welded connections to AISC 360 and AASHTO LRFD requirements, unless otherwise indicated or specified. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Perform welding as specified in this section, except where additional requirements are shown on the drawings or are specified in other sections. Do not commence welding until welding procedures, inspectors, nondestructive testing personnel, welders, welding operators, and tackers have been qualified and the submittals approved by the Engineer. Perform testing at or near the work site. Maintain records of the test results obtained in welding procedure, welder, welding operator, and tacker performance qualifications.

2.2 WELDING EQUIPMENT AND MATERIALS

Provide welding equipment, welding electrodes and rods, welding wire, and fluxes capable of producing satisfactory welds when used by a qualified welder or welding operator. Provide welding equipment and materials that comply with the applicable requirements of AWS D1.1/D1.1M. Submit product data on welding electrodes and rods.

PART 3 EXECUTION

3.1 WELDING OPERATIONS

3.1.1 Requirements

Conform workmanship and techniques for welded construction to the requirements of AASHTO LRFD requirements, AWS D1.1/D1.1M and AISC 360. When AWS D1.1/D1.1M and the AISC 360 specification conflict, the requirements of AWS D1.1/D1.1M govern.

3.1.2 Identification

Identify welds in one of the following ways:

a. Submit written records to indicate the location of welds made by each welder, welding operator, or tacker.

b. Identify work performed by each welder, welding operator, or tacker with an assigned number, letter, or symbol to identify welds made by that individual. The Engineer may require welders, welding operators, and tackers to apply their symbol next to the weld by means of rubber stamp, felt-tipped marker with waterproof ink, or other methods that do not cause an indentation in the metal. Place the identification mark for seam welds adjacent to the weld at 3 foot intervals. Identification with die stamps or electric etchers is not allowed.

3.2 QUALITY CONTROL

Perform testing using an approved independent inspection or testing laboratory or technical consultant. A Certified Welding Inspector must perform visual inspection on 100% of welds. Document this inspection in the Visual Weld Inspection Log. Test 50% of CJP welds using ultrasonic testing per Table 6.2 of AWS D1.1/D1.1M. Randomly test 50% of PJP and fillet welds or as indicated by magnetic particle or dye penetrant testing. Verify the welds conform to paragraph 3.3 STANDARDS OF ACCEPTANCE. Conform procedures and techniques for inspection with applicable requirements of AWS D1.1/D1.1M, ASTM E165/E165M, and ASTM E709. Submit a Welding Quality Assurance Plan and records of tests and inspections.

3.3 STANDARDS OF ACCEPTANCE

Conform dimensional tolerances for welded construction, details of welds, and quality of welds with the applicable requirements of AWS D1.1/D1.1M and the contract drawings. One hundred percent (100%) of the welds on the proposed steel outlet pipe to be encased (through the dam) shall be tested with magnetic and ultrasonic methods per Table 6.2 of AWS D1.1/D1.1M. Submit records of nondestructive testing.

3.3.1 Nondestructive Testing

The welding is subject to inspection and tests in the mill, shop, and field. Inspection and tests in the mill or shop do not relieve the Contractor of the responsibility to furnish weldments of satisfactory quality. When materials or workmanship do not conform to the specification requirements, the Engineer reserves the right to reject material or workmanship or both at any time before final acceptance of the structure containing the weldment. Indication of a defect is regarded as a defect unless re-evaluation by nondestructive methods or by surface conditioning shows that no unacceptable defect is present. Submit records of nondestructive testing in accordance with paragraph 3.3 STANDARDS OF ACCEPTANCE.

3.4 CORRECTIONS AND REPAIRS

If inspection or testing indicates defects in the weld joints, repair defective welds using a qualified welder or welding operator as applicable. Conduct corrections in accordance with the requirements of AWS D1.1/D1.1M and the specifications. Repair defects in accordance with the approved procedures. Repair

defects discovered between passes before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, blend the affected area into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before re-welding, examine the area by suitable methods to ensure that the defect has been eliminated. Repaired welds must meet the inspection requirements for the original welds.

-- End of Section --

SECTION 05 50 15

CIVIL WORKS FABRICATIONS

PART 1 GENERAL

1.1 SCOPE

Section includes metal pipe railing and grates. Section also includes a prefabricated steel pedestrian bridge, with a "Bow Truss" style.

Related requirements:

Section 05 05 23 – STRUCTURAL WELDING
Section 05 50 14 – STRUCTURAL METAL FABRICATIONS
Section 05 52 00 – METAL RAILINGS

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|---|---|
| ASME B18.2.1 | (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series) |
| ASME B18.2.2 | (2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series) |
| ASME B18.6.2 | (2020) Square Head Set Screws and Slotted Headless Set Screws (Inch Series) |
| ASME B18.6.3 | (2013; R 2017) Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series) |
| ASME B18.21.1 | (2009; R 2016) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series) |

AMERICAN WELDING SOCIETY (AWS)

| | |
|---|---|
| AWS D1.1/D1.1M | (2020) Structural Welding Code – Steel |

ASTM INTERNATIONAL (ASTM)

| | |
|---|---|
| ASTM A1 | (2000; R 2018) Standard Specification for Carbon Steel Tee Rails |

| | |
|---|---|
| ASTM A36/A36M | (2019) Standard Specification for Carbon Structural Steel |
| ASTM A48/A48M | (2003; R 2021) Standard Specification for Gray Iron Castings |
| ASTM A53/A53M | (2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |
| ASTM A123/A123M | (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| ASTM A193/A193M | (2020) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications |
| ASTM A276/A276M | (2017) Standard Specification for Stainless Steel Bars and Shapes |
| ASTM A307 | (2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength |
| ASTM A320/A320M | (2021a) Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service |
| ASTM A500/A500M | (2021) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| ASTM A563 | (2015) Standard Specification for Carbon and Alloy Steel Nuts |
| ASTM A563M | (2007; R 2013) Standard Specification for Carbon and Alloy Steel Nuts (Metric) |
| ASTM A653/A653M | (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM A780/A780M | (2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings |
| ASTM A924/A924M | (2020) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process |
| ASTM A1085/A1085M | (2015) Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS) |
| ASTM B26/B26M | (2018; E 2018) Standard Specification for Aluminum-Alloy Sand Castings |
| ASTM B209 | (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate |

| | |
|---|---|
| ASTM B209M | (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) |
| ASTM B211/B211M | (2019) Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire |
| ASTM B241/B241M | (2016) Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube |
| ASTM B308/B308M | (2010; R 2020) Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles |
| ASTM B429/B429M | (2010; E 2012) Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube |
| ASTM C1513 | (2018) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections |
| ASTM D1187/D1187M | (1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal |
| ASTM E488/E488M | (2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements |
| ASTM F436/F436M | (2019) Standard Specification for Hardened Steel Washers Inch and Metric Dimensions |
| ASTM F844 | (2019) Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use |
| ASTM F3125/F3125M | (2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 Mpa and 1040 Mpa Minimum Tensile Strength |

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

| | |
|---|---|
| NAAMM MBG 531 | (2017) Metal Bar Grating Manual |

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

| | |
|---|---|
| SSPC Paint 20 | (2019) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic) |
| SSPC Paint 29 | (2002; E 2004) Zinc Dust Sacrificial Primer, Performance-Based |

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety – Safety and Health Requirements Manual

1.3 SUBMITTALS

Engineer approval is required for submittals with an "E" classification. Submittals not having an "E" classification are for information only. When used, a code following the "E" classification identifies the office that will review the submittal for the Engineer. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Fabricated Metal Items; E
Prefabricated steel bridge; E

SD-03 Product Data

Expansion Anchors
Sleeve Anchors
Adhesive Anchors
Gratings
Stairs
Ladders
Shop Fabricated Metal Items; E
Prefabricated steel bridge; E

SD-04 Samples

Shop Fabricated Metal Items; E

SD-06 Test Reports

Hardness Check
Rotational Capacity

SD-07 Certificates

Welder Certifications

1.3 QUALITY ASSURANCE

a. Form miscellaneous metalwork to shape and size, with sharp lines and angles and true curves. Drill and punch producing clean true lines and surfaces. Provide exposed surfaces of work in place with a smooth finish, and unless otherwise approved. Where tight fits are required, mill joints. Cope or miter corner joints, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

b. Perform welding continuously along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections of work in place. Grind exposed welds smooth.

c. Qualify welders, perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work. Submit welder certifications for each welder stating the type of welding and position qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.

## 1.4 ENVIRONMENTAL REQUIREMENTS

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Engineer.

# PART 2 PRODUCTS

## 2.1 MISCELLANEOUS METALS AND STANDARD METAL ARTICLES

Conform to the respective specifications and other designated requirements for miscellaneous metal materials and standard metal articles. Size as specified or indicated. Where material requirements are not specified, furnish materials suitable for the intended use and subject to approval.

### 2.1.1 Aluminum

#### 2.1.1.1 Sheets and Plates

ASTM B209.

#### 2.1.1.2 Bars, Rods and Wire

ASTM B211/B211M.

#### 2.1.1.3 Structural Shapes

ASTM B308/B308M.

#### 2.1.1.4 Castings

ASTM B26/B26M.

#### 2.1.1.5 Pipes and Tubes

ASTM B241/B241M, Alloy 6063, size and schedule number or outside diameter and wall thickness as shown.

### 2.1.2 Bolts, Nuts, and Washers

Provide bolts, nuts, and washers of the material, grade, type, class, style, and finish indicated or best suited for intended use.

2.1.2.1 High-Strength Bolts, Nuts, and Washers

Furnish and install high strength bolts, nuts and washers in accordance with NMDOT *Standard Specifications for Highway and Bridge Construction* (2019 Edition).

a. ASTM F3125/F3125M Grade A325, hot-dip galvanized.

b. Conduct Rotational-capacity testing for fastener assemblies in accordance with ASTM F3125/F3125M. Test as an assembly each combination of bolt production lot, nut lot, and washer lot. Assign a rotational-capacity lot number to each combination of lots tested. Test bolts in a Skidmore-Wilhelm Calibrator or an acceptable equivalent device. Submit test report for rotational capacity.

2.1.2.2 Bolts, Nuts, and Washers (Other Than High-Strength)

a. Bolts and Nuts - ASTM A307, Grade A, hot-dip galvanized or ASTM A320/A320M.

b. Bolts - ASME B18.2.1.

c. Nuts - ASME B18.2.2.

d. Washers

1) Plain Washers - ASME B18.21.1, Type B.

2) Lock Washer - ASME B18.21.1.

2.1.2.3 Foundation Anchorage

2.1.2.3.1 Anchor Nuts

ASTM A563M (ASTM A563), Grade A, hex style. Stainless steel ASTM A193/A193M.

2.1.2.3.2 Anchor Washers

ASTM F844. Stainless steel Type 304 conforming to ASTM A276/A276M.

2.1.2.3.3 Anchor Plate Washers

ASTM A36/A36M Stainless steel Type 304 conforming to ASTM A276/A276M.

2.1.3 Expansion Anchors

Provide 3/4 inch diameter expansion anchors. Minimum concrete embedment must be 4-3/4 in. Design values listed must be as tested according to ASTM E488/E488M.

a. Minimum allowable pullout value: 10,561 lb.

b. Minimum allowable shear value: 6,601 lb.

2.1.4 Lag Screws and Bolts

ASME B18.2.1, type and grade best suited for the purpose.

2.1.5 Screws

ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C1513.

2.1.6 Safety Treads

Not used.

2.1.7 Steel Rails

ASTM A1, No. 1.

2.1.8 Gratings

a. Gray cast iron ASTM A48/A48M, Class 40.

b. Metal plank grating, non-slip requirement, aluminum ASTM B209M, ASTM B209, 6061-T6; steel ASTM A653/A653M, Z275 G90.

c. Metal bar type grating NAAMM MBG 531.

2.1.9 Submittals Requirements

This applies to SHOP FABRICATED METAL ITEMS also. Submit the following:

a. Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Include in the drawings catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for the following items: Intake structure grate

b. Lists of materials, and records which identify the disposition of approved material and fabricated items in the work.

c. Samples of the following items: Provide full size samples of standard or fabricated items, taken from manufacturer's stock, and complete as required for installation in the structure. Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

2.2 SHOP FABRICATED METAL ITEMS

Conform shop fabricated metal items to the requirements and details as specified or shown and to the workmanship provisions and other applicable fabrication requirements as specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

2.2.1 Railings

Provide railings as type specified and show, furnish, and install complete with fittings, brackets, fasteners, sleeves, anchors, and other appurtenances as shown and as required for proper installation. See Section 05 52 00 METAL RAILINGS.

2.2.1.1 Materials

Steel pipe railing, including inserts in concrete, provide steel pipe conforming to ASTM A53/A53M or structural tubing conforming to ASTM A500/A500M, Grade A or B of equivalent strength ASTM A1085/A1085M. Provide steel railings with 2 inch nominal size. Hot-dip galvanize railings. Provide pipe collars of hot-dip galvanized steel. Provide aluminum handrails of 2 inch nominal Schedule 40 pipe ASTM B429/B429M . Railings and pipe collars must be anodized. Provide fasteners of Series 300 stainless steel.

2.2.1.2 Fabrication

Rigid joints in railings must be welded, threaded, or slip-on fittings assembly and be flush-finished. Reinforce welded joints with tight-fitting interior sleeves assembled by welding rails and posts to flush-type fittings, or by mitering and welding joining rails and posts. Exposed threads are not permitted on assembled threaded joints. Use tight fitting slip-on fittings. Provide self-locking, concealed type fasteners for slip-on fittings. Provide aluminum or stainless steel fasteners for aluminum fittings. Provide stainless steel fasteners for steel fittings. Expansion joints in railings must be an outer-sleeved or inner-sleeved slip-joint, with one end of the sleeve secured to one rail and the ends of the adjoining rails separated a minimum of 1 inch in the installed position. Locate expansion joints in rails near the intersection of rails and posts. Make bends in railings in a manner that railings are not crushed and maintain their original cross-sectional shape. Ground welds smooth. Provide railings free of burrs, sharp corners, and sharp edges.

2.2.2 Gratings and Cover Plates

Provide grating and cover plates of the material and size shown and fabricated in sectional panels of the width and length shown, or as appropriate, to accurately fit within the supporting recess frames. Provide openings through panels as shown or as required.

2.2.2.1 Grating

Gratings are as specified in previous paragraph 2.2.2 GRATINGS AND COVER PLATES. Band edges of gratings and openings through gratings which require the cutting of more than one bearing bar. Provide fasteners of the type recommended by the manufacturer and approved.

2.2.2.2 Cover Plates

Provide cover plates as specified in paragraph 2.2.2 GRATINGS AND COVER PLATES. Provide cover plate panels as shown or as required. Remove sharp edges and burrs from plates.

2.2.3 Recess Frames

Not used.

2.2.4 Ladders

Not used.

2.2.5 Surface Finishes

2.2.5.1 Galvanizing and Zinc Repair

Hot-dip galvanize items specified to be galvanized, when practicable and not indicated otherwise, after fabrication. Galvanize in accordance with ASTM A123/A123M, ASTM A653/A653M, or ASTM A924/A924M, as applicable. Regalvanize areas where zinc coatings are destroyed by cutting, welding or other causes. Repair damaged coatings with a suitable low-melting zinc base alloy similar to the recommendations of the American Hot-Dip Galvanizers Association to the thickness and quality specified for the original zinc coating. Repair coatings less than 2 ounces in accordance with ASTM A780/A780M.

2.2.5.2 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Prefabricated Steel Pedestrian Bridge

The steel pedestrian bridge shall be prefabricated by a licensed and experienced bridge manufacturer, and the final plans shall be stamped by a registered NM Professional Engineer. The rated load capacity of the bridge shall be 10,000 bs. The bridge shall be a “Bow Truss” style bridge. The manufacturer of the bridge shall be selected from the following list of bridge builders, or from another bridge building business if approved in advance by the Design Engineer:

1. Excel Bridges; 800-548-0054
2. Big “R” Manufacturing; 800-234-0734
3. Continental Bridges; 800-328-2047
4. Steadfast Bridges; 800-749-7515
5. Bridge America; 320-763-5600

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify measurements and take all field measurements necessary before fabrication. Exposed fastenings must be compatible materials, generally match in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners is cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports provide strength and stiffness. Form joints exposed to the weather to exclude water. Items listed below require additional procedures.

3.2 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion anchors, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

## 3.3 FINISHES

### 3.3.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to SSPC Paint 20 or SSPC Paint 29 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D1187/D1187M, asphalt-base emulsion.

### 3.3.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Provide surfaces, when assembled, free of rust, grease, dirt and other foreign matter.

## 3.4 ATTACHMENT OF HANDRAILS

Set railing posts anchored to concrete surfaces perpendicular to the posts Railing posts anchored to concrete surfaces parallel to the posts must have the sides of posts continuously welded to base plates anchored to concrete with expansion anchors. Railing posts anchored to structural metal must be welded to base plates. Rigidly secure ends of rails anchored to concrete or masonry to flange fittings anchored to concrete or masonry with expansion anchors. Install toe boards and brackets where indicated. Splice, where required, at expansion joints. Install removable sections as indicated.

### 3.4.1 Installation of Steel Pipe Railing

Perform installation by means of pipe sleeves secured to base plates bolted to stringers or structural steel framework. Secure rail ends by steel pipe flanges anchored by expansion anchors.

-- End of Section --

SECTION 05 52 00

METAL RAILINGS

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Section includes: structural fabrication requirements for steel pipe railings.

1.1.2 Related requirements

None

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

| | |
|---|---|
| AWS D1.1/D1.1M | (2020) Structural Welding Code - Steel |

ASTM INTERNATIONAL (ASTM)

| | |
|---|---|
| ASTM A27/A27M | (2020) Standard Specification for Steel Castings, Carbon, for General Application |
| ASTM A36/A36M | (2019) Standard Specification for Carbon Structural Steel |
| ASTM A47/A47M | (1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings |
| ASTM A53/A53M | (2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |
| ASTM A108 | (2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished |
| ASTM A123/A123M | (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| ASTM A153/A153M | (2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| ASTM A283/A283M | (2013) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates |
| ASTM A307 | (2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength |

| | |
|---|---|
| ASTM A500/A500M | (2021) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| ASTM A512 | (2006; R 2012) Standard Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing |
| ASTM A575 | (2020) Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades |
| ASTM B26/B26M | (2018; E 2018) Standard Specification for Aluminum-Alloy Sand Castings |
| ASTM B221 | (2020) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes |
| ASTM B429/B429M | (2010; E 2012) Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube |

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

| | |
|---|---|
| NAAMM AMP 521 | (2001; R 2012) Pipe Railing Systems Manual |

NEW MEXICO DEPARTMENT OF TRANSPORTATION (NMDOT)

Standard Specifications for Road and Bridge Construction (2019 Edition)

1.2 ADMINISTRATIVE REQUIREMENTS

Section not used.

1.3 SUBMITTALS

Engineer approval is required for submittals with an "E" classification. Submittals not having an "E" classification are for information only. When used, a code following the "E" classification identifies the office that will review the submittal for the Engineer. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings; E
Iron and Steel Hardware; E
Steel Shapes, Plates, Bars and Strips; E

SD-03 Product Data

Structural-Steel Plates, Shapes, and Bars; E
Structural-Steel Tubing; E
Cold-Finished Steel Bars; E

Hot-Rolled Carbon Steel Bars; E
Cold-Drawn Steel Tubing; E

Concrete Inserts; E
Protective Coating; E
Steel Railings and Handrails; E
Anchorage and Fastening Systems; E

SD-07 Certificates

Welding Procedures; E
Welder Qualification; E

SD-08 Manufacturer's Instructions

Installation Instructions

## 1.4 QUALITY CONTROL

### 1.4.1 Welding Procedures

Section 05 05 23.16 STRUCTURAL WELDING applies to work specified in this section.

Submit results of welding procedures testing in accordance with AWS D1.1/D1.1M made in the presence of the Engineer and by an approved testing laboratory at the Contractor's expense.

### 1.4.2 Welder Qualification

Submit certified welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition, perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, conduct an immediate retest of two test welds and ensure that each test weld passes. Failure in the immediate retest will require that the welder be retested after further practice or training and make a complete set of test welds.

# PART 2 PRODUCTS

## 2.1 FABRICATION

Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning, treating, and applying surface finishes, including zinc coatings.

Provide railing detail plans and elevations at not less than 1 inch to 1 foot, plans must be prepared by a registered New Mexico Professional Engineer. Provide details of sections and connections at not less

than 3 inches to 1 foot. Also detail setting drawings, diagrams, templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchors.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce adequate strength and durability in the finished product for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven details of fabrication and support. Use the type of materials indicated or specified for the various components of work.

Form exposed work true to line and level, with accurate angles and surfaces and straight sharp edges. Exposed edges are to be eased to a radius of approximately 1/32 inch. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Weld corners and seams continuously and in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form the exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use countersunk Phillips flathead screws or bolts.

Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified to be fabricated from cold-finished or cold-rolled stock.

### 2.1.1 Steel Pipe Railing

Fabricate joint posts, rail, and corners by one of the following methods:

a. Flush-type rail fittings of commercial standard, welded and ground smooth, with railing splice locks secured with 3/8 inch hexagonal-recessed-head setscrews.

b. Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove-welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight-fitting interior sleeve not less than 6 inches long.

c. Railings may be bent at corners in lieu of jointing, provided that bends are made in suitable jigs and the pipe is not crushed.

## 2.2 COMPONENTS

### 2.2.1 Structural Steel Plates, Shapes And Bars

Provide structural-size shapes and plates, except plates to be bent or cold-formed, conforming to ASTM A36/A36M, unless otherwise noted.

Provide steel plates, to be bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Provide steel bars and bar-size shapes conforming to ASTM A36/A36M, unless otherwise noted.

2.2.2 Structural-Steel Tubing

Provide structural-steel tubing, hot-formed, welded or seamless, conforming to ASTM A500/A500M, Grade B, unless otherwise noted.

2.2.3 Hot-Rolled Carbon Steel Bars

Provide bars and bar-size shapes conforming to ASTM A575, grade as selected by the fabricator.

2.2.4 Cold-Finished Steel Bars

Provide cold-finished steel bars conforming to ASTM A108, grade as selected by the fabricator.

2.2.5 Cold-Drawn Steel Tubing

Provide tubing conforming to ASTM A512, sunk-drawn, butt-welded, cold-finished, and stress-relieved.

2.2.6 Steel Pipe

Provide pipe conforming to ASTM A53/A53M, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

2.2.7 Fasteners

Provide galvanized zinc-coated fasteners in accordance with ASTM A153/A153M used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.

Provide standard hexagon-head bolts, conforming to ASTM A307, Grade A.

2.2.8 Steel Railings

Design railing to resist a concentrated load of 200 lb in any direction at any point of the top of the rail or 50 lb per foot applied horizontally to the top of the rail, whichever is more severe. NAAMM AMP 521, provide the same size rail and post. Provide pipe collars of the same material and finish as the handrail and posts.

2.2.8.1 Steel Pipe Railing

Provide steel pipe railing, including inserts in concrete, steel pipe conforming to ASTM A53/A53M or structural tubing conforming to ASTM A500/A500M, Grade A or B of equivalent strength. Provide steel railings of 2 inch nominal size, hot-dip galvanized.

Provide kickplates between railing posts where indicated and consisting of 1/8 inch steel flat bars not less than 6 inches high. Secure kickplates as indicated.

Galvanize exterior railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components. Provide black steel pipe for interior railings.

## PART 3 EXECUTION

### 3.1 PREPARATION

Adjust railings before securing in place in order to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than 8 feet on center. Plumb posts in each direction. Secure posts and rail-ends to building construction as follows:

Install toe boards and brackets where indicated. Make splices, where required, at expansion joints. Install removable sections as indicated.

### 3.2 INSTALLATION

Submit manufacturer's installation instructions for the products to be used in the fabrication of handrail work. Provide complete, detailed fabrication and installation drawings for iron and steel hardware, and for steel shapes, plates, bars, and strips used in accordance with the design specifications cited in this section.

### 3.3 FIELD QUALITY CONTROL

#### 3.3.1 Field Welding

Ensure that procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welding work comply with AWS D1.1/D1.1M.

-- End of Section --

# SECTION 31 10 00

# SITE CLEARING

## PART 1 GENERAL

### 1.1 DEFINITIONS

#### 1.1.1 Trees

The line of demarcation between brush and trees, for the purpose of distinguishing clearing requirements, is that trees, as used, will be considered as that woody growth not falling within the limits of brush as defined below. Where shown on the Drawings, existing trees and shrubs that are marked for retention shall be clearly marked in the field with plastic safety fencing set up around the perimeter at the drip line, to prevent the accidental removal of these vegetation features.

#### 1.1.2 Brush

Brush is that growth which is less than 2 inches in diameter measured 6 inches from the ground on the uphill side and is less than 6 feet in height measured from the ground on the uphill side.

#### 1.1.3 Structures

The term "structures" includes buildings or portions thereof, walls, drop inlets, curbs, drive aprons, existing concrete pads/liners, existing rock armoring, stormwater pipe, corrugated metal culverts, etc. The Contractor shall avoid designated cultural and biological resources. The Contractor shall avoid any activities outside of the designated areas of disturbance. Additionally, existing mine features and interpretive displays shall not be removed or damaged as a result of the work. Access routes and methods to construction areas shall be coordinated with the AMLP Project Manager prior to mobilizing to targeted mine features. No construction disturbances (including excavation, fill and stockpiling of construction materials) or moving of artifacts shall take place unless directly specified in design documents. Avoidance zones within the designated disturbance area shall extend to five meters (16.4 feet) from the existing mine features structures, except where construction is indicated within this zone in which case the disturbance within the avoidance zone shall be minimized as practicable. The Project Manager or Design Engineer may designate special avoidance areas.

### 1.2 PROJECT/SITE CONDITIONS

#### 1.2.1 Aesthetics and Pollution Control

##### 1.2.1.1 Ground Areas

Ground areas which are disturbed by clearing operations and which would become subject to erosion will be protected or restored.

##### 1.2.1.2 Construction Roads

Construction roads proposed for use by the Contractor for removing debris or for access to the work area shall be approved, as to location and alignment, prior to construction. Where such roads are determined to be of no value to project operation or will not serve recreational access needs after project construction, the areas occupied by these roads will be restored as nearly as possible to pre-construction conditions by reasonable grading and seeding along with the planting of seedling trees if in a tree cover area.

## PART 2 PRODUCTS

Not used

## PART 3 EXECUTION

### 3.1 CLEARING REQUIREMENTS

#### 3.1.1 Work Zone

Select trees shall be removed while others remain, as indicated on the plan set. Brush and woody vegetation shall be removed.

### 3.2 SELECTIVE DEMOLITION

The sites may require the removal of debris such as boards, signs, timbers, wire, temporary fencing, etcetera. The recommendations of the SHPO and the AML Archaeologist will be followed by the Contractor during selective demolition.

Salvageable materials (e.g. T-posts and temporary chain link fencing) shall be neatly stacked on the site, while trash shall be properly disposed of at the Contractor's expense at an appropriate licensed landfill. All fasteners shall be removed from the lumber and timbers. All specified or established avoidance areas shall be avoided, and the recommendations of the State Historic Preservation Office (SHPO) will be followed. Other debris that may cause bridging of backfill material or otherwise interfere with construction shall be removed as directed by the Engineer.

### 3.3 SITE PREPARATION/CLEARING

This work shall consist of trimming, removing, and disposing of vegetation and debris in accordance with these specifications, except those items designated to remain. This work shall also include the preservation from damage or defacement of all vegetation and items designated to remain.
Trimming shall consist of pruning low-hanging branches from trees and shrubs designated to remain to provide enough clearance for construction activities. Removal shall consist of cutting vegetation flush with the ground surface and the satisfactory disposal of trees, brush, and any other vegetation. The Contractor shall perform selective tree and shrub removal and trimming only in designated work areas as shown on the drawings.

The Contractor shall remove vegetation outside of the migratory bird nesting season (February 15-September 15). If any vegetation is to be removed during the migratory bird nest season, the Contractor shall contact the AMLP Project Manager four weeks prior to the removal to allow for completion of a migratory bird survey.

Within construction limits for borrowing backfill material, all surface debris, roots, stumps, trees, and other objectionable protruding obstructions shall be cleared with the Engineer's concurrence.

All vegetation from trimming and removal operations shall be spread along and adjacent to the disturbed area as practicable and as designated by the Engineer.

## 3.4 DISPOSAL OF MATERIAL

### 3.4.1 General

The material cleared from the areas shall be completely removed by transporting from the AMLP property unless otherwise approved by the Engineer. In no case shall cleared material be thrown into or left in drainage ditches or arroyos. Clean-up of debris shall be accomplished by practical means. The cutting of branches and debris remaining after clean-up, to reduce their length in order to avoid removal, will not be permitted.

### 3.4.2 Removal from Site

Except as otherwise provided, the Contractor will be permitted to remove felled and trimmed timber from the site of the work. The Contractor will be allowed to stockpile salvaged timber at approved locations. The project owner will assume no responsibility for the protection and safekeeping of such material. Stockpiled timber must be removed from project lands before final acceptance of the work will be made.

## 3.5 MARKETABLE MATERIALS

The cleared materials which the Contractor considers marketable shall become its property and shall be removed from the reservoir area.

## 3.6 ITEMS

The structures and debris to be cleared are tabulated below.

Existing Drop Inlets
Pavement above Designed Culvert Crossing on NM Highway 14
Coal Waste within Designed Interceptor Channels
Fat Clay within Designed Interceptor Channels
Cobble and Rock Waste Not Meeting Design Requirements for Re-Use in Construction
Trees, Shrubs, and Brush within Construction Areas

-- End of Section --

SECTION 31 23 00.00 20

EXCAVATION AND FILL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORATION OFFICIALS (AASHTO)

| | |
|---|---|
| AASHTO T103 | (2022) Standard Method of Test for Soundness of Aggregates by Freezing and Thawing |
| AASHTO T 180 | (2017) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop |

ASTM INTERNATIONAL (ASTM)

| | |
|---|---|
| ASTM C33/C33M | (2023) Standard Specification for Concrete Aggregates |
| ASTM C88 | (2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate |
| ASTM C127 | (2015) Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate |
| ASTM C535 | (2016) Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine |
| ASTM D698 | (2012; E 2014; E 2015) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.)) |
| ASTM D1140 | (2017) Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing |
| ASTM D1556/D1556M | (2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method |
| ASTM D1557 | (2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3) |

| | |
|---|---|
| ASTM D2216 | (2019) Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass |
| ASTM D2487 | (2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) |
| ASTM D3786/D3786M | (2018) Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method |
| ASTM D4253 | (2016; E 2019) Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table |
| ASTM D4254 | (2016) Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density |
| ASTM D4318 | (2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils |
| ASTM D4491/D4491M | (2017) Standard Test Methods for Water Permeability of Geotextiles by Permittivity |
| ASTM D4533/D4533M | (2015) Standard Test Method for Trapezoid Tearing Strength of Geotextiles |
| ASTM D4632/D4632M | (2015a) Grab Breaking Load and Elongation of Geotextiles |
| ASTM D4751 | (2020) Standard Test Method for Determining Apparent Opening Size of a Geotextile |
| ASTM D4759 | (2011; R 2018) Standard Practice for Determining the Specification Conformance of Geosynthetics |
| ASTM D4833/D4833M | (2007; R 2020) Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products |
| ASTM D5195 | (2021) Density of Soil and Rock In-Place at Depths Below the Surface by Nuclear Methods |
| ASTM D6913 | (2017) Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis |
| ASTM D6938 | (2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) |
| ASTM D7928 | (2021) Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis |

NEW MEXICO DEPARTMENT OF TRANSPORTATION (NMDOT)

Standard Specifications for Highway and Bridge Construction (2019 Edition)

| | |
|---|---|
| Section 203: | Excavation, Borrow, and Embankment |
| Section 206 | Excavation and Backfill for Culverts and Minor Structures |
| Section 207 | Subgrade Preparation |
| Section 303 | Base Course |
| Section 602 | Slope and Erosion Protection Structures |
| Section 604 | Soil and Drainage Geotextiles |

U.S. ARMY CORPS OF ENGINEERS (USACE)

| | |
|---|---|
| EM 385-1-1 | (2014) Safety -- Safety and Health Requirements Manual |

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

| | |
|---|---|
| EPA SW-846.3-3 | (1999, Third Edition, Update III-A) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods |

## 1.2 DEFINITIONS

### 1.2.1 Degree of Compaction

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D698 or ASTM D1557, for general soil types, abbreviated as percent laboratory maximum density. See the Geotechnical Evaluation Report for specific compaction requirements.

### 1.2.4 Backfill

Backfills as used in these specifications; is borrow, general fill, common fill, structural fill, pipe fill bedding, initial backfill, defined as that excavation refill which cannot be placed around or adjacent to a structure until the structure is completed and reached a specified concrete strength, requires special compaction efforts, and is defined by limits indicated on the plans and specifications.

### 1.2.5 Filter Materials

Filter materials are defined as material used as drainage or transition zones between various types of fill and backfill (impervious, pervious, random, and rock fill).

### 1.2.7 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials, or other materials determined by the Engineer to not meet the specifications for fill. Unsatisfactory materials also include man-made fills, coal waste, clay soils, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than one inch diameter. The Engineer shall be notified of contaminated materials.

### 1.2.8 Satisfactory Materials

Materials that comply with the requirements of these specifications for satisfactory materials. Satisfactory materials shall be free of organic matter, silt, clay balls, lumps, or large stones, and other deleterious materials.

## 1.3 SUBMITTALS

Engineer approval is required for submittals with an “E” classification. Submittals not having an "E" classification are for information only. When used, a code following the "E" classification identifies the office that will review the submittal for the Engineer. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Plan of Operations; E

Shoring and Sheeting Plan

Dewatering work plan

Embankment and Backfill Material; E

At least 30 days prior to delivery of Contractor-furnished materials to the site of the work, submit soil classification test results, moisture-density curves, gradation curves, and laboratory results of the required tests of the proposed material.

Submit 30 days prior to starting work.

SD-06 Test Reports

Borrow Site Testing; E

Fill and backfill Testing; E

Select Material Testing; E

At least 30 days prior to delivery of Contractor-furnished materials to the site of the work, submit soil classification test results, moisture-density curves, gradation curves, and laboratory results of the required tests of the proposed material. Submit copies of laboratory and field test reports within 24 hours of the completion of the test.

SD-07 Certificates

Testing; E

Qualifications of the validate commercial testing laboratory.

Nuclear Density; E

Use nuclear density testing equipment in accordance with ASTM D6938. In addition, the following conditions are applicable:

a. Prior to using the nuclear density testing equipment on the site, submit to the Contracting Officer a certification that the operator has completed a training course approved by the nuclear density testing equipment manufacturer, the most recent data sheet from the manufacturer's calibration, and a copy of the most recent statistical check of the standard count precision.

b. Provide nuclear density testing equipment capable of extending a probe a minimum of 12 inches down into a hole.

c. Field density reports must include the laboratory density reports applicable to the field data presented.

## 1.4 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Known pipes or other artificial obstructions are identified in the drawings.

c. Ground water elevations indicated by the boring log were those existing at the time of subsurface investigations and do not necessarily represent ground water elevation at the time of construction.

## 1.5 REQUIREMENTS FOR BORROW (OFF SITE) SOIL

Soils brought in from off site for use as backfill shall be tested for volatile organic compound (VOC) environmental contaminants such as petroleum hydrocarbons and BTEX. Backfill shall not contain concentrations of these analytes above the appropriate State and/or EPA criteria. Determine petroleum hydrocarbon concentrations by using appropriate State protocols. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5035/8260B. Provide borrow site testing for petroleum hydrocarbons and BTEX from a grab sample of material from the area most likely to be contaminated at the borrow site (as indicated by visual or olfactory evidence), with at least one test from each borrow site. Do not bring material onsite until tests results have been received and approved by the Engineer.

## 1.6 QUALITY ASSURANCE

### 1.6.1 Shoring and Sheeting Plan

Submit drawings and calculations, certified by a New Mexico registered professional engineer, describing the methods for shoring and sheeting of excavations. Drawings shall include material sizes and types, arrangement of members, and the sequence and method of installation and removal. Calculations shall include data and references used.

### 1.6.2 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Report damage to utility lines or subsurface construction immediately to the Engineer.

## PART 2 PRODUCTS

### 2.1 SOIL MATERIALS

#### 2.1.1 Satisfactory Materials for General Fill

Satisfactory materials for fill, backfill, and/or any in-situ soils to remain in place comprise any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, ML, and MH that meet the degree of compaction and requirements specified in the Geotechnical Evaluation Report. Maximum particle size shall be no greater than one-half of the allowable lift thickness in any dimension

Pieces larger than 4 inches shall not be placed within 12 inches of any structure.

Pieces larger than 2 1/2 inches shall not be placed within 12 inches of the subgrade for paving.

Common trench backfill may be obtained from the trench excavation provided it has been tested in accordance with the requirements of these specifications.

#### 2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials, or other materials determined by the Engineer to not meet the specifications for fill. Unsatisfactory materials also include man-made fills, coal waste, clay soils, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than one inch diameter. The Engineer shall be notified of contaminated materials.

#### 2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP.

Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials with a high silt content classified as GM, GP-GM, GW-GM, SW-SM, SP-SM, and SM shall not be identified as cohesive.

#### 2.1.4 Imported Borrow (Backfill)

Imported soil material with the characteristics listed below maybe use for foundation areas, under slabs, under pavement, and backfill per the Geotechnical Evaluation Report:

| **Sieve Size** | **Percent Passing by Weight** |
|---|---|
| 6 inches | 100 |
| 4 inches | 85-100 |
| ¾ inch | 70 - 100 |
| No. 4 | 50 - 100 |
| No. 200 | 30 max |

The maximum allowable plasticity index for common fill and backfill is 5. The maximum soluble sulfates are 0.10%.

2.1.5 Pipe Trench Bedding

Bedding and initial backfill shall consist of ¾-inch minus granular fill material composed of hard, tough, and durable particles, and meeting the following sieve analysis:

| Sieve Size | Percent Passing by Weight |
|---|---|
| 1 inch | 100 |
| ¾ inch | 80 - 90 |
| No. 4 | 25-50 |
| No. 10 | 0-20 |
| No. 200 | 0-5 |

Backfill materials to be used for bedding and initial backfill shall be approved by the Engineer prior to placing the materials in the pipe trench. Native material obtained from the trench excavation may be used provided it has been tested in accordance with the requirements of these Specifications. If bedding and initial backfill materials are imported from off site, the material shall be tested for volatile organic compounds.

The loose thickness of each layer of fill material before compacting shall not exceed 8 inches.

2.1.6 Type 1 Base Course Aggregate for Subgrade Material

New Mexico Department of Transportation Type I Base Course (Standard Specification Section 303) consisting of sand, gravel, or crushed rock, well graded, or open graded with a maximum particle size of 1 inch. Material shall be composed of tough, durable particles. Fines passing the No. 200 standard sieve shall have a plasticity index less than six and meet the following gradation requirements in accordance with ASTM D6913:

| Sieve Size | Percent Passing by Weight |
|---|---|
| 1 inch | 100 |
| ¾ inch | 80 - 100 |
| No. 4 | 30 - 60 |
| No. 10 | 20 - 45 |
| No. 200 | 3 – 10 |

Material passing the No. 40 sieve shall meet the following plasticity requirements in accordance with ASTM D4318:

| Passing No. 40 Sieve | Maximum Plasticity | Minimum Plasticity |
|---|---|---|
| 25% - 40% | 15 | 3 |
| 10% - 25% | 20 | 4 |

2.1.7 Topsoil

All topsoil and topsoil-like materials, as determined by Engineer, from within the proposed surface disturbance area will be collected and stored for use during reclamation operations. For bidding purposes, salvage and stockpile operations will include the upper four to six inches (4-6") of the soil profile from all areas within the delineated stockpile and excavation areas identified on the drawings. Actual removal of soil materials may be to a shallower or deeper depth depending upon local conditions, including, but not limited to depth to bedrock. The Engineer will determine depth of excavation as topsoil removal operations proceed.

The actual excavation area from which topsoil will be salvaged will be determined and delineated in the field by the Engineer prior to excavation. See design drawing Sheets for surface disturbance and approximate stockpile and excavation area delineation boundaries at each site.

The topsoil will be hauled to a temporary stockpile(s) area(s) located within the project area at a location designated by the AMLP Project Manager. The topsoil in the stockpile will be stored at slopes no steeper than two horizontal to one vertical (2H: 1V).

Topsoil shall be stored with signs provided by Contractor indicating that the material is topsoil and is not to be disturbed. Once all salvaged soil is removed to the stockpile, a berm will be constructed around the entire perimeter of the stockpile.

Following completion of the backfilling and grading operations, soil materials salvaged from the site will be redistributed to all disturbed areas. The soil will be distributed to a uniform depth across all areas from which soil was salvaged, including excavation, backfill, and stockpile locations, per Engineer direction.

2.2 ROCK MATERIAL

2.2.1 Stone

Stone material used for riprap shall conform to requirements for New Mexico Department of Transportation (NMDOT) Class A (non-wire enclosed riprap) B, C, E, or F (grouted riprap) where shown on the Drawings and described in Section 602 of the NMDOT Standard Specifications for Highway and Bridge Construction, 2019 Edition. See Section 31 37 00 – STONE RIPRAP

2.2.2 Crushed Filter Rock and Drainage Rock (Non-Arroyo work)

ASTM or AASHTO #57 stone shall be used where filter rock or drainage rock is shown on the Drawings.

| **Sieve Size** | **Percent Passing by Weight** |
|---|---|
| 1 1/2 inch | 100 |
| 1 inch | 95 - 100 |
| 1/2 inch | 25 - 60 |
| No. 4 | 0-10 |

## 2.3 GEOTEXTILE FABRIC

Geotextile fabrics shall conform to requirements for New Mexico Department of Transportation (NMDOT) Class 3 per Section 604 of the NMDOT Standard Specifications for Highway and Bridge Construction, 2019 Edition.

Provide a pervious sheet of polyester, nylon, glass or polypropylene filaments woven, spun bonded, fused, or otherwise manufactured into a non-raveling fabric with uniform thickness and strength. Fabric shall have the following manufacturer certified minimum average roll properties as determined by ASTM D4759:

| Property | NMDOT Class 3 |
|---|---|
| (12 ounce Nonwoven) | |
| Grab tensile strength (ASTM D4632/D4632M) machine and transversed direction | 225 lbs |
| Grab elongation (ASTM D4632/D4632M) machine and transverse direction | 50% |
| Puncture resistance (ASTM D4833/D4833M) | 130 lbs |
| Mullen burst strength (ASTM D3786/D3786M) | 450 psi |
| Trapezoidal Tear (ASTM D4533/D4533M) | 90 lbs |
| Apparent Opening Size (ASTM D4751) | 70 |
| Permeability (ASTM D4491/D4491M) | 0.44 cm/s |

# PART 3 EXECUTION

## 3.1 PROTECTION

### 3.1.1 Shoring and Sheeting

Provide shoring when required for trench safety. In addition to Section 25 A and B of EM 385-1-1 and other requirements set forth in this contract, include provisions in the shoring and sheeting plan that will accomplish the following:

a. Prevent undermining of foundations and slabs.

b. Prevent slippage or movement in banks or slopes adjacent to the excavation.

### 3.1.2 Drainage and Dewatering

Provide for the collection and disposal of surface and subsurface water encountered during construction.

#### 3.1.2.1 Drainage

So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material, and provide new soil

material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

3.1.2.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of structures, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in-situ material. While the excavation is open, the water level shall be maintained continuously, at least two feet below the working level.

Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly.

3.1.3 Clean Water Act Compliance

The Contractor shall comply with the New Mexico Water Quality Act (NMSA 1978, 74-6-1 et seq.) and applicable permits and regulations in accordance with the Federal Clean Water Act ( 33 USC 1251 et seq.).

3.1.4 Slope Protection and Erosion Control

The Contractor shall take measures to control erosion and subsequent sediment carried off the project sites and access roads due to construction activities. These controls shall be included in the Storm Water Pollution Prevention Plan (SWPPP) to be developed by the Contractor in accordance with guidelines given by the U.S. Environmental Protection Agency. Sediment control measures shall be placed wherever soil disturbed by construction could erode and be carried beyond the limits of construction. These areas include areas disturbed by construction activities, temporary access and haul roads, and temporary earth stockpiles.

Erosion and sediment control measures shall be placed as grading and earthmoving operations progress. The operation shall not progress at a distance further than the distance that sediment control installations can be placed by the end of daily operations. Areas of surface disturbance shall be kept to a practicable minimum. Best Management Practices (BMPS's) will be implemented to contain any sediment generated during earthmoving and other reclamation activities. Erosion control BMP's to be implemented may include silt fence, mulch socks, hay bales, and/or earthen berms along excavation boundaries and at the toe of all slopes being disturbed by reclamation activities. Erosion control will also be used above any depression or swale where sediment laden water could pool, and along the margins of any open water adjacent to ground disturbing activities. Mulch socks will be utilized at the end of the project to protect regraded and revegetated slopes.

Unless temporarily demobilized from the project area due to specified seasonal limitations, the Contractor shall inspect the erosion and sediment control features at least bi-weekly and within 24 hours of each rainfall. The Contractor shall repair any erosion and sediment control feature within seven days following

the inspection during which damage is noted or following notification by the Engineer that repairs are required. Repairs shall be initiated within 24 hours of damage occurring to erosion control features that could result in a discharge of sediment into a stream, arroyo or water impoundment.

All erosion and sediment control measures shall be maintained by cleaning or replacement as needed, or as directed by the Engineer. These measures shall be fully effective for the purpose intended until permanent erosion control measures are in place and operational. Temporary erosion and sediment control features shall remain in place after construction operations are completed, unless otherwise designated in the contract, and shall be maintained until the date of final acceptance of the project.

3.1.5 Underground Utilities

See Section 01 11 00, paragraph 1.4. Location of the existing utilities indicated on the Drawings is approximate. The Contractor shall verify the location and elevation of the existing utilities indicated prior to excavation.

3.1.6 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

3.2 SURFACE PREPARATION

3.2.1 Clearing and Grubbing

Please see specific vegetation to remain as shown on the plan set. Unless indicated otherwise in the plan set, remove trees, stumps, logs, shrubs, brush and vegetation and other items that would interfere with construction operations within the project site per Section 31 10 00. Cultural resources are to be protected as detailed in Section 31 10 00: SITE CLEARING

3.2.2 Stripping

Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material for use as topsoil. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

3.2.3 Unsuitable Material

Remove vegetation, debris, decayed vegetable matter, sod, mulch, and rubbish underneath concrete slab, or embankment fill. Remove trash and mine related waste materials from Madrid arroyo where shown and as directed by the Engineer. Cultural resources are to be protected as detailed in Section 31 10 00: SITE CLEARING

3.3 EXCAVATION

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from

water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather.

Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed. Refill with backfill and fill material and compact as described in Paragraph 3.9 of this specification.

Satisfactory material removed below the depths indicated, without specific direction of the Engineer, shall be replaced with satisfactory materials to the indicated excavation grade; except as specified for spread footings. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Engineer.

3.3.1 Excavation of Coal Waste

Excavation activities will include excavation of non-carbonaceous material, consisting of soil, sandstones and shales, and the excavation of coal or carbon. Excavation limits will be determined by Engineer during project execution. Engineer will determine when excavation is complete.

3.3.1 BLASTING

Blasting will not be allowed.

3.3.2 Pipe Trenches

Excavate to the dimension indicated. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement. Tamp if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 6 inches below the bottom of the pipe.

3.3.3 Excavated Materials

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and unsatisfactory material shall be disposed of as specified in Paragraph 3.12 DISPOSITION OF SURPLUS MATERIAL.

3.3.4 Final Grade of Surfaces to Support Concrete

Excavation to final grade shall not be made until just before concrete is to be placed. Only excavation methods that will leave the soil in an undisturbed, “in-situ” conditions, or foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. Shales shall be protected from slaking and surfaces shall be protected from erosion resulting from ponding or flow of water.

3.4 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Engineer. The surface shall be scarified to a depth of 6

inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, embankment material is to use a sheepsfoot (padfoot) rollers or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to plus or minus two percent of optimum moisture. Minimum subgrade density shall be as specified herein.

## 3.5 SUBGRADE GEOTEXTILE FILTER FABRIC

Place synthetic fiber filter fabric as indicated directly on prepared subgrade free of vegetation, stumps, rocks larger than 2 inches diameter and other debris which may puncture or otherwise damage the fabric. Repair damaged fabric by placing an additional layer of fabric to cover the damaged area a minimum of 3 feet overlap in all directions. Overlap fabric at joints a minimum of 3 feet. Obtain approval of filter fabric installation before placing fill or backfill. Place fill or backfill on fabric in the direction of overlaps and compact as specified herein. Follow manufacturer's recommended installation procedures.

## 3.6 FILLING AND BACKFILLING

Fill and backfill to contours, elevations, and dimensions indicated on the drawings. Compact each lift before placing overlaying lift.

Do not place backfill against a concrete structure until the top of the structure has been completely placed and has reached 80 percent of its design strength. Bring fill up in lifts evenly on both sides of structure and headwall structures with no more than 0.5 feet difference in elevation on opposing sides of the structure. After the concrete structure attaining 80 percent of design strength, backfill operations may be initiated but no rolling or hauling equipment will be permitted to pass over the structure, or within 4 feet of the structure.

Do not place fill upon a frozen surface, nor shall snow, ice, or frozen earth. Fill will not be placed on or against dry surfaces, but against a surface that is moist or damp.

### 3.6.1 Common Fill Placement

Provide for general site. Use satisfactory materials. Place in 8-inch loose lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Add moisture as necessary to overly dry material. Aerate material excessively moistened by rain to a satisfactory moisture content. Finish to a surface by blading and rolling with a pad foot roller.

### 3.6.2 Select Material Placement

Not used.

### 3.6.3 Backfill and Fill Material Placement Over Pipes and at Walls

Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash

and debris. Backfill shall be brought to indicated finish grade. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 2 feet above pipe and 1 foot above other utility lines shall be free from stones larger than 1 inch in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or boulder retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes to avoid damage to coatings and wrappings. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall.

3.6.4 Trench Backfilling

Backfill as rapidly as construction, testing, and acceptance of work permits. Place and compact backfill under structures and paved areas in 8-inch loose lifts to top of trench and in 8-inch loose lifts to one foot over pipe outside structures and paved areas.

3.7.5.2 Frozen Material

Do not place fill on frozen material, or on material which has been subjected to freeze-thaw action. This prohibition encompasses natural ground, prepared subgrades in excavations and layers of previously placed and compacted earth fill upon which successive layers of fill will be placed. Remove material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, or winter shutdowns or earthwork operations, to a depth that is acceptable to the Engineer and replace with new material. Alternatively, the material must be thawed, dried, reworked, and recompacted to the specified criteria before additional material is placed. The Engineer will determine when placement of fill must cease due to cold weather. Fill material containing frozen clumps of soil, snow, or ice is not acceptable.

3.8 OFF-SITE COMMERCIAL MATERIAL SOURCE

Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials from off-site commercial sources shall be obtained as specified herein.

3.9 COMPACTION

3.9.1 Structures, Spread Footings and Concrete Slab (EXCLUDING ARROYO PROJECT AREA)

Compact fill, backfill, and 12 inches of subgrades to 98 percent of maximum dry density within +/- 2% of optimum moisture content per ASTM D698.

3.9.2 Areas Adjacent to Structures, Spread Footings, and Concrete Slab

Compact fill to 90 percent of maximum dry density +/- 2% of optimum moisture content per ASTM D698.

3.9.3 Pipe Trenches

Compact the trench embedment and final backfill to 95 percent of maximum dry density +/- 2% of optimum moisture content per ASTM D698.

3.9.4 Madrid Arroyo Project Area

Compact fill and subgrade as indicated on the Drawings.

3.9.5 NMDOT Right-of-Way (NM-14)

Backfill and compact within the NMDOT right of way (NM-14) per Section 206 (Excavation and Backfill for Culverts and Minor Structures) of the NMDOT Standard Specifications for Highway and Bridge Construction

3.10 RIP-RAP CONSTRUCTION

Construct rip-rap on filter fabric in the areas indicated on the drawings. See Section 31 37 00 STONE RIPRAP.

3.10.1 Preparation

Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 0.1 foot.

3.10.2 Bedding Placement

Spread filter fabric bedding material uniformly to a thickness of at least 6 inches on prepared subgrade as indicated in project drawings.

3.10.3 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above.

3.11 FINISH OPERATIONS

3.11.1 Grading

Finish grades as indicated within one-tenth of one foot. Grade areas to drain water away from structures. Maintain areas free of trash and debris. For existing grades that will remain, but which were disturbed by Contractor's operations, grade as directed.

3.11.2 Topsoil and Seed

Provide as specified in Section 32 92 19 SEEDING.

3.11.3 Protection of Surfaces

Protect newly backfilled, graded, and topsoiled areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

## 3.12 DISPOSITION OF SURPLUS MATERIAL

Remove from project site surplus or other soil material not required or suitable for filling, or backfilling, and brush, refuse, stumps, roots, and timber. Soil removed from Madrid Arroyo and other project sites will disposed of in the designated soil disposal area shown on the plans.

## 3.13 FIELD QUALITY CONTROL

### 3.13.1 Sampling

Take the number and size of samples required to perform the following tests.

### 3.13.2 Testing

Perform one of each of the following tests for each material used. Provide additional tests for each source change.

#### 3.13.2.1 Backfill Material Testing

Test backfill material in accordance with ASTM D6913 for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D4318 for liquid limit and for plastic limit; ASTM D698 or for moisture density relations.

#### 3.13.2.3 Density Tests

Test density in accordance with ASTM D6938. Density tests shall be performed once every 500 CY placed, or per shift, or per lift/zone/area, whichever results in more tests. Include density test results in daily report.

Bedding and backfill in trenches: One test per 100 linear feet in each lift.

#### 3.13.2.4 Moisture Content Tests

Moisture content to be tested concurrently with density. Include moisture content test results in daily report.

-- End of Section --

SECTION 31 37 00

STONE RIPRAP

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Section Includes:

a. Riprap Interceptor Channels

b. Grouted Riprap Interceptor Channels

c. Riprap Lined Drainage Channels

d. Crushed Filter Rock Under Large Rock Drainage Structures

e. Large Rocks (boulders) For Drainage Structures and Boulder Retaining Walls

1.1.2 Related Requirements:

a. Section 31 00 00 – Earthwork

1.2 REFERENCES

NEW MEXICO DEPARTMENT OF TRANSPORTATION (NMDOT)
Standard Specifications for Highway and Bridge Construction

| | |
|---|---|
| Section 602 | Slope and Erosion Protection Structures |
| Section 604 | Soil and Drainage Geotextiles |

PART 2 SUBMITTALS

Submit the following in accordance with the Contract.

a. Product Data
Submit manufacturer information regarding size distribution and types for rock for riprap.

b. Samples
Submit samples of riprap materials to the testing laboratory.

c. Manufacturer's Certificate
Certify that products meet or exceed specified requirements.

d. Materials Resources Certificates
e. Photo examples of large rocks at the quarry.

1. Certify recycled material content for recycled content products.

2. Certify source for regional materials and distance from Project Site.

f. Quality Assurance
Furnish each aggregate material from single source throughout Work. Provide product according to Section 109 of the New Mexico Standard Specifications for Public Work Construction.

g. Qualifications Manufacturer
Company specializing in manufacturing products specified in this Section with minimum **three** years' **documented** experience.

PART 3 PRODUCTS

3.1 MATERIALS

3.1.1 Riprap

a. Description:

Riprap shall be broken stone or irregular-shaped rock solid and nonfriable. Broken concrete or asphalt will not be accepted for riprap.

d. Type B and C Riprap: Furnish according to Section 602 of the New Mexico Department of Transportation Standard Specifications for Highway and Bridge Construction.

3.1.2 Grouted Riprap

a. Description: Riprap shall be broken stone or irregular-shaped rock, solid and nonfriable. Broken concrete or asphalt will not be accepted for riprap.

b. Type E and F Grouted Riprap: furnish according to Section 602 of the New Mexico Department of Transportation Standard Specifications for Highway and Bridge Construction. Use Portland Cement mortar for grout as specified (see Section 03 30 00 – Cast-in-Place Concrete).

Furnish according to Section 602 of the New Mexico Department of Transportation Standard Specifications for Highway and Bridge Construction.

3.1.3 Crushed Filter Rock (Arroyo work area)

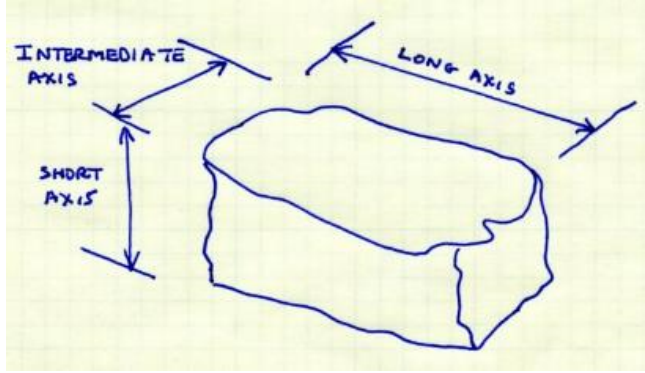
Crushed filter rock under Arroyo riprap structures must conform to the density, hardness and wear requirements of NMDOT Section 602. The material must conform to the following gradation:

| Sieve Size | Percent Passing by Weight |
|---|---|
| 6” | 100% passing |
| 4” | 80 – 100% passing |
| 3” | 50 - 80% passing |
| 2” | 20 – 50 % passing |
| 1” | 0 - 10% passing |

3.1.4 Large Rocks and Boulders

Large rocks must conform to the density, hardness and wear requirements of NMDOT Section 602. The rocks must meet minimum size and shape requirements as follows:

A. Large rocks must be blocky in shape, not round, with at least two parallel sides. The project requires large rocks with a nominal size of 3 - 4 ft. and the typical weight per rock is 2-4 tons. Typical dimensions for the boulders are shown in the illustration below, with the "Long Axis" dimension ranging from 3 - 5 ft, the "Intermediate Axis" ranging from 2 - 4 ft, and the "Short Axis" ranging from 1.3 – 2.0 ft. At least 60% of the large rocks must equal or exceed 2.5 ft in size when measured on the intermediate axis, and at least 75% of the rocks must equal or exceed 4.0 ft when measured on the long axis. Rocks smaller than these size requirements may be included in the total number of rocks delivered to the site, but it will be at the Engineer's discretion if the smaller rock is paid for at "2 for 1" or even "3 for 1", and in no case shall the total volume of small rock exceed 10% of the total rock volume imported for the project.




3.2 EXECUTION

3.2.1 Riprap Placement

a. Place riprap as shown on the plans.

b. Place riprap in position and remove foreign material from surfaces.

c. Do not place riprap over frozen or spongy subgrade surfaces.

d. Average Installed Thickness: As indicated on the Drawings.

3.2.2 Grouted Riprap and Boulder Applications (Arroyo and Boulder Retaining Walls)

a. Riprap shall be placed as specified and grouted with Portland cement mortar. The grout shall consist of one part cement and 3 parts by volume of aggregate. The Portland cement shall be Type V as and the aggregate shall be 2 parts sand and 1 part gravel passing a 3/8 inch square mesh screen. The amount of water shall be such as to permit gravity flow into the interstices with limited spading and brooming. The consistency of the grout shall be as approved by the Engineer.

b. Except when hand mixing is permitted by the Engineer, grout shall be mixed in an approved machine mixer for not less than 1 1/2 minutes. Should hand mixing be permitted, the cement and aggregate shall be thoroughly mixed in a clean, tight mortar box until the mixture is of uniform color after which clean water shall be added in such quantity as to provide a grout of the specified consistency.

3.2.3 Large Rock Placements (Arroyo and Boulder Retaining Walls)

Large rock placements shall be where shown on the Drawings, and as directed by the Engineer. For sloping ramps with a large rock and concrete grout surfaces, the finish surface of each large rock shall be placed, rotated and tilted to work together to form a uniform sloping surface without un-necessary roughness. For stepped rock structures or stacked rock walls, the large rocks shall be stacked in a running bond pattern, where the rock above spans across the joint between adjacent rocks below. These stepped and stacked structures shall have an integral batter, where the rocks above are set back from the front face of the rocks below by about 6" – 12". Large rocks shall be set to fit tightly together when ungrouted, and selected so that each rock sets solidly on the gravel substrate, footer rock or bedrock below. When placed on soil, gravel or crushed rock substrate, each large rock must be tamped into place, typically with a blow from the back of the excavator bucket. The orientation and elevation of each rock shall be reviewed and approved by the Engineer during installation. Because these large rocks are irregular in shape, the Contractor must exercise some judgment to achieve the lines and grades shown in the Drawings, and to achieve a reasonable aesthetic in the finished product. It is in everyone's best interest for the Contractor to assign the same excavator operator to the placement of large rocks, and that this person has 1) experience working with large rocks, 2) has the maturity and patience to select rocks as the work progresses that achieve the best fit and look for the work, and 3) an operator who takes pride in their work and the finished product. Final acceptance of all large rock structure work will be determined solely by the Engineer.

3.2.3 Crushed Filter Rock Placements (Madrid Arroyo)

Crushed filter rock shall be placed to the lines and grades shown in the plans. Where appropriate, the Contractor will compact this material using whatever means are available, however there are no specific density requirements for this material. In most locations, the crushed rock filter material is used as structural bedding for large rock placements. Because the large rocks are usually not uniform in thickness or shape, the Contractor can expect to remove or add crushed rock filter material as the work proceeds, in order to set the large rocks to their required finished grade and orientation.

-- End of Section --

SECTION 32 01 13.62

ASPHALT SURFACE TREATMENT

PART 1 GENERAL

Asphalt surface treatment refers to asphalt patching on the New Mexico Highway 14 culvert crossing. Refer to the 2019 Edition of the New Mexico Department of Transportation Standard Specifications for Highway and Bridge Construction, Sections 416 and Section 423.2 and modified here-in. See Attachment B a of this specification.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

| | |
|---|---|
| ASTM C29/C29M | (2017a) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate |
| ASTM C88 | (2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate |
| ASTM C131/C131M | (2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine |
| ASTM C136/C136M | (2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates |
| ASTM D75/D75M | (2019) Standard Practice for Sampling Aggregates |
| ASTM D140/D140M | (2016) Standard Practice for Sampling Asphalt Materials |
| ASTM D946/D946M | (2020) Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction |
| ASTM D977 | (2019a; E 2019) Standard Specification for Emulsified Asphalt |
| ASTM D2028/D2028M | (2015) Cutback Asphalt (Rapid-Curing Type) |
| ASTM D2397/D2397M | (2019a) Standard Specification for Cationic Emulsified Asphalt |
| ASTM D2995 | (1999; R 2009) Determining Application Rate of Bituminous Distributors |

| | |
|---|---|
| ASTM D3625/D3625M | (2012) Standard Practice for Effect of Water on Bituminous-Coated Aggregate Using Boiling Water |
| ASTM D6373 | (2016) Standard Specification for Performance Graded Asphalt Binder |

AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS (AASHTO)

| | |
|---|---|
| NMDOT SECTION 416 | Minor Paving |
| NMDOT SECTION 423 | Hot Mix Asphalt (Hma) (Major Paving) |
| AASHTO T 166 | Standard Method of Test for Bulk Specific Gravity (Gmb) of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens |
| AASHTO T 209 | Effect of Agitation Equipment Type on Theoretical Maximum Specific Gravity Values |

NEW MEXICO DEPARTMENT OF TRANSPORTATION (NMDOT)
Standard Specifications for Highway and Bridge Construction

## 1.2 SUBMITTALS

Engineer approval is required for submittals with a "E" classification. Submittals not having a "E" classification are for information only. All products shall comply with NMDOT materials specifications. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Waybills and Delivery Tickets
Cutback Asphalt
Emulsified Asphalt
Asphalt Cement

SD-06 Test Reports

Tests

## 1.3 QUALITY CONTROL

### 1.3.1 Safety Precautions

Smoking or open flames will not be permitted within 25 feet of heating, distributing, or transferring operations of bituminous materials other than bituminous emulsions.

1.3.2 Sampling and Testing

Sampling and testing is the responsibility of the Contractor. Perform sampling and testing using an approved commercial testing laboratory, or by the Contractor, subject to approval. Sampling must be in accordance with ASTM D75/D75M for aggregates and ASTM D140/D140M for bituminous material, unless otherwise directed. Perform aggregate gradation tests on each sample in accordance with ASTM C136/C136M. Perform all other aggregate tests on the initial source samples and repeat tests when there is a change of source. Perform sieve analyses daily from material samples including an analysis of each gradation of material. Perform tests in sufficient number to ensure that materials meet specified requirements. Submit copies of test results, within 24 hours after completion of each test. Repeat aggregate testing (wear, soundness, deleterious material and stripping) for each 20,000 tons of aggregate used in the project.

1.3.3 Wear Test

Perform the wear test in accordance with ASTM C131/C131M to ensure that aggregates have a percentage of wear not exceeding 40 percent after 500 revolutions.

1.3.4 Soundness Test

Perform the soundness test as specified by ASTM C88 to ensure that aggregates have a weight loss not greater than 18 percent when subjected to five cycles of the magnesium sulfate test or 12 percent when subjected to five cycles of the sodium sulfate test.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect the materials delivered to the site for contamination and damage. Unload and store the materials with a minimum of handling. Store aggregates preventing segregation and contamination.

1.5 EQUIPMENT, TOOLS AND MACHINES

Provide equipment dependable and adequate for the purpose intended and properly maintained in satisfactory and safe operating condition at all times. Discontinue the use of equipment which fails to produce satisfactory work and replace with satisfactory equipment. Equipment such as asphalt distributors, scales, batching equipment, spreaders and similar equipment, must have been calibrated by an approved calibration laboratory within 12 months prior to commencing work .

1.5.1 Bituminous Distributors

Provide a self propelled distributor with pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the surface being sprayed. Calibrate the distributer in accordance with ASTM D2995. Design and equip the distributor to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled total liquid rates from 0.03 to 1.0 gallons per square yard, with a pressure range of 25 to 75 psi and with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Include with the distributor equipment a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper

application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor will be capable of circulating and agitating the bituminous material during the heating process.

1.5.2 Single-Pass, Surface-Treatment Machines

Use only machines capable of spraying bituminous material and spreading aggregate in one pass. Use only bituminous spraying equipment conforming to the requirements given above for a bituminous distributor. Use only machines capable of spreading aggregates at controlled amounts per square yard as specified. In addition, only use single-pass, surface-treatment machines capable of placing a surface treatment adjacent to an existing surface treatment, forming a joint of the same thickness and uniformity as other portions of the surface treatment. Ridges or blank spaces will not be permitted. Form joints in the second application at least 1 foot from those formed in the first application.

1.5.3 Power Rollers

Use only steel-wheeled or pneumatic-tired type power rollers conforming to the following requirements:

a. Use only steel-wheeled rollers having at least one steel drum and weigh a minimum of 5 tons. Equip steel wheels of the rollers with adjustable scrapers.

b. Use only self-propelled pneumatic-tired rollers having wheels mounted on two axles in such manner that the rear tires will not follow in the tracks of the forward group. Maintain uniform tire inflation to not less than 60 psi nor more than 80 psi pressure. Equip pneumatic-tired rollers with boxes or platforms for ballast loading. Load rollers so that the tire print width of each wheel is not less than the clear distance between tire prints.

1.5.4 Mechanical Spreaders

Use only adjustable spreaders capable of spreading aggregate at controlled amounts per square yard, as specified.

1.5.5 Brooms and Blowers

Use only power type brooms and blowers capable of cleaning surfaces to be treated.

1.6 ENVIRONMENTAL REQUIREMENTS

Apply bituminous surface treatment only when the existing surface or base course is dry or contains moisture not in excess of the amount that will permit uniform distribution of the asphalt material and provide the desired adhesion between the asphalt material and the materials underneath and above. Do not apply bituminous surface treatment when either the atmospheric temperature, in the shade, is below 50 degrees F or the pavement surface to be treated is below 70 degrees F unless otherwise directed.

PART 2 PRODUCTS

Use mineral aggregate and bituminous material of the following types, gradations, grades, and consistencies that meet the requirements of stripping, wear, deleterious materials and soundness tests as specified in paragraph SAMPLING AND TESTING.

## 2.1 MINERAL AGGREGATE

Provide aggregate consisting of crushed stone, crushed gravel, or crushed slag of such nature that thorough coating of bituminous material, used in the work, will not strip off upon contact with water when testing using ASTM D3625/D3625M. Maintain aggregate moisture content so that the aggregate will be readily coated with the bituminous material. Drying may be required, as directed. Determine gradation of the aggregates by ASTM C136/C136M.

### 2.1.1 Crushed Stone

Provide crushed stone consisting of clean, sound, durable particles, free of soft or disintegrated pieces, dust, or foreign matter.

### 2.1.2 Crushed Gravel

Provide crushed gravel consisting of clean, sound, durable particles, free of soft or disintegrated pieces or foreign matter. At least 90 percent by weight of the particles must have at least two fractured faces.

### 2.1.3 Aggregate Quantities

Spread the bituminous material and aggregate within the quantity limits shown below. The individual quantities of bituminous material and aggregate may be varied to meet specific field conditions at all times during progress of the work, as directed, without adjustments to contract unit prices. Aggregate weights shown are for aggregates having a specific gravity of 2.65. Adjust the number of pounds required if the specific gravity of the aggregate used is other than 2.65 in order to ensure a constant volume of aggregate per square yard of treatment.

| AGGREGATE GRADATION SINGLE BITUMINOUS SURFACE TREATMENT (PERCENT BY WEIGHT PASSING) | | | |
|---|---|---|---|
| Sieve Designation | No. 1 | No. 2 | No. 3 |
| 1 inch | 100 | -- | -- |
| 3/4 inch | 90-100 | 100 | -- |
| 1/2 inch | 20-55 | 90-100 | 100 |
| 3/8 inch | 0-15 | 40-70 | 85-100 |
| No. 4 | 0-5 | 0-15 | 10-30 |
| No. 8 | -- | 0-5 | 0-10 |
| No. 16 | -- | -- | 0-5 |

## 2.2 BITUMINOUS MATERIALS

### 2.2.1 Cutback Asphalt

Use rapid curing cutback asphalt conforming to ASTM D2028/D2028M, Designation RC-250 . Submit temperature-viscosity relationship of cutback asphalt.

### 2.2.2 Emulsified Asphalt

Use rapid-setting emulsified asphalt conforming to ASTM D977, Grade RS-1 or RS-2 or ASTM D2397/D2397M, Grade CRS-1 or CRS-2.

### 2.2.3 Asphalt Cement

Use asphalt cement conforming to ASTM D946/D946M, Penetration Grade 120-150 or ASTM D6373, Performance Graded Asphalt Binder PG 64-22 . Submit temperature-viscosity relationship of asphalt cement.

# PART 3 EXECUTION

## 3.1 SURFACE PREPARATION

Immediately before applying the first course of bituminous material, clean the surface of loose material with power brooms or power blowers. Take care to remove all dirt, clay, and other loose or foreign matter. Earthwork operations will be performed in accordance with Section 31 23 00.00 20 of this specification prior to placement of base course and asphalt.

Flush the surface with water, when necessary, to achieve a clean surface, only when directed by the Design Engineer; allow the surface to dry after flushing.

## 3.2 APPLICATION OF FIRST COURSE

### 3.2.1 Bituminous Material

Apply bituminous material by means of a bituminous distributor at the temperature specified in paragraph APPLICATION TEMPERATURE OF MATERIALS, below or as directed; and within the limits specified in paragraph QUANTITY LIMITS in PART 1. Apply bituminous material in such a manner that uniform distribution is obtained over all surfaces treated. Unless the distributor is equipped to obtain a satisfactory result at the junction of previous and subsequent applications, spread building paper on the surface for a sufficient distance back from the ends of each application so that flow through the sprays may be started and stopped on the paper in order that all sprays will operate at full force on the surface treated. Immediately after application, remove and destroy the building paper. Properly treat areas inaccessible to the distributor with bituminous material using the hose attachment. Protect adjacent buildings, structures, and trees to prevent their being spattered or marred.

### 3.2.2 Spreading of Aggregate

Immediately following application of bituminous material, spread aggregate uniformly over the surface within the limits of the quantities specified in paragraph QUANTITY LIMITS in PART 1 using

mechanical spreaders. Spread aggregate evenly by hand on all areas missed by the mechanical spreader. Operate equipment spreading aggregate so that the bituminous material will be covered ahead of the truck wheels. When hand spreading is employed on inaccessible areas, spread aggregate directly from trucks. Spread additional aggregate by hand over areas having insufficient cover. Continue spreading during these operations when necessary.

3.2.3 Brooming and Rolling

Roll the surface with a pneumatic-tired and a steel-wheeled roller after sufficient aggregate is spread. Continue rolling until no more aggregate can be worked into the treated surface. The use of the steel-wheeled roller will be discontinued, or a lighter weight steel wheel roller substituted, as directed, if the roller being used causes excessive crushing and shattering of the aggregate. If the aggregate is not distributed properly, broom the surface as soon as possible after the first coverage by the roller, but not until the surface has set sufficiently to prevent excessive marking. Continue brooming, rolling, and supplemental spreading of aggregate until the surface is cured and rolled sufficiently to key and set the aggregate. In places not accessible to rollers, compact the aggregate with pneumatic tampers. Remove aggregate that has become contaminated with foreign matter and replace with clean aggregate and reroll as directed. Maintain and protect the treated areas by use of barricades until properly cured.

3.3 APPLICATION OF SECOND COURSE

3.3.1 Bituminous Treatment

Apply the bituminous material for the second course within 48 hours after construction of the first course, weather permitting. Remove excess aggregate prior to the second application of bituminous material. If the treated surface is excessively moistened by rain, allow the surface to dry for such time as deemed necessary. Perform the second application of bituminous material in the manner specified in paragraph APPLICATION OF FIRST COURSE, including temperature and QUANTITY LIMITS.

3.3.2 Aggregate

Immediately following the second application of bitumen, spread aggregate conforming to the gradation and limits specified in paragraph QUANTITY LIMITS uniformly over the bituminous material and process in the manner specified for the first course.

3.3.3 Brooming and Rolling Second Course

Roll and broom the surface in the manner specified for the first course until a thoroughly bonded, smooth, even-textured surface is produced. Sweep off the surface surplus aggregate and remove it prior to final acceptance.

3.4 APPLICATION TEMPERATURE OF MATERIALS

3.4.1 Cutback Asphalt

Apply cutback asphalt in the range of 100 to 200 degrees F.

3.4.2 Emulsified Asphalt

Apply asphalt emulsions in the range of 90 to 160 degrees F.

3.4.3 Asphalt Cement

Apply asphalt cement in the range of 325 to 375 degrees F.

3.5 PROTECTION

Keep all traffic off surfaces freshly treated with bituminous material. Provide sufficient warning signs and barricades so that traffic will not travel over freshly treated surfaces. Protect the treated areas from traffic for at least 24 hours after final application of bituminous material and aggregate, or for such time as necessary to prevent picking up. Immediately prior to opening to traffic, roll the entire treated area with a self-propelled pneumatic-tired roller.

SEE ATTACHMENTS:

B - NMDOT SECTION 416 – MINOR PAVING

C - NMDOT SECTION 423 – HOT MIX ASPHALT (HMA) (MAJOR PAVING)

-- End of Section –

SECTION 32 92 19

SEEDING, PLANTING, AND IRRIGATION

PART 1 GENERAL

1.1 References

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

| | |
|---|---|
| ASTM C602 | Agricultural Liming Materials (2020) |
| ASTM D4427 | Standard Classification of Peat Samples by Laboratory Testing (2018) |
| ASTM D4972 | Standard Test Methods for pH of Soils (2018) |

U.S. Department of Agriculture (USDA)

AMS Seed Act (1940; R 1988; R 1998) Federal Seed Act

DOA SSIR 42 Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

Federal Highway Administration (FHWA).

Roadside Revegetation: An Integrated Approach to Establishing Native Plants and Pollinator Habitat. Chapter 5 Implementation

1.2 Definitions

Stand of Turf: 60 percent ground cover of the established species.

1.3 Related Requirements

New Mexico Department of Transportation (NMDOT) Standard Specification for Highway and Bridge Construction, 2019 edition, Section 632 Revegetation.

1.4 Submittals

Engineer approval is required for seed, live plants, and related materials. Submit the following:

SD-03 Product Data

Seed sources and certifications.

Compost Mulch

Hydroseeding Fertilizer

Hydro Mulch with Tackifier

SD-06 Test Reports

Topsoil Composition Tests: reports and recommendations, if required).

SD-07 Certificates

State Certification and Approval for Seed SD-08 Manufacturer's Instructions

Erosion Control Materials, including straw wattles

Submit complete data on the solar powered water pumping system and controls. Submit complete data on the irrigation controller and solenoid valve system. Submit the operations logic control plan for operation of the water pumping and irrigation control systems.

1.5 Delivery, Storage, and Handling

A. Delivery

1. Seed Protection: Protect from drying out and from contamination during delivery, on-site storage, and handling.

2. Fertilizer and Lime Delivery: Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer may be furnished in bulk with a certificate indicating the above information.

B. Storage

1. Seed, Fertilizer Storage: Store in cool, dry locations away from contaminants.

2. Topsoil: Prior to stockpiling topsoil, treat growing vegetation with the application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

C. Handling

1. Do not drop or dump materials from vehicles.

1.6 Time Restrictions and Planting Conditions

A. Restrictions

1. Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90°F.

2. Hydroseeding with fertilizer and hydromulching shall be completed as soon as possible after finish grading and underground utility construction is completed. Preferably, these two steps will be completed in the Fall. Plug planting and tree/shrub planting shall be completed in the Spring season, before May 1st.

1.7 Time Limitations

A. Seed: Apply seed within 24 hours after seed bed preparation.

PART 2 PRODUCTS

2.1 Seed

Classification: Obtain seed mixes from the closest possible source (e.g., Curtis and Curtis in Clovis, New Mexico or a seed supplier in Colorado). Provide AMLP-approved seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Engineer.

A. Seed Mixture by Weight: See the following table:

**Table 1. Seed Quantities**

| Plant Name | Scientific name | Seeding (Pure Live Seed) Recommended lbs/acre** | Type “A” seeding | Type “B” seeding | Type “C” seeding |
|---|---|---|---|---|---|
| *WOODY PLANTS - seed mix* | | | | | |
| Four-winged saltbush | *Atriplex canescens* | 1.20 | 1.20 | | |
| *HERBACEOUS PLANTS - wildflower seed mix* | | | | | |
| Scarlet globemallow | *Sphaeralcea coccinea* | 0.90 | 0.90 | | |
| Evening primrose | *Oenothera pallida* | 0.30 | 0.30 | | |
| Winterfat | *Krascheninnikovia lanata* | 0.60 | 0.60 | | |
| Butterfly-weed (showy milkweed) | *Asclepias speciosa* | 2.10 | 2.10 | 2.10 | |
| Palmer's Penstemon | *Penstemon palmeri* | 0.60 | 0.60 | 0.60 | |
| Scarlet penstemon | *Penstemon barbatus ssp. torreyi* | 0.60 | 0.60 | 0.60 | 0.60 |
| Scarlet gilia | *Ipomopsis aggregata* | 0.60 | 0.60 | 0.60 | 0.60 |
| Desert marigold | *Baileya multiradiata* | 0.30 | 0.30 | 0.30 | |
| Sand verbana | *Abronia villosa* | 0.30 | 0.30 | 0.30 | |
| Common hoptree | *Ptelea trifoliata* | 1.00 | | | 1.00 |
| Utah juneberry | *Amelanchier utahensis* | 0.50 | | 0.50 | |
| Datura | *Datura wrightii* | 0.50 | | 0.50 | 0.50 |

| | | | | | |
|---|---|---|---|---|---|
| Desert four o'clock | *Mirabolis multiflora* | 0.60 | | | 0.60 |
| *GRASSES PLANTS* | | | | | |
| Alkali sacaton grass | *Sporobolus airoides* | 0.70 | 0.70 | 0.70 | |
| Sideoats grama | *Bouteloua curtipendula* | 1.75 | 1.75 | 1.75 | |
| Blue grama | *Bouteloua gracilis* | 1.75 | 1.75 | 1.75 | |
| Western wheatgrass | *Agropyron smithii* | 3.75 | 3.75 | 3.75 | 3.75 |
| Sand dropseed | *Sporobolus cryptandrus* | 0.28 | 0.28 | 0.28 | |
| James galleta | *Pleuraphis jamesii* | 3.50 | 3.50 | 3.50 | 3.50 |
| *WOODY* | | | | | |
| Chamisa | *Ericameria nauseosa* | 0.20 | | 0.20 | 0.20 |
| Apache plume | *Fallugia paradoxa* | 0.20 | | 0.20 | 0.20 |
| New Mexico locust | *Robinia neomexicana* | 1.00 | | | 1.00 |
| Mahonia/desert holly | *Mahonia haematocarpa* | 0.75 | | 0.75 | |
| *HERBACEOUS PLANTS* | | | | | |
| Broadleaf milkweed | *Asclepias latifoliav* | 1.50 | | 1.50 | |
| Antelope horns milkweed | *Asclepias asperula* | 1.50 | 1.50 | 1.50 | |
| Sweet sand verbana | *Abronia fragrans* | 0.25 | | 0.25 | 0.25 |
| ---------- | ---------- | ---------- | ---------- | ---------- | ---------- |
| **TOTAL SEEDING RATE (lbs/acre)** | | | **20.73** | **21.63** | **12.2** |

Seed Ratio Formulas:
Type “D” seeding: 0.6 times the Type “A” quantity, plus 0.4 times the Type “B” quantity
Type “E” seeding: 0.6 times the Type “B” quantity, plus 0.4 times the Type “C” quantity

**Table 2. Live Plant Quantities**

| Plant Type | | Units | | | |
|---|---|---|---|---|---|
| No Supplemental Water Required | | | | | |
| *LIVE PLANTINGS (PLUGS)* | | | | | |
| Native grasses (same species listed above, in equal quantities) | | 400 | | | |
| Shrubs (Chamisa, Apache Plume, in equal quantities) | | 200 | | | |
| | **TOTAL** | 600 | | | |
| Supplemental Water Required | | | | | |
| *LIVE PLANTINGS (10-GALLON CONTAINERS)* | | | | | |
| Two-needle pinyon | *Pinus edulis* | 5 | | | |
| NM Locust | *Robinia neomexicana* | 9 | | | |
| Three-leaf sumac | *Rhus trilobata* | 11 | | | |
| Scrub oak - gambel or wavyleaf | *Quercus sp.* | 22 | | | |
| | **TOTAL** | **47** | | | |

2.2 Topsoil

A. On-Site Topsoil: Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph 2.2.C Composition. When available, topsoil must be existing surface soil stripped and stockpiled on-site.

B. Off-Site Topsoil: Conform to requirements specified in paragraph 2.2.C Composition. Additional topsoil must be furnished by the Contractor.

C. Composition: Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, ¾ inch, with maximum 3 percent retained on ¼-inch screen. The pH must be tested in accordance with ASTM D4972. Topsoil must be free of sticks, stones, roots, and other debris and objectionable materials.

2.3 Mulch

A. Compost Mulch: Mulch must include producer's guaranteed analysis for percentages of mixture, purity, weed/seed content, and inert material and certify the mulch as

being free from noxious weeds, mold, and other deleterious materials. Composted mulch provider must be registered with or permitted by the New Mexico Environment Department Solid Waste Bureau and must be in compliance with 20.9.1 NMAC. Composted mulch is defined as the product of a controlled aerobic thermophilic biological decomposition process that meets the quality requirements in NMDOT Section 632.2.6, Table 632.2.6:1, "Requirements of Compost Mulch." Raw materials used in producing composted mulch may include green waste, animal manure, animal bedding, paper waste, food waste, biosolids or other non-toxic organic matter, but shall not include animal mortalities. Compost mulch shall be 134 cubic yards per acre.

B. Hydro Mulch with Tackifier: Hydro-mulch shall be a Bonded Fiber Matrix (BFM). BFM is a hydraulically-applied blanket that controls soil erosion and accelerates seed germination. BFM is a three-dimensional composite of wood or paper fibers bonded by polymer tackifier that provides high performance erosion prevention on slopes. Dye and tackifier shall be included in the BFM formulation. BFM shall be applied at a rate of 2,000 pounds per acre.

2.4 Fertilizer

A. Granular Fertilizer: Not used

B. Hydroseeding Fertilizer:

1. Fertilizer shall be organic, slow release with an N-P-K (nitrogen, phosphorous, potassium) analysis of either 3-6-3 or 3-7-2 and blended with endo-mycorrhiza and humates. (NMDOT Section 632.2.3)

2. Application rate shall be 1,000 pounds per acre. Humates must comprise a minimum of 15% by weight. Endo-mycorrhiza must be arbuscular with a minimum propagule of 1.33 propagules per gram.

3. The Contractor shall provide fertilizer (specified type and formulation) and supplier's certification in accordance with the Contract. Each bag or tote of fertilizer shall have a visible, sealed, and un-altered analysis tag from the manufacturer. The tag must include the manufacturer's information, the N-P-K analysis of the product, and the weight of the bag or tote.

2.5 Water

A. Source of water must be approved by Engineer and of suitable quality for irrigation, containing no elements toxic to plant life.

2.6 Irrigation Water Piping

A. All irrigation water piping in the "Primary" water lines shall be ¾" schedule 40 PVC with solvent welded joints. Secondary water piping shall be determined by the irrigation installer, provided that the flow rate and pressure requirements are achieved (10 GPH at each emitter head, with a minimum pressure of 20 PSI immediately upstream of the emitter head).

2.7 Solar Powered Water Pumping System

A. The solar powered water pumping system shall be a complete system of centrifugal pump, solar panels, controller, stand and rack for solar panels, etc. manufactured as a stand-alone system. The system shall be a 400 watt system such as the RPS 400V Solar Well Pump kit, as manufactured by RPS Solar Pumps, or Engineer approved equal. The system shall be capable of delivering 9 GPM at 50 ft of TDH.

PART 3 EXECUTION

3.1 Preparation

A. Extent of Work: Provide soil preparation prior to planting (including soil conditioners as required), fertilizing, seeding, and surface topdressing of newly graded finished earth surfaces, unless indicated otherwise, and at areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

B. Prior to seedbed preparation, the Contractor shall grade all disturbed areas as described and roughen the surface as specified. On slopes up to 1.5h:1v, the soil surface in areas to be seeded shall be prepared to be continuously rough and hummocky. This shall be accomplished by using an excavator bucket, or other acceptable methods that produce similar results, to create small pockets and furrows to trap water and create favorable microclimates for plant growth.

Topsoil: Provide 4 inches of existing soil with 1 inch compost mulch to meet the indicated finish grade. After areas have been brought to indicated finish grade, incorporate compost mulch into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Engineer. Remove debris and stones larger than ¾ inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.2 Seeding

A. Seed Application Seasons and Conditions

1. Seeding shall be accomplished after September 15 and before November 15th, unless specific permission in writing is issued by the Project Engineer to allow seeding at a different time of year. Refer to the plant species list for exceptions (e.g. allowed fall planting for trees). Immediately before seeding, restore soil to proper grade. Do not seed when the ground is muddy, frozen snow covered, or in an unsatisfactory condition for seeding. Apply seed within 24 hours after seedbed preparation.

2. Any Project areas with slopes less than 3:1 requiring revegetation which are less than 8 feet wide, or are inaccessible to drill seeding equipment, or are too rocky to disk to a 4 inch depth, shall use the following procedure.

a. The Contractor shall disk soil to a 4 inch depth with 1 inch of incorporated compost mulch. A skid steer with attachments may be used. If the seed bed is too rocky to disk to 4 inches, the Contractor shall chain harrow or hand rake the entire area and proceed with Steps 1 and 2 below.

B. Seed Application Method

Seeding method shall be hydroseeding. A hydro-seeder shall be used to apply the seed and hydro seeding fertilizer in the following two steps.

a. Step 1. The Contractor shall apply seed and fertilizer to the newly disked soil and compost, rake or chain harrow so seed is covered with soil.

b. Step 2. The Contractor shall apply an approved bonded hydro-mulch BFM with dye and tackifier applied in two coats from opposing directions at rate of 2,000 pounds per acre.

2. Hydroseeding Mix: Mix water and hydroseeding fertilizer. Fertilizer shall be added at 1,000 pounds, dry weight, per acre. Add and mix seed and fertilizer to produce a homogeneous slurry. Seed must be mixed to ensure broadcasting at the rate of 2,000 pounds per acre. When hydraulically sprayed on the ground, material must form a blotter like cover impregnated uniformly with seed. Spread with one application with no second application of mulch.

C. Hydro Mulch with Tackifier: Hydro-mulch shall be BFM, a hydraulically-applied blanket that controls soil erosion and accelerates seed germination. BFM shall be applied at a rate of 2,000 pounds per acre using a blower-type mulch spreader, or other approved method. Areas installed with seed must be mulched within 72 hours of the seeding.

D. Erosion Control Material

1. Install in accordance with manufacturer's instructions. Straw Wattles will be used for erosion and sediment control following the completion of earth moving operations, placed along contour of reconstructed slopes, spaced at intervals of 5 feet vertically along slopes with a final grade steeper than 10%.

2. Acceptable straw wattles will be manufactured from rice straw and must be wrapped in tubular plastic netting. The netting, which must have a strand thickness of 0.03 inch, must consist of 85% high density polyethylene (HDPE), 14% ethyl vinyl acetate, and 1% color for ultraviolet inhibition. The wattles must be a nominal 9 inches in diameter and a nominal 25 feet long, with a weight of approximately 35 pounds each.

3. Wattles will be installed on contour in trenches that are 3 to 5 inches in depth, and 9 inches wide. Wattles will be anchored in the trench by l-inch x l-inch by 24-inch stakes on 4-foot centers. The ends of adjacent wattles must be butted one to another. Wattles must be certified weed free.

E. Watering: Water live plant materials immediately after installation: 2 gallons per live tree or shrub, and 1 quart of water per plug plant. Set up drip irrigation timer to deliver 5 gallons of water per tree or shrub once per week. Continue watering once weekly throughout the first growing season. The contractor will be responsible for maintaining a sufficient volume of water in the tank during the supplemental watering

period. Live Plantings. Refer to the FHWA guidelines for planting methods and irrigation recommendations. Following planting, supplemental irrigation will be provided to the plantings by providing water through a temporary irrigation system that will include a buried 1,200-gallon water tank and 50 emitters (see construction plans for tank location). Only the 10-gallon containerized shrubs and trees will receive supplemental water in the form of piped bubbler irrigation. All live plant materials shall be installed AFTER the hydromulch has been applied, so that the plants will stick up through & above the hydromulch layer.

3.3 Restoration

Remove any overspray of hydroseed & fertilizer, and any overspray of hydromulch from roads, walking paths, rock walls, fences and other structures in the project area.

-- End of Section –

SECTION 33 11 00

WATER PIPING

PART 1 GENERAL

This section covers waterline re-location installations shown on the Plans including pipelines, valves, manhole covers, and fire hydrants.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

| | |
|---|---|
| AWWA C605 | (2013) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water |
| AWWA C900 | (2016) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm) |
| AWWA M23 | (2002, 2nd Ed) Manual: PVC Pipe – Design and Installation |
| AWWA C550 | (2017) Protective Interior Coatings for Valves and Hydrants |
| AWWA C800 | (2021) Underground Service Line Valves and Fittings |
| AWWA M9 | (2014; Errata 2013) Manual: Concrete Pressure Pipe |

ASTM INTERNATIONAL (ASTM)

| | |
|---|---|
| ASTM D1784 | (2011) Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds |
| ASTM D1785 | (2012) Standard Specifications for Poly (Vinyl Chloride) (PVC), Plastic Pipe, Schedule 40, 80, and 120 |
| ASTM D2241 | (2015) Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series) |
| ASTM D2464 | (2015) Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 |
| ASTM D2466 | (2015) Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 |

| | |
|---|---|
| ASTM D2467 | (2015) Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 |
| ASTM D2564 | (2012) Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems |
| ASTM D2855 | (2015) Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings |

UNDERWRITERS LABORATORIES (UL)

| | |
|---|---|
| UL 262 | (2004; Reprint Oct 2011) Gate Valves for Fire-Protection Service |

## 1.3 SUBMITTALS

Engineer approval is required for submittals with an "E" classification. Submittals not having an "E" classification are for information only. When used, a code following the "E" classification identifies the office that will review the submittal for the Engineer. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Connections; E

SD-03 Product Data

Pipe, Fittings, Joints and Couplings; E
Hydrants; E

SD-06 Test Reports

Leakage Test
Hydrostatic Test

SD-07 Certificates

Pipe, Fittings, Joints and Couplings
Shop-Applied Lining
Valves

## 1.4 DELIVERY, STORAGE, AND HANDLING

### 1.5.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling and in accordance with manufacturer's instructions. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight.

Do not store materials directly on the ground. Keep inside of pipes, fittings, valves, and other accessories free of dirt and debris.

1.5.2 Handling

Handle pipe, fittings, valves, and other accessories in accordance with manufacturer's instructions and in a manner to ensure delivery to the trench in sound undamaged condition. Avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place other material, hooks, or pipe inside a pipe or fitting after the coating has been applied. Inspect the pipe for defects before installation. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. Clean the interior of pipe and accessories of foreign matter before being lowered into the trench and keep them clean during laying operations by plugging. Replace defective material without additional expense to the project owner. Store rubber gaskets, not immediately installed, under cover or out of direct sunlight.

PART 2 PRODUCTS

2.1 MATERIALS

Provide all materials in accordance with AWWA C200 and as indicated herein. Provide valves and fittings with pressure ratings equivalent to the pressure ratings of the pipe.

2.1.1 Pipe, Fittings, Joints, and Couplings

2.1.1.1 Steel Piping

2.1.1.1.1 Carbon Steel Pipe and Fittings

Carbon steel pipe shall meet the requirements of ASTM A53/A53M butt welded Grade A. Buried carbon steel piping and fittings shall be Schedule 40.

Fittings, AWWA C208 and AWWA C200, with reference to the requirements specified therein for "Special Sections." Utilize pipe ends and fittings compatible for the joints and jointing materials used.

a. Utilize welded or seamless pipe with plain, or shouldered and grooved ends in accordance with AWWA C606 for use with mechanical couplings,

b. Provide fittings and specials made of the same material as the pipe. Use specials and fittings made of standard steel tube turns or segmentally welded sections, with ends to accommodate the type of couplings or joints specified for the pipe. Match the thickness rating of pipe fittings and specials to the thickness specified and the pressure rating calculated for the pipe with which they are used. Provide identical protective materials for fittings and specials as specified for the pipe. Hand wrap, line, or coat specials and fittings that cannot be mechanically wrapped, lined, or coated using the same material used for the pipe with the same number of applications of each material, smoothly applied.

2.1.1.1.2 Wall Thickness for Pipe and Fittings

The minimum metal thickness for steel pipe wall is 0.375 inches, based on steel having a yield strength of 30,000 psi. Pipe has been designed for the following minimum conditions:

Ensure that the wall thickness of fittings is equal to or greater than that required for the pipe. Reinforce fittings in accordance with methods given in AWWA M11, Chapter 13, "Supplementary Design Data and Details" when necessary to meet the pressure test requirements.

2.1.1.1.3 Joints and Jointing Material

Provide rubber-gasketed pipe and fitting bell-and-spigot joints, welded joints, or the mechanically coupled type using a sleeve-type mechanical coupling. Provide flanged joints where indicated.

a. Rubber-Gasketed Bell-and-Spigot Joints: Provide joints and pipe ends in accordance with the pipe manufacturer's standard for this type of joint, except that the joint is to also meet the requirements specified for rubber-gasketed joints and rubber gaskets in AWWA C200.

b. Welded Joints: Provide electrodes of the quality specified in AWWA C206.

c. Type Joints: Couplings and shouldered pipe ends, AWWA C606. Match the joint dimensions as specified in AWWA C606 for rigid joint.

d. Flanged Joints: Provide pipe ends with steel flanges, AWWA C207; Class D. Bolts and nuts for flanged connections, AWWA C207. Rubber gaskets, AWWA C207; asbestos gaskets are not allowed.

e. Insulating Joints: Designed to prevent metal-to-metal contact at the joint between adjacent sections of piping. Provide flange type joints with insulating gasket, insulating bolt sleeves, and insulating washers. Provide dielectric type gaskets, full face, and in other respects as recommended in the Appendix to AWWA C115/A21.15. Bolts and nuts as recommended in the Appendix to AWWA C115/A21.15.

2.1.1.1.4 Lining and Coating:

Not Used.

2.1.2 Valves

Provide protective interior coating in accordance with AWWA C550.

2.1.2.1 Gate Valves 3 Inch Size and Larger in Valve Pit(s) and Aboveground Locations

AWWA C500, AWWA C509, AWWA C515, or UL 262 and:

a. AWWA C500: nonrising stem type with solid-wedge gates and flanged ends

b. AWWA C509 or AWWA C515: nonrising stem type with flanged ends

c. UL 262: inside-screw type, with solid or one-piece type gate and flanged ends, and designed for a hydraulic working pressure of 175 psi

Match materials for UL 262 gate valves to the reference standards specified in AWWA C500. Provide gate valves with wrench nut that open by counterclockwise rotation of the valve stem. Bolt and construct stuffing boxes so as to permit easy removal of parts for repair.

Provide valves with gearing, stems, supports and indicator per AWWA C500 or AWWA C509.

2.1.3 Fire Hydrants

a. Fire hydrants shall be furnished and installed per NM APWA Section 801 and the Plans

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Operation of Existing Valves

Do not operate valves within or directly connected to the existing water system unless expressly directed to do so by the Engineer.

3.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

3.2 INSTALLATION

Install all materials in accordance with the applicable reference standard, manufacturer’s instructions and as indicated herein.

3.2.1 Piping

3.2.1.1 General Requirements

Install pipe, fittings, joints, and couplings in accordance with the applicable referenced standard, the manufacturer's instructions and as specified herein.

3.2.1.1.1 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Under no circumstances is it permissible to drop or dump pipe, fittings, valves, or other water line material into trenches. Cut pipe cleanly, squarely, and accurately to the length established at the site and work into place without springing or forcing. Replace a pipe or fitting that does not allow sufficient space for installation of jointing material.

Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at the design elevation and grade. Secure firm, uniform support. Wood support blocking is not permitted. Lay pipe so

that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports for fastening work into place. Keep trenches free of water until joints have been assembled. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation.

3.2.1.1.2 Penetrations

Provide ductile-iron or Schedule 40 steel wall sleeves for pipe passing through walls of valve pits and structures. Fill annular space between walls and sleeves with rich cement mortar. Fill annular space between pipe and sleeves with mastic.

3.2.1.2 Steel Piping

Unless otherwise specified, install pipe and fittings in accordance with AWWA C604 and AWWA M11, Chapter 12, "Transportation, Installation, and Testing."

a. Jointing: Make welded joints in accordance with AWWA C206 and with the recommendations given for installation of pipe in AWWA M11, Chapter 12, "Transportation, Installation, and Testing." Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer. Make flanged joints with the gaskets, bolts, and nuts specified for this type of joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories. Align bolt holes for each flanged joint. Use full-size bolts for the bolt holes; use of undersized bolts is not permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without straining the flange. Replace flanged pipe or fittings with dimensions that do not allow the making of a flanged joint as specified. Finish joints on piping with cement-mortar lining as specified in Appendix on Field Joints in AWWA C205.

3.2.2 Pipe Restraint

3.2.2.1 Concrete Encasement

Install concrete pipe encasement where indicated. See Section 03 30 00 CAST-IN-PLACE CONCRETE

3.2.2.2 Restrained Joints

Install restrained joints in accordance with the manufacturer's instructions where indicated. Install concrete thrust blocking in conformance with NMAPWA or COA standard drawings at all bends, tees and valves in the fires suppression water line.

3.2.3 Valves

3.2.3.1 Gate Valves

Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves, AWWA C509 or AWWA C515, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the

recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509 or AWWA C515. Make and assemble joints to gate valves as specified for making and assembling the same type joints between pipe and fittings.

## 3.3 SYSTEM STARTUP

Water mains and appurtenances must be installed to obtain approval by the Engineer prior to the new water piping being placed into service. All piping for potable water must be disinfected prior to being placed in service.

## 3.4 CLEANUP

Upon completion of the installation of water lines and appurtenances, remove debris and surplus materials resulting from the work.

-- End of Section –

SECTION 33 40 00

STORMWATER UTILITIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

| | |
|---|---|
| AASHTO M36 | Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains |

ASTM INTERNATIONAL (ASTM)

| | |
|---|---|
| ASTM A760/A760M | (2015, R 2020) Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains |
| ASTM A798/A798M | (2022) Standard Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications |
| ASTM C76 | (2022a) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe |
| ASTM C231/C231M | (2022) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method |
| ASTM C270 | (2019a; E 2019) Standard Specification for Mortar for Unit Masonry |
| ASTM C443 | (2021) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets |
| ASTM C478/C478M | (2022) Standard Specification for Circular Precast Reinforced Concrete Manhole Sections |
| ASTM C655 | (2019a) Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe |
| ASTM C655M | (2019a) Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe (Metric) |

| | |
|---|---|
| ASTM C923/C923M | (2020) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals |
| ASTM C990 | (2009; R 2019) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants |
| ASTM D1751 | (2018) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) |
| ASTM D2487 | (2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) |

## 1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Leakage Test; G

SD-07 Certificates

Hydrostatic Test on Watertight Joints; G

Frame and Cover or Gratings; G

SD-08 Manufacturer's Instructions

Placing Pipe and Box Culvert; G

SD-11 Closeout Submittals

Post-Installation Inspection Report; G

LID Verification Report; G

## 1.3 DELIVERY, STORAGE, AND HANDLING

### 1.3.1 Delivery and Storage

Inspect materials delivered to site for damage and unload and store materials with minimal handling. Do not store materials directly on the ground. Keep the inside of pipes and fittings free of dirt and debris. Before, during, and after installation, protect plastic pipe and fittings from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer. Store solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe in accordance with the manufacturer's recommendations and

discard if the storage period exceeds the recommended shelf life. Discard solvents in use when the recommended pot life is exceeded.

1.3.2 Handling

Handle materials in a manner that ensures delivery to the trench in sound, undamaged condition. Carry pipe to the trench.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe sizes for culverts and storm drains are indicated on the drawings.

2.1.1 Concrete Pipe

2.1.1.1 Reinforced Culvert and Storm Drain Pipe

Manufactured in accordance with and conforming to ASTM C76M ASTM C76, Class as indicated, or ASTM C655M ASTM C655, D-Load as indicated.

2.1.2 Corrugated Steel Pipe

Provide corrugated steel pipe conforming to AASHTO M36.

2.2 PIPE JOINTS

Provide joints that have been tested for and meet the requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS.

2.2.1 Concrete Pipe

2.2.1.1 Rubber Gasket Joints

Provide rubber gasket joints of a design and physical requirements conforming to ASTM C443.

2.2.1.2 Preformed Flexible Sealant Joints

Provide joints made with preformed flexible joint sealant conforming to ASTM C990.

2.3 PRECAST REINFORCED CONCRETE BOX CULVERT

Manufacture precast reinforced concrete box culverts in accordance with and conforming to ASTM C1433

2.4 MISCELLANEOUS MATERIALS

2.4.1 Concrete

Unless otherwise specified, provide concrete and reinforced concrete conforming to the requirements for 3,000 psi concrete under Section 03 30 00 CAST-IN-PLACE CONCRETE. Provide air content by volume of concrete mixture, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Determine air content in accordance with ASTM C231/C231M. Provide a minimum concrete covering over steel reinforcing of not less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. For concrete deposited directly against the ground, provide a covering thickness of at least 3 inches between steel and ground. Provide expansion-joint filler material conforming to ASTM D1751, or ASTM D1752, or provide be resin-impregnated fiberboard conforming to the physical requirements of ASTM D1752.

2.4.2 Mortar

Mortar is not allowed for pipe joints. Provide mortar for pipe connections to drainage structures conforming to ASTM C270, Type M, except that the maximum placement time will be 1 hour. Provide a sufficient quantity of water in the mixture to produce a stiff workable mortar but in no case may the quantity exceed 5 gallons of water per sack of cement. Use water that is clean and free of harmful acids, alkalis, and organic impurities. Use the mortar within 30 minutes after the ingredients are mixed with water.

2.4.3 Precast Reinforced Concrete Manholes

Provide precast reinforced concrete manholes conforming to ASTM C478/C478M . Provide joints between precast concrete risers and tops that are full-bedded in cement mortar and smoothed to a uniform surface on both interior and exterior of the structure.

2.4.4 Frame and Cover or Gratings

Submit certification on the ability of frame and cover or gratings to carry the imposed live load indicated on the drawings. Provide frame and cover or gratings made of cast gray iron, ASTM A48/A48M, Class 35B; cast ductile iron, ASTM A536, Grade 65-45-12; or cast aluminum, ASTM B26/B26M, Alloy 356.0-T6. Provide curb inlet grates conforming to the weight, shape, size, and waterway openings indicated on the plans. Stamp or cast the word "Storm Sewer" into covers so that it is plainly visible.

2.4.5 Resilient Connectors

Provide flexible, watertight connectors conforming to ASTM C923/C923M for connecting pipe to manholes and inlets.

2.3.6 Flared End Sections

2.4.6.1 Metal Flared End Sections

Provide sections of a standard design fabricated from zinc or aluminum (Type 2) coated steel sheets meeting requirements of ASTM A929/A929M.

2.4.6.2 Concrete Flared End Sections

Provide sections of a standard design fabricated with reinforced concrete.

## PART 3 EXECUTION

### 3.1 EXCAVATION FOR PIPE CULVERTS, BOX CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavate trenches, excavate for appurtenances and backfill for culverts and storm drains, in accordance with the applicable portions of Section 31 23 00 EXCAVATION AND FILL and the requirements specified below.

#### 3.1.1 Trenching

Excavate trenches to the width indicated on the drawings or as specified herein. Trench width should permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Place sheeting and bracing, where required, within the trench width as specified, without any overexcavation.

#### 3.1.2 Removal of Rock

Replace rock in either ledge or boulder formation with suitable materials to provide a compacted earth cushion. Provide a compacted earth cushion between unremoved rock and the pipe with a thickness of at least 8 inches or 1/2 inch for each foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Maintain the cushion under the bell as well as under the straight portion of the pipe where bell-and-spigot pipe is used. Provide a compacted earth cushion between unremoved rock and the box culvert of at least 8 inches in thickness for concrete box culverts. Excavate rock as specified and defined in Section 31 00 00 EARTHWORK.

#### 3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe or box culvert, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, remove such material to the depth required and replace with select granular material to the proper grade. Compact select granular material as specified in paragraph FINAL BACKFILL. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheeting, water removal, or other specified requirements, perform such removal and replacement at no additional cost to the Government.

### 3.2 BEDDING AND INITIAL BACKFILL

Provide a firm bedding foundation of uniform density throughout the entire length of the pipe or box culvert.

#### 3.2.1 Concrete Pipe

Use select granular material conforming to Section 31 00 00 EARTHWORK for haunch and bedding material. Compact haunch and outer bedding to at least 90 percent laboratory maximum density and place in layers not exceeding 6 inch loose thickness for compaction by hand-operated compactors and 200 mm 8 inches for other than hand-operated machines. Loosely place middle bedding and do not compact. After the pipe has been properly bedded, place haunch material, at a moisture content that will facilitate compaction, evenly along both sides of the pipe and thoroughly compact each layer with mechanical

tampers or rammers to the spring line of the pipe. Thoroughly compact the haunch material under the haunches of the pipe. For bell and spigot pipe, form a depression in bedding material for bells so entire barrel of pipe is uniformly supported. Minimize the length, depth, and width of bell depressions to that required for properly making the particular type of joint.

3.2.1.1 Trenches

After the pipe has been properly bedded and haunch material placed to the midpoint (springline) of the pipe, backfill and compact the remainder of the trench by spreading and rolling or compacting by mechanical rammers or tampers in layers not exceeding 6 inches. Test for density as necessary to ensure conformance to the compaction requirements specified below. Leave untreated sheeting in place beneath structures or pavements.

3.2.1.2 Fill Sections

For pipe placed in fill sections, uniformly spread fill material longitudinally on both sides of the pipe in layers not exceeding 6 inches in compacted depth, and compact by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe must extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, place and thoroughly compact the remainder of the fill in layers not exceeding 8 inches.

3.2.2 Corrugated Steel Pipe

Provide bedding and structural backfill for corrugated steel and aluminum pipe and pipe arch in accordance with ASTM A798/A798M. It is not required to shape the bedding to the pipe geometry. However, for pipe arches, either shape the bedding to the relatively flat bottom arc or fine grade the foundation to a shallow v-shape. Structural backfill material consists of materials classified by ASTM D2487 as either GW, GM, GP-GM, GW-GM, GC, GP-GC or SW. Provide bedding for corrugated structural plate pipe meeting the requirements of ASTM A807/A807M.

3.3 PLACING PIPE AND BOX CULVERT

Lay pipelines to the grades and alignment indicated. Provide proper facilities for lowering sections of pipe into trenches. Do not lay pipe in water or when trench conditions or weather are unsuitable for such work. Divert drainage or dewater trenches during construction as necessary.

3.3.7 Multiple Culverts

Where multiple lines of pipe are installed, adjacent sides of pipe must be at least half the nominal pipe diameter or 3 feet apart, whichever is less.

3.4 JOINTING

3.4.1 Concrete

3.4.1.1 Plastic Sealing Compound Joints for Tongue-and-Grooved Pipe and Box Culverts

Follow the recommendation of the particular manufacturer in regard to sealing compound special installation requirements. When lubricants, primers, or adhesives are used, only apply on surfaces that are dry and clean. Affix sealing compounds to the pipe or box culvert not more than 3 hours prior to installation of the pipe or box culvert. Protect sealing compounds from the sun, blowing dust, and other deleterious agents at all times. Inspect sealing compounds before installation of the pipe or box culvert,and remove and replace any loose or improperly affixed sealing compound. Align the pipe or box culvert with the previously installed pipe or box culvert,and pull the joint together.

3.4.1.2 Flexible Watertight Joints

Use lubricants, cements, adhesives, and other special installation requirements for gaskets and jointing materials as recommended by the manufacturer. When lubricants, cements, or adhesives are used, only apply on surfaces that are clean and dry. Affix gaskets and jointing materials to the pipe not more than 24 hours prior to the installation of the pipe, and protect from the sun, blowing dust, and other deleterious agents at all times. Inspect gaskets and jointing materials before installing the pipe; remove and replace any loose or improperly affixed gaskets and jointing materials. Align the pipe with the previously installed pipe, and push the joint home. If the gasket becomes visibly dislocated when joining sections of pipe, remove the pipe and remake the joint.

3.4.2 Corrugated Steel Pipe

3.4.2.1 Field Joints

Provide transverse field joints designed so that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. Provide joints meeting the general performance requirements described in ASTM A798/A798M. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. Keep the space between the pipe and connecting bands free from dirt and grit so that corrugations fit snugly. While being tightened, tap the connecting band with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. [Fill the annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 30 inches or larger, with a bituminous material after jointing.] Provide field joints for each type of corrugated metal pipe that maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. [Provide bands of the type, size, and sheet thickness indicated. Provide angles or lugs and bolts of the size indicated.] [Provide bands and angles or lugs and bolts as specified in the applicable standards or specifications for the pipe.]

3.4.2.2 Flexible Watertight, Gasketed Joints

Use lubricants or cements and other special installation requirements as recommended by the gasket manufacturer. Where sleeve type gaskets are used, place the gasket over one end of a section of pipe for half the width of the gasket. Then double over the other half over the end of the same pipe. When the adjoining section of pipe is in place, roll the doubled-over half of the gasket over the adjoining section. Correct any unevenness in overlap so that the gasket covers the end of pipe sections equally. Center connecting bands over adjoining sections of pipe, and place rods or bolts in position and tighten nuts. Band Tightening: Tighten the band evenly, keep even tension on the rods or bolts, and the gasket;

properly seat the gasket in the corrugations. Keep watertight joints uncovered for a period of time designated by the Contracting Officer. Before covering joints, measure the tightness of the nuts with a torque wrench. If the nut has tended to loosen its grip on the bolts or rods, retighten the nut with a torque wrench and keep uncovered until a tight, permanent joint is assured.

## 3.5 DRAINAGE STRUCTURES

### 3.5.1 Manholes and Inlets

Construct manholes of precast reinforced concrete. Construct inlets of cast in place reinforced concrete. Provide manholes and inlets complete with frames and covers or gratings as indicated.

### 3.5.2 Walls and Headwalls

Construct headwalls as indicated.

## 3.6 FINAL BACKFILL

Backfill trenches with satisfactory material deposited in layers of a maximum of 8 inches loose thickness in accordance with Section 31 23 00.00 EXCAVATION AND FILL.

Do not displace or damage pipe or box when compacting final backfill by rolling or operating heavy equipment parallel with the pipe or box. Movement of construction machinery over a culvert or storm drain at any stage of construction will be at the Contractor's risk. Repair or replace any damaged pipe.

Provide the minimum cover for construction loads over corrugated steel pipes as specified in Section 26, Division II of AASHTO HB-17. Provide minimum cover for construction loads over plastic pipes as specified in ASTM D2321.

## 3.7 FIELD QUALITY CONTROL

### 3.7.1 Tests

Testing is the responsibility of the Contractor. Perform all testing and retesting at no additional cost.

### 3.7.2 Repair of Defects

#### 3.7.2.1 Leakage Test

When leakage exceeds the maximum amount specified, correct source of excess leakage by replacing damaged pipe and gaskets and retest.

#### 3.7.3.2 Deflection Testing

When deflection readings are in excess of the allowable deflection of average inside diameter of pipe are obtained, remove pipe which has excessive deflection and replace with new pipe. Retest 30 days after completing backfill, leakage testing and compaction testing.

3.7.3.3 Inspection

Replace pipe or repair defects indicated in the Post-Installation Inspection Report.

3.7.3.3.1 Concrete Pipe

Replace pipes having cracks with a width greater than 0.1 inches.

## 3.8 PROTECTION

Protect storm drainage piping and adjacent areas from superimposed and external loads during construction.

## 3.9 WARRANTY PERIOD

Pipe segments found to have defects during the warranty period must be replaced with new pipe and retested.

-- End of Section --

# ATTACHMENT A
# GEOTECHNICAL EVALUATION REPORT

Western Technologies
An RMA Company

# GEOTECHNICAL EVALUATION REPORT

## MADRID STORMWATER & EROSION CONTROL IMPROVEMENT

Along NM 14
Madrid, New Mexico
WT Job No. 32-223560-0

**PREPARED FOR:**

State of New Mexico EMNRD
1220 South St. Franci Drive
Santa Fe, New Mexico 87505
Attn: Leeland Murray

April 25, 2024


Azupuri Kaba, PhD, PE, PMP
Geotechnical Engineer

for
Justin M. Heinecke, PE
Senior Geotechnical Engineer

# TABLE OF CONTENTS

# GEOTECHNICAL EVALUATION
# MADRID STORMWATER & EROSION CONTROL IMPROVEMENT
# ALONG NM 14
# MADRID, NEW MEXICO
# JOB NO. 32-223560-0

## 1.0 PURPOSE

This report contains the results of our geotechnical evaluation for a proposed Madrid stormwater and erosion control improvement project in Madrid, New Mexico. The purpose of these services is to provide information and recommendations regarding:

- Subsurface conditions
- Foundation design parameters
- Lateral earth pressures
- Earthwork guidelines
- Drainage
- Groundwater
- Corrosivity (soil to concrete)
- Seismic considerations
- Excavation conditions
- Pavement

Results of the field exploration, field tests, and laboratory testing program are presented in the Appendices.

## 2.0 PROJECT DESCRIPTION

Based on the information provided in the request for proposal (RFP), the proposed project will consist of improvement of stormwater and erosion improvements to include road improvements, arroyo improvements and drainage structures, and general pipeline installation. We assumed that maximum wall and column loads will not exceed 3 klf and 50 kips, respectively. We anticipate no extraordinary slab-on-grade criteria, and that ground floor level will be within a few feet of existing site grade. Any off-site improvements have not been included as part of this evaluation. Should any of our information or assumptions not be correct, we should be notified.

# 3.0 SCOPE OF SERVICES

## 3.1 Field Exploration

The table below outlines WT field exploration program as outlined in the RFP.

Field Exploration Program

| Boring ID | Latitude (degrees) | Longitude (degrees) | Depth (feet) | Purpose |
|---|---|---|---|---|
| 1 | 35.407757 | -106.149751 | 21.5 | Retaining Wall |
| 2 | 35.407279 | -106.150909 | 21.5 | Retaining Wall |
| 3 | 35.400532 | -106.157710 | 11.5 | Tank |
| 4 | 35.410807 | -106.152358 | 14 | Culvert |
| 5 | 35.410619 | -106.152089 | 10 | Culvert |
| 6 | 35.408360 | -106.152897 | 16.5 | General Geotech |
| 7 | 35.407840 | -106.151183 | 16.5 | Culvert |
| 8 | 35.408017 | -106.151583 | 16.5 | Culvert |
| 9 | 35.403267 | -106.154606 | 16.5 | Culvert |
| 10 | 35.409936 | -106.152206 | 6.5 | Roadway |
| 11 | 35.407908 | -106.152702 | 2 | Roadway |
| 12 | 35.407020 | -106.151328 | 6.5 | Roadway |
| 13 | 35.406723 | -106.151494 | 6.5 | Roadway |
| 14 | 35.406602 | -106.152821 | 6.5 | Roadway |
| 15 | 35.404115 | -106.153807 | 6.5 | Roadway |
| 16 | 35.403931 | -106.154368 | 6.5 | Roadway |
| ReMi | 35.407757 | -106.149751 | 100 | Tank |

### 3.1.1 Hollow Stem Auger Boring

Nine (9) borings were drilled to depths ranging from 16.5 to 21.5 feet below the existing site grade in the proposed retaining wall, tank, and drainage conveyance structures areas. In addition, seven (7) borings were drilled to depths of about 5 feet in the proposed roadways. The specific number, locations, and depths, of our explorations were selected by the client. They were field-adjusted based on existing site features under the constraints of surface access. The borings are at the approximate locations shown on the attached Boring Location Diagram. The boring locations shown in the Boring Location Diagram and in the table above are based on

Google Earth Pro (accessed March 5, 2024) and should be considered accurate only to the degree permitted by our data sources and implied by our measuring methods.

The drilling was conducted using CME 75 and a track-mounted for less accessible areas. The drill rigs were equipped with 7" O.D. continuous flight, hollow stem augers. Disturbed but representative samples were obtained during drilling by using the Standard Penetration Test (SPT) procedure in accordance with American Society for Testing and Materials (ASTM) D1586 during the explorations. This test and sampling method consists of driving a standard 2-inch outside-diameter, split-barrel sampler to depth 18 inches into the soil with a 140-pound hammer free-falling a height of 30 inches. Disturbed bulk samples were also obtained. Marginally disturbed samples were collected by driving a 2.5-inch inside diameter, modified California brass ring sampler (ring or R) to a depth of 12 inches from a given referenced point.

The number of blows (split-barrel and ring) for each 6-inch interval were recorded and the number of blows required to drive the sampler the final 12 inches was taken as the Standard Penetration Resistance ("N") or blow count. If a total of 50 blows was recorded within one 6-inch interval, the blow count was recorded as the number of blows for the corresponding number of inches of penetration. The resistance, or N-value, provides a measure of the relative density of granular soils or the relative consistency of cohesive soils; these values are reported on the attached boring logs.

A field log was prepared for each boring. These logs contain visual classifications of the materials encountered during drilling as well as interpolation of the subsurface conditions between samples. Final logs, included in Appendix A, represent our interpretation of the field logs and may include modifications based on laboratory observations and tests of the field samples. The final logs describe the materials encountered, their thickness, and the locations where samples were obtained.

### 3.1.2 Refraction Microtremor (ReMi)

A refraction micro-tremor (ReMi) survey was performed to estimate the average shear wave velocity profile at the site for assessment of the seismic site classification in accordance with the 2021 IBC. The survey was conducted at the tank area. Location of the ReMi survey line is depicted on the attached Boring Location Diagram. The results of the survey are also discussed in Section 6.5 **Seismic Considerations** of this report.

### 3.2 Laboratory Analyses

Laboratory analyses were performed on representative soil samples to aid in material classification and to estimate pertinent engineering properties of the on-site soils for preparation of this report. Testing was performed in general accordance with applicable standard test methods. The following tests were performed and the results are presented in Appendix B.

- Field moisture content
- In-situ soil density
- Expansion Potential
- Compression
- CBR
- Gradation
- Liquid Limit and Plasticity Index
- Water Soluble Sulfate Content
- Water Soluble Chloride Content
- pH & minimum resistivity

### 3.3 Analyses and Report

This geotechnical engineering report includes a description of the project, a discussion of the field and laboratory testing programs, a discussion of the subsurface conditions, and design recommendations as appropriate to its purpose. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site, discovery of underground storage tanks or other underground structures, or identification of contaminated or hazardous materials or conditions. If there is concern about the potential for such contamination, other studies should be undertaken. We are available to discuss the scope of such studies with you.

## 4.0 SITE CONDITIONS

### 4.1 Surface

At the time of our exploration, the site was a residential. The ground surface was hilly and contained a sparse to moderate growth of grasses, shrubs, and trees. Site drainage was relatively poor, and the residential roadways were in poor condition. With the exception of NM 14, all roadways within the project site were unpaved with no gravel surfacing. Photographs of the site at the time of our exploration are provided below.

### 4.2 Subsurface

As presented on the Boring Logs, surface soils to depths of 15 feet consist of loose to very dense Silty SAND with Gravel and Cobbles, very stiff to hard Fat CLAY and COAL fragments. Near surface soils are of nil to high plasticity. The materials underlying the surface soils and extending to the full depth of exploration consisted of medium dense to very dense Poorly-graded SAND, very stiff to hard Lean CLAY, COAL and SHALE fragments. Auger refusal occurred at 2 to 14 feet below existing site grade. Groundwater was not encountered in any boring at the time of exploration. A detailed description of the soils encountered can be found on the boring logs in Appendix A.

## 5.0 GEOTECHNICAL PROPERTIES & ANALYSIS

### 5.1 Laboratory Tests

Laboratory test results (see Appendix B) indicate that on-site subsoils near shallow foundation level exhibit low to moderately high compressibility at existing water contents. The moderately high compressible soils are in Borings 4, 5, 7 and 9 as shown Plate B-1 & B-2. Low to high levels of additional compression occurs when the water content is increased. Moderately high to high compressible soils are present in Borings 7, and 9. It should be noted that selected borings and samples were tested. It is possible that untested samples may exhibit comparable compressibility characteristics.

Near-surface soils are of nil to high plasticity. These soils exhibit low to high expansion potential when recompacted, confined by loads approximating floor loads and saturated. Highly expansive soils were recorded in Boring 1, which consisted of Fat CLAY. CLAY or clayey soils are also present in other borings and may exhibit similar expansive potential when saturated. Slabs-on-grade supported on recompacted on-site soils will have a low to high potential for heaving if the water content of the soil increases.

CBR tests were performed on representative samples from Borings 10, 11, 12, 13, 14, 15 and 16 to determine the bearing capacity of the on-sites for support of pavement. The test was performed in accordance with ASTM D1883. The test results are presented in Appendix B.

Chemical tests were performed on representative samples in Borings 3 and 5 to determine the amount of water-soluble sulfates and chlorides. The test results indicate that the soils

in the area of Boring 3 are classify as negligibly corrosive and samples in the vicinity of Boring 5 are classified as severely corrosive to concrete according to Table 19.3.1.1 of ACI 318-19.

Minimum electrical resistivity and hydrogen ion concentration (pH) were performed on representative samples to aid in assessing, by others, the potential for corrosion of buried metals. The test results are presented in Appendix B.

### 5.2 Field Tests

The boring logs included in this report are indicators of subsurface conditions only at the specific location and date noted. Variations from the field conditions represented by the borings may become evident during construction. If variations appear, we should be contacted to re-evaluate our recommendations.

## 6.0 RECOMMENDATIONS

### 6.1 General

Recommendations contained in this report are based on our understanding of the project criteria described in Section 2.0 and the assumption that the soil and subsurface conditions are those disclosed by the explorations. Others may change the plans, final elevations, number and type of structures, foundation loads, and floor levels during design or construction. Substantially different subsurface conditions from those described herein may be encountered or become known. Any changes in the project criteria or subsurface conditions shall be brought to our attention in writing. This report does not encompass the effects, if any, of underlying geologic hazards or regional groundwater withdrawal and expresses no opinion regarding their effects on surface movements at the project site.

### 6.2 Design Considerations

The borings indicate the presence of clay soils on the site. The clay soils may expand or swell with an increase in moisture content. Slabs-on-grade and related improvements situated on expansive clay soils could be subject to relatively large movements if the foundation soils experience an increase or decrease in moisture content. In addition, densification of the soil by the passage of construction equipment may increase the expansion potential of the on-site clayey soil. As expansive soils are encountered during earthwork operations,

selective placement procedures should be implemented. Moderately to highly expansive soils should not be used as fill in the structure areas within 36 inches of the final subgrade. It should be understood that if moisture penetrates expansive soils, there could be some heave and resultant cracking/distress of the proposed structures and related improvements. Conversely, as expansive soils dry, shrinkage and resultant cracking/distress of the proposed structures and related improvements may occur.

## 6.3 Retaining Wall and Drainage Structures Foundations

Conventional spread-type foundation can be used to support the proposed structures. We recommend that the spread foundations bear upon engineered fill for support of anticipated loads. The depth and lateral extent of the engineered fills are presented in the **EARTHWORK** section of this report. Footings should bear a minimum of 24 inches below finished grade, which is the lowest adjacent grade for perimeter footings and floor level for interior footings. Recommended minimum widths of column, wood-frame and/or masonry wall footings are 24 and 16 inches, respectively.

Alternative footing depths and allowable bearing capacities are presented in the table below:

| Footing Depth Below Finished Grade[4] (ft) | Allowable Bearing Capacity[5] (psf) |
|---|---|
| 2.0[6] | 3,000 |
| 3.0 | 4,000 |

We anticipate that total and differential settlement of the proposed structures, supported as recommended, should be less than 1 inch and ½ inch, respectively. Additional foundation movements could occur if water from any source infiltrates the foundation soils. Therefore, proper drainage should be provided in the final design and during construction.

[4] Finished grade is the lowest adjacent grade for perimeter footings and floor level for interior footings.

[5] Allowable bearing capacities assume fulfillment of **EARTHWORK** recommendations. Pounds per square foot (psf). Allowable Bearing Capacities also assume a minimum factor of safety equal to 3.

[6] Minimum depth for frost protection of exterior footings or footings in unheated spaces.

The uplift resistance of spread footings supporting the structures may be calculated using the cone method. The equation for determining the ultimate uplift capacity as a function of footing width, footing depth, and soil weight is presented below:

$$T = \gamma D2\ (0.6W + 0.6L + 0.4D + \frac{W\ L}{D})$$

Where:
T = ultimate uplift capacity (lbs.)
D = depth of footing below final grade (ft.)
L = length of footing (ft.)
W = width of footing (ft.)
$\gamma$ = unit weight of soil (pcf)*

*a unit weight of 100 pcf is recommended for the soils at this site

The design uplift resistance should be calculated by dividing the ultimate uplift capacity obtained from the equation above by a factor of safety. A factor of safety of at least 1.5 is recommended for live uplift loads.

All footings, stem walls and masonry walls should be reinforced to reduce the potential for distress caused by differential foundation movements. The use of joints at openings or other discontinuities in masonry walls is recommended.

We recommend that the geotechnical engineer or his representative observe the footing excavations before reinforcing steel and concrete are placed. This observation is to evaluate whether the soils exposed are similar to those anticipated for support of the footings. Any soft, loose, or unacceptable soils should be undercut to suitable materials and backfilled with approved fill materials or lean concrete. Soil backfill should be properly compacted.

## 6.4 Tank Foundations

It is our opinion that a concrete ring wall foundation confining a concrete slab can be used to support the proposed tank. Since the on-site soils exhibit moderate to high compressibility within the upper 5 feet, the ring wall foundations should bear on engineered fills achieved by removal and recompaction of the soils below the foundations. The depth and lateral extent of the engineered fills are presented in the **EARTHWORK** section of this report. The ring wall should bear at a minimum of 24 inches below finished grade, which is the lowest adjacent grade for perimeter footings and floor level for interior footings.

We recommend that the proposed ring wall foundation be structurally reinforced to limit the anticipated total and differential settlement to ¾ inch and ½ inch, respectively.

## 6.5 Stormwater Pipe Foundations

The soils encountered within the upper 10 feet are predominantly Class III according to the New Mexico Standard Specification for Public Works (NMSSPW), Section 701. These materials should provide adequate support for the culverts and stormwater pipes. Class IV material including coal were encountered in Borings 1, 5 and 7. The majority of the site is coal, which varied in the degree of lithification and cementation. Any undisturbed coal can support the proposed stormwater pipes. However, we recommend that pipe bears on a minimum of 12 inches of Class I, II, or III as recommended in the **EARTHWORK** section of this report. Class IV material is not suitable for pipe support and should be removed if encountered. The stormwater pipes foundation should be prepared in accordance with NMSSPW section 700. Differential settlement in the pipe should not exceed ½ of an inch for 20-foot sewer sections if the recommended **EARTHWORK** is followed. Settlement will primarily result from elastic movement of the soil mass during backfill and compaction operations.

## 6.6 Lateral Design Criteria

Lateral loads may be resisted by concrete interface friction and by passive resistance. For shallow foundations bearing on properly compacted fill at this site, we recommend the following lateral resistance criteria:

- Passive:
  Shallow wall footings.....250 psf/ft
  Shallow column footings.....400 psf/ft

- Coefficient of base friction (passive).....0.30

Earth retaining structures less than 10 feet in height, above any free water surface, with level backfill and no surcharge loads may be designed using the equivalent fluid pressure method. Recommended active equivalent fluid pressures and coefficients of base friction for unrestrained elements are:

- Active:
  Undisturbed subsoil.....40 psf/ft
  Compacted granular backfill .....30 psf/ft
  Compacted site soils .....35 psf/ft
  On-site clayey soils .....not recommended for use

- Coefficient of base friction (active).....0.40

Where the design includes restrained elements, the following equivalent fluid pressures are recommended:

- At-rest:
  Undisturbed subsoil.....60 psf/ft
  Compacted granular backfill .....55 psf/ft

The equivalent fluid pressures presented herein do not include the lateral pressures arising from the presence of:

- hydrostatic conditions, submergence or partial submergence
- sloping backfill, positively or negatively
- surcharge loading, permanent or temporary
- seismic or dynamic conditions

We recommend a free-draining soil layer or manufactured geosynthetic material be constructed adjacent to the back of any retaining walls. A filter may be required between the soil backfill and drainage layer. This drainage zone should help prevent development of hydrostatic pressure on the wall. This vertical drainage zone should be tied into a gravity drainage system at the base of the wall. It is important that all backfill be properly placed and compacted. Backfill should be mechanically compacted in layers. Flooding or jetting should not be permitted. Care should be taken not to damage the walls when placing the backfill. Backfills should be observed and tested during placement.

Fill against footings, stem walls, and retaining walls should be compacted to densities specified in **EARTHWORK**. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors. Over-compaction may cause excessive lateral earth pressures that could result in wall movements.

## 6.7 Seismic Considerations

Structures should be designed in accordance with applicable building codes. The seismic design parameters presented in the following table, in accordance with the 2021 International Building Code/American Society of Civil Engineers (ASCE) 7-16 are applicable to the project site:

| Seismic Design Parameters<br>2021 IBC/ASCE 7-16 | |
|---|---|
| Soil Site Class based on ReMi Velocity Profile | C |
| Mapped Spectral Response Acceleration at 0.2 sec period ($S_s$) | 0.411g |
| Mapped Spectral Response Acceleration at 1.0 sec period ($S_1$) | 0.137g |
| Site Coefficient for 0.2 sec period ($F_a$) | 1.300 |
| Site Coefficient for 1.0 sec period ($F_v$) | 1.500 |
| Design Spectral Response Acceleration at 0.2 sec period ($S_{DS}$) | 0.356g |
| Design Spectral Response Acceleration at 1.0 sec period ($S_{D1}$) | 0.137g |

## 6.8 Slab Support

Floor slabs can be supported on properly placed and compacted fill. The slab subgrade should be prepared by the procedures outlined in this report. A minimum 4-inch layer of base course should be provided beneath all slabs to help prevent capillary rise and a damp slab. The modulus of subgrade reaction (k) is estimated to be 150 pounds per cubic inch (pci), based upon a 30-inch diameter plate.

The use of vapor retarders or barriers is desirable for any slab-on-grade where the floor will be covered by products using water-based adhesives, wood, vinyl backed carpet, impermeable floor coatings (urethane, epoxy, acrylic terrazzo, etc.) or where the floor will be in contact with moisture sensitive equipment or product. When used, the design and installation should be in accordance with the recommendations given in ACI 302.1R and 302.2R. Final determination on the use of a vapor retarder should be left to the slab designer.

All concrete placement and curing operations should follow the American Concrete Institute manual recommendations. Improper curing techniques and/or high slump (high water-cement ratio) could cause excessive shrinkage, cracking or curling. Concrete slabs

should be allowed to cure adequately before placing vinyl or other moisture sensitive floor covering.

## 6.9 Drainage

The major cause of soil problems in this vicinity is moisture increase in soils below structures. Therefore, it is extremely important that positive drainage be provided during construction and maintained throughout the life of the proposed structures. Infiltration of water into utility or foundation excavations must be prevented during construction. Planters or other surface features that could retain water adjacent to the proposed structures, should not be constructed. It is also important that proper planning and control of any landscape and irrigation practices be performed.

In areas where sidewalks or paving do not immediately adjoin the building, protective slopes should be provided with an outfall of 5 percent for at least 10 feet from perimeter walls. Scuppers and drainpipes should be designed to provide drainage away from the structures for a minimum of 10 feet. Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to minimize the possibility of moisture infiltration.

Water and sewer utility lines should be properly installed to avoid possible sources for subsurface saturation. It is important that all utility trenches be properly backfilled. If practicable, planters and/or landscaping should not be constructed adjacent to or near structures. If planters and/or landscaping are adjacent to or near the structures, we recommend the following:

- Planters should be sealed
- Grades should slope away from the proposed structures
- Only shallow rooted landscaping should be used
- Watering should be kept to a minimum

## 6.10 Corrosivity to Concrete and Metal Components

A major factor in determining soil corrosivity is electrical resistivity. The electrical resistivity of a soil is a measure of its resistance to the flow of electrical current. Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportional to the flow of electrical current (DC) from the metal into the soil.

Corrosion current, following Ohm's Law, is inversely proportional to soil resistivity. Lower electrical resistivities result from higher moisture and soluble salt contents and indicate corrosive soil.

The correlation between electrical resistivity and corrosivity ferrous metals is presented in the table below.

| Soil Resistivity (ohm-cm) | Corrosivity Category |
|---|---|
| Greater than 10,000 | Mildly Corrosive |
| 2,001 to 10,000 | Moderately Corrosive |
| 1,001 to 2,000 | Corrosive |
| 0 to 1,000 | Severely Corrosive |

Based on the laboratory results, the soils at the site can be classified as moderately corrosive to ferrous metals and severe for sulfate attack on concrete. Consequently, ASTM Type V cement or equivalent sulfate resistant cement be used for concrete structures bearing on and/or in on-site soils. For metallic components of the structures in contact with soils and groundwater in this site, we recommend that the contractor implement corrosion protection.

## 6.11 Pavements

Pavement analysis was performed for the residential streets. We have also provided concrete paving and treated base course options for the roadway sections crossing the Madrid arroyo. We assumed design vehicles consisted of:

- 18-wheelers/trailers
- Firetrucks/ambulances
- Snowplows
- Passenger cars
- Trucks/SUVs

The encountered soils in the areas of the roadways at Borings 10, 11, 12, 13, 14, 15, and 16 consisted of predominantly COAL. The CBRs for these roadways ranged from 3 (Boring 16) to 32 (Boing 10). The coal is considered highly lithified and cemented in Borings 10 through 15. Boring 16 showed less lithification and cementations. Due to wide variation in the degree of lithification and compaction of the coal, separation pavement sections are

provided as well as subgrade preparation as outlined in the **EARTHWORK** section of this report.

This slab analysis utilized the flexible pavement CBR analysis of the U.S. Army Corps of Engineers' PCASE pavement design program. This PCASE design methodology determines a design vehicle from vehicles input by the user for analysis and then determines the equivalent number of passes or load repetitions of all the input vehicles equated to the design vehicle.

Traffic analysis was performed based on estimates of the number of passes of the fully loaded vehicle on a given point during a standard business day. The number of projected passes was not provided to us, so we performed an analysis using the estimated passes, as follows:

- 18-wheelers/trailers – 29,200 total passes - 4 loaded passes per day for 20 years
- Firetrucks/ambulances – 3,650 total passes – 0.5 loaded passes per day for 20 years
- Snowplows – 3,650 total passes – 0.5 loaded passes per day for 20 years
- Passenger cars – 584,000 total passes – 80 loaded passes per day for 20 years
- Trucks/SUVs – 146,000 total passes – 30 loaded passes per day for 20 years

The rigid pavement was designed as plain, unreinforced 650 psi flexural strength concrete. The k-value used in design calculations was 200 pounds per cubic inch (pci) for subgrade soils. The CBRs used for the various are listed on the below. The recommended section thicknesses for the paved areas are included in the following table.

| Pavement Area | Surfacing Option | Design CBR | Portland Cement Concrete (PCC) Thickness | Treated ABC | ABC |
|---|---|---|---|---|---|
| Firehouse Lane | ABC | 3 | -- | -- | 12 |
| Other Residential Streets | ABC | 24 | -- | -- | 10 |
| Madrid Arroyo Crossing | PCC | 24 | 6 | -- | 4 |
| | Treated ABC | 24 | -- | 8 | -- |
| Fire Lane | ABC | 24 | -- | -- | 10 |

Note: PCC – Portland Cement Concrete
ABC- Aggregate Base Course

For the design of concrete pavement subjected to loading, the important strength property is flexural strength. The design strength value of 650 psi utilized here is reasonable and achievable for our local concrete materials. Because flexural strength is seldom measured or even understood on most commercial projects, it is usually best to specify the concrete with a required compressive strength. We recommend utilizing a concrete compressive strength of 4,000 psi or an NMDOT Class P concrete.

Pavements Sections for NM Highway 14

| Pavement Areas | Design ESAL | Design Boring ID | Asphalt Concrete Pavement (inches) | Base Course (inches) |
|---|---|---|---|---|
| 1 | 10 | 8 | 4.0 | 10 |
| 2 | | | 4.5 | 8 |

If the existing pavement sections on NM 14 are thicker than those recommended above, the existing pavement section should be matched. Once final traffic information becomes available, we can provide final pavement design sections.

Base course and asphalt concrete should conform to the New Mexico Department of Transportation (NMDOT) Standard Specifications for Road and Bridge Construction or the New Mexico Standard Specifications for Public Works Construction, whichever is applicable. Bituminous surfacing should be constructed of dense-graded, central plant-mix, asphalt concrete and SP-IV or SP-III.

Material and compaction requirements should conform to recommendations presented under **EARTHWORK**. The gradient of paved surfaces should ensure positive drainage. Water should not pond in areas directly adjoining paved sections. The on-site subgrade soils may soften and lose stability if subjected to conditions that result in an increase in water content.

**Jointing**

As stated in ACI 360R-10, Guide to Design of Slabs-on-Ground: “Joints are used in slab-on-ground construction to limit the frequency and width of random cracks caused by concrete volume changes.” The volume changes are caused by changing temperature and from concrete moisture loss over time. Cracking then occurs in the concrete due to resistance to those movements by gravity and subgrade friction. Joints are placed at relatively close

spacing for plain, unreinforced slabs and are typically spaced farther apart when slabs are reinforced. Joint spacing recommendations are provided in Table 2 below. Dowels should be placed in all construction joints and are not necessary in sawcut contraction joints. Dowel recommendations are also included in Table 2.

Contraction joints should be made by appropriately timed sawcuts following the guidelines of Section 6.3 of ACI 360R-10. Sawcuts can be made with conventional wet-cut (water-injection) saws, conventional dry-cut saws, or early-entry dry-cut sawcuts. Sawcuts made by conventional saws should be made to a minimum depth of 1/4 of the concrete depth whereas early-entry cuts should be a minimum of 1.5 inches deep.

An isolation joint is recommended at or along all interfaces with existing structures or building components. At those edge locations that will be subjected to vehicular loading such as at dock entry points, the concrete slab should be thickened an additional 25 percent with a taper or transition of 5 feet back to the standard pavement thickness.

The joints, and particularly the joint edges, need to be protected from degradation due to impact loading from the fire app and from the dragging of pallets, etc., across the joints. Typically, the more economical method to provide protection is to fill the joint with an appropriate material to maintain surface continuity across the joint. The typical joint fill materials for this purpose are certain types of semi-rigid epoxy and polyuria. These materials should be 100 percent solids and have a minimum ASTM D2240 Shore A hardness of 80. These particular joint fillers should be installed full depth to the bottom of the sawcut so that the sawcut ledge provides support for the filler material.

The table below summarizes joint and dowel spacing per the PCASE pavement design program.

PCASE Joint and Dowel Summary

| Pavement Area | Joint Spacing, feet | Dowel Spacing, inches | Dowel Length, inches | Dowel Diameter, inches |
|---|---|---|---|---|
| Pavement Areas | 10 – 15 | 12 | 16 | 0.8 |

# 7.0 EARTHWORK

## 7.1 General

The conclusions contained in this report for the proposed construction are contingent upon compliance with recommendations presented in this section. Any excavating, trenching, or disturbance that occurs after completion of the earthwork must be backfilled, compacted and tested in accordance with the recommendations contained herein. It is not reasonable to rely upon our conclusions and recommendations if any future unobserved and untested trenching, earthwork activities or backfilling occurs.

If any unobserved and untested earthwork, trenching or backfilling occurs, then the conclusions and recommendations in this report may not be relied on. We recommend that Western Technologies Inc. be retained to provide services during these phases of the project. Observation and testing of all foundation excavations should be performed prior to placement of reinforcing steel and concrete to confirm that foundations are constructed on satisfactory bearing materials.

## 7.2 Site Clearing

Strip and remove any existing vegetation, debris, and any other deleterious materials from the structures areas. The structures area is defined as areas within the structures' footprint plus 5 feet beyond the perimeter of that footprint. All exposed surfaces should be free of mounds and depressions that could prevent uniform compaction.

## 7.3 Excavation

We anticipate that excavations for the foundations and utility trenches for the proposed construction can be accomplished with conventional equipment. It is our opinion that that the auger refusal material is rippable, but may require the use of heavy-duty or specialized equipment to facilitate removal. The speed and ease of excavation is dependent on the nature of the deposit, the type of equipment used, and the skill and experience of the equipment operator. Note that selection of excavation equipment is the responsibility of the contractor.

The soils to be penetrated by the proposed excavations may vary significantly across the site. Our soil classifications are based solely on the materials encountered in widely spaced exploratory test borings. The contractor should verify that similar conditions exist

throughout the proposed area of excavation. If different subsurface conditions are found at the time of construction, we should be contacted immediately to evaluate the conditions encountered.

### 7.3.1 Temporary Excavations and Slopes

Temporary, non-surcharged construction excavations should be sloped or shored. The individual contractor should be made responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom. All excavations should be sloped or shored in the interest of safety following local and federal regulations, including current OSHA excavation and trench safety standards. OSHA recommends a maximum slope inclination of ¾:1 (horizontal:vertical) for Type A soils, 1:1 for Type B soils, and 1½:1 for Type C soils.

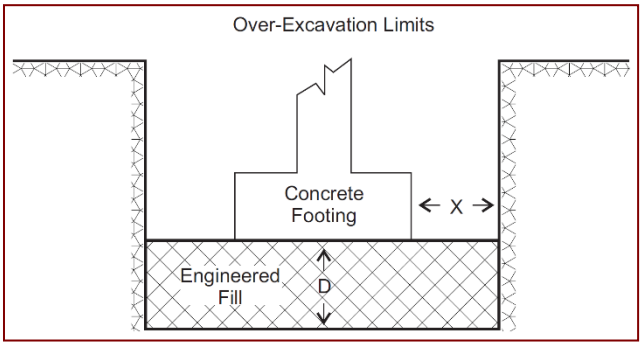
As a safety measure, it is recommended that all vehicles and soil piles be kept a minimum lateral distance back from the crest of the slope at least equal to the slope height. The exposed slope face should be protected against the elements.

If any excavation, including a utility trench, is extended to a depth of more than 20 feet, it will be necessary to have the side slopes designed by a professional engineer.

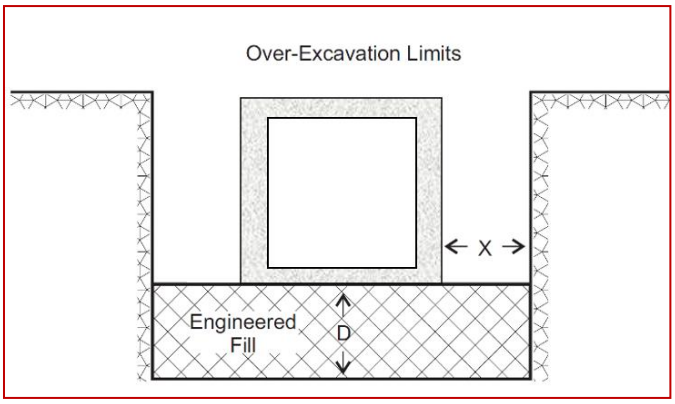
We recommend that the contractor retain a geotechnical engineer to observe the soils exposed in all excavations and provide engineering design for the slopes. This will provide an opportunity to classify the soil types encountered, and to modify the excavation slopes as necessary. This also allows the opportunity to analyze the stability of the excavation slopes during construction.

## 7.4 Foundation Preparation

In the tank and retaining wall areas, remove existing soils throughout the entire tank footprint to a minimum depth of 3 feet below the bottom of footing elevation or 5 below existing site grade, whichever is deepest. Following the removal, scarify, moisten or dry as required, and recompact the bottom of the excavation to a minimum depth of 10 inches. Refill the excavation with properly compacted engineered fill material. The removal and replacement should extend laterally a minimum of 3 feet beyond the foundation or perimeter of the tank.




In drainage crossing areas, remove existing soils as required to a minimum depth of 2 feet below the bottom of the box culvert (length Y in the diagram below). Removal and recompaction should extend a minimum of 3 feet beyond the footing edges (length X in the diagram below).




## 7.5 Slab Preparation

Slabs should be founded on engineered fill material. Remove existing soils to a minimum depth of 24 inches below the bottom of the slab. Replace with properly compacted, low-expansive, fill material.

## 7.6 Pavement Preparation

In pavement areas, remove existing soils to minimum depths of 18 inches and replace with engineered fill. Following the removal, the bottom of the excavation should be scarified, moistened as required, and recompacted to a minimum depth of 10 inches prior to placement of fill and pavement materials.

## 7.7 Stormwater Pipes Foundation Preparation

The sewer line should be installed in accordance with New Mexico Standard Specification for Public Works (NMSSPW), specifically, Section 701.13 and any other applicable national, state, city, and county standards. Bedding materials should surround the sewer line for support. The sewer line trench backfill should be designed in accordance with NMSSPW, Section 701.14.

## 7.8 Materials

Clean on-site soils with low expansive potentials and maximum dimension of 6 inches or imported materials may be used as fill material for the following:

- Foundation areas
- Slabs
- Pavement
- Backfill

Frozen soils should not be used as fill or backfill.

Imported soils should conform to the following:

- Gradation (ASTM C136): percent finer by weight

  6" ..... 100
  4" ..... 85-100
  ¾" ..... 70-100
  No. 4 Sieve ..... 50-100
  No. 200 Sieve ..... 30 (max)
- Maximum Plasticity Index ..... 5
- Maximum soluble sulfates (%) ..... 0.10

On-site low expansive soils can be used as backfill.

Base course should conform to the New Mexico Department of Transportation (NMDOT) Standard Specifications for Road and Bridge Construction or the New Mexico Standard Specifications for Public Works Construction, whichever is applicable.

## 7.9 Placement and Compaction

a. Place and compact fill in horizontal lifts, using equipment and procedures that will produce recommended water contents and densities throughout the lift.

b. Uncompacted lift thickness should not exceed 10 inches.

c. Materials should be compacted to the following:

| Material | Minimum Percent Compaction (ASTM D1557) |
|---|---|
| On-site or imported soil, reworked and fill | 95 |
| Base course below slabs-on-grade | 95 |
| Aggregate base below pavement | 96 |
| Nonstructural backfill | 90 |

Fill at depths greater than 5 feet below finished grade should be compacted to at least 98 percent of the ASTM D1557 dry-density value to within 5 feet of finished grade. Fill at depths less than 5 feet below finished grade should be compacted to the minimum values provided above.

Imported or blended soils meeting import soils specification should be compacted to within a water content range of 3 percent below to 3 percent above optimum. On-site clay soils should be compacted to within a water content range of 1 percent below to 3 percent above optimum.

## 7.10 Compliance

Recommendations for foundations, and pavements supported on compacted fills or prepared subgrade depend upon compliance with the **EARTHWORK** recommendations. To assess compliance, observation and testing should be performed under the direction of a WT geotechnical engineer. Please contact us to provide these observation and testing services.

## 8.0 PLAN REVIEW

Foundation and grading plans were not available at the time of this report. WT should be retained to review the final plans to determine if they are consistent with the recommendations presented in this report. If the Client does not retain WT to review the plans and specifications, WT shall have no responsibility for the suitability of the plans for project application.

## 9.0 ADDITIONAL SERVICES

The recommendations provided in this report are based on the assumption that a sufficient schedule of tests and observations will be performed during construction to verify compliance. At a minimum, these tests and observations should be comprised of the following:

- Observations and testing during site preparation and earthwork,
- Observation of foundation excavations, and
- Consultation as may be required during construction.

Retaining the geotechnical engineer who developed your report to provide construction observation is the best way to verify compliance and to help you manage the risks associated with unanticipated conditions.

## 10.0 LIMITATIONS

This report has been prepared assuming the project criteria described in **2.0 PROJECT DESCRIPTION**. If changes in the project criteria occur, or if different subsurface conditions are encountered or become known, the conclusions and recommendations presented herein shall become invalid. In any such event, WT should be contacted in order to assess the effect that such variations may have on our conclusions and recommendations. If WT is not retained for the construction observation and testing services to determine compliance with this report, our professional responsibility is accordingly limited.

The recommendations presented are based entirely upon data derived from a limited number of samples obtained from widely spaced explorations. The attached logs are indicators of subsurface conditions only at the specific locations and times noted. This report assumes the uniformity of the geology and soil structure between explorations, however variations can and

often do exist. Whenever any deviation, difference, or change is encountered or becomes known, WT should be contacted.

This report is for the exclusive benefit of our client alone. There are no intended third-party beneficiaries of our contract with the client or this report, and nothing contained in the contract or this report shall create any express or implied contractual or any other relationship with, or claim or cause of action for, any third party against WT.

This report is valid for the earlier of one year from the date of issuance, a change in circumstances, or discovered variations. After expiration, no person or entity shall rely on this report without the express written authorization of WT.

## 11.0 CLOSURE

We prepared this report as an aid to the designers of the proposed project. The comments, statements, recommendations and conclusions set forth in this report reflect the opinions of the authors. These opinions are based upon data obtained at the location of the explorations, and from laboratory tests. Work on your project was performed in accordance with generally accepted standards and practices utilized by professionals providing similar services in this locality. No other warranty, express or implied, is made.


Approximate ReMi Location

Approximate Boring Location

NOT TO SCALE

Western Technologies
An RMA Company

| | |
|---|---|
| PROJECT: | MADRID STORMWATER & EROSION CONTROL |
| JOB NO.: | 32-223560-0 |

PLATE 1

# BORING LOCATION DIAGRAM

| | |
|---|---|
| **Allowable Soil Bearing Capacity** | The recommended maximum contact stress developed at the interface of the foundation element and the supporting material. |
| **Backfill** | A specified material placed and compacted in a confined area. |
| **Base Course** | A layer of specified aggregate material placed on a subgrade or subbase. |
| **Base Course Grade** | Top of base course. |
| **Bench** | A horizontal surface in a sloped deposit. |
| **Caisson/Drilled Shaft** | A concrete foundation element cast in a circular excavation which may have an enlarged base (or belled caisson). |
| **Concrete Slabs-On-Grade** | A concrete surface layer cast directly upon base course, subbase or subgrade. |
| **Crushed Rock Base Course** | A base course composed of crushed rock of a specified gradation. |
| **Differential Settlement** | Unequal settlement between or within foundation elements of a structure. |
| **Engineered Fill** | Specified soil or aggregate material placed and compacted to specified density and/or moisture conditions under observations of a representative of a soil engineer. |
| **Existing Fill** | Materials deposited through the action of man prior to exploration of the site. |
| **Existing Grade** | The ground surface at the time of field exploration. |
| **Expansive Potential** | The potential of a soil to expand (increase in volume) due to absorption of moisture. |
| **Fill** | Materials deposited by the actions of man. |
| **Finished Grade** | The final grade created as a part of the project. |
| **Gravel Base Course** | A base course composed of naturally occurring gravel with a specified gradation. |
| **Heave** | Upward movement. |
| **Native Grade** | The naturally occurring ground surface. |
| **Native Soil** | Naturally occurring on-site soil. |
| **Rock** | A natural aggregate of mineral grains connected by strong and permanent cohesive forces. Usually requires drilling, wedging, blasting or other methods of extraordinary force for excavation. |
| **Sand and Gravel Base Course** | A base course of sand and gravel of a specified gradation. |
| **Sand Base Course** | A base course composed primarily of sand of a specified gradation. |
| **Scarify** | To mechanically loosen soil or break down existing soil structure. |
| **Settlement** | Downward movement. |
| **Soil** | Any unconsolidated material composed of discrete solid particles, derived from the physical and/or chemical disintegration of vegetable or mineral matter, which can be separated by gentle mechanical means such as agitation in water. |
| **Strip** | To remove from present location. |
| **Subbase** | A layer of specified material placed to form a layer between the subgrade and base course. |
| **Subbase Grade** | Top of subbase. |
| **Subgrade** | Prepared native soil surface. |

## COARSE-GRAINED SOILS

LESS THAN 50% FINES

| GROUP SYMBOLS | DESCRIPTION | MAJOR DIVISIONS |
|---|---|---|
| **GW** | WELL-GRADED GRAVEL OR WELL-GRADED GRAVEL WITH SAND, LESS THAN 5% FINES | GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE |
| **GP** | POORLY-GRADED GRAVEL OR POORLY-GRADED GRAVEL WITH SAND, LESS THAN 5% FINES | |
| **GM** | SILTY GRAVEL OR SILTY GRAVEL WITH SAND, MORE THAN 12% FINES | |
| **GC** | CLAYEY GRAVEL OR CLAYEY GRAVEL WITH SAND, MORE THAN 12% FINES | |
| **SW** | WELL-GRADED SAND OR WELL-GRADED SAND WITH GRAVEL, LESS THAN 5% FINES | SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE |
| **SP** | POORLY-GRADED SAND OR POORLY-GRADED SAND WITH GRAVEL, LESS THAN 5% FINES | |
| **SM** | SILTY SAND OR SILTY SAND WITH GRAVEL, MORE THAN 12% FINES | |
| **SC** | CLAYEY SAND OR CLAYEY SAND WITH GRAVEL, MORE THAN 12% FINES | |

**NOTE:** Coarse-grained soils receive dual symbols if they contain 5% to 12% fines (e.g., SW-SM, GP-GC).

## FINE-GRAINED SOILS

MORE THAN 50% FINES

| GROUP SYMBOLS | DESCRIPTION | MAJOR DIVISIONS |
|---|---|---|
| **ML** | SILT, SILT WITH SAND OR GRAVEL, SANDY SILT, OR GRAVELLY SILT | SILTS AND CLAYS LIQUID LIMIT LESS THAN 50 |
| **CL** | LEAN CLAY OF LOW TO MEDIUM PLASTICITY, SANDY CLAY, OR GRAVELLY CLAY | |
| **OL** | ORGANIC SILT OR ORGANIC CLAY OF LOW TO MEDIUM PLASTICITY | |
| **MH** | ELASTIC SILT, SANDY ELASTIC SILT, OR GRAVELLY ELASTIC SILT | SILTS AND CLAYS LIQUID LIMIT MORE THAN 50 |
| **CH** | FAT CLAY OF HIGH PLASTICITY, SANDY FAT CLAY, OR GRAVELLY FAT CLAY | |
| **OH** | ORGANIC SILT OR ORGANIC CLAY OF HIGH PLASTICITY | |
| **PT** | PEAT AND OTHER HIGHLY ORGANIC SOILS | HIGHLY ORGANIC SOILS |

**NOTE:** Fine-grained soils may receive dual classification based upon plasticity characteristics (e.g. CL-ML).

### SOIL SIZES

| COMPONENT | SIZE RANGE |
|---|---|
| BOULDERS | Above 12 in. |
| COBBLES | 3 in. – 12 in. |
| GRAVEL | No. 4 – 3 in. |
| Coarse | ¾ in. – 3 in. |
| Fine | No. 4 – ¾ in. |
| SAND | No. 200 – No. 4 |
| Coarse | No. 10 – No. 4 |
| Medium | No. 40 – No. 10 |
| Fine | No. 200 – No. 40 |
| Fines (Silt or Clay) | Below No. 200 |

**NOTE:** Only sizes smaller than three inches are used to classify soils

### CONSISTENCY

| CLAYS & SILTS | BLOWS PER FOOT |
|---|---|
| VERY SOFT | 0 – 2 |
| SOFT | 3 – 4 |
| FIRM | 5 – 8 |
| STIFF | 9 – 15 |
| VERY STIFF | 16 – 30 |
| HARD | OVER 30 |

### RELATIVE DENSITY

| SANDS & GRAVELS | BLOWS PER FOOT |
|---|---|
| VERY LOOSE | 0 – 4 |
| LOOSE | 5 – 10 |
| MEDIUM DENSE | 11 – 30 |
| DENSE | 31 – 50 |
| VERY DENSE | OVER 50 |

**NOTE:** Number of blows using 140-pound hammer falling 30 inches to drive a 2-inch-OD (1⅜-inch ID) split-barrel sampler (ASTM D1586).

### PLASTICITY OF FINE GRAINED SOILS

| PLASTICITY INDEX | TERM |
|---|---|
| 0 | NON-PLASTIC |
| 1 – 7 | LOW |
| 8 – 20 | MEDIUM |
| Over 20 | HIGH |

### DEFINITION OF WATER CONTENT

DRY
SLIGHTLY DAMP
DAMP
MOIST
WET
SATURATED

The number shown in **"BORING NO."** or "**TEST PIT NO.**" refers to the approximate location of the same number indicated on the "Boring and Test Pit Location Diagram" as positioned in the field by pacing or measurement from property lines and/or existing features, or through the use of Global Positioning System (GPS) devices. The accuracy of GPS devices is somewhat variable.

**"DRILLING TYPE"** refers to the exploratory equipment used in the boring wherein **HSA = hollow stem auger**, and the dimension presented is the outside diameter of the HSA used.

**"EQUIPMENT TYPE"** refers to the equipment used in the excavation of the test pit, and may include the width of the bucket on the excavator and the use of "rock" teeth or attachments.

**"N" in "BLOW COUNTS"** refers to a 2-in. outside diameter split-barrel sampler driven into the ground with a 140 lb. drop-hammer dropped 30 in. repeatedly until a penetration of 18 in. is achieved or until refusal. The number of blows, or "blow count", of the hammer is recorded for each of three 6-in. increments totaling 18 in. The number of blows required for advancing the sampler for the last 12 in. (2nd and 3rd increments) is defined as the Standard Penetration Test (SPT) "N"-Value. Refusal to penetration is considered more than 50 blows for a 6-inch increment. (Ref. ASTM D1586).
If,
N = a whole # e.g. "15", it represents the SPT blow counts for the last 12 inches.
N = stacked numbers e.g., 5/10/20, it represents the blow counts for each 6 inches increment.

**"R" in "BLOW COUNTS"** refers to a 3-in. outside diameter ring-lined split spoon sampler driven into the ground with a 140 lb. drop-hammer dropped 30 inches repeatedly until a penetration of 12 inches is achieved or until refusal. The number of blows required to advance the sampler 12 inches is defined as the "R" blow count. The "R" blow count requires an engineered conversion to an equivalent SPT N-Value. Refusal to penetration is considered more than 50 blows for a 6-inch increment. (Ref. ASTM D3550).
If,
R = a whole # e.g. "15", it represents the unconverted blow counts for 12 inches.
For refusal (penetration less than 12 inches), R=a whole #/X" e.g., 50/10"

**"CS" in "BLOWS/FT."** refers to a 2½-in. outside diameter California style split-barrel sampler, lined with brass sleeves, driven into the ground with a 140-pound hammer dropped 30 inches repeatedly until a penetration of 18 inches is achieved or until refusal. The number of blows of the hammer is recorded for each of the three 6-inch increments totaling 18 inches. The number of blows required for advancing the sampler for the last 12 inches (2nd and 3rd increments) is defined as the "CS" blow count. The "CS" blow count requires an engineered conversion to an equivalent SPT N-Value. Refusal to penetration is considered more than 50 blows for a 6-inch increment. (Ref. ASTM D3550)

**"SAMPLE TYPE"** refers to the form of sample recovery, in which **N** = Split-barrel sample, **R** = Ring-lined sample, **CS** = California style split-barrel sample, **G** = Grab sample, **B** = Bucket sample, **C** = Core sample (ex. diamond-bit rock coring), **S** = Shelby Tube.

**"DRY DENSITY (LBS/CU FT)"** refers to the laboratory-determined dry density in pounds per cubic foot. The symbol **"NR"** indicates that no sample was recovered.

**"WATER (MOISTURE) CONTENT (% OF DRY WT.)"** refers to the laboratory-determined water content in percent using the standard test method ASTM D2216.

**"USCS"** refers to the "Unified Soil Classification System" Group Symbol for the soil type as defined by ASTM D2487 and D2488. The soils were classified visually in the field, and where appropriate, classifications were modified by visual examination of samples in the laboratory and/or by appropriate tests.

These notes and boring logs are intended for use in conjunction with the purposes of our services defined in the text. Boring log data should not be construed as part of the construction plans nor as defining construction conditions.

Boring logs depict our interpretations of subsurface conditions at the locations and on the date(s) noted. Variations in subsurface conditions and characteristics may occur between borings. Groundwater levels may fluctuate due to seasonal variations and other factors.

The stratification lines shown on the boring logs represent our interpretation of the approximate boundary between soil or rock types based upon visual field classification at the boring location. The transition between materials is approximate and may be more or less gradual than indicated.

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 1** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **21.5** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

| Depth (feet) | WATER CONTENT | DRY DENSITY (LBS/CU FT) | SAMPLE TYPE | SAMPLE | BLOW COUNTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | G | | CH | | Fat CLAY with Sand and Gravel; dark grey, very stiff or medium dense, moist | |
| | | | | N | 9<br>14<br>15 | | | no gravel | |
| 5 | | | | R | 41 | | | | |
| | | | | N | 13<br>15<br>19 | | | hard or dense | |
| 10 | | | | R | 50/10" | | | brown, hard or dense, damp | |
| | | | | G | | | | | |
| 15 | | | | N | 76/4" | SC | | Clayey SAND; brown, very dense, damp | |
| 20 | | | | N | 50/5" | CL | | Lean CLAY; with shale / sandstone, dark brown, hard, damp | |
| | | | | | | | | BORING TERMINATED AT 21.5 FEET | |
| 25 | | | | | | | | | |

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**PLATE A-4**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 2** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **21.5** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

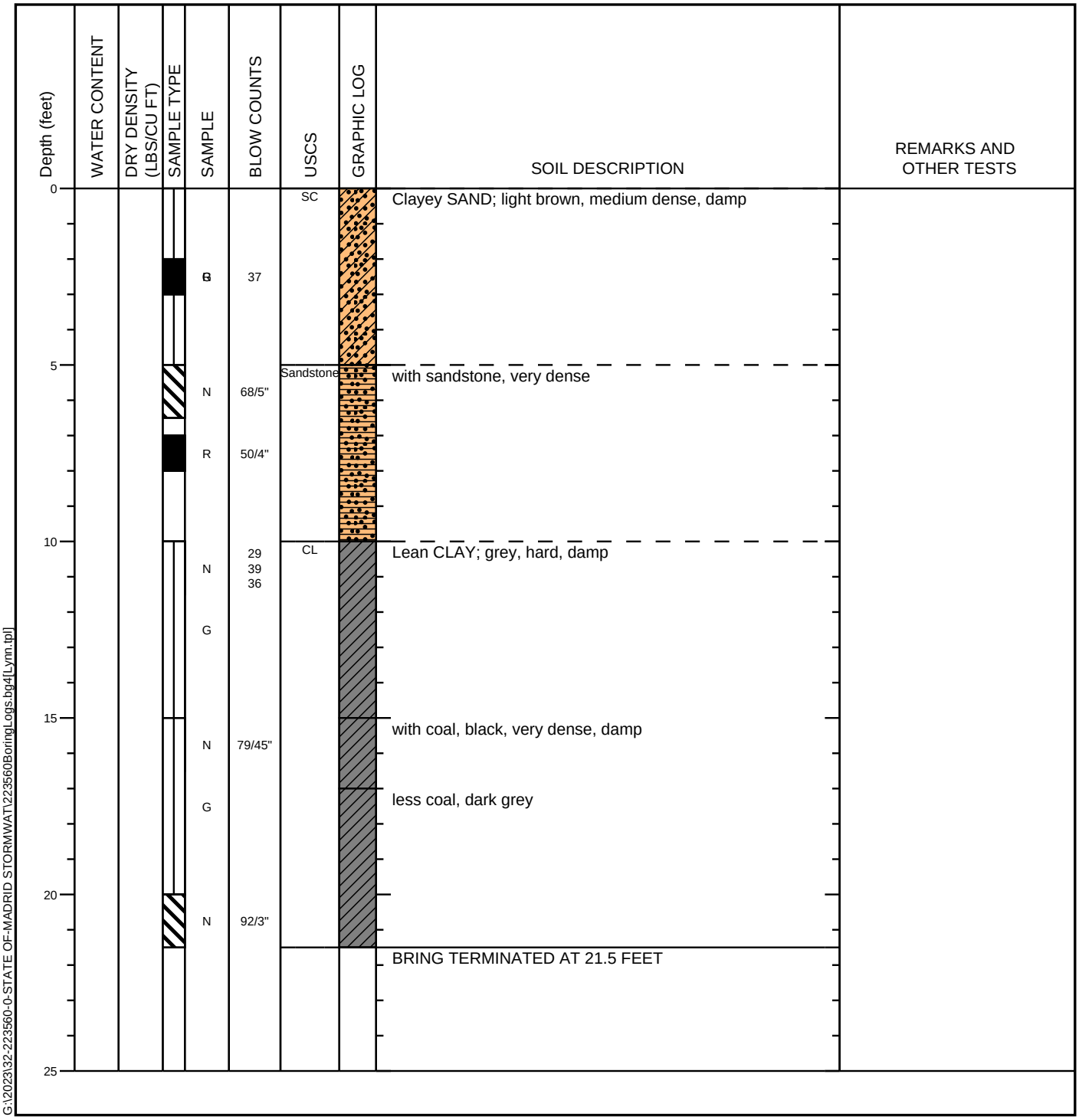


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**PLATE A-5**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 3** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **11.5** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

| Depth (feet) | WATER CONTENT | DRY DENSITY (LBS/CU FT) | SAMPLE TYPE | SAMPLE | BLOW COUNTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | G | | SC | | Clayey SAND with cobbles and Gravel; dark brown, dense, fine to coarse grained, low to medium PI, damp | |
| | | | | R | 54 | | | white layers / light brown | |
| 5 | | | | N | 13<br>12<br>17 | SP-SM | | Poorly-graded SAND with Silt; with gravel and cobbles, light brown / white, medium dense, fine to coarse grained, low to medium PI | |
| 10 | | | | R | 50/8" | | | partial recovery, cobbles, dense, low PI | |
| | | | | | | | | REFUSAL ENCOUNTERED AT 11.5 FEET | |
| 15 | | | | | | | | | |
| 20 | | | | | | | | | |
| 25 | | | | | | | | | |

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**PLATE A-6**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 4** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **14** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

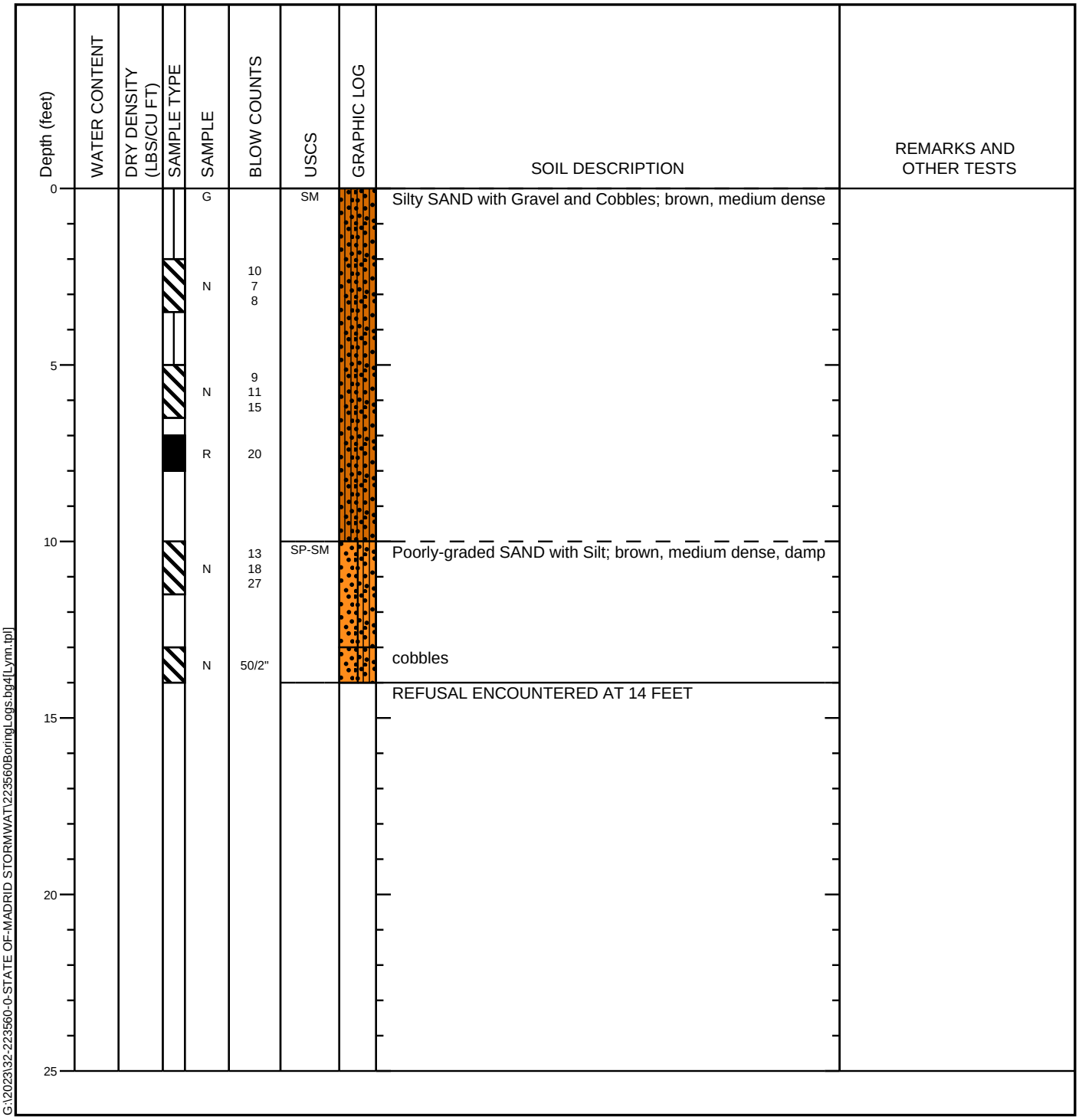


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**PLATE A-7**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 5** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **10** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

| Depth (feet) | WATER CONTENT | DRY DENSITY (LBS/CU FT) | SAMPLE TYPE | SAMPLE | BLOW COUNTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | G | | C | | COAL consisting of Poorly-graded to Silty Sand fragments that of fine to coarse grained | |
| | | | | N | 3<br>4<br>4 | | | | |
| 5 | | | | R | 15 | | | | |
| | NR | | | N | 50/3" | | | cobbles | |
| | NR | | | N | 50/1" | | | | |
| 10 | | | | | | | | REFUSAL ENCOUNTERED AT 10 FEET | |
| 15 | | | | | | | | | |

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**PLATE A-8**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 6** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

| Depth (feet) | WATER CONTENT | DRY DENSITY (LBS/CU FT) | SAMPLE TYPE | SAMPLE | BLOW COUNTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | G | | SM | | Silty SAND with Gravel and Cobbles; dark brown, fine to coarse grained, low PI | |
| | | | | | | | | large boulders | |
| 5 | | | | N | 8<br>10<br>10 | SP-SM | | Poorly-graded SAND with Silt; trace gravel and coal, brown /white / grey, medium dense, coarse grained, low PI | |
| | | | | R | 60 | | | cobbles, dark brown, dense | |
| 10 | | | | N | 55/4.5" | | | some gravel, grey, very dense | |
| 15 | | | | N | 50/3" | | | BORING TERMINATED AT 16.5 FEET | |
| 20 | | | | | | | | | |

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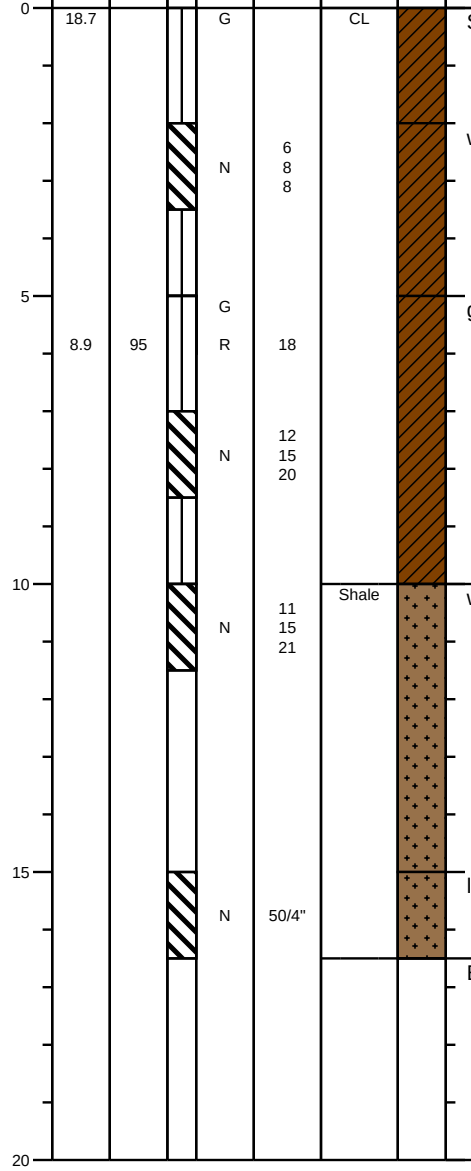
**PLATE A-9**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 7** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **16.5** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |




| SOIL DESCRIPTION | REMARKS AND OTHER TESTS |
|---|---|
| Sandy Lean CLAY; dark brown, very stiff, moist | |
| with coal | |
| grey / brown | |
| with shale | |
| lots of shale | |
| BORING TERMINATED AT 16.5 FEET | |

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**PLATE A-10**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 8** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **16.5** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

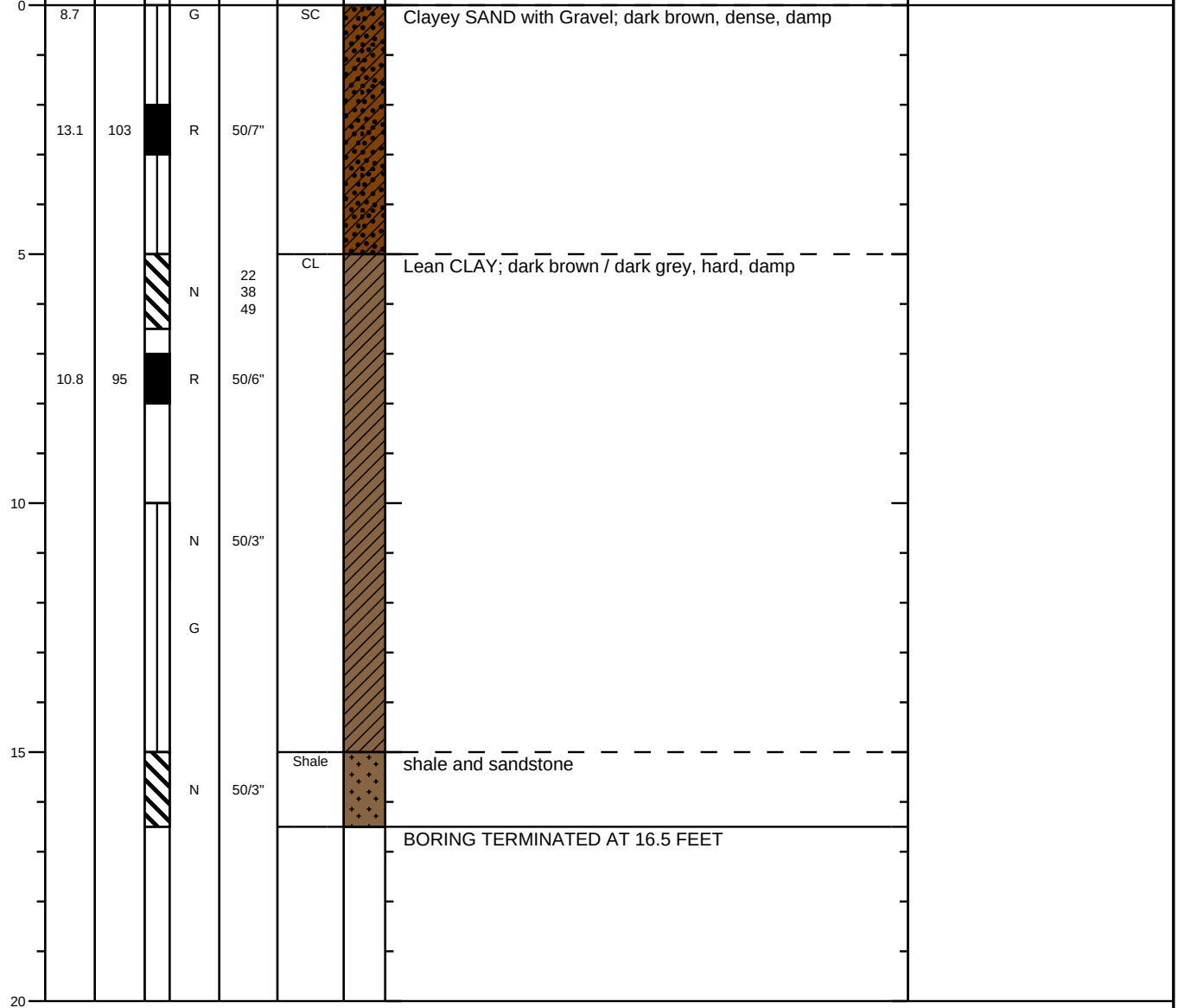


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**PLATE A-11**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 9** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **16.5** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

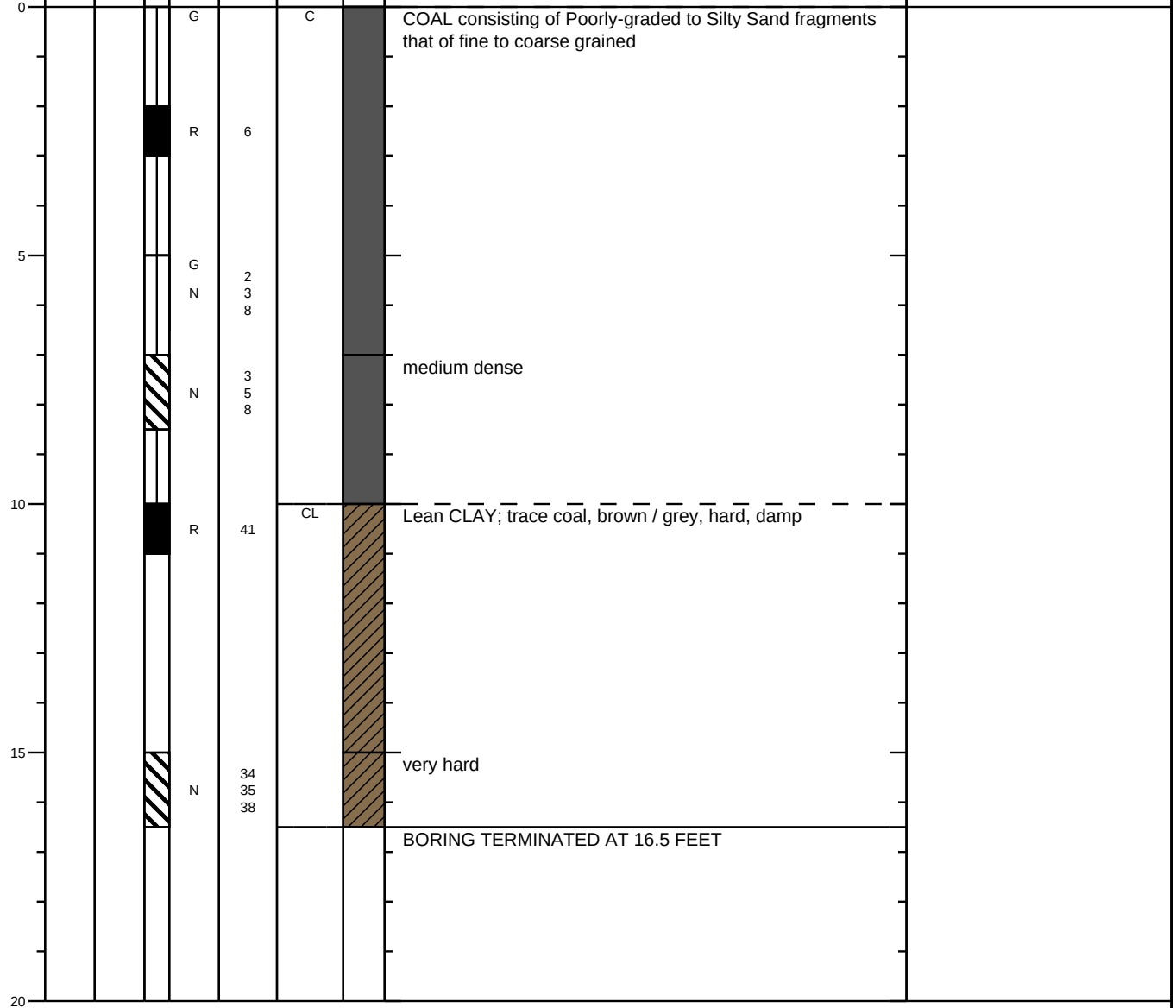


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**PLATE A-12**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 10** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **6.5** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

| Depth (feet) | WATER CONTENT | DRY DENSITY (LBS/CU FT) | SAMPLE TYPE | SAMPLE | BLOW COUNTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 18.1 | | | G | | SM | | Silty SAND; dark brown, medium dense, moist | |
| | | | | | | | | with gravel | |
| | 6.0 | 104 | | R | 32 | | | | |
| 5 | | | | | | | | dense | |
| | | | | N | 23<br>27<br>13 | | | | |
| | | | | | | | | BORING TERMINATED AT 6.5 FEET | |
| 10 | | | | | | | | | |

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**PLATE A-13**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 11** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **2** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

| Depth (feet) | WATER CONTENT | DRY DENSITY (LBS/CU FT) | SAMPLE TYPE | SAMPLE | BLOW COUNTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | G | | SC | | Clayey SAND with Gravel and Cobbles; dark brown, very dense, moist | |
| | | | | N | 50/1" | | | REFUSAL ENCOUNTERED AT 2 FEET | |
| 5 | | | | | | | | | |

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**PLATE A-14**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 12** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **6.5** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

| Depth (feet) | WATER CONTENT | DRY DENSITY (LBS/CU FT) | SAMPLE TYPE | SAMPLE | BLOW COUNTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | G | | SM | | Silty SAND with Shale; dark brown, grey, very stiff or medium dense, moist | |
| | | | | N | 8<br>10<br>11 | | | | |
| 5 | | | | R | 50/3" | | | BORING TERMINATED AT 6.5 FEET | |
| 10 | | | | | | | | | |

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**PLATE A-15**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 13** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **5** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **35.40836°,-106.15289°** | |

| Depth (feet) | WATER CONTENT | DRY DENSITY (LBS/CU FT) | SAMPLE TYPE | SAMPLE | BLOW COUNTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 14.4 | | | G | | SC | | Clayey SAND; light brown, medium PI, damp | A-6(5) |
| 5 | | | | | | | | BORING TERMINATED AT 5 FEET | |
| 10 | | | | | | | | | |

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**PLATE A-16**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 14** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **6.5** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

| Depth (feet) | WATER CONTENT | DRY DENSITY (LBS/CU FT) | SAMPLE TYPE | SAMPLE | BLOW COUNTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 7.0 | | | G | | SC | | Clayey SAND with Gravel; brown, loose, damp | |
| | | | | N | 4<br>4<br>5 | | | | |
| 5 | 11.5 | 90 | | R | 13 | | | BORING TERMINATED AT 6.5 FEET | |
| 10 | | | | | | | | | |

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**PLATE A-17**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 15** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **6.5** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

| Depth (feet) | WATER CONTENT | DRY DENSITY (LBS/CU FT) | SAMPLE TYPE | SAMPLE | BLOW COUNTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 12.5 | | | G | | C | | COAL consisting of Poorly-graded to Silty Sand fragments that of fine to coarse grained | |
| | 10.6 | | | G | | | | | |
| | 9.6 | 65 | | R | 15 | | | basalt | |
| 5 | | | | N | 3<br>3<br>2 | | | loose, damp | |
| | | | | | | | | BORING TERMINATED AT 6.5 FEET | |
| 10 | | | | | | | | | |

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**PLATE A-18**

| Project: MADRID STORMWATER END EROSION CONTROL<br>Project Number: 32-223560-0 | **BORING NO. 16** | Western Technologies An RMA Company |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **1/17/2024** | Logged By **S. O'HERRON-ALEX** | Checked By **A. KABA** |
| Drilling Method **GEOPROB** | Drill Bit Size/Type **7"** | Total Depth of Borehole **6.5** |
| Drill Rig Type **GEOPROB** | Drilling Contractor **WESTERN TECHNOLOGIES** | Approximate Surface Elevation **NOT DETERMINED** |
| Groundwater Level and Date Measured **NO GROUNDWATER ENCOUNTERED** | Sampling Method(s) **GRAB, RING, SPT** | Hammer Data **140-LB AUTOHAMMER** |
| Borehole Backfill **GEOPROB CUTTINGS** | Location **SEE LOCATION DIAGRAM** | |

| Depth (feet) | WATER CONTENT | DRY DENSITY (LBS/CU FT) | SAMPLE TYPE | SAMPLE | BLOW COUNTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 10.1 | | | G | | SC | | Clayey SAND with gravel; dark brown / black, very dense, moist | |
| | NR | | | R | 50/2" | | | with cobbles | |
| | | | | | | SP-SC | | Poorly-graded SAND with Clay; trace gravel, brown, medium dense, damp | |
| 5 | | | | N | 6<br>8<br>6 | | | | |
| | | | | | | | | BORING TERMINATED AT 6.5 FEET | |
| 10 | | | | | | | | | |

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**PLATE A-19**

| Boring No. | Depth (ft.) | USCS (AASHTO) | Initial Dry Density (pcf) | Initial Water Content (%) | Compression Properties | | | Expansion Properties | | Plasticity | | Soluble Sulfate (ppm) | Soluble Sulfate (ppm) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Surcharge (ksf) | Total Compression (%) | | Surcharge (ksf) | Expansion (%) | Liquid Limit | Plasticity Index | | | |
| | | | | | | In-Situ | After Saturation | | | | | | | |
| 1 | 5-6 | CH (A-7-6(27)) | 112 | 9.1 | | | | 0.1 | 6.0 | | | | | 1,2 |
| 1 | 5-6 | CH (A-7-6(27)) | 112 | 9.1 | 0.5 | -0.4 | 3.6 | | | | | | | 2 |
| | | | | | 1.0 | | 3.3 | | | | | | | 2 |
| | | | | | 2.0 | | 2.4 | | | | | | | 2 |
| | | | | | 4.0 | | 1.0 | | | | | | | 2 |
| 2 | 2-3 | SC (A-6(7)) | 100 | 6.4 | 0.5 | 0.4 | | | | | | | | |
| | | | | | 1.0 | 1.0 | | | | | | | | |
| | | | | | 2.0 | 1.4 | 2.3 | | | | | | | 2 |
| | | | | | 4.0 | | 3.6 | | | | | | | 2 |
| 4 | 7-8 | SM (A-1-b(0)) | 104 | 3.0 | 0.5 | 1.6 | | | | | | | | |
| | | | | | 1.0 | 2.9 | | | | | | | | |
| | | | | | 2.0 | 3.9 | 9.2 | | | | | | | 2 |
| | | | | | 4.0 | | 11.2 | | | | | | | 2 |

**Note**: Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted.
NP = Non-Plastic

**Remarks**

1. Compacted density (approx. 95% of ASTM D1557 max. density at moisture content slightly below optimum.)
2. Submerged to approximate saturation.
3. Slight rebound after saturation.
4. Sample disturbance observed.

Western Technologies
An RMA Company

PROJECT: **MADRID STORMWATER**
JOB NO.: **32-223560-0**

**SOIL PROPERTIES**

PLATE
**B-1**

| Boring No. | Depth (ft.) | USCS (AASHTO) | Initial Dry Density (pcf) | Initial Water Content (%) | Compression Properties | | | Expansion Properties | | Plasticity | | Soluble Chloride (ppm) | Soluble Sulfate (ppm) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Surcharge (ksf) | Total Compression (%) | | Surcharge (ksf) | Expansion (%) | Liquid Limit | Plasticity Index | | | |
| | | | | | | In-Situ | After Saturation | | | | | | | |
| 5 | 5-6 | COAL (A-1-a(0)) | 77 | 5.6 | 0.5 | 1.6 | | | | | | | | |
| | | | | | 1.0 | 2.1 | | | | | | | | |
| | | | | | 2.0 | 3.1 | 4.6 | | | | | | | 2 |
| | | | | | 4.0 | | 6.7 | | | | | | | 2 |
| 5 | 0-5 | COAL (A-1-a(0)) | | | | | | | | | | ND | 2200 | |
| 7 | 5-6 | CL (A-6(9)) | 95 | 8.9 | | | | 0.1 | 0.4 | | | | | 1,2 |
| 7 | 5-6 | CL (A-6(9)) | 95 | 8.9 | 0.6 | 1.5 | 6.4 | | | | | | | 2 |
| | | | | | 1.1 | | 9.1 | | | | | | | 2 |
| | | | | | 2.2 | | 12.7 | | | | | | | 2 |
| | | | | | 4.4 | | 16.5 | | | | | | | 2 |
| 9 | 2-3 | SP-SM (A-1-b(0)) | 46 | 10.3 | 0.6 | 2.6 | | | | | | | | |
| | | | | | 1.1 | 3.7 | | | | | | | | |
| | | | | | 2.2 | 5.7 | 7.3 | | | | | | | 2 |
| | | | | | 4.4 | | 10.4 | | | | | | | 2 |

**Note**: Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted.
NP = Non-Plastic

**Remarks**

1. Compacted density (approx. 95% of ASTM D1557 max. density at moisture content slightly below optimum.)
2. Submerged to approximate saturation.
3. Slight rebound after saturation.
4. Sample disturbance observed.

Western Technologies
An RMA Company

PROJECT: MADRID STORMWATER
JOB NO.: 32-223560-0

**SOIL PROPERTIES**

PLATE
**B-2**

| Boring No. | Depth (ft.) | USCS Class. | Initial Dry Density (pcf) | Initial Water Content (%) | Compression Properties | | | Expansion Properties | | Plasticity | | Soluble Chloride (ppm) | Soluble Sulfate (ppm) | Minimum Resistivity (OHM-CM) | pH | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Surcharge (ksf) | Total Compression (%) | | Surcharge (ksf) | Expansion (%) | Liquid Limit | Plasticity Index | | | | | |
| | | | | | | In-Situ | After Saturation | | | | | | | | | |
| 5 | 0-5 | COAL | | 9.4 | | | | | | NV | NP | ND | 2200 | 1400 | 8 | |
| 5 | 5-6 | COAL | 77 | 5.6 | 0.5 | 1.6 | | | | | | | | | | |
| | | | | | 1.0 | 2.1 | | | | | | | | | | |
| | | | | | 2.0 | 3.1 | 4.6 | | | | | | | | | 2 |
| | | | | | 4.0 | | 6.7 | | | | | | | | | 2 |
| 7 | 5-6 | CL | 95 | 8.9 | | | | 0.1 | 0.4 | | | | | | | 1,2 |
| 7 | 5-6 | CL | 95 | 8.9 | 0.6 | 1.5 | 6.4 | | | | | | | | | 2 |
| | | | | | 1.1 | | 9.1 | | | | | | | | | 2 |
| | | | | | 2.2 | | 12.7 | | | | | | | | | 2 |
| | | | | | 4.4 | | 16.5 | | | | | | | | | 2 |
| 9 | 2-3 | COAL | 46 | 10.3 | 0.6 | 2.6 | | | | | | | | | | |
| | | | | | 1.1 | 3.7 | | | | | | | | | | |
| | | | | | 2.2 | 5.7 | 7.3 | | | | | | | | | 2 |
| | | | | | 4.4 | | 10.4 | | | | | | | | | 2 |

**Note**: Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted.
NP = Non-Plastic

**Remarks**

1. Compacted density (approx. 95% of ASTM D1557 max. density at moisture content slightly below optimum.)
2. Submerged to approximate saturation.
3. Slight rebound after saturation.
4. Sample disturbance observed.

Western Technologies
An RMA Company

PROJECT: **MADRID STORMWATER**
JOB NO.: **32-223560-0**

**SOIL PROPERTIES**

PLATE
**B-2**

## SOIL PROPERTIES

| Boring No. | Depth (ft.) | Soil Class (AASHTO) | Particle Size Distribution - (%) Passing by Weight | | | | | | | | | | | | | | Plasticity | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1¼" | 1" | ¾" | ½" | 3/8" | #4 | #8 | #10 | #16 | #30 | #40 | #50 | #100 | #200 | L L | P I | |
| 1 | 0-5 | CH (A-7-6(27)) | - | 100 | 97 | 96 | 96 | 94 | 92 | 91 | 90 | 89 | 88 | 87 | 83 | 78 | 56 | 33 | |
| 2 | 0-5 | SC (A-6(7)) | - | - | 100 | 99 | 98 | 91 | 84 | 83 | 77 | 72 | 70 | 69 | 56 | 49 | 39 | 23 | |
| 3 | 0-5 | SC (A-2-6(0)) | - | 100 | 93 | 84 | 78 | 65 | 54 | 52 | 45 | 42 | 40 | 36 | 29 | 28 | 29 | 13 | |
| 4 | 0-5 | SM (A-1-b(0)) | - | 100 | 88 | 85 | 77 | 66 | 60 | 59 | 55 | 50 | 46 | 42 | 30 | 19 | NV | NP | |
| 5 | 0-5 | COAL (A-1-a(0)) | - | 100 | 95 | 88 | 79 | 53 | 37 | 34 | 27 | 21 | 18 | 16 | 12 | 8.8 | NV | NP | |
| 6 | 0-5 | SM (A-1-b(0)) | - | 100 | 93 | 86 | 80 | 68 | 57 | 55 | 46 | 37 | 32 | 28 | 19 | 13 | NV | NP | |
| 6 | 15-16.5 | SC (A-2-6(0)) | - | 100 | 97 | 91 | 88 | 72 | 55 | 52 | 42 | 35 | 32 | 29 | 24 | 20 | 29 | 14 | |
| 7 | 0-5 | CL (A-6(9)) | - | - | 100 | 98 | 96 | 91 | 86 | 85 | 81 | 78 | 76 | 73 | 65 | 57 | 39 | 21 | |

Note: NP = Non-Plastic
Samples obtained excluded cobbles and boulders.

Western Technologies
An RMA Company

PROJECT: **MADRID STORMWATER**
JOB NO.: **32-223560-0**

**SOIL PROPERTIES**

PLATE
**B-3**

## SOIL PROPERTIES

| Boring No. | Depth (ft.) | Soil Class (AASHTO) | Particle Size Distribution - (%) Passing by Weight | | | | | | | | | | | | | | Plasticity | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1¼" | 1" | ¾" | ½" | 3/8" | #4 | #8 | #10 | #16 | #30 | #40 | #50 | #100 | #200 | L L | P I | |
| 8 | 0-5 | SC (A-6(3)) | - | 100 | 91 | 88 | 87 | 83 | 76 | 75 | 70 | 63 | 60 | 56 | 47 | 40 | 40 | 20 | |
| 9 | 0-5 | SP-SM (A-1-b(0)) | - | - | 100 | 98 | 95 | 83 | 61 | 58 | 45 | 33 | 27 | 23 | 16 | 12 | NV | NP | |
| 10 | 0-5 | SM (A-2-4(0)) | - | - | 100 | 97 | 96 | 92 | 85 | 84 | 79 | 71 | 64 | 57 | 34 | 19 | NV | NP | |
| 11 | 0-5 | SM (A-1-b(0)) | - | 100 | 89 | 86 | 81 | 75 | 68 | 67 | 61 | 54 | 48 | 43 | 31 | 21 | NV | NP | |
| 12 | 0-5 | SC (A-6(5)) | - | - | 100 | 97 | 95 | 91 | 85 | 84 | 79 | 72 | 69 | 64 | 55 | 48 | 40 | 19 | |
| 13 | 0-5 | SC (A-6(5)) | - | - | 100 | 97 | 95 | 95 | 91 | 85 | 84 | 76 | 72 | 69 | 65 | 55 | 40 | 19 | |
| 14 | 0-5 | SC (A-2-4(0)) | - | 100 | 96 | 89 | 80 | 70 | 62 | 61 | 56 | 50 | 44 | 41 | 34 | 29 | 27 | 10 | |
| 15 | 0-4 | COAL (A-1-b(0)) | - | - | 100 | 97 | 94 | 84 | 71 | 68 | 56 | 43 | 37 | 32 | 23 | 17 | NV | NP | |

Note: NP = Non-Plastic
Samples obtained excluded cobbles and boulders.

Western Technologies
An RMA Company

PROJECT: **MADRID STORMWATER**
JOB NO.: **32-223560-0**

**SOIL PROPERTIES**

PLATE
**B-4**

## SOIL PROPERTIES

| Boring No. | Depth (ft.) | Soil Class (AASHTO) | Particle Size Distribution - (%) Passing by Weight | | | | | | | | | | | | | | Plasticity | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1¼" | 1" | ¾" | ½" | 3/8" | #4 | #8 | #10 | #16 | #30 | #40 | #50 | #100 | #200 | L L | P I | |
| 15 | 4-5 | SP-SM (A-1-b(0)) | - | 100 | 98 | 96 | 95 | 82 | 62 | 57 | 44 | 31 | 26 | 22 | 16 | 12 | NV | NP | |
| 16 | 0-5 | SM (A-1-b(0)) | - | 100 | 89 | 85 | 80 | 67 | 57 | 55 | 49 | 41 | 37 | 34 | 25 | 16 | NV | NP | |

Note: NP = Non-Plastic
Samples obtained excluded cobbles and boulders.

Western Technologies
An RMA Company

PROJECT: **MADRID STORMWATER**
JOB NO.: **32-223560-0**

**SOIL PROPERTIES**

PLATE
**B-5**

# CALIFORNIA BEARING RATIO (CBR)
## Boring 10 (0'-5')

| | | | |
|---|---|---|---|
| Client: | State of New Mexico EMNRD | Job Number: | 32-223560-0 |
| Address: | | Lab Number: | |
| City, State: | Madrid, New Mexico | Report Date: | |
| Attn: | Leeland Murray | | |

| | | | |
|---|---|---|---|
| Project: | Madrid Stormwater & Eriosion Control | Authorized By: | Date: |
| Location: | Madrid, New Meixco | Sampled By: | Date: |
| Material: | | Submitted By: | Date: |
| Source: | B 10 (0-5') | | |

Moisture Density Relationship

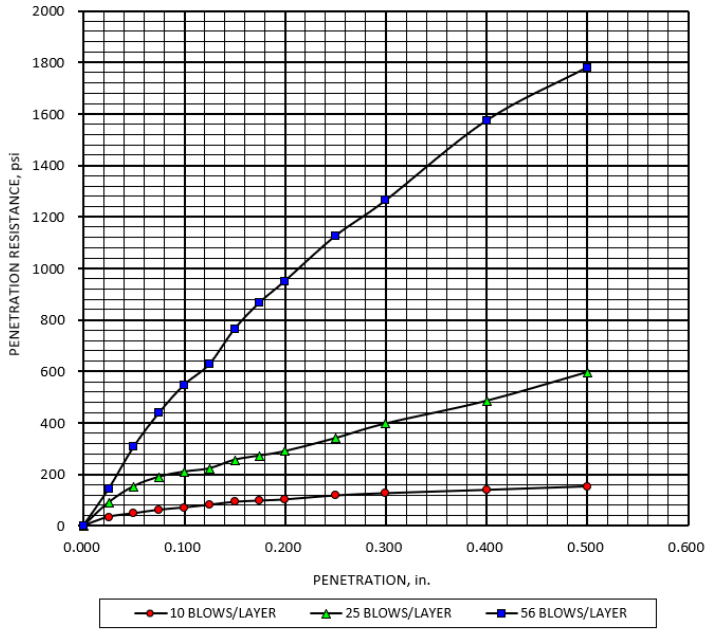
Procedure: ASTM D1557 Method: A

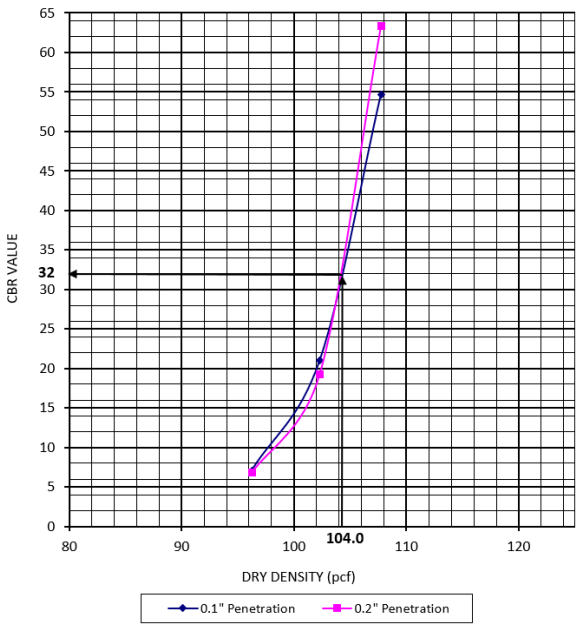
Maximum Dry Density, pcf: 109.5

Optimum Moisture, % : 12.0

Compacted Specimen Results — Procedure: ASTM D1883

| | | | |
|---|---|---|---|
| Compactive Effort (Blows per Layer): | 10 | 25 | 56 |
| Dry Density at Compaction, pcf: | 96.2 | 102.3 | 107.8 |
| Percent of Maximum Dry Density: | 87.9 | 93.4 | 98.4 |
| Percent Moisture Before Compaction: | 11.1 | 11.8 | 11.9 |
| Percent Moisture After Compaction: | 11.1 | 12.0 | 11.8 |
| Percent Moisture after Soaking (Avg. of Total Sample): | 18.1 | 15.3 | 11.9 |
| Dry Density after Soaking, pcf: | 97.9 | 104.4 | 110.9 |
| Percent Moisture after Soaking (Top 1 in.): | 19.0 | 16.1 | 11.9 |
| Swell, %: | 0.0 | 0.0 | 0.0 |
| Corrected CBR at 0.100 in. Penetration: | 7 | 21 | 55 |
| Corrected CBR at 0.200 in. Penetration: | 7 | 19 | 63 |
| Surcharge Weight, lbs.: | 10 | 10 | 10 |
| California Bearing Ratio (CBR) at 95% Relative Compaction: | | **32** | |

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An RMA Company

PROJECT: **MADRID STORMWATER & EROSION CONTROL IMPROVEMENT**

JOB NO.: **32-223560-0**

# CALIFORNIA BEARING RATIO

PLATE

**B-5**

# CALIFORNIA BEARING RATIO (CBR)
## Boring 11 (0'-5')

CALIFORNIA BEARING RATIO (CBR)

| | | | |
|---|---|---|---|
| Client: | State of New Mexico EMNRD | Job Number: | 32-223560-0 |
| Address: | | Lab Number: | |
| City, State: | Madrid, New Mexico | Report Date: | |
| Attn: | Leeland Murray | | |

| | | | |
|---|---|---|---|
| Project: | Madrid Stormwater & Erosion Control | Authorized By: | Date: |
| Location: | Madrid, New Mexico | Sampled By: | Date: |
| Material: | | Submitted By: | Date: |
| Source: | B 11 (0-5') | | |

Moisture Density Relationship

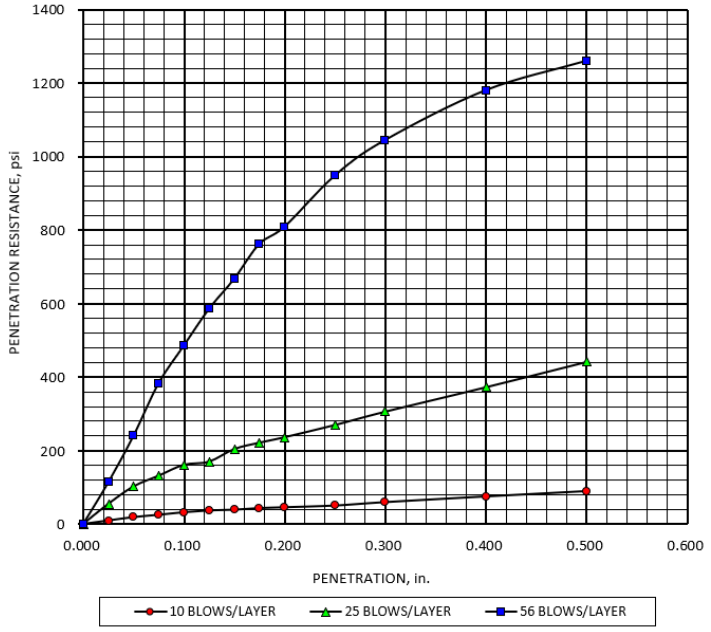
Procedure: ASTM D1557 Method: A

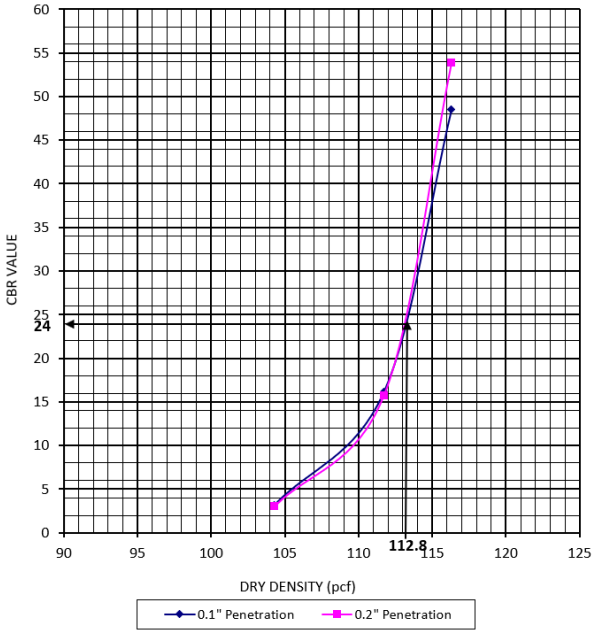
Maximum Dry Density, pcf: 118.7

Optimum Moisture, % : 9.3

Compacted Specimen Results — Procedure: ASTM D1883

| | | | |
|---|---|---|---|
| Compactive Effort (Blows per Layer): | 10 | 25 | 56 |
| Dry Density at Compaction, pcf: | 104.3 | 111.7 | 116.3 |
| Percent of Maximum Dry Density: | 87.9 | 94.1 | 98.0 |
| Percent Moisture Before Compaction: | 8.6 | 10.0 | 8.7 |
| Percent Moisture After Compaction: | 8.8 | 9.9 | 9.0 |
| Percent Moisture after Soaking (Avg. of Total Sample): | 17.8 | 14.4 | 12.7 |
| Dry Density after Soaking, pcf: | 104.4 | 111.5 | 116.8 |
| Percent Moisture after Soaking (Top 1 in.): | 20.4 | 15.4 | 14.3 |
| Swell, %: | 0.1 | 0.1 | 0.0 |
| Corrected CBR at 0.100 in. Penetration: | 3 | 16 | 49 |
| Corrected CBR at 0.200 in. Penetration: | 3 | 16 | 54 |
| Surcharge Weight, lbs.: | 10 | 10 | 10 |
| California Bearing Ratio (CBR) at 95% Relative Compaction: | | **24** | |

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PROJECT: **MADRID STORMWATER & EROSION CONTROL IMPROVEMENT**

JOB NO.: **32-223560-0**

# CALIFORNIA BEARING RATIO

PLATE

**B-6**

# CALIFORNIA BEARING RATIO (CBR)
## Boring 14 (0'-5')

| | | | |
|---|---|---|---|
| Client: | State of New Mexico EMNRD | Job Number: | 32-223560-0 |
| Address: | | Lab Number: | |
| City, State: | Madrid, New Mexico | Report Date: | |
| Attn: | Leeland Murray | | |

| | | | |
|---|---|---|---|
| Project: | Madrid Stormwater & Eriosion Control | Authorized By: | Date: |
| Location: | Madrid, New Meixco | Sampled By: | Date: |
| Material: | | Submitted By: | Date: |
| Source: | B 14 (0-5') | | |

Moisture Density Relationship

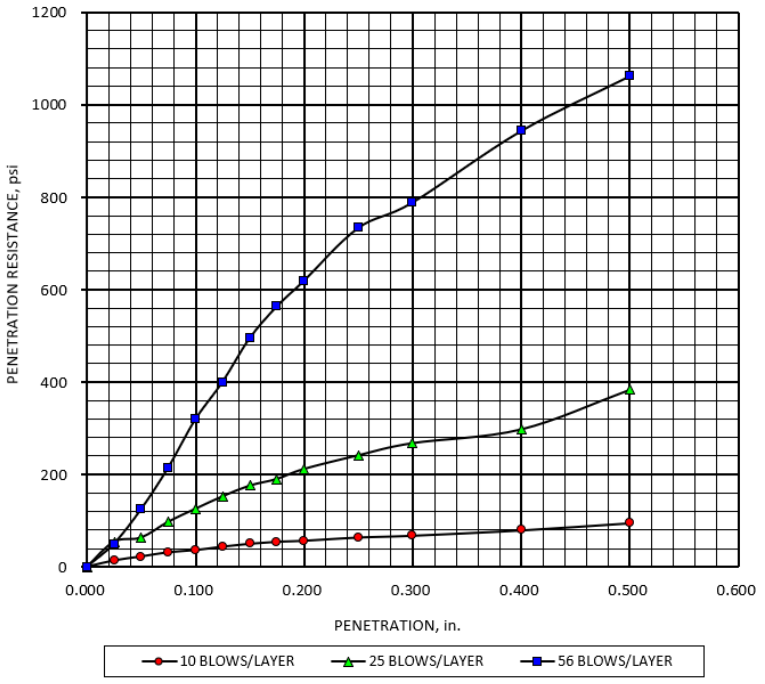
Procedure: ASTM D1557 Method: C

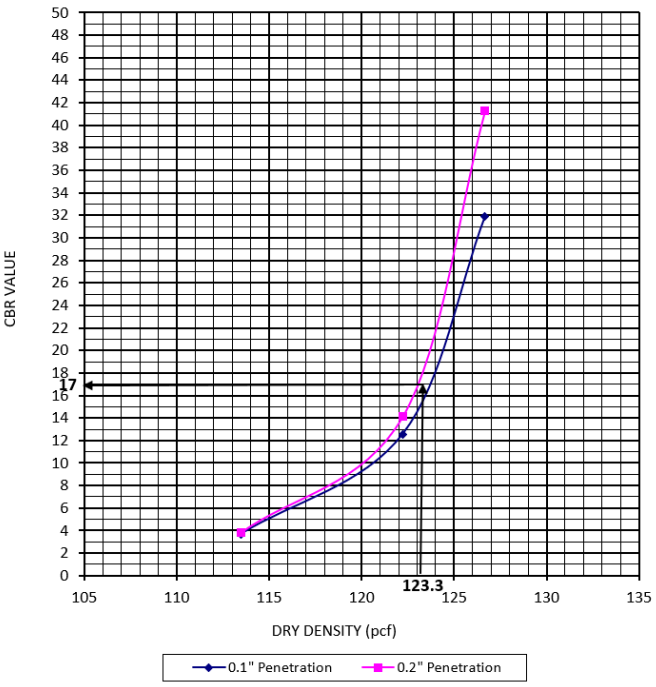
Maximum Dry Density, pcf: 129.8

Optimum Moisture, % : 8.2

Compacted Specimen Results Procedure: ASTM D1883

| Compactive Effort (Blows per Layer): | 10 | 25 | 56 |
|---|---|---|---|
| Dry Density at Compaction, pcf: | 113.5 | 122.2 | 126.7 |
| Percent of Maximum Dry Density: | 87.4 | 94.2 | 97.6 |
| Percent Moisture Before Compaction: | 7.7 | 7.6 | 7.8 |
| Percent Moisture After Compaction: | 7.9 | 7.7 | 8.1 |
| Percent Moisture after Soaking (Avg. of Total Sample): | 14.3 | 13.6 | 12.9 |
| Dry Density after Soaking, pcf: | 112.7 | 123.6 | 124.3 |
| Percent Moisture after Soaking (Top 1 in.): | 15.6 | 15.2 | 14.6 |
| Swell, %: | 0.1 | 0.1 | 0.2 |
| Corrected CBR at 0.100 in. Penetration: | 4 | 13 | 32 |
| Corrected CBR at 0.200 in. Penetration: | 4 | 14 | 41 |
| Surcharge Weight, lbs.: | 10 | 10 | 10 |
| California Bearing Ratio (CBR) at 95% Relative Compaction: | | 17 | |

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PROJECT: **MADRID STORMWATER & EROSION CONTROL IMPROVEMENT**

JOB NO.: **32-223560-0**

# CALIFORNIA BEARING RATIO

PLATE

**B-6**

# CALIFORNIA BEARING RATIO (CBR)
## Boring 15 (0'-5')

CALIFORNIA BEARING RATIO (CBR)

| | | | |
|---|---|---|---|
| Client: | State of New Mexico EMNRD | Job Number: | 32-223560-0 |
| Address: | | Lab Number: | |
| City, State: | Madrid, New Mexico | Report Date: | |
| Attn: | Leeland Murray | | |

| | | | |
|---|---|---|---|
| Project: | Madrid Stormwater & Erosion Control | Authorized By: | Date: |
| Location: | Madrid, New Mexico | Sampled By: | Date: |
| Material: | | Submitted By: | Date: |
| Source: | B 15 (0-5') | | |

Moisture Density Relationship

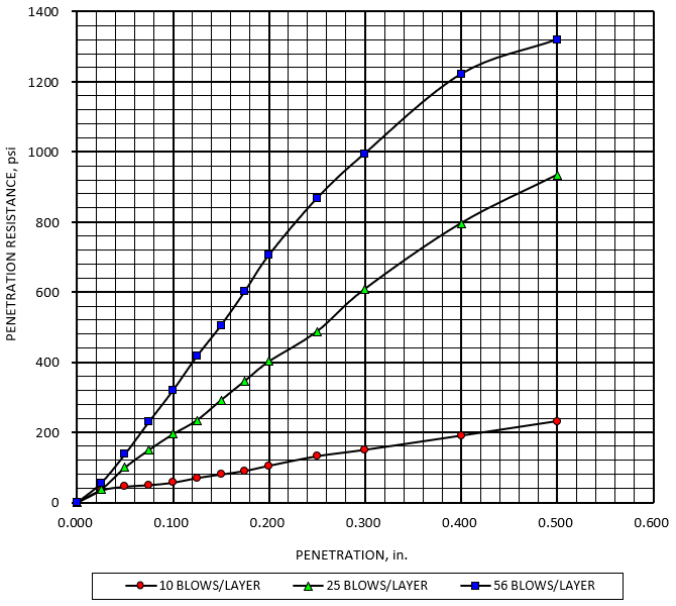
Procedure: ASTM D1557 Method: A

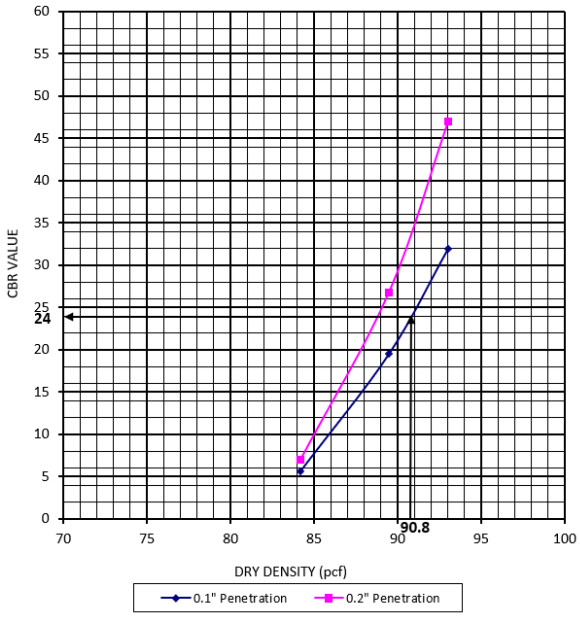
Maximum Dry Density, pcf: 95.6

Optimum Moisture, % : 14.8

Compacted Specimen Results Procedure: ASTM D1883

| | | | |
|---|---|---|---|
| Compactive Effort (Blows per Layer): | 10 | 25 | 56 |
| Dry Density at Compaction, pcf: | 84.2 | 89.5 | 93.0 |
| Percent of Maximum Dry Density: | 88.1 | 93.6 | 97.3 |
| Percent Moisture Before Compaction: | 15.1 | 14.9 | 16.1 |
| Percent Moisture After Compaction: | 15.0 | 14.8 | 14.7 |
| Percent Moisture after Soaking (Avg. of Total Sample): | 20.5 | 17.0 | 15.4 |
| Dry Density after Soaking, pcf: | 85.8 | 90.6 | 94.6 |
| Percent Moisture after Soaking (Top 1 in.): | 21.6 | 18.0 | 16.1 |
| Swell, %: | 0.0 | 0.0 | 0.0 |
| Corrected CBR at 0.100 in. Penetration: | 6 | 20 | 32 |
| Corrected CBR at 0.200 in. Penetration: | 7 | 27 | 47 |
| Surcharge Weight, lbs.: | 10 | 10 | 10 |
| California Bearing Ratio (CBR) at 95% Relative Compaction: | | **24** | |

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PROJECT: **MADRID STORMWATER & EROSION CONTROL IMPROVEMENT**

JOB NO.: **32-223560-0**

# CALIFORNIA BEARING RATIO

PLATE

**B-8**

# CALIFORNIA BEARING RATIO (CBR)
## Boring 16 (0'-5')

CALIFORNIA BEARING RATIO (CBR)

| | | | |
|---|---|---|---|
| Client: | State of New Mexico EMNRD | Job Number: | 32-223560-0 |
| Address: | | Lab Number: | |
| City, State: | Madrid, New Mexico | Report Date: | |
| Attn: | Leeland Murray | | |

| | | | |
|---|---|---|---|
| Project: | Madrid Stormwater & Erosion Control | Authorized By: | Date: |
| Location: | Madrid, New Mexico | Sampled By: | Date: |
| Material: | | Submitted By: | Date: |
| Source: | B 16 (0-5') | | |

Moisture Density Relationship

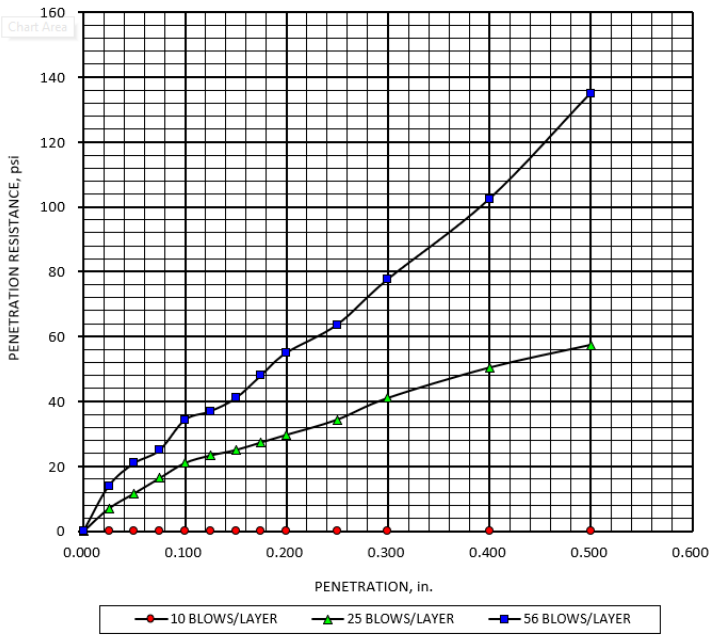
Procedure: ASTM D1557 Method: A

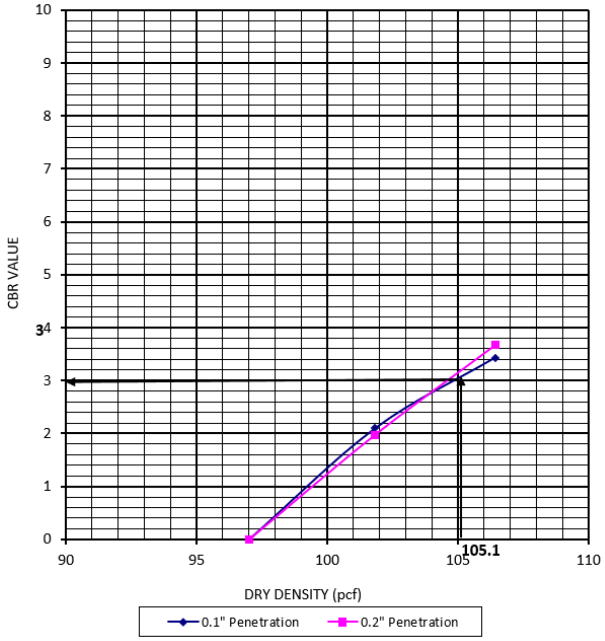
Maximum Dry Density, pcf: 110.6

Optimum Moisture, % : 13.8

Compacted Specimen Results Procedure: ASTM D1883

| | | | |
|---|---|---|---|
| Compactive Effort (Blows per Layer): | 10 | 25 | 56 |
| Dry Density at Compaction, pcf: | 97.0 | 101.8 | 106.4 |
| Percent of Maximum Dry Density: | 87.7 | 92.1 | 96.2 |
| Percent Moisture Before Compaction: | 14.7 | 14.9 | 14.8 |
| Percent Moisture After Compaction: | 14.3 | 14.6 | 14.8 |
| Percent Moisture after Soaking (Avg. of Total Sample): | 27.8 | 25.7 | 23.5 |
| Dry Density after Soaking, pcf: | 91.8 | 99.3 | 103.3 |
| Percent Moisture after Soaking (Top 1 in.): | 30.5 | 28.6 | 27.5 |
| Swell, %: | 0.4 | 0.4 | 0.4 |
| Corrected CBR at 0.100 in. Penetration: | 0 | 2 | 3 |
| Corrected CBR at 0.200 in. Penetration: | 0 | 2 | 4 |
| Surcharge Weight, lbs.: | 10 | 10 | 10 |
| California Bearing Ratio (CBR) at 95% Relative Compaction: | | 3 | |

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PROJECT: **MADRID STORMWATER & EROSION CONTROL IMPROVEMENT**

JOB NO.: **32-223560-0**

# CALIFORNIA BEARING RATIO

PLATE

**B-9**

# CALIFORNIA BEARING RATIO (CBR)
## Boring 13 (0'-5')

CALIFORNIA BEARING RATIO (CBR)

| | | | |
|---|---|---|---|
| Client: | State of New Mexico EMNRD | Job Number: | 32-223560-0 |
| Address: | | Lab Number: | |
| City, State: | Madrid, New Mexico | Report Date: | |
| Attn: | Leeland Murray | | |

| | | | |
|---|---|---|---|
| Project: | Madrid Stormwater & Erosion Control | Authorized By: | Date: |
| Location: | Madrid, New Mexico | Sampled By: | Date: |
| Material: | | Submitted By: | Date: |
| Source: | B 13 (0-5') | | |

Moisture Density Relationship

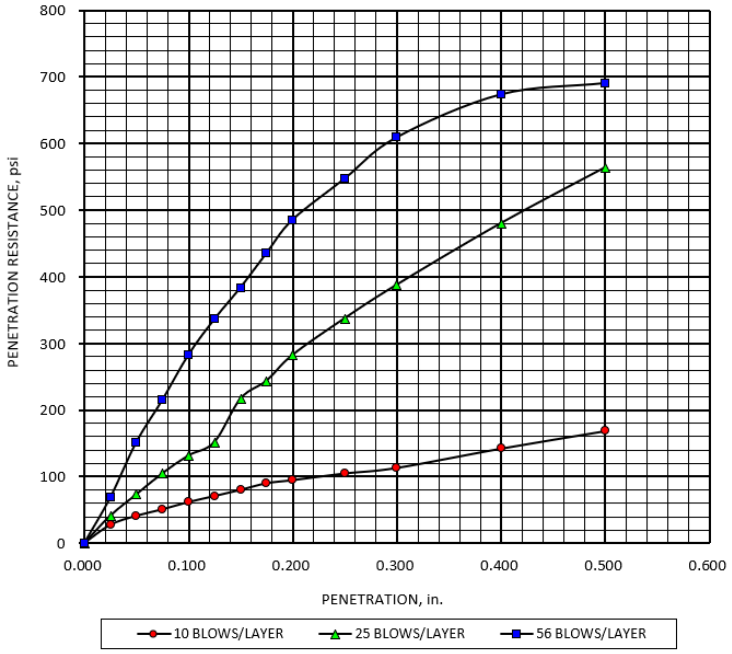
Procedure: ASTM D1557 Method: A

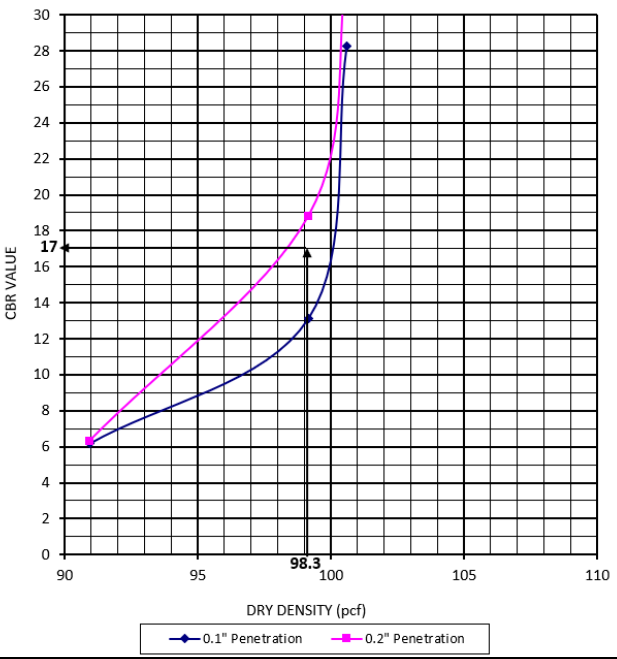
Maximum Dry Density, pcf: 103.5

Optimum Moisture, % : 12.7

Compacted Specimen Results Procedure: ASTM D1883

| | | | |
|---|---|---|---|
| Compactive Effort (Blows per Layer): | 10 | 25 | 56 |
| Dry Density at Compaction, pcf: | 90.9 | 99.1 | 100.6 |
| Percent of Maximum Dry Density: | 87.9 | 95.8 | 97.2 |
| Percent Moisture Before Compaction: | 11.1 | 12.4 | 11.5 |
| Percent Moisture After Compaction: | 11.1 | 12.2 | 11.7 |
| Percent Moisture after Soaking (Avg. of Total Sample): | 19.4 | 16.7 | 14.3 |
| Dry Density after Soaking, pcf: | 90.1 | 97.3 | 101.5 |
| Percent Moisture after Soaking (Top 1 in.): | 20.1 | 17.7 | 16.1 |
| Swell, %: | 0.0 | 0.0 | 0.0 |
| Corrected CBR at 0.100 in. Penetration: | 6 | 13 | 28 |
| Corrected CBR at 0.200 in. Penetration: | 6 | 19 | 32 |
| Surcharge Weight, lbs.: | 10 | 10 | 10 |
| California Bearing Ratio (CBR) at 95% Relative Compaction: | | **12** | |

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PROJECT: **MADRID STORMWATER & EROSION CONTROL IMPROVEMENT**

JOB NO.: **32-223560-0**

**CALIFORNIA BEARING RATIO**

PLATE

**B-10**

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# Soil / Aggregate Test Report

Client **STATE OF NEW MEXICO EMNRD**
**1220 SOUTH ST FRANCIS DRIVE**
**SANTA FE , NM**

Date of Report **03/26/24**
Job No. **32-223560-0**
Event No. **10 (0-5)**
Authorized By **A. Kaba**
Sample Location Designated By
Sampled By **S. O'Herron-Alex**
Submitted By **L. Anderson**



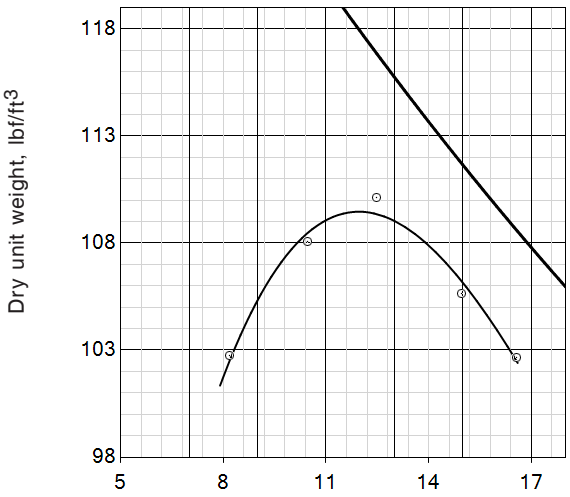
Lab No. **50535**
Date **01/17/24**
Date
Date **01/17/24**
Date **03/26/24**

Project **MADRID STORMWATER AND EROSION CONTROL PROJECT**
Project Address **ICE HOUSE ROAD TO FIREHOUSE LANE - MADRID, NM**
Material Description **A-2-4 (0)**
Material Use **Silty SAND**
Material Source **B 10 (0-5')**
Sample Location
Special Instructions

Sieve analysis **AASHTO T27 Non-Referee**
Finer Than No. 200 **AASHTO T11, Procedure A**

| Sieve | Accumulative % passing | Specification |
|---|---|---|
| 6 in. | | |
| 4 in. | | |
| 3 in. | | |
| 2 in. | | |
| 1-1/2 in. | | |
| 1 in. | | |
| 3/4 in. | **100** | |
| 1/2 in. | **97** | |
| 3/8 in. | **96** | |
| 1/4 in. | **95** | |
| No. 4 | **92** | |
| No. 8 | **85** | |
| No. 10 | **84** | |
| No. 16 | **79** | |
| No. 30 | **71** | |
| No. 40 | **64** | |
| No. 50 | **57** | |
| No. 100 | **34** | |
| No. 200 | **19** | |

Laboratory compaction characteristics **ASTM D1557** Method **A**




Sample Preparation **Moist**

Rammer Used **Mechanical**

Proctor curve Id. No. **3**
Maximum dry unit weight, lbf/ft³ **109.5**
Optimum water content, % **12.0**

Oversize Aggregate
Assumed bulk specific gravity **2.60**
Assumed absorption, % **1.0**
Oversize in laboratory sample, % **0**

| | | Result | Specs. |
|---|---|---|---|
| Liquid Limit, Plastic Limit & Plasticity Index | | | |
| Preparation method | **Oven-dried** | | |
| Processing method | **ASTM D4318, Dry Preparation** | | |
| Liquid Limit | **ASTM D4318, Method B** LL | **NV** | |
| Plastic Limit | **ASTM D4318** PL | | |
| Plasticity Index | **ASTM D4318** PI | **NP** | |
| Water Content | **AASHTO T265** % dry weight | **18.1** | |
| Swell Test | Surcharge psf Expansion, % | | |
| Compacted to approximately of ASTM Method | | | |
| Initial water content % | Dry unit weight lbf/ft3 | | |
| Organic Matter | % | | |
| Unified Soil Classification | **AASHTO M145** | | |
| Group Symbol: **A-2-4(0)** | Name: **Silty Sand** | | |

| | | Result | Specs. |
|---|---|---|---|
| Los Angeles (LA) Abrasion | Grading rev., % loss | | |
| | Grading rev., % loss | | |
| Fractured Faces By Weight | One or more, % | | |
| | Two or more, % | | |
| Total Salts (Solubility) | % | | |
| Sulfates | % | | |
| Chlorides | | | |
| pH Determination | pH | | |
| Minimum Resistivity | ohm-cm | | |
| Expansion Index of Soil | EI | | |
| | Initial dry unit weight, lbf/ft3 | | |
| | Initial degree of saturation | | |
| Initial water content, % | Final water content, % | | |

Comments:





Reviewed By **JAMES DACY, LAB SUPERVISOR**

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# Soil / Aggregate Test Report

Client **STATE OF NEW MEXICO EMNRD**
**1220 SOUTH ST FRANCIS DRIVE**
**SANTA FE , NM**

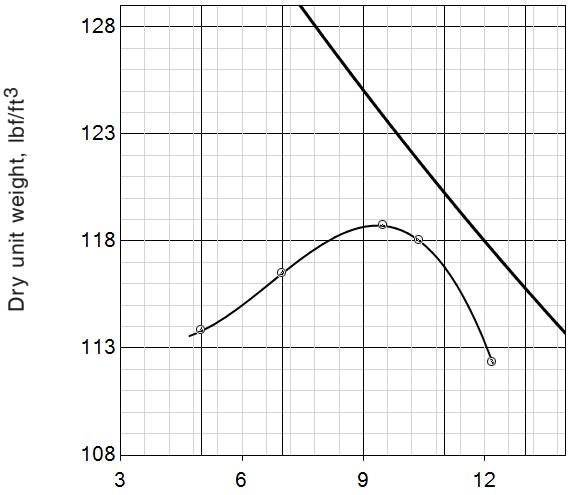
Date of Report **03/26/24** Page **1** of **1**
Job No. **32-223560-0**
Event No. **11 (0-5)** Lab No. **50518**
Authorized By **A. Kaba** Date **01/17/24**
Sample Location Designated By Date
Sampled By **S. O'Herron-Alex** Date **01/17/24**
Submitted By **L. Anderson** Date **03/26/24**

Project **MADRID STORMWATER AND EROSION CONTROL PROJECT**
Project Address **ICE HOUSE ROAD TO FIREHOUSE LANE, MADRID, NM**
Material Description **A-1-b (0)**
Material Use **Silty SAND with Gravel**
Material Source **B 11 (0-5)**
Sample Location **B 11 (0-5)**
Special Instructions

Sieve analysis **AASHTO T27 Non-Referee**
Finer Than No. 200 **AASHTO T11, Procedure A**

| Sieve | Accumulative % passing | Specification |
|---|---|---|
| 6 in. | | |
| 4 in. | | |
| 3 in. | | |
| 2 in. | | |
| 1-1/2 in. | | |
| 1 in. | **100** | |
| 3/4 in. | **89** | |
| 1/2 in. | **86** | |
| 3/8 in. | **81** | |
| 1/4 in. | **78** | |
| No. 4 | **75** | |
| No. 8 | **68** | |
| No. 10 | **67** | |
| No. 16 | **61** | |
| No. 30 | **53** | |
| No. 40 | **48** | |
| No. 50 | **43** | |
| No. 100 | **31** | |
| No. 200 | **21** | |

Laboratory compaction characteristics **ASTM D1557** Method **C**




Sample Preparation **Moist**
Rammer Used **Mechanical**

Proctor curve Id. No. **1**
Maximum dry unit weight, lbf/ft³ **118.7**
Optimum water content, % **9.3**

Oversize Aggregate
Assumed bulk specific gravity **2.60**
Assumed absorption, % **1.0**
Oversize in laboratory sample, % **0**

| | | Result | Specs. |
|---|---|---|---|
| Liquid Limit, Plastic Limit & Plasticity Index | | | |
| Preparation method | **Oven-dried** | | |
| Processing method | **ASTM D4318, Dry Preparation** | | |
| Liquid Limit | **ASTM D4318, Method B** LL | **NV** | |
| Plastic Limit | **ASTM D4318** PL | | |
| Plasticity Index | **ASTM D4318** PI | **NP** | |
| Water Content | **AASHTO T265** % dry weight | **11.3** | |
| Swell Test | Surcharge psf Expansion, % | | |
| Compacted to approximately of ASTM Method | | | |
| Initial water content % | Dry unit weight lbf/ft3 | | |
| Organic Matter | % | | |
| Unified Soil Classification **AASHTO M145** | | | |
| Group Symbol: **A-1-b(0)** | Name: **Silty Sand with Gravel** | | |

| | | Result | Specs. |
|---|---|---|---|
| Los Angeles (LA) Abrasion | Grading rev., % loss | | |
| | Grading rev., % loss | | |
| Fractured Faces By Weight | One or more, % | | |
| | Two or more, % | | |
| Total Salts (Solubility) | % | | |
| Sulfates | % | | |
| Chlorides | | | |
| pH Determination | pH | | |
| Minimum Resistivity | ohm-cm | | |
| Expansion Index of Soil | EI | | |
| | Initial dry unit weight, lbf/ft3 | | |
| | Initial degree of saturation | | |
| Initial water content, % | Final water content, % | | |

Comments:





Reviewed By **JAMES DACY, LAB SUPERVISOR**

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# Soil / Aggregate Test Report

Client **STATE OF NEW MEXICO EMNRD**
**1220 SOUTH ST FRANCIS DRIVE**
**SANTA FE , NM**

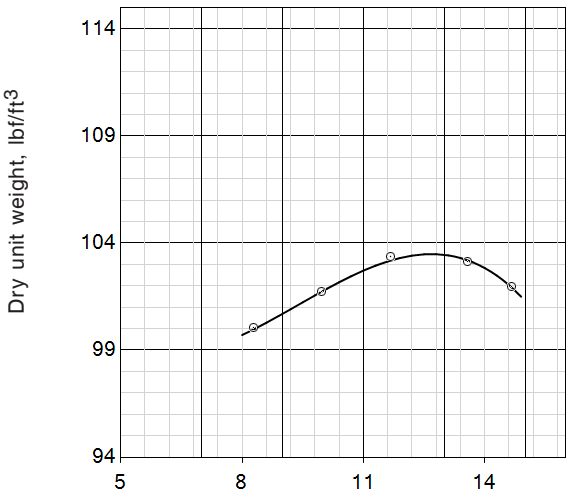
Date of Report **03/26/24** Page **1** of **1**
Job No. **32-223560-0**
Event No. **13 (0-5)** Lab No. **50773**
Authorized By **A. Kaba** Date **01/17/24**
Sample Location Designated By Date
Sampled By **S. O'Herron-Alex** Date **01/17/24**
Submitted By **L. Anderson** Date **03/26/24**

Project **MADRID STORMWATER AND EROSION CONTROL PROJECT**
Project Address **ICE HOUSE ROAD TO FIREHOUSE LANE, MADRID, NM**
Material Description **A-6 (5)**
Material Use **Clayey SAND**
Material Source **B 13 (0-5')**
Sample Location
Special Instructions

Sieve analysis **AASHTO T27 Non-Referee**
Finer Than No. 200 **AASHTO T11, Procedure A**

| Sieve | Accumulative % passing | Specification |
|---|---|---|
| 6 in. | | |
| 4 in. | | |
| 3 in. | | |
| 2 in. | | |
| 1-1/2 in. | | |
| 1 in. | | |
| 3/4 in. | **100** | |
| 1/2 in. | **97** | |
| 3/8 in. | **95** | |
| 1/4 in. | **95** | |
| No. 4 | **91** | |
| No. 8 | **85** | |
| No. 10 | **84** | |
| No. 16 | **79** | |
| No. 30 | **72** | |
| No. 40 | **69** | |
| No. 50 | **64** | |
| No. 100 | **55** | |
| No. 200 | **48** | |

Laboratory compaction characteristics **ASTM D1557** Method **A**




Sample Preparation **Moist**

Rammer Used **Manual**

Proctor curve Id. No. **6**
Maximum dry unit weight, lbf/ft³ **103.5**
Optimum water content, % **12.7**

Oversize Aggregate
Assumed bulk specific gravity **2.60**
Assumed absorption, % **1.0**
Oversize in laboratory sample, % **0**

| | | Result | Specs. |
|---|---|---|---|
| Liquid Limit, Plastic Limit & Plasticity Index | | | |
| Preparation method | **Oven-dried** | | |
| Processing method | **ASTM D4318, Dry Preparation** | | |
| Liquid Limit | **ASTM D4318, Method B** LL | **40** | |
| Plastic Limit | **ASTM D4318** PL | **21** | |
| Plasticity Index | **ASTM D4318** PI | **19** | |
| Water Content | **AASHTO T265** % dry weight | **14.4** | |
| Swell Test | Surcharge psf Expansion, % | | |
| Compacted to approximately of ASTM Method | | | |
| Initial water content % | Dry unit weight lbf/ft3 | | |
| Organic Matter | % | | |
| Unified Soil Classification **AASHTO M145** | | | |
| Group Symbol: **A-6(5)** | Name: **Clayey Sand** | | |

| | | Result | Specs. |
|---|---|---|---|
| Los Angeles (LA) Abrasion | Grading rev., % loss | | |
| | Grading rev., % loss | | |
| Fractured Faces By Weight | One or more, % | | |
| | Two or more, % | | |
| Total Salts (Solubility) | % | | |
| Sulfates | % | | |
| Chlorides | | | |
| pH Determination | pH | | |
| Minimum Resistivity | ohm-cm | | |
| Expansion Index of Soil | EI | | |
| | Initial dry unit weight, lbf/ft3 | | |
| | Initial degree of saturation | | |
| Initial water content, % | Final water content, % | | |

Comments:





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# Soil / Aggregate Test Report

Client **STATE OF NEW MEXICO EMNRD**
**1220 SOUTH ST FRANCIS DRIVE**
**SANTA FE , NM**

Date of Report **03/26/24**
Job No. **32-223560-0**
Event No. **14 (0-5)**
Authorized By **A. Kaba**
Sample Location Designated By
Sampled By **S. O'Herron-Alex**
Submitted By **L. Anderson**



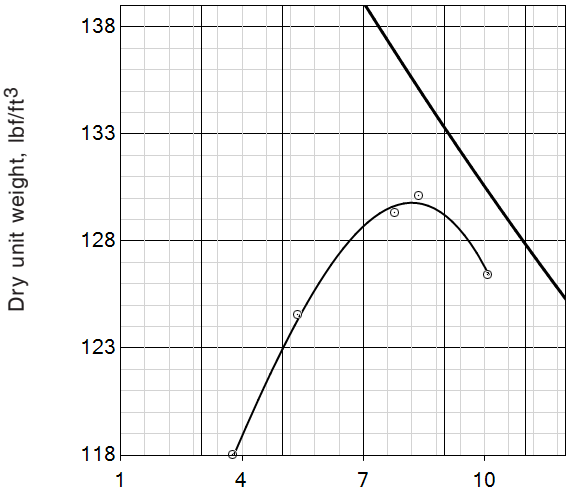
Lab No. **50534**
Date **01/17/24**
Date
Date **01/17/24**
Date **03/26/24**

Project **MADRID STORMWATER AND EROSION CONTROL PROJECT**
Project Address **ICE HOUSE ROAD TO FIREHOUSE LANE, MADRID, NM**
Material Description **A-2-4 (0)**
Material Use **Clayey SAND with Gravel**
Material Source **B 14 (0-5')**
Sample Location
Special Instructions

Sieve analysis **AASHTO T27 Non-Referee**
Finer Than No. 200 **AASHTO T11, Procedure A**

| Sieve | Accumulative % passing | Specification |
|---|---|---|
| 6 in. | | |
| 4 in. | | |
| 3 in. | | |
| 2 in. | | |
| 1-1/2 in. | | |
| 1 in. | **100** | |
| 3/4 in. | **96** | |
| 1/2 in. | **86** | |
| 3/8 in. | **80** | |
| 1/4 in. | **79** | |
| No. 4 | **70** | |
| No. 8 | **62** | |
| No. 10 | **61** | |
| No. 16 | **56** | |
| No. 30 | **50** | |
| No. 40 | **44** | |
| No. 50 | **41** | |
| No. 100 | **29** | |
| No. 200 | **29** | |

Laboratory compaction characteristics **ASTM D1557** Method **C**




Sample Preparation **Moist**

Rammer Used **Mechanical**

Proctor curve Id. No. **2**
Maximum dry unit weight, lbf/ft³ **129.8**
Optimum water content, % **8.2**

Oversize Aggregate
Assumed bulk specific gravity **2.60**
Assumed absorption, % **1.0**
Oversize in laboratory sample, % **0**

| | | Result | Specs. |
|---|---|---|---|
| Liquid Limit, Plastic Limit & Plasticity Index | | | |
| Preparation method | **Oven-dried** | | |
| Processing method | **ASTM D4318, Dry Preparation** | | |
| Liquid Limit | **ASTM D4318, Method B** LL | **27** | |
| Plastic Limit | **ASTM D4318** PL | **17** | |
| Plasticity Index | **ASTM D4318** PI | **10** | |
| Water Content | **AASHTO T265** % dry weight | **7.0** | |
| Swell Test | Surcharge psf Expansion, % | | |
| Compacted to approximately of ASTM Method | | | |
| Initial water content % | Dry unit weight lbf/ft3 | | |
| Organic Matter | % | | |
| Unified Soil Classification **AASHTO M145** | | | |
| Group Symbol: **A-2-4(0)** | Name: **Clayey Sand with Gravel** | | |

| | | Result | Specs. |
|---|---|---|---|
| Los Angeles (LA) Abrasion | Grading rev., % loss | | |
| | Grading rev., % loss | | |
| Fractured Faces By Weight | One or more, % | | |
| | Two or more, % | | |
| Total Salts (Solubility) | % | | |
| Sulfates | % | | |
| Chlorides | | | |
| pH Determination | pH | | |
| Minimum Resistivity | ohm-cm | | |
| Expansion Index of Soil | EI | | |
| | Initial dry unit weight, lbf/ft3 | | |
| | Initial degree of saturation | | |
| Initial water content, % | Final water content, % | | |

Comments:





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# Soil / Aggregate Test Report

Client **STATE OF NEW MEXICO EMNRD**
**1220 SOUTH ST FRANCIS DRIVE**
**SANTA FE , NM**

Date of Report **03/26/24**
Job No. **32-223560-0**
Event No. **15 (0-5)**
Authorized By **A. Kaba**
Sample Location Designated By
Sampled By **S. O'Herron-Alex**
Submitted By **L. Anderson**



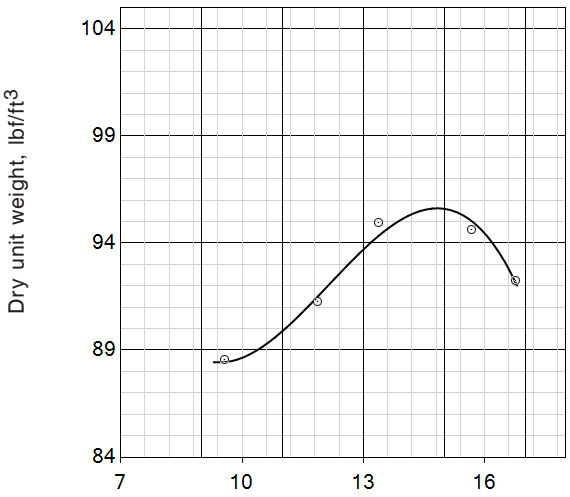
Lab No. **50638**
Date **01/17/24**
Date
Date **01/17/24**
Date **03/26/24**

Project **MADRID STORMWATER AND EROSION CONTROL PROJECT**
Project Address **ICE HOUSE ROAD TO FIREHOUSE LANE, MADRID, NM**
Material Description **A-1-b (0)**
Material Use **Silty SAND with Gravel**
Material Source **B 15 (0-5')**
Sample Location
Special Instructions

Sieve analysis **AASHTO T27 Non-Referee**
Finer Than No. 200 **AASHTO T11, Procedure A**

| Sieve | Accumulative % passing | Specification |
|---|---|---|
| 6 in. | | |
| 4 in. | | |
| 3 in. | | |
| 2 in. | | |
| 1-1/2 in. | | |
| 1 in. | | |
| 3/4 in. | **100** | |
| 1/2 in. | **97** | |
| 3/8 in. | **94** | |
| 1/4 in. | **93** | |
| No. 4 | **84** | |
| No. 8 | **71** | |
| No. 10 | **68** | |
| No. 16 | **56** | |
| No. 30 | **43** | |
| No. 40 | **37** | |
| No. 50 | **32** | |
| No. 100 | **23** | |
| No. 200 | **17** | |

Laboratory compaction characteristics **ASTM D1557** Method **A**




Sample Preparation **Moist**

Rammer Used **Manual**

Proctor curve Id. No. **5**
Maximum dry unit weight, lbf/ft³ **95.6**
Optimum water content, % **14.8**

Oversize Aggregate
Assumed bulk specific gravity **2.60**
Assumed absorption, % **1.0**
Oversize in laboratory sample, % **0**

| | | Result | Specs. |
|---|---|---|---|
| Liquid Limit, Plastic Limit & Plasticity Index | | | |
| Preparation method | **Oven-dried** | | |
| Processing method | **ASTM D4318, Dry Preparation** | | |
| Liquid Limit | **ASTM D4318, Method B** LL | **NV** | |
| Plastic Limit | **ASTM D4318** PL | | |
| Plasticity Index | **ASTM D4318** PI | **NP** | |
| Water Content | **AASHTO T265** % dry weight | **12.5** | |
| Swell Test | Surcharge psf Expansion, % | | |
| Compacted to approximately of ASTM Method | | | |
| Initial water content % | Dry unit weight lbf/ft3 | | |
| Organic Matter | % | | |
| Unified Soil Classification | **AASHTO M145** | | |
| Group Symbol: **A-1-b(0)** | Name: **Silty Sand with Gravel** | | |

| | | Result | Specs. |
|---|---|---|---|
| Los Angeles (LA) Abrasion | Grading rev., % loss | | |
| | Grading rev., % loss | | |
| Fractured Faces By Weight | One or more, % | | |
| | Two or more, % | | |
| Total Salts (Solubility) | % | | |
| Sulfates | % | | |
| Chlorides | | | |
| pH Determination | pH | | |
| Minimum Resistivity | ohm-cm | | |
| Expansion Index of Soil | EI | | |
| | Initial dry unit weight, lbf/ft3 | | |
| | Initial degree of saturation | | |
| Initial water content, % | Final water content, % | | |

Comments:





Reviewed By **JAMES DACY, LAB SUPERVISOR**

Western Technologies
An RMA Company

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488 • wt-us.com

# Soil / Aggregate Test Report

Client **STATE OF NEW MEXICO EMNRD**
**1220 SOUTH ST FRANCIS DRIVE**
**SANTA FE , NM**

Date of Report **03/26/24**
Job No. **32-223560-0**
Event No. **16 (0-5)**
Authorized By **A. Kaba**
Sample Location Designated By
Sampled By **S. O'Herron-Alex**
Submitted By **L. Anderson**



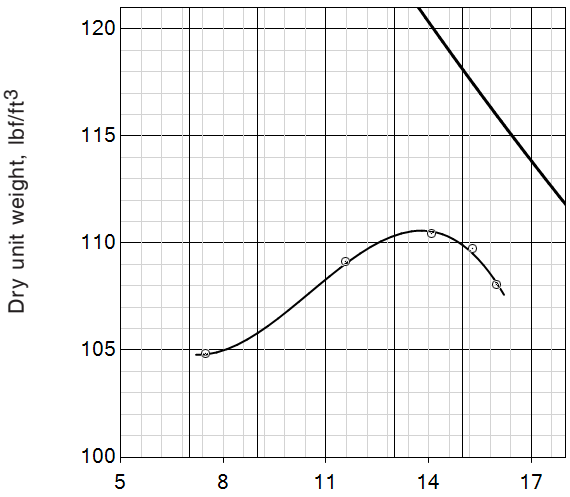
Lab No. **50609**
Date **01/17/24**
Date
Date **01/17/24**
Date **03/26/24**

Project **MADRID STORMWATER AND EROSION CONTROL PROJECT**
Project Address **ICE HOUSE ROAD TO FIREHOUSE LANE, MADRID, NM**
Material Description **A-1-b (0)**
Material Use **Silty SAND with Gravel**
Material Source **B 16 (0-5')**
Sample Location
Special Instructions

Sieve analysis **AASHTO T27 Non-Referee**
Finer Than No. 200 **AASHTO T11, Procedure A**

| Sieve | Accumulative % passing | Specification |
|---|---|---|
| 6 in. | | |
| 4 in. | | |
| 3 in. | | |
| 2 in. | | |
| 1-1/2 in. | | |
| 1 in. | **100** | |
| 3/4 in. | **89** | |
| 1/2 in. | **85** | |
| 3/8 in. | **80** | |
| 1/4 in. | **80** | |
| No. 4 | **67** | |
| No. 8 | **57** | |
| No. 10 | **55** | |
| No. 16 | **49** | |
| No. 30 | **41** | |
| No. 40 | **37** | |
| No. 50 | **34** | |
| No. 100 | **25** | |
| No. 200 | **16** | |

Laboratory compaction characteristics **ASTM D1557** Method **A**




Sample Preparation **Moist**

Rammer Used **Manual**

Proctor curve Id. No. **4**
Maximum dry unit weight, lbf/ft³ **110.6**
Optimum water content, % **13.8**

Oversize Aggregate
Assumed bulk specific gravity **2.60**
Assumed absorption, % **1.0**
Oversize in laboratory sample, % **0**

| | | Result | Specs. |
|---|---|---|---|
| Liquid Limit, Plastic Limit & Plasticity Index | | | |
| Preparation method | **Oven-dried** | | |
| Processing method | **ASTM D4318, Dry Preparation** | | |
| Liquid Limit | **ASTM D4318, Method B** LL | **NV** | |
| Plastic Limit | **ASTM D4318** PL | | |
| Plasticity Index | **ASTM D4318** PI | **NP** | |
| Water Content | **AASHTO T265** % dry weight | **10.1** | |
| Swell Test | Surcharge psf Expansion, % | | |
| Compacted to approximately | of ASTM Method | | |
| Initial water content % | Dry unit weight lbf/ft3 | | |
| Organic Matter | % | | |
| Unified Soil Classification | **AASHTO M145** | | |
| Group Symbol: **A-1-b(0)** | Name: **Silty Sand with Gravel** | | |

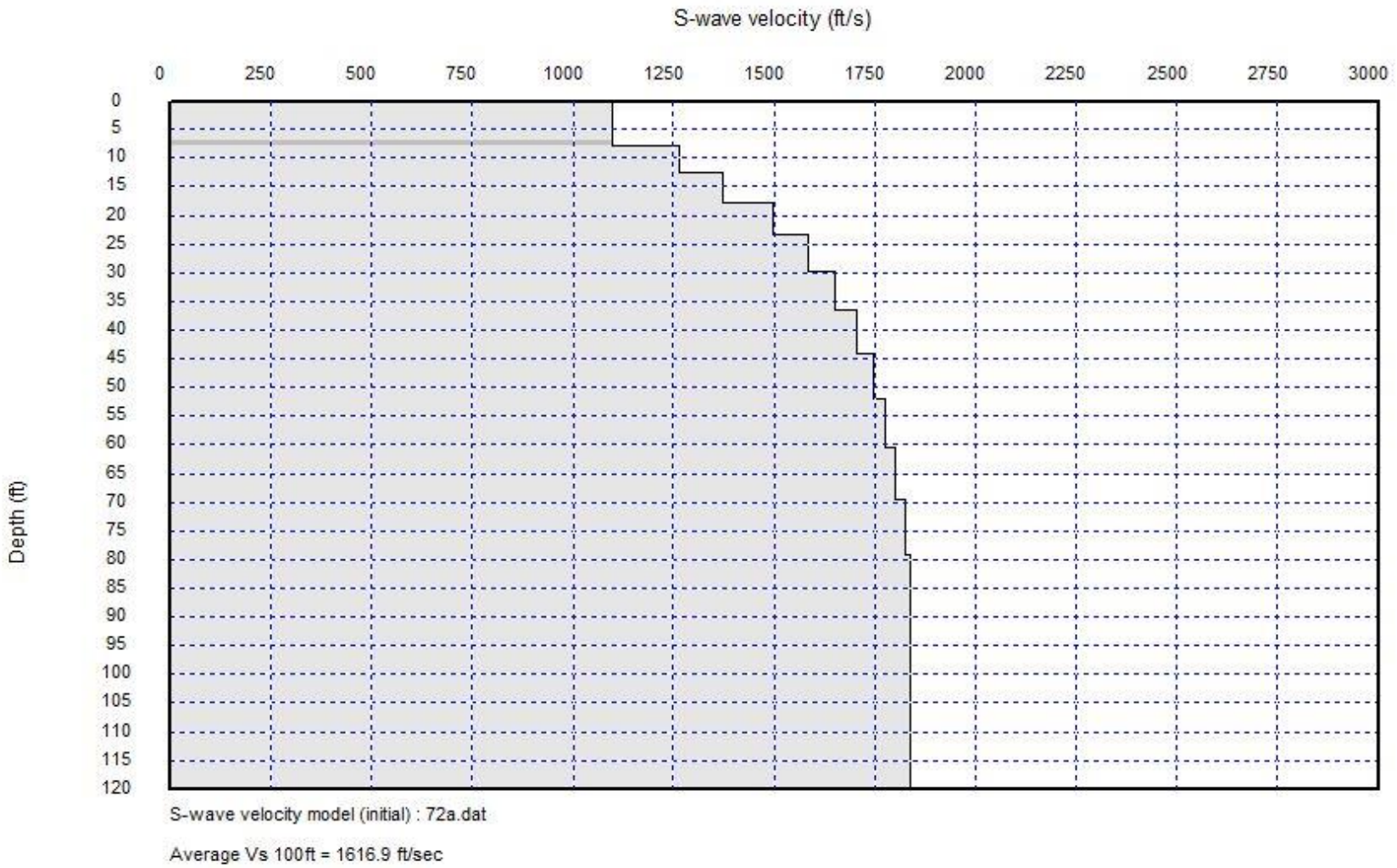
| | | Result | Specs. |
|---|---|---|---|
| Los Angeles (LA) Abrasion | Grading rev., % loss | | |
| | Grading rev., % loss | | |
| Fractured Faces By Weight | One or more, % | | |
| | Two or more, % | | |
| Total Salts (Solubility) | % | | |
| Sulfates | % | | |
| Chlorides | | | |
| pH Determination | pH | | |
| Minimum Resistivity | ohm-cm | | |
| Expansion Index of Soil | EI | | |
| | Initial dry unit weight, lbf/ft3 | | |
| | Initial degree of saturation | | |
| Initial water content, % | Final water content, % | | |

Comments:





Reviewed By **JAMES DACY, LAB SUPERVISOR**




**AVS = 1616.9 ft/s**

**Site Classification is Class C**

*Geotechnical*
*Environmental*
*Inspections*
*Materials*

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PROJECT: **CMADRID STORMWATER**

JOB NO.: **32-223560-0**

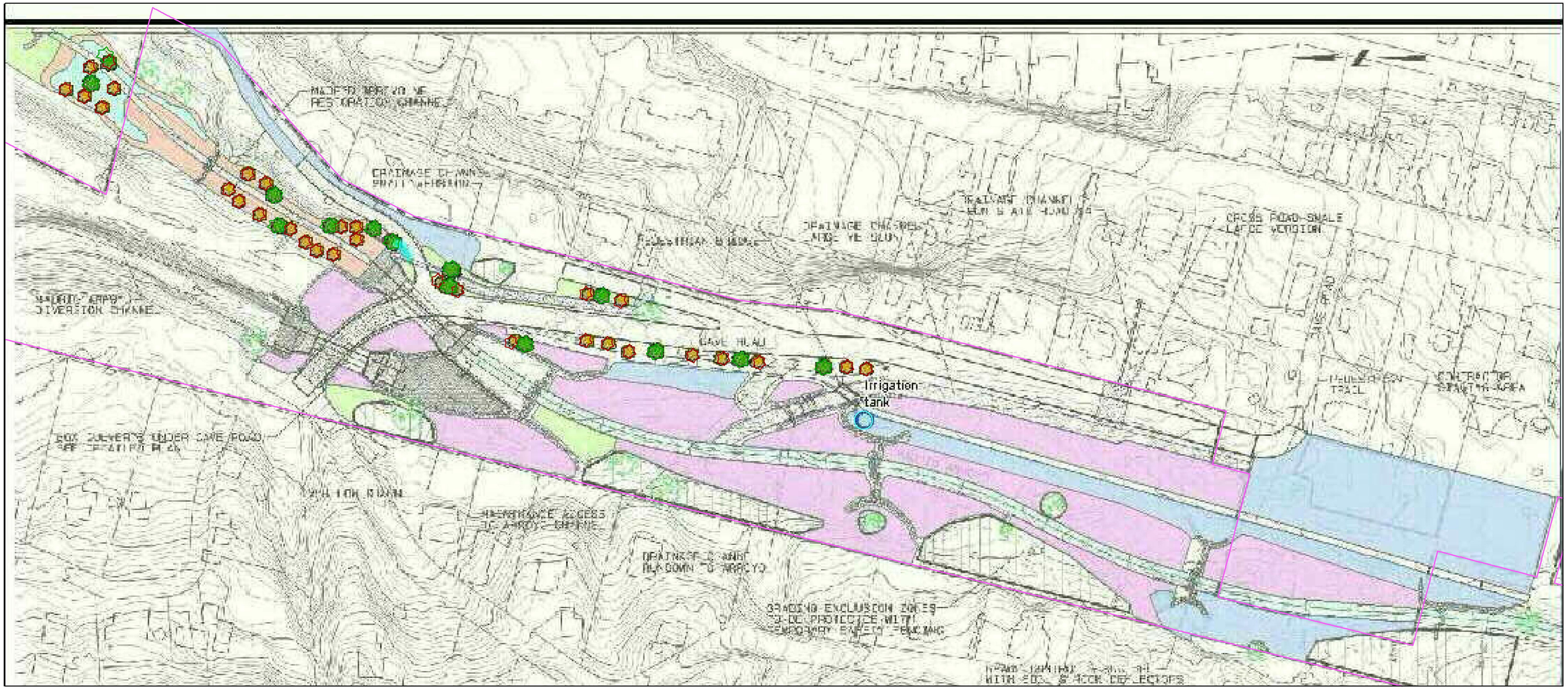
PLATE

**C-1**

## SHEAR WAVE VELOCITY PROFILE

# ATTACHMENT B
# MADRID ARROYO REVEGETATION PLAN

N




0 50' 100' 200'

Riverbend Engineering, LLC

5929 Pauline Ave NW Albuquerque, NM 87107

Tel: 505.344.3315 Website: www.riverrestoration.com

Madrid Drainage Improvements

Madrid, NM

Sheet 1 of 1

DBS&A PLANTING PLAN

Scale: 1" = 50 ft

6-20-2024

# ATTACHMENT C
# NMDOT SECTION 416 – MINOR PAVING

# SECTION 416: MINOR PAVING

## 416.1 DESCRIPTION

This Work consists of constructing one (1) or more pavement courses of Hot Mix Asphalt (HMA) or Warm Mix Asphalt (WMA) on a prepared base or milled surface, and to include crushing, stockpiling, hauling, asphalt binder, mineral admixture, mix design, mixing, providing cold feeds, process control testing, and placement.

## 416.2 MATERIALS

The Contractor shall use Materials for minor paving in accordance with Section 423.2, “Materials.”

## 416.3 CONSTRUCTION REQUIREMENTS

The Contractor shall perform minor paving in accordance with the following 423 Sections or the correlating 424 Sections:

1. Section 423.3.1, “Construction Requirements, General;”
2. Section 423.3.2, “Mix Temperature Requirements;”
3. Section 423.3.3, “Addition of Mineral Admixtures;”
4. Section 423.3.4, “Equipment;” and
5. Section 423.3.5, “Placement Operations” excluding 423.3.5.7, “Test Strip & Shakedown Period.”

No referee testing will be required for Minor Paving, but may be used if both parties agree in writing at the Pre-Pave Conference. If used, referee testing will be done in accordance with Sections 423.3.7, “Dispute Resolution” and 424.3.7, “Dispute Resolution.”

### 416.3.1 Sampling and Testing

#### 416.3.1.1 Contractor Quality Control

The Contractor shall provide quality control measures in accordance with Section 902, “Quality Control.”

#### 416.3.1.2 Department Quality Assurance

The Department will provide quality assurance measures in accordance with Section 903, “Quality Assurance.”

##### 416.3.1.2.1 Acceptance

The Department will Accept the constructed product based on inspection and on Laboratory testing for conformance with the Contract. The Department will test samples of HMA/WMA taken from the Roadway before compaction. The Department will Accept the constructed product based on the following criteria:

1. Air voids as determined from Laboratory-compacted specimens in accordance with AASHTO T 166 and AASHTO T 209;
2. Asphalt content as determined by the tank strap method or plant asphalt metering system defined in the Contractor’s Quality Control Plan (binder ignition oven calibration samples will not be required);

3. Final thickness of the compacted Material as measured from cores in accordance with ASTM D 3549; and
4. Density of the compacted Roadbed as determined in accordance with AASHTO T 310, Standard Method of Test for In-Place Density and Moisture Content of Soil-Aggregate by Nuclear Methods (Shallow Depth). Daily densities will be calculated using the current running average Gmm for the lot. The Contractor shall provide cores from three (3) locations designated by the Project Manager for correlation with the Nuclear Densometer. A new correlation factor can be requested if a change in Materials or conditions has occurred or if the accuracy of the established correlation factor is in question.

The Project Manager may reject Material that appears to be defective based on visual inspection.

Department representatives, certified in the relevant test procedures by the State Materials Bureau through TTCP, will perform Acceptance testing in accordance with AASHTO or Department methods, using the test methods and modifications in the current TTCP Manual.

# ATTACHMENT D
# NMDOT SECTION 423 – HOT MIX ASPHALT (HMA) (MAJOR PAVING)

## SECTION 423: HOT MIX ASPHALT (HMA) (MAJOR PAVING)

### 423.1 DESCRIPTION

This Work consists of constructing one (1) or more pavement courses of Hot-Mix Asphalt (HMA) on a prepared base, to include crushing, stockpiling, hauling, binder, mineral admixture, mix design, mixing, providing cold feeds, process control testing and placement.

### 423.2 MATERIALS

#### 423.2.1 General

HMA is a mixture of asphalt binder, aggregate, blending sand, mineral filler, and mineral admixture. Unless otherwise prohibited in the Contract, the Department will allow Recycled Asphalt Pavement (RAP) in HMA mixtures as long as the resulting mixture conforms to all Specification requirements.

The Contractor shall size, uniformly grade, and combine aggregate fractions in accordance with the Contract. The Contractor shall test Materials in accordance with applicable AASHTO/ASTM methods, as modified by the Department (if applicable) or other test procedures as directed by the Department. The State Materials Bureau will decide all questions pertaining to the interpretation of test procedures.

#### 423.2.2 Aggregate

The Contractor shall ensure the aggregate gradation of the HMA mixture meets the requirements of Table 540
.2.2.1:1, “HMA Aggregate Gradation Control Points.” The Project Manager may require, at no additional cost to the Department, wet preparation, per AASHTO T 146, Method A, if the Project Manager determines there are Deleterious Materials present in the aggregate stockpiles before aggregate gradation testing. The Contract will specify the type of HMA the Contractor is to use. The Department will allow the Contractor to combine Materials from two (2) or more sources to produce aggregate only when each individual aggregate source meets all applicable quality requirements.

#### 423.2.2.1 Gradation and Quality Requirements

**Table 423.2.2.1:1**
**HMA Aggregate Gradation Control Points**

| | % passing per HMA type | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | SP-II | | SP-III | | SP-IV | | SP-V | |
| Sieve size | Min | Max | Min | Max | Min | Max | Min | Max |
| Two (2) inch | — | — | — | — | — | — | — | — |
| 1 1/2 inch | 100 | — | — | — | — | — | — | — |
| One (1) inch | 90 | 100 | 100 | — | — | — | — | — |
| 3/4 inch | — | 90 | 90 | 100 | 100 | — | — | — |
| 1/2 inch | — | — | — | 90 | 90 | 100 | 100 | |
| 3/8 inch | — | — | — | — | — | 90 | 90 | 100 |
| No. 8 | 19 | 45 | 23 | 49 | 28 | 58 | 32 | 67 |
| No. 200 | 1.0 | 7.0 | 2.0 | 8.0 | 2.0 | 10.0 | 2.0 | 10.0 |

#### 423.2.2.1.1 Aggregate Quality

For each Material source, the Contractor shall ensure the HMA coarse aggregate has an AI of 25 or less when calculated in accordance with Section 901, "QUALITY CONTROL/QUALITY ASSURANCE (QC/QA)."

The Contractor shall regulate the crushing of aggregate to:

1. Minimum Fractured Faces content of the plus No. 4 Material complies with the requirements of Table 423.2.2.1.2:1, "Fractured Faces, Sand Equivalent, and Fine Aggregate Angularity," and evaluation by AASHTO 335-09, "*Fractured Face Determination for Coarse Aggregate;*"
2. Ensure the combined plus 3/8 inch material contains no more than 20% flat, elongated particles with a dimensional ratio of 3:1 or greater as determined by ASTM D 4791 (TTCP Modified);
3. Ensure the combined Material, excluding RAP; passing the No. 40 sieve is non-plastic;
4. Ensure that before the addition of mineral admixtures, the minimum sand equivalent value and the minimum fine aggregate angularity value of the combined aggregate, excluding RAP, complies with the requirements of Table 423.2.2.1.2:1, "Fractured Faces, Sand Equivalent, and Fine Aggregate Angularity;" and
5. Determine the Sand Equivalent value in accordance with AASTHO T 176, Alternate Method No. 1, and Fine Aggregate Angularity value in accordance with AASHTO T 304, Method A.

#### 423.2.2.1.2 Fractured Faces

The Department will consider a face to be fractured when at least one-half of the projected particle area exhibits a rough, angular, or broken texture with well-defined edges.

**Table 423.2.2.1.2:1**
**Minimum Fractured Faces, Sand Equivalent, and Fine Aggregate Angularity for Virgin Aggregates**

| Design Traffic, ESALs[a] x $10^6$ | Fractured Faces[b] | Sand Equivalent (%) | Fine Aggregate Angularity |
|---|---|---|---|
| < 3.0 | 75.0 / — | 45.0 | 40.0 |
| ≥ 3.0 – < 10.0 | 85.0 / 80.0 | 45.0 | 45.0 |
| ≥ 10.0 – < 30.0 | 95.0 / 90.0 | 45.0 | 45.0 |
| ≥ 30.0 | 99.0 / 95.0 | 50.0 | 45.0 |

[a]ESALs are based on a 20-year design life for all scenarios.

[b]Under "Fractured Faces," 85.0 / 80.0 denotes that 85.0% of the coarse aggregate has at least one (1) Fractured Face and 80.0% has at least two (2) Fractured Faces.

Ensure RAP provided from sources outside the Project has at least 75% Fractured Faces (one (1) Fractured Face); however, Sand Equivalent and Fine Aggregate Angularity do not apply.

#### 423.2.2.2 Production

When producing aggregates for HMA, the Contractor shall:

1. Remove natural fines by screening and stockpiling separately;

2. Use a No. 4 screen, minimum, or a larger screen if needed to properly control the crushing and screening operation;
3. Crush the aggregate retained on the scalping screen and separate the crushed Material into at least two (2) stockpiles of fine and coarse aggregates; and
4. Regulate crushing operations to produce Material that meets design requirements when combined.

#### 423.2.2.3 Stockpiling

The following requirements apply to stockpiles, the Contractor shall:

1. Place stockpiles upon prepared sites;
2. Make stockpiles neat and regular to prevent segregation;
3. Provide enough storage space for each size of aggregate;
4. Separate the aggregate stockpiles far enough apart to prevent mixing, or with walls or partitions;
5. Prevent contamination (store stockpiles away from vehicular and Equipment traffic);
6. Keep the storage yard neat and orderly and keep the stockpiles accessible for sampling; and
7. Keep the aggregate sizes separated until delivered to the cold feed system that feeds the drier.

#### 423.2.2.4 Combining

When combining crushed Materials from different stockpiles, including RAP (if in the mixture); the Contractor shall ensure the product is in accordance with the mix design gradation requirements. The Contractor shall use controlled feeders from each stockpile to combine crushed Material.

### 423.2.3 Asphalt Binder

The Contract will specify the type and grade of asphalt binder. The Contractor shall provide asphalt binders in accordance with Section 402, “Asphalt Materials and Mineral Admixtures.” The Contractor shall not change the asphalt source after approval of the mix design without written approval of the State Materials Bureau.

### 423.2.4 Mineral Admixtures

The Contractor shall provide mineral admixtures in accordance with Section 402, “Asphalt Materials and Mineral Admixtures.”

### 423.2.5 Blending Sand

Blending sand consists of the following:

1. Natural fines from the scalping process;
2. Concrete sand;
3. Sandy Material; or
4. A combination of these, graded to the mix design requirements.

The Contractor shall determine the need for and percentage (a maximum of 20.0%) of blending sand using mix design tests on samples taken from stockpiles during crushing operations and submitted to an approved testing Laboratory.

### 423.2.6 Mineral Filler

The Contractor shall, if required by mix design, provide mineral filler in accordance with AASHTO M 17 and approved by the State Materials Bureau. The Department will not allow fly ash as mineral filler for HMA.

### 423.2.7 Reclaimed Asphalt Pavement (RAP)

Unless otherwise specified in the Contract, the Contractor may use RAP removed under the Contract consisting of salvaged, milled, pulverized, broken, or crushed asphalt pavement. The Contractor may use RAP produced from outside sources provided the following is met: after the Contractor obtains sufficient quantities of RAP aggregate samples in accordance with AASHTO T 308; the Department will Accept RAP for which the coarse aggregate has a percent wear of 40.0 or less, at 500 revolutions, when tested in accordance with AASHTO T 96. The Contractor shall provide plus No. 4 RAP Material with a minimum of 75% Fractured Faces content (one (1) face). The Department will make no additional payment for the asphalt binder in the RAP or asphalt binder due to asphalt binder grade adjustment.

The Contractor may use a maximum of 15% RAP (by weight) in the production of HMA mixtures without changing the asphalt binder.

For quantities greater than 15% and up to 25% RAP, the Contractor shall:

1. Either lower the asphalt binder's high and low temperature grades by one (1) grade (e.g. lower a PG 76-22 to a PG 70-28); or
2. Extract, recover, and combine the RAP's asphalt binder with a virgin asphalt binder per AASHTO M 323, Appendix A, ensuring the resultant binder meets the entire AASHTO M 320 (excluding direct tension) required Project PG asphalt binder properties indicated on the approved mix design.

For quantities greater than 25% and up to 35% RAP, the Contractor shall:

1. Extract, recover, and combine the RAP's asphalt binder with a virgin asphalt binder per AASHTO M 323, Appendix A; and
2. Ensure the resultant binder meets the entire AASHTO M 320 (excluding direct tension) required Project PG asphalt binder properties indicated on the approved mix design.

The Department will not allow the Contractor to use more than 35% RAP in the production of HMA mixtures.

For Projects of entirely new construction, the Contractor shall:

1. Limit the RAP to 15% in the top mat or extract, recover and combine the RAP's asphalt binder with a virgin asphalt binder per AASHTO M323, Appendix A; and
2. Ensure the resultant binder meets the entire AASHTO M320 (excluding direct tension) required Project PG asphalt binder properties indicated on the approved mix design.

If Plus Grades of PG asphalt binder is specified on the project, for quantities greater than 15% RAP, the Contractor shall extract, recover, and combine the RAP's asphalt binder with a virgin asphalt binder per AASHTO M 323, Appendix A. The Contactor shall ensure the

resultant binder meets the entire AASHTO M 320 required Project PG asphalt binder properties indicated on the approved mix design including the additional Plus Grade requirements for Elastic Recovery and Solubility.

The Contractor shall:

1. Process RAP so that 100% passes a 1-1/2-inch sieve;
2. Maintain adequate stockpile management (i.e. sufficient quantities and shaping of the stockpiles);
3. Address in the Quality Control Plan how RAP will be controlled, such as which screen will be used to split into two (2) stockpiles, or by what method the RAP will be controlled to keep the resultant mix within Acceptable limits;
4. Account for the weight of the binder in the RAP when batching aggregates;
5. Provide RAP that is free of Deleterious Materials; and
6. Perform process control testing in accordance with Section 901, "Quality Control/Quality Assurance (QC/QA)" and Table 901.5:3, "Minimum Process Control Guidelines for Aggregates, Base Course, and RAP (QC);" as RAP is produced and prepared for inclusion in the HMA.

If problems with HMA consistency or compliance with Project Specifications occur, additional efforts taken to achieve Acceptable levels of consistency and compliance with Contract Specifications, at the Contractor's discretion (at no additional cost to the Department), include, but are not limited to:

1. Reduce the top size of the RAP from 1-1/2 inch to one (1) inch;
2. Fractionate the aggregates on a second screen, such as the 3/8 inch or ¼ inch Screen so that the RAP is maintained in three (3) stockpiles, one being RAP larger than 1-1/2 inch to two (2) inches, Coarse RAP and the third being Fine RAP;
3. Ensure that the RAP used in the HMA mix design is representative of the RAP available on the Project;
4. Cover the RAP pile(s) so that ambient moisture is not absorbed; and
5. Process and maintain the stockpiles so that the RAP Material is equally and uniformly distributed throughout the entire stockpile(s) and is withdrawn such that uniform, non-segregated RAP is delivered to the hoppers.

### 423.2.8 Mix Design

The Contractor shall provide a mix design developed by a Department approved testing Laboratory, reviewed and signed by a professional Engineer licensed by the New Mexico Board of Registration for Professional Engineers and Land Surveyors. A list of approved private testing laboratories is available from the State Materials Bureau. The Contractor shall develop the mix design at no additional cost to the Department. The Contractor may develop the mix design at any time prior to the Project Pre-Paving Conference.

The Contractor shall provide to the State Asphalt Engineer the mix design developed in accordance with the Contract documents and AASHTO R35 as modified by NMDOT for review and concurrence. The Contractor shall summarize the mix design results from the Department approved testing Laboratory in a format approved by the State Materials Bureau. Department concurrence of a mix design will not relieve the Contractor of full responsibility for producing an Acceptable mixture. The mix design may require adjustment in accordance with Section 423.2.9, "Job Mix Formula."

The Department will require a minimum of one percent (1.0%) for mix designs that include hydrated lime, anhydrite based Material, or Portland cement. The Contractor shall include these mineral admixtures in the gradation for developing the mix design. AASHTO T 354 may be used in lieu of AASHTO T 84/T 85. If lubricating antistrip is used as a mineral admixture, the percent dosage shall be done in accordance with the manufacturer's recommendation and approved by the Contractor's design Lab. Lubricating antistrip shall be approved by the Department and included in the most current Approved Products List (APL). The mix design shall be in accordance with Table 423.2.8:1, "HMA Superpave Design Requirements for Aggregates with Less Than three percent (3.0%) Absorption," or Table 423.2.8:2, "HMA Superpave Design Requirements for Aggregates with three percent (3.0%) or Greater Absorption."

The Contractor shall test the HMA in accordance with AASHTO T 283, as indicated below:

1. Use six (6) inch diameter specimens; Compact all test specimens in accordance with AASHTO T 312;
2. Conditioned specimens shall include one (1) freeze thaw cycle;
3. On the AASHTO T283 Section 11.3 scale of zero (0)-five (5), with five (5) exhibiting the most damage from moisture, visually estimate the amount of damage caused by moisture on the interior surfaces of each broken specimen; and
4. The tensile stress ratio shall be a minimum of 85%.

The Contractor shall provide a mixture that meets all applicable criteria. If tests indicate the need for additives or modifiers not specified in the Contract or a change in source of binder to satisfy mix design requirements, the Contractor shall perform the required changes at no additional cost to the Department.

**Table 423.2.8:1**
**HMA Superpave Design Requirements for Aggregates with Less Than 3.0% Absorption**

| **20-year design ESALs** (a) | **N initial** | **N design** (b) | **N max** | **Percent Voids in the Mineral Aggregate (VMA) per nominal maximum aggregate size** | | | | **Voids Filled with Asphalt (VFA) Range, %** (c) | **Dust to Binder Ratio Range** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **One (1) inch (SP-II)** | **3/4 inch (SP-III)** | **1/2 inch (SP-IV)** | **3/8inch (SP-V)** | | |
| < 0.3 | <91.5 | 96.0 | < 98.0 | 12.5 – 14.0 | 13.5 – 15.0 | 14.5 – 16.0 | 15.5 – 17.0 | 72.0–80.0 | 0.6 to 1.4 |
| 0.3-3.0 | <90.5 | | | | | | | 68.0–78.0 | |
| ≥3.0 | <89.0 | | | | | | | 68.0–75.0 | |

**Table 423.2.8:1**
**HMA Superpave Design Requirements for Aggregates with Less Than 3.0% Absorption**

| 20-year design ESALs | N initial | N design (b) | N max | Percent Voids in the Mineral Aggregate (VMA) per nominal maximum aggregate size | Voids Filled with Asphalt (VFA) | Dust to Binder Ratio Range |
|---|---|---|---|---|---|---|

[a]In Millions.

[b]Design Air Void Content of four percent (4%).

[c]For one (1) inch nominal maximum size mixtures, the specified lower limit of the VFA shall be 70% for the design traffic level <0.3 million ESALs.

**Table 423.2.8:2**
**HMA Superpave Design Requirements for Aggregates with 3.0% or Greater Absorption**

| 20-year design ESALs (a) | N initial | N design (b) | N max | Percent Voids in the Mineral Aggregate (VMA) per nominal maximum aggregate size | | | | Voids Filled with Asphalt (VFA) Range, % (c) | Dust to Binder Ratio Range |
|---|---|---|---|---|---|---|---|---|---|
| | | | | One(1) inch (SP-II) | 3/4 inch (SP-III) | 1/2 inch (SP-IV) | 3/8 inch (SP-V) | | |
| <0.3 | <91.5 | | | | | | | 70.0–80.0 | |
| 0.3–<3.0 | <90.5 | 96.5 | < 98.0 | 12.0 – 14.0 | 13.0 – 15.0 | 14.0 – 16.0 | 15.0 - 17.0 | 65.0–78.0 | 0.6 to 1.4 |
| ≥3.0 | <89.0 | | | | | | | 65.0–78.0 | |

[a]In Millions.

[b]Design Air Void Content of 3.5%.

[c]For one (1) inch nominal maximum size mixtures, the specified lower limit of the VFA will be 70% for the design traffic level <0.3 million ESALs.

Department reviewed commercial mix designs are Acceptable for use on NMDOT Projects with the concurrence of the State Asphalt Engineer. The commercial mix design will be submitted for review and concurrence by the State Asphalt Engineer for conformance with the Contract documents and re-issued with Project information.

An approved mix design is valid up to one (1) year from the date of review. If the Aggregate Index expires within that year, a new Aggregate Index needs to be established in order to keep the mix design valid. The Contractor shall submit a new mix design if changing the source of Materials.

For Projects that are longer than one (1) year and aggregate Materials are produced and stockpiled the mix design and Aggregate Index (AI) may be approved for an extension by the State Asphalt Engineer.

### 423.2.9 Job Mix Formula

The Job Mix Formula (JMF) must be in accordance with all aggregate gradation requirements and result in a mix that meets all specified mix design requirements. The Department will refer to the result of the Laboratory mix design developed in accordance with Section 423.2.8, “Mix Design,” as JMF1.

#### 423.2.9.1 Job Mix Formula Adjustment

The Contractor may request a modification to the JMF based on field testing of Material produced through the plant. Test results and calculations that verify a proposed JMF adjustment complies with the Specifications will be required prior to being reviewed by the Project Manager, District Lab Supervisor, and concurred by the State Asphalt Engineer. Review and concurrence of a JMF adjustment can only be made after:

1. JMF adjustment results in a new TV that is within the tolerance from the design TV. (Example: If design TV for No. 4 sieve is 30%, then a new TV may be approved in the field from 23% - 37%);
2. Submittal by the Testing Laboratory responsible for the original mix design to the Project Manager with a copy to the State Asphalt Engineer;
3. Confirmation by the Project Manager that the Quality Control Plan is being followed; and
4. If the JMF is adjusted after the Shakedown Period, the Contractor shall terminate the current lot. Once the adjusted JMF has been reviewed and concurred by the Project Manager, Assistant District Engineer for Construction and the State Asphalt Engineer; the Contractor shall begin a new lot with the adjusted JMF.

### 423.3 CONSTRUCTION REQUIREMENTS

#### 423.3.1 General

The Contractor shall:

1. Provide sufficient storage space for each size of aggregate and RAP;
2. Keep the different sizes separate and ensure that segregation, degradation, or combination of Materials of different aggregate sizes does not occur until delivery to the cold feed system;
3. Re-screen or waste segregated or degraded Material;
4. Provide separate storage and feeder for mineral filler if the Contract requires mineral filler; and
5. If the Project Manager determines that uncoated aggregate exists, the Contractor shall take corrective action.

#### 423.3.2 Mix and Laydown Temperature Requirements

The Contractor shall not allow the temperature of the HMA discharged from the mixer into the transport vehicle to be greater or less than ten percent (10%) of the target mixing temperature specified in the mix design, not to exceed 350° F, unless written concurrence by the asphalt binder supplier and design lab are provided to the Project Manager.

HMA delivered to the Project with mix temperatures outside the acceptable laydown temperature range as specified in the mix design shall, at the sole discretion of the Project Manager, be removed and replaced at no cost to the Department.

#### 423.3.3 Addition of Mineral Admixtures

The Contractor shall:

1. Monitor the out feed of the mineral admixture with sensors that provide audible and visual signals to control the out feed with an accuracy of ± three percent (3.0 %) by weight;
2. Control the mineral admixture content such that it meets the range specified in the approved mix design;
3. Add the mineral admixture to the aggregate in an enclosed pug mill immediately after leaving the cold feed and just before introduction into the drier drum or aggregate drier; and
4. Minimize the loss of mineral admixture while adding to the aggregate.

When mixing the aggregate and mineral admixture, the Contractor shall maintain the moisture content of the combined aggregate at the recommended moisture content as shown on the approved mix design.

#### 423.3.4 Equipment

#### 423.3.4.1 Mixing Plants

##### 423.3.4.1.1 Plant Scales

The Contractor shall ensure that the scales are accurate to 0.5% of the maximum allowable load in accordance with the Federal Motor Carrier Safety Administration (FMCSA) publication, as certified by a licensed scale technician. The Contractor shall submit a copy of the certification to the Project Manager.

##### 423.3.4.1.2 Storage of Asphalt Binder Materials

The Contractor shall provide storage tanks for asphalt binder capable of holding, heating and circulating the asphalt at the required temperatures and measuring the temperature of the asphalt in the tank.

The Contractor shall allow measuring and sampling of asphalt binder from the delivery trucks upon arrival.

##### 423.3.4.1.3 Feeder for Drier

The Contractor shall equip the plant with an accurate feeding mechanism to deliver the aggregate into the drier and maintain uniform production.

##### 423.3.4.1.4 Drier

The Contractor shall equip the plant with a system to continuously agitate the aggregate during the heating and drying process. The Contractor shall use a drier that can dry and heat the aggregate and prevent fuel oil or carbon from coating the aggregate. The Contractor shall take corrective action if the aggregate becomes coated with burner fuel.

##### 423.3.4.1.5 Bins

The Contractor shall equip the plant with storage bins large enough to supply the mixer when it is operating at full capacity and arrange the bins to ensure separate and adequate

storage of the appropriate aggregate sizes. The Contractor shall equip the bins with warning devices that notify the control panel when the bins are low.

#### 423.3.4.1.6 Asphalt Binder Control Unit

The Contractor shall equip the plant with a scale or meter to control the rate of flow to determine the amount of asphalt binder added to the mix.

#### 423.3.4.1.7 Thermometers

The Contractor shall equip the discharge chute of the drier with a recording thermometer to register the temperature of the heated aggregates or mix. The Contractor shall provide the Project Manager with a record of discharge temperatures at the end of each week's production or as requested by the Project Manager.

#### 423.3.4.1.8 Truck Scales

The Contractor shall weigh the HMA on approved plant or truck scales provided by the Contractor or public scales in accordance with Section 109.1, "Measurement of Quantity."

#### 423.3.4.1.9 Requirements for Batching Plants

#### 423.3.4.1.9.1 Weigh Box or Hopper

The Contractor shall provide a batching plant that can accurately weigh aggregate in a weigh box or hopper suspended on scales. The Contractor shall use a weigh box or hopper that can hold a full batch. The Contractor shall ensure that the gate of the weigh box or hopper does not allow Material to leak into the mixer while being weighed. The Contractor shall test the scales in accordance with Section 109.1, "Measurement of Quantity."

#### 423.3.4.1.9.2 Mixer

The Contractor shall provide a batch mixer with a capacity of at least 2,000 lb, capable of producing a uniform mixture within specified tolerances.

#### 423.3.4.1.9.3 Control of Mixing Time

The Contractor shall equip the mixer with an accurate timing device that signals the end of the mixing time.

#### 423.3.4.1.10 Drum Mix Plants

The Contractor shall equip the drum mix plant with the following auxiliary Equipment and capabilities:

1. Separate cold feed controls for each Material;
2. An automatic interlocking device for cold feed, asphalt, and mineral admixtures;
3. A means for controlling moisture content of aggregate. A means for sampling individual cold feeds and provisions for sequential sampling of aggregate, RAP, asphalt binder, and mineral admixtures;
4. Equip the bins with mechanical or electrical devices that provide an audible or visual warning when the bins are less than 1/4 full;
5. Bins shall be designed and equipped to prevent segregation;

6. Equip the bin containing fine aggregate and filler, if required, with a device that prevents Material hang-up during plant operation;
7. A minimum of one (1) cold feed bin for each aggregate size in the mix;
8. Equip the cold feed with mechanical or electrical devices that indicate with an audible or visual warning when the cold feed belt is not carrying the proper amount of Material;
9. A separate cold feed for RAP Material. Introduce RAP so that it does not come into direct contact with the burner flame; and
10. Couple the asphalt feed control with the total-aggregate-weight measurement device to automatically vary the asphalt feed rate to maintain the required proportion.

#### 423.3.4.2 Haul Equipment

The Contractor shall haul asphalt mixtures with trucks that are tarped and have tight, clean, smooth metal beds and a thin coat (a minimal amount) of a Department approved release agent in accordance with Section 423.3.4.2.1, “Asphalt Release Agent (ARA).”

#### 423.3.4.2.1 Asphalt Release Agent (ARA)

The Contractor shall use Asphalt Release Agents (ARA) for prevention of asphalt mixtures adhering to haul trucks and any other type of Equipment that is used for asphalt paving operations. ARA shall meet the requirements of Table 423.3.4.2.1:1, “Asphalt Release Agent Properties” and shall be on the NMDOT’s Approved Products List. All testing will be in accordance with NTPEP Evaluation of Asphalt Release Agents AASHTO ARA 14.

**Table 423.3.4.2.1:1**
**Asphalt Release Agent Properties**

| Test | Result |
|---|---|
| 7-Day Asphalt Stripping Test | |
| Diluted | No Stripping |
| Full Strength | No Stripping |
| Mixture Slide Test (truck beds) | 10 g retained, maximum |
| Asphalt Performance Test | Does not fall after 3 pours |

#### 423.3.4.3 Pavers

The Contractor shall use self-contained, self-propelled pavers, with activated screeds or strike-off assemblies, heated if necessary, and capable of spreading and finishing courses of HMA in accordance with the Plans.

#### 423.3.4.4 Compaction Equipment

The Contractor shall provide a sufficient number, weight, and type of rollers to obtain the required compaction and specified pavement density while the HMA is in a workable condition. All rollers must be capable of reversing direction without shoving or tearing the mixture.

### 423.3.5 Placement Operations

For cold milled surfaces, the Contractor shall prepare the surface in accordance with Section 414, “Cold Milling.” The Contractor shall clean the existing surfaces and apply a tack coat as required in the Plans or at an application rate as approved by the Project Manager in accordance with Section 407, “Tack Coat.”

The Contractor shall place HMA on prepared Base Course in accordance with Section 303, “Base Course.” The Contractor shall apply prime coat as required in the Plans or at an application rate as approved by the Project Manager in accordance with Section 408, “Prime Coat.”

The Contractor shall place the HMA on the Accepted surface, spread and compact to specified width, lift thickness, and cross slope in accordance with the Plans.

Materials Transfer Vehicle (MTV): The Contractor shall use a MTV with storage and remixing capabilities on all mainline construction that utilizes greater than 25% RAP when placing HMA State approved designs. The MTV will independently remix and deliver mixture from the hauling Equipment to the paving Equipment.

The Contractor shall furnish an MTV with the following capabilities:

1. An unloading system to receive mixtures from the hauling Equipment;
2. A minimum storage capacity of 13 tons with a remixing system in the MTV storage bin;
3. A discharge conveyor to deliver the mixture to the paver hopper; and
4. The MTV system cannot exceed maximum legal loading on Structures.

Pick-up machines, hopper inserts and Material transfer devices are not considered MTVs.

In the event the MTV malfunctions during paving operations, the Contractor can finish the Day without the MTV. The Contractor shall not resume further mainline mix placement until the MTV is operational.

Consistently overloading the HMA mix into the paving machine is not Acceptable. The Contractor shall coordinate the speed of the paving machine with the production of the plant and keep enough haul Equipment available to achieve continuous operation.

The Contractor shall use the control system on the paving machine to control the grade and the transverse slope by either of the following methods:

1. One end directly and the other indirectly through controlling the transverse slope; or
2. Each end independently, including screed attachments.

The Contractor shall suspend operations if the control system does not achieve the typical section in accordance with the Plans. The Contractor shall place, spread, and finish the courses of HMA according to the following:

1. Without segregation or tearing;
2. True to the line, grade, and crown in accordance with the Plans; and
3. With self-propelled pavers, except as otherwise directed.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing Equipment impracticable, the Contractor shall dump, spread, and level the HMA by other methods to achieve the required compacted thickness.

#### 423.3.5.1 Weather Limitations

The Contractor shall not place HMA on wet or frozen surfaces or if weather conditions prevent proper handling, finishing, and compacting. The Contractor shall place HMA when the

Chill Factor is at least 40 °F and rising. If the air temperature is 60 °F or warmer do not consider the Chill Factor.

#### 423.3.5.2 Compaction

The Contractor shall:

1. Compact the HMA thoroughly and uniformly immediately after placement. Operate rollers at speeds slow enough to minimize displacement of the HMA, including the lines and grades of the asphalt edges. Remove marks from pneumatic rollers;
2. Prevent the HMA from sticking to the roller wheels by keeping the wheels moistened with water; water mixed with very small quantities of detergent or other approved Material. Do not use diesel fuel or other petroleum diluents;
3. At locations inaccessible to the rollers, the Contractor shall compact the HMA with hot hand tampers, smoothing irons, or mechanical tampers;
4. Use a trench roller or cleated compression strips under the roller to transmit compression to depressed areas; and
5. Remove areas that become loose, broken, mixed with dirt, segregated or defective, replace with fresh HMA, and compact to match the surrounding area, at no additional cost to the Department.

#### 423.3.5.3 Not Used

#### 423.3.5.4 Joints

The Contractor shall off set longitudinal joints at least six (6) inches relative to the longitudinal joints of the underlying course.

Unless otherwise specified, the Contractor shall taper transverse and longitudinal joints as follows:

1. At least a three (3) ft taper for transverse joints, with a taper slope no steeper than 24:1;
2. At least a one (1) ft taper or a notched taper, for longitudinal joints, with a taper slope no steeper than 6:1 or a notched taper with a one (1) inch vertical edge at the top of the taper connected to a slope no steeper than 6:1;
3. Cut and square off transverse tapers before commencing new Work;
4. Clean and tack coat longitudinal joints from previous operations; and
5. Avoid placing longitudinal joints in the wheel paths, unless approved by the Project Manager.

The Contractor shall completely bond joints and provide smooth surface for each course at the joints. The Department will not allow deviations greater than 3/16 inch when tested with a ten (10) ft straightedge in any direction. When paving under traffic, the Contractor shall schedule the daily surfacing operations so that tapered longitudinal joints are not exposed for longer than seven (7) Days.

#### 423.3.5.5 Surface Tolerances

The Contractor shall provide a final HMA surfacing course that conforms to Section 401, “Pavement Smoothness Measurement.”

#### 423.3.5.6 Plan Surfacing Thickness

The Contractor shall:

1. Place pavement at the thickness specified in the Contract;
2. Monitor thickness by calculating continuous production yields using the formula found in the MT-1, as maintained by the State Materials Bureau;
3. Calculate the required yield and the corresponding yields for 0.25 inch increase (upper limit) and decrease (lower limit). The Project Manager may adjust the required yield to fit field conditions. If adjusted, the new target yield will be communicated to the Contractor in writing;
4. Control production to keep yield within the upper and lower limits;
5. Correct deficiencies at no cost to the Department;
6. Correct deficient depths during placement; and
7. Address Plan Surfacing thickness in the Quality Control Plan.

**423.3.5.7 Test Strip & Shakedown Period**

Prior to the Test Strip & Shakedown Period, the Contractor shall provide binder ignition oven calibration samples in accordance with the State Materials Bureau's, current *Binder Ignition Calibration Procedure.* All Quality Control, Quality Assurance and Independent Assurance ovens must be calibrated by this procedure. The Project Manager will suspend paving operations until calibration of the ovens has been completed. No additional time or compensation will be granted for completion of this requirement.

The "NMDOT Binder Ignition Calibration Procedure" is available by accessing the NMDOT website, and navigating within the Construction and Civil Rights Bureau's (CCRB) link.

The Contractor shall construct a test strip for each HMA mix design to be incorporated in the Project prior to placing the Material on mainline. The test strip will consist of a maximum of 1,000 tons, the minimum test strip size will be 500 tons or as approved by the Project Manager. The Contractor shall construct test strip on shoulders, low volume segments of the pavement, or area approved by the Project Manager.

The Contractor shall obtain a minimum of three (3) Contractor and three (3) agency samples to evaluate the JMF, process control, and placement operations. If necessary, based on the results obtained from the test strip, the Contractor shall develop a revised JMF, modify placement operations, and/or implement adjustments to process control procedures. Production and placement operations performed prior to approval of a revised JMF are at the Contractor's risk.

The test strip will be evaluated for Acceptance according to Table 423.3.5.7:1, "Test Strip Acceptance Limits." If Accepted, the test strip will be paid at the unit price for HMA Complete or HMA per Section 423.5, "Basis of Payment." If rejected, said Material shall be handled in accordance with Section 423.3.6.3.2," Adherence to Specifications and Rejection of Non-Specification Material." The Contractor shall remove rejected test strip Material placed within the Roadway Prism at no cost to the Department. If the Contractor disagrees with removing and replacing unacceptable Material placed in test strips outside the Roadway Prism, the Assistant District Engineer for Construction, based on engineering judgment, will decide if the Material can remain in place with a maximum pay factor of 50%, or shall be removed and replaced at no cost to the Department.

If the test strip is rejected, the Contractor shall construct a subsequent test strip. The Contractor shall not proceed to full production until an Accepted test strip is produced. After the test strip is Accepted, the Contractor shall continue to evaluate the mix properties and the JMF during the placement of the first two (2) sublots in the first lot. Changes may be made to the JMF or the mix proportions and/or properties with the concurrence of the State Materials Bureau, Project Manager, and Assistant District Engineer for Construction. For changes made prior to the completion of the first two (2) sublots, the adjustments will be applied to the entire lot for purposes of payment.

The Project Manager may waive test strip requirements for the Project, if requested by the Contractor based on prior experience with the JMF.

The Shakedown Period is defined as the first two (2) sublots produced in the first lot.

As the test strip is placed, the Contractor shall evaluate the mix properties and the JMF. Changes may be made to the JMF or the mix proportions and/or properties with the concurrence of the State Materials Bureau, Project Manager, and the Assistant District Engineer for Construction.

**Table 423.3.5.7:1**
**Test Strip Acceptance Testing Limits [a,c]**

| Characteristic | Allowable Tolerances from TV |
|---|---|
| Air Voids, % | ± 2.0 |
| Pavement Density %[c] | 90% to 97% |
| Mineral Admixture % | ±0.2% |
| Voids in the Mineral Aggregate (VMA), % [a] | ± 2.0 |
| Asphalt Content %[a,b] | ± 0.50 |

[a] Asphalt Content will be determined using AASHTO T308 as modified by TTCP.

[b] HMA will not be rejected based on Asphalt Content Determined by AASHTO T 308.

[c] Acceptance will be based on the average test values.

### 423.3.6 Sampling and Testing

The Contractor shall sample and test in accordance with Section 901, “Quality Control Quality Assurance General Provisions,” and Section 906, “Minimum Testing Requirements.” The Department will sample and test in accordance with Section 901, “Quality Control /Quality Assurance General Provisions,” and Section 906, “Minimum Testing Requirements.”

#### 423.3.6.1 Contractor Quality Control

The Contractor shall administer a Quality Control Plan, referred to hereafter as “the Plan”. The Contractor shall ensure the Plan conforms to Section 902, “Quality Control.” The Contractor shall submit the Plan a minimum of two (2) weeks prior to commencement of crushing operations and at a minimum comply with “Contractor Quality Control Plan Guidelines.” No HMA operations are allowed until the Plan has been approved by the Project Manager and the District Lab Supervisor. The Contractor shall sample and test the mixture and pavement on a statistically random basis in accordance with Section 906, “Minimum Testing Requirements.”

##### 423.3.6.1.1 Contractor Quality Control of Aggregate

The Contractor shall obtain samples in accordance with Section 902.5, “Sampling.”

The Project Manager may sample and test the aggregate at any time during production or stockpiling, or may request to split samples with the Contractor.

#### 423.3.6.1.2 Contractor Quality Control for Compaction

The Contractor shall:

1. Monitor the compaction process by determining the density of the HMA with a portable densometer in accordance with the Plan;
2. Establish calibration of the portable densometer from cut pavement samples;
3. Determine the density readings of the cut pavement samples in accordance with AASHTO T 166 (weight, volume method); determine the density readings of the pavement with the portable densometer and correlate these test results;
4. Conduct Quality Control testing in accordance with Division 900, “QUALITY CRITERIA” and provide test results to the Project Manager;
5. Perform Quality Control density testing while the asphalt mixture is hot enough to permit further compaction;
6. Not roll for compaction when it becomes ineffective or damages the HMA; and
7. Not use vibratory mode when it becomes ineffective or damages the HMA.

#### 423.3.6.2 Department Quality Assurance

The Department will sample and test the mixture and pavement on a statistically random basis in accordance with Section 906, “Minimum Testing Requirements.”

#### 423.3.6.3 Acceptance

The Department will evaluate Materials using Contractor and Department test data from each Random sampling Plan for Acceptance in accordance with this section.

**Table 423.3.6.3:1**
**Acceptance Testing Tolerances[a]**

| Characteristic | Specification limit, percentage points from TV |
|---|---|
| Air Voids, % | ± 1.4 |
| Pavement Density %[c] | ± 2.5 |
| Mineral Admixture%[e] | Minimum of JMF Target Value |
| Voids in the Mineral Aggregate (VMA), % [a,d] | ± 1.6 |
| Asphalt Content %[a,b] | ± 0.50 |

[a] All gradation, Asphalt Content, VMA, and VFA values shall be determined using the AASHTO T 308 testing results.

[b] HMA will not be rejected based on Asphalt Content Determined by AASHTO T 308.

[c] Density payment will be adjusted in accordance with Section 901.3.11, “QLA.”

[d] If Gmm fluctuates more than ±0.03 on a consistent basis, it is recommended that the Specific Gravity of the aggregates be checked in order to verify VMA.

[e] If Mineral Admixture is below Design TV cease hot mix production, investigate and correct.

Department personnel may test locations other than the random locations generated for statistical analysis. These tests will not be used for pay factor determination, but may be used to determine Acceptance or rejection of localized Material.

#### 423.3.6.3.1 Quality Level Analysis (QLA)

The Department will determine Acceptance of the Materials in accordance with Section 904, "Quality Level Analysis (QLA)," using the Acceptance limits in Table 423.3.6.3, "Acceptance Testing Tolerances." Acceptance lot sizes shall be determined at the Pre-Paving Conference. The Department will have the final authority for determination of Acceptance lot size. For all QLA Projects, if a composite pay factor of more than one (1.00) is calculated, the composite pay factor will be a one (1.00) for the purposes of payment.

##### 423.3.6.3.1.1 Acceptance of Pavement Density

The target density for Acceptance of HMA will be 94.50% of the theoretical maximum density as determined from AASHTO T 209. For determination of maximum specific gravity, the Contractor shall obtain and test a minimum of two (2) samples and ensure the Department obtains and tests a minimum of one (1) sample for each Day that the HMA is placed, in accordance with the random sampling Plan. Each individual density test value obtained less than 92.0% or more than 97.0% of the theoretical maximum density will be evaluated in accordance with Section 423.3.6.3.2, **"**Adherence to Specifications and Rejection of Non-specification Material."

For purposes of Acceptance and pay factor determination:

1. Determine the density from cut pavement sections (cores) with six (6) inch diameters extending through the full thickness of the HMA;
2. Determine the pay factor in accordance with Section 904, "Quality Level Analysis;"
3. To be prepared for dispute resolution, the Contractor shall provide one (1) additional core for each core tested by the Department for Acceptance of density in accordance with section 423.3.7, "Dispute Resolution;" and
4. If a composite pay factor of more than one (1.00) is calculated, the composite pay factor will be a one (1.00) for the purposes of payment.

For Projects consisting of single lift overlays or mill and inlay with a single lift of two and a half inches or less, the Project Manager may grant an exception to the mean density target requirement of at least 94.5% of the theoretical maximum density if the Contractor can demonstrate that a minimum of 92.0% cannot be reasonably obtained because of the existing conditions of the Pavement Structure or Subgrade Materials. The Contractor demonstrates this by providing non-destructive density results obtained during paving operations witnessed by a State Inspector at the location in question. If the Project Manager grants this exemption, the Contractor shall construct a Roadway test strip and develop an HMA compaction process to get the highest possible density based on an approved roller's density gain per pass, in accordance with Section 423.3.4.4, "Compaction Equipment." The Project Manager will approve the process, establish a new target value for density and establish a new Acceptance lot only for the portion of the Project addressed herein (except for the Roadway test strip) before paving begins or continues. Lot density shall not fall below 91%. If a lot does not meet either of the revised density requirements, the Project Manager will, with the concurrence of the Assistant District Engineer for Construction do the following:

1. Accept and pay for the lot of HMA at 50% of the Bid Item Unit Price; or
2. Reject the in-place Material and require the Contractor to remove and replace at no cost to the Department.

#### 423.3.6.3.2 Adherence to Specifications and Rejection of Non-Specification Material

The Contractor shall produce Material in substantial compliance with all Specification requirements. The Department will evaluate Air Voids, Pavement Density, Void in Mineral Aggregate (VMA), and Asphalt Content test results for Specification compliance. Evaluation of Material that does not meet Specifications will be in accordance with the following:

**Individual Test Results**. If an individual test is outside the Specification limits but is less than two (2) standard deviations from the mean of previously produced Material of the current lot, investigate and propose corrective actions but production may continue and the result will be entered into QLA. If an individual test result (for the current lot) is outside the Specification limits and is two (2) or more standard deviations from the mean of previously produced Material, the Contractor shall cease production, investigate the causes of the failure, and propose corrective actions. The Contractor shall not resume production until the proposed corrections are approved by the Project Manager.

**Consecutive Test Results**. If two (2) consecutive test results of the same property (for the current lot) are outside the Specification limits, cease production, investigate the causes of the failure, and propose corrective action. The Contractor shall not resume production until the proposed corrections are Accepted by the Project Manager in writing. Limit production to a maximum of 1,000 tons, production will include a minimum of two (2) Contractor tests and one (1) Department test. If testing indicates that the problem has been corrected, the Contractor shall resume full operations. If the problem has not been corrected, the Contractor shall perform further trial runs and testing.

**Pavement Density Below 90.000%.** All pavement density tests that are below 90.000% are rejected and the Contractor shall remove and replace all Material represented by the test with Specification Material at the Contractors expense. The Contactor shall submit a Plan in writing for approval by the Project Manager that determines the limits of Material to be removed within 48 hours of reporting a Quality Control test or receiving a Quality Assurance test for pavement density below 90.000% density. If the test below 90.000% is a Department test, the Department will obtain a new test from the Material replaced by the Contractor to replace the density test reported by the Department. If the test below 90.000% is a Contractor test, the Contractor shall obtain a new test from the Material replaced by the Contractor to replace the test reported by the Contractor. The test obtained from the replaced Material will be input into the QLA to replace the test below 90.000%.

All Material that is rejected, at the sole discretion of the Department, shall be removed and replaced with Specification Material at the Contractor's expense. If the Material is allowed to remain in place by the Department all random, sample data will be entered into QLA, this does not apply to pavement density below 90.000% that shall be removed and replaced. Sampling for corrective action will not be entered into QLA.

The Project Manager may reject Material that appears to be defective based on visual inspection.

#### 423.3.6.4 Independent Assurance Testing

The Department will perform Independent Assurance sampling and testing in accordance with Section 906, "Minimum Testing Requirements."

#### 423.3.7 Dispute Resolution

For any test incorporated into the pay factor, if a dispute exists the Project Manager and Contractor will investigate to determine why and make corrections if possible. If the