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**PAVEMENT DESIGN REPORT  
LATIGO TRAILS FILING NO. 9  
EL PASO COUNTY, COLORADO**

Prepared for:  
**RDMA, LLC**  
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**El Paso County, CO**

Attn: Akeem Seriki/Glenn Kunkel

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Respectfully Submitted,

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Entech Job No. 231802

**Table of Contents**

**1 Introduction ..... 1**

**2 Project Description ..... 1**

**3 Subsurface Explorations and Laboratory Testing ..... 1**

    3.1 Subsurface Exploration Program ..... 1

    3.2 Geotechnical Index and Engineering Property Testing ..... 2

**4 Subgrade Conditions ..... 2**

    4.1 Subsurface Conditions ..... 2

    4.2 Groundwater ..... 3

**5 Pavement Design Recommendations ..... 3**

    5.1 Subgrade Conditions ..... 3

    5.2 Swell Mitigation ..... 4

    5.3 Traffic Loading ..... 4

    5.4 Pavement Design ..... 4

**6 Construction Recommendations ..... 5**

    6.1 Earthwork Recommendations for Pavement Subgrade ..... 5

        6.1.1 Subgrade Preparation ..... 5

        6.1.2 Fill Placement and Compaction ..... 6

    6.2 Aggregate Base Course ..... 6

    6.3 Concrete Degradation Due to Sulfate Attack ..... 6

    6.4 Construction Observation ..... 6

**7 Closure ..... 7**

**Figures**

Figure 1: Vicinity Map

Figure 2: Site and Exploration Plan

**List of Appendices**

Appendix A: Test Boring Logs

Appendix B: Laboratory Test Results

Appendix C: Pavement Design Calculations

## **1 Introduction**

Entech Engineering, Inc. (Entech) completed a subsurface exploration program and a pavement design for roadways within the Latigo Trails Filing No. 9. This report describes the subsurface exploration program conducted for the proposed roadway improvements and provides a pavement section alternative and construction recommendations. Entech participated in this project as a subconsultant to RDMA, LLC. The contents of this report, including the pavement design recommendations, are subject to the limitations and assumptions presented in Section 7. This report supersedes all previous versions of this report.

## **2 Project Description**

Latigo Trails Filing No. 9 is located east of Curtis Road and south of Judge Orr Road in eastern El Paso County, Colorado (Figure 1). The proposed roadway construction includes portions of Conestoga Trail South, Buffalo River Trail, and the Horse Canyon Trail cul-de-sac. The extent of our investigation is shown in Figure 2. The topography of the site consists of gently rolling hills and valleys with rough-graded roads and utilities installed. Surrounding properties include vacant land or land being developed for residential lots. Vegetation was absent along the roadways due to recent site grading.

## **3 Subsurface Explorations and Laboratory Testing**

### **3.1 Subsurface Exploration Program**

Subsurface conditions at the project site were explored by ten test borings, designated TB-1 through TB-10, drilled on April 23, 2024. The locations of the test borings are shown on the Site and Exploration Plan (Figure 2). The borings were drilled to depths of 5 to 10 feet below the existing ground surface (bgs). The drilling was performed using a truck-mounted, continuous flight auger drill rig supplied and operated by Entech. Descriptive boring logs providing the lithologies of the subsurface conditions encountered during drilling are presented in Appendix A. Groundwater levels were measured in each of the open boreholes at the conclusion of drilling.

Soil and bedrock samples were obtained from the borings utilizing the Standard Penetration Test (ASTM D1586) using a split-barrel California sampler. Results of the Standard Penetration Test (SPT) are included on the boring logs in terms of N-values expressed in blows per foot (bpf). Soil and bedrock samples recovered from the borings were visually classified and recorded on the

boring logs. The soil classifications were later verified utilizing laboratory testing and grouped by soil type. The soil type numbers are included on the boring logs. It should be understood that the soil descriptions shown on the boring logs may vary between boring location and sample depths. It should also be noted that the lines of stratigraphic separation shown on the boring logs represent approximate boundaries between soil types and the actual stratigraphic transitions may be more gradual or variable with location.

### **3.2 Geotechnical Index and Engineering Property Testing**

Water content testing (ASTM D2216) was performed on the samples recovered from the borings and the results are shown on the boring logs. Grain-Size Analysis (ASTM D422) and Atterberg Limits testing (ASTM D4318) were performed on selected samples to assist in classifying the materials encountered in the borings.

One-dimensional swell/collapse testing (ASTM D4546) was performed on a select sample to determine the expansive or compressive characteristics of the soil. For pavement design, a modified proctor (ASTM D1557) and California Bearing Ratio (CBR) test (ASTM D1883) were completed. Soluble sulfate testing was performed on select soil samples to evaluate the potential for below-grade degradation of concrete due to sulfate attack. The laboratory testing results are presented in Appendix B and summarized in Table B-1.

## **4 Subgrade Conditions**

Four primary soil types and two bedrock types were encountered in the test borings drilled for the subsurface investigation. Each soil type was classified in accordance with the Unified Soil Classification System (USCS) and the American Association of State Highway and Transportation Officials (AASHTO) soil classification system using the laboratory testing results and the observations made during drilling.

### **4.1 Subsurface Conditions**

Subsurface conditions along the proposed roadway generally consisted of medium dense to dense silty to clayey sand fill (Soil Type 1), medium dense clayey sand fill (Soil Type 2), native dense silty sand to sand with silt (Soil Type 3), and native dense clayey sand (Soil Type 4). Sandstone bedrock, which classified as very dense silty sand to sand with silt (Soil Type 5) and (Soil Type 6), was also encountered. Water soluble sulfate tests indicated that the soils exhibit a negligible potential for sulfate attack. Laboratory test results are presented in Appendix B and are

summarized in Table B-1. Soil Types and corresponding AASHTO soil classifications are listed as follows:

- Soil Type 1: A-1-b and A-2-4 (Design Soil Type)
- Soil Type 2: A-6
- Soil Type 3: A-1-b
- Soil Type 4: A-2-6
- Soil Type 5: A-1-b

#### 4.2 Groundwater

Groundwater was not encountered in the test borings. Groundwater fluctuations are possible and will depend on seasonal variations, local precipitation, runoff, and other factors; however, we do not anticipate groundwater to affect the proposed construction.

### 5 Pavement Design Recommendations

Pavement design recommendations were made in accordance with the *El Paso County Engineering Criteria Manual (ECM)*.

#### 5.1 Subgrade Conditions

California Bearing Ratio (CBR) testing was performed on a representative sample of the Type 1 silty sand fill subgrade from TB-1 to determine the support characteristic of the subgrade soils for the roadway section. Soil Type 1 was selected as the representative design subgrade material based on materials encountered during our subsurface exploration program and subsequent laboratory testing. Isolated areas with cohesive materials (A-6) should be removed and replaced as discussed in Section 6.1.1. The results of the CBR testing are presented in Appendix B and summarized in Exhibit 1.

**Exhibit 1: Subsurface Laboratory Testing Summary**

| Design Parameter             | Value               |
|------------------------------|---------------------|
| Soil Type                    | 1 – Silty Sand Fill |
| CBR at 95%                   | 56.53               |
| Design CBR                   | 10                  |
| Liquid Limit                 | NV                  |
| Plasticity Index             | NP                  |
| Percent Passing 200          | 31.9                |
| AASHTO Classification        | A-2-4               |
| Unified Soils Classification | SM                  |

## 5.2 Swell Mitigation

El Paso County requires swell mitigation for soils with swell testing results greater than 2% under a 150 pounds per square foot (psf) surcharge. Based on the classifications, mitigation for expansive soils will not be required on this site.

## 5.3 Traffic Loading

Traffic data was referenced from the Traffic Impact Study “Latigo Preserve Filing, No. 9 PCD File No. SF-21-36”. The roadways classify as rural local based on the current development plans. The *El Paso County Engineering Criteria Manual* provides default 18-kip equivalent single axle loadings (ESAL) based on the street classifications (ECM Section D.3.3, Table D-2). For design, a default ESAL value of 36,500 was used for the local low-volume residential designations.

## 5.4 Pavement Design

The pavement section was determined utilizing the *El Paso County Engineering Criteria Manual*, the CBR testing, and the default ESAL value. Design parameters used in the pavement analysis are presented in Exhibit 2.

**Exhibit 2: Pavement Design Parameters**

| Design Parameter                    | Value      |
|-------------------------------------|------------|
| Reliability                         | 80%        |
| Standard Deviation                  | 0.45       |
| Serviceability Loss ( $\Delta$ psi) | 2.5        |
| Design CBR                          | 10         |
| Resilient Modulus                   | 15,000 psi |
| Structural Coefficients             |            |
| Hot Bituminous Pavement             | 0.44       |
| Aggregate Base Course               | 0.11       |

The recommended hot mix asphalt (HMA) over aggregate base course (ABC) composite pavement section for the roadways at Latigo Trails Filing No. 9 is provided in Exhibit 3. The pavement design calculations are presented in Appendix C.

**Exhibit 3: Recommended Pavement Section**

| Pavement Area                                                      | Design ESAL | Alternative <sup>1</sup>              |
|--------------------------------------------------------------------|-------------|---------------------------------------|
| Conestoga Trail South, Buffalo River Trail, and Horse Canyon Trail | 36,500      | 1. 4.0 inches HMA over 4.0 inches ABC |

*ABC = Aggregate Base Course; ESAL = equivalent single axle loads; HMA = Hot Mix Asphalt*

**Notes:**

1. Pavement alternative meets the minimum HMA and ABC thickness required per *El Paso County Pavement Design Manual*.

**6 Construction Recommendations**

Pavement design recommendations provided herein are contingent on good construction practices and poor construction techniques may result in poor performance. Our analyses assumed that this project will be constructed according to the *El Paso County Engineering Criteria Manual* and the *Pikes Peak Region Asphalt Paving Specifications*.

**6.1 Earthwork Recommendations for Pavement Subgrade**

Proper subgrade preparation is required for adequate pavement performance. Paving areas should be cleared of all deleterious materials including but not limited to: existing pavements, utility poles, and fence poles. Surface vegetation, if any, should be removed by stripping, with the depth to be field determined.

**6.1.1 Subgrade Preparation**

To provide uniform subgrade support and mitigate any potentially expansive soils, we recommend overexcavating 12 inches of the roadway subgrade, scarifying an additional 6 inches, moisture conditioning the scarified subgrade to within +/-2% of its optimum moisture content, and compacting it to 95% of the Modified Proctor Maximum Dry Density (ASTM D1557). The overexcavated subgrade soils can then be replaced in 6-inch compacted lifts to the same specifications as described above. Any cohesive materials (AASHTO A-6) encountered during subgrade preparation should be removed and replaced with granular fill (Section 6.1.2).

The final moisture-treated subgrade surface should be proof-rolled with a fully loaded, tandem-axle, 10-yard dump truck or equivalent. Any areas that are delineated to be soft, loose, or yielding during proof-rolling should be removed and reconditioned or replaced.

### **6.1.2 Fill Placement and Compaction**

Granular fill placed as part of the pavement subgrade shall consist of non-expansive, granular soil, free of organic matter, unsuitable materials, debris, and cobbles greater than 3 inches in diameter. Additionally, any granular fill placed as part of the roadway subgrade should have a minimum CBR of 10. All granular fill placed within the pavement subgrade should be compacted to a minimum of 95% of its maximum Modified Proctor Dry Density (ASTM D1557) at +/-2% of optimum moisture content. Fill material should be placed in horizontal lifts such that each finished lift has a compacted thickness of 6 inches or less. Entech should approve any imported fill to be used within the pavement subgrade area prior to delivery to the site.

### **6.2 Aggregate Base Course**

ABC materials shall conform to the *El Paso County Engineering Criteria Manual*, Section D.5.5.1 and Table D-6 Aggregate Base Course Materials. ABC materials should be compacted to a minimum of 95% of their maximum Modified Proctor Dry Density (ASTM D1557) at +/-2% of optimum moisture content.

### **6.3 Concrete Degradation Due to Sulfate Attack**

Sulfate solubility testing was conducted on several samples recovered from the test borings to evaluate the potential for sulfate attack on concrete. The test results indicated less than 0.01% soluble sulfate (by weight). The test results indicate the sulfate component of the in-place soils presents a negligible exposure threat to concrete placed below the site grade.

Type 1L or Type II cement is recommended for all concrete on this site. To further avoid concrete degradation during construction, it is recommended that concrete not be placed on frozen or wet ground.

### **6.4 Construction Observation**

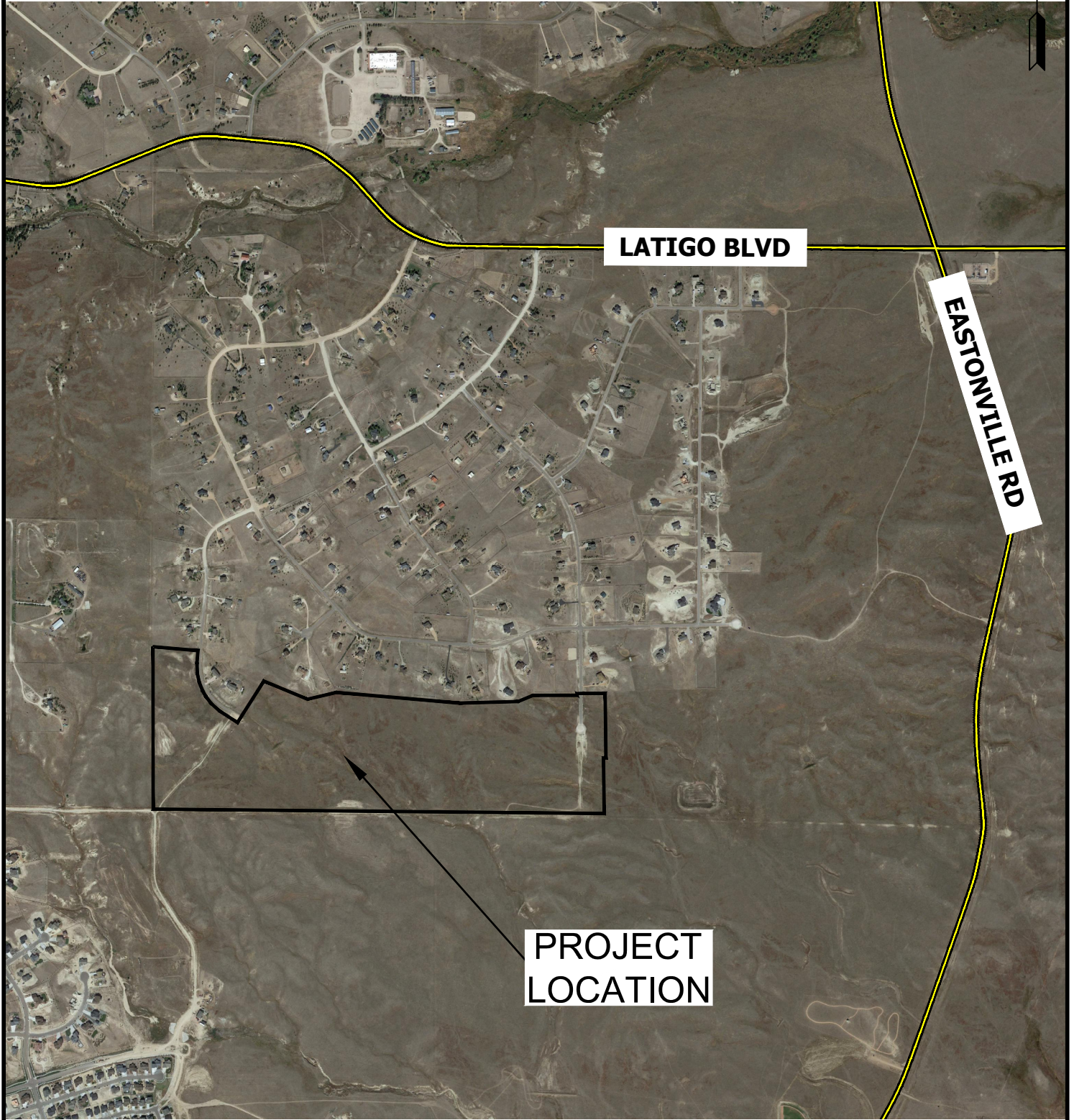
Subgrade preparation for pavement structures should be observed by Entech in order to verify that (1) no anomalies are present, (2) materials similar to those described in this report have been encountered or placed, and (3) no soft spots, expansive or organic soil, or debris are present in the pavement subgrade prior to paving.



## 7 Closure

The subsurface investigation, geotechnical evaluation, and recommendations presented in this report are intended for use by RDMA with application to the paving of the Latigo Trails Filing No. 9 project in east El Paso County, Colorado. In conducting the subsurface investigation, laboratory testing, engineering evaluation, and reporting, Entech Engineering, Inc. endeavored to work in accordance with generally accepted professional geotechnical and geologic practices and principles consistent with the level of care and skill ordinarily exercised by members of the geotechnical profession currently practicing in the same locality and under similar conditions. No other warranty, expressed or implied, is made. During final design and/or construction, if conditions are encountered that appear different from those described in this report, Entech Engineering, Inc. requests to be notified so that the evaluation and recommendations presented herein can be reviewed and modified as appropriate.

If there are any questions regarding the information provided herein, or if Entech Engineering, Inc. can be of further assistance, please do not hesitate to contact us.



**LATIGO BLVD**

**EASTONVILLE RD**

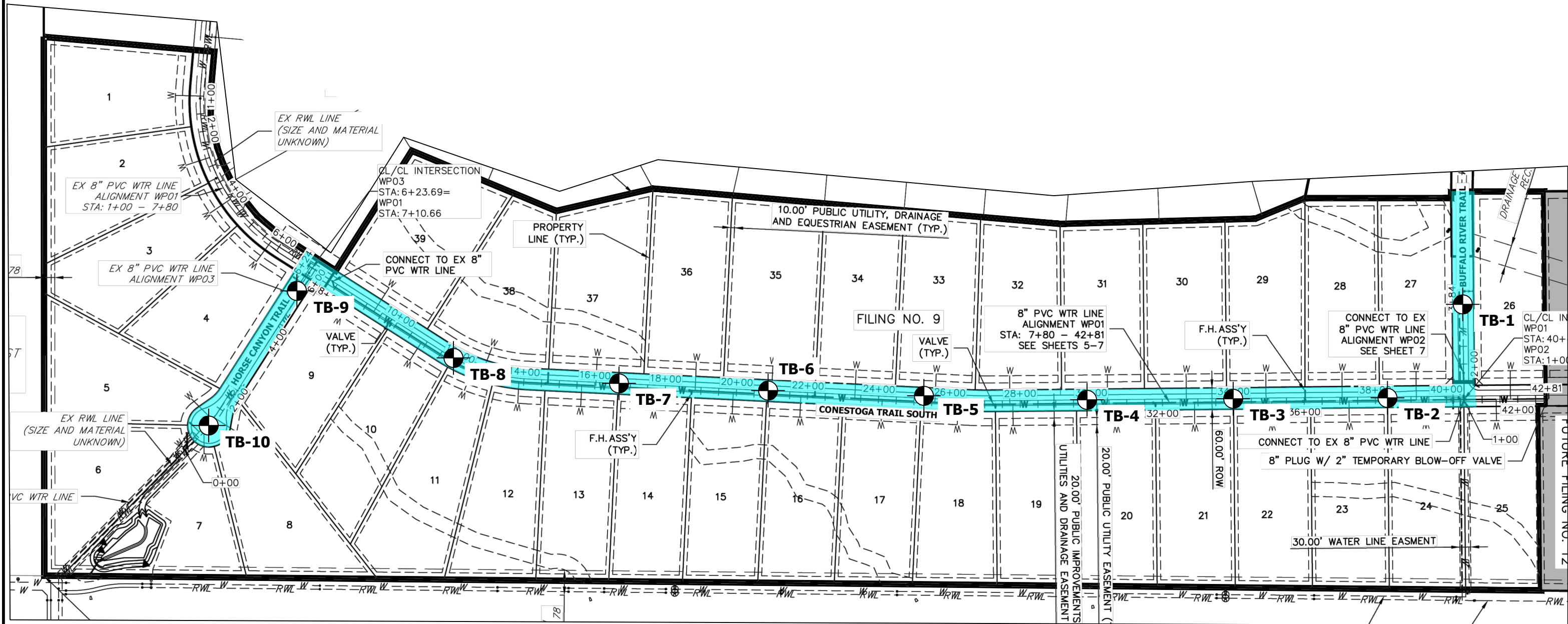
**PROJECT  
LOCATION**



**VICINITY MAP**  
LATIGO TRAILS FILING No. 9  
RDMA

JOB NO.  
231802

**FIG. 1**



CONESTOGA TRAIL SOUTH, BUFFALO RIVER TRAIL, HORSE CANYON TRAIL  
 Roadway Classification: Local Rural Residential  
 Design 18-kip ESAL = 36,500  
 Soil Type 1 (AASHTO A-2-4)  
 Pavement Section: 4" HMA over 4" ABC

**TB- APPROXIMATE TEST BORING LOCATION AND NUMBER**



**SITE AND EXPLORATION PLAN**  
 LATIGO TRAILS FILING No. 9  
 RDMA

JOB NO.  
 231802  
**FIG. 2**



## **APPENDIX A: Test Boring Logs**

**TABLE A-1**  
**DEPTH TO BEDROCK**

| TEST BORING | DEPTH TO BEDROCK (ft.) |
|-------------|------------------------|
| 1           | 4                      |
| 2           | >5                     |
| 3           | 3                      |
| 4           | SURFACE                |
| 5           | SURFACE                |
| 6           | SURFACE                |
| 7           | SURFACE                |
| 8           | SURFACE                |
| 9           | 4                      |
| 10          | 4                      |

TEST BORING 1  
DATE DRILLED 4/23/2024

TEST BORING 2  
DATE DRILLED 4/23/2024

REMARKS

REMARKS

DRY TO 10', 4/23/24

DRY TO 5', 4/23/24

FILL 0-4', SAND, SILTY, BROWN,  
MEDIUM DENSE, MOIST

FILL 0-5', SAND, CLAYEY, BROWN,  
MEDIUM DENSE, MOIST

SANDSTONE, VERY WEAK,  
BROWN, MODERATELY  
WEATHERED (SAND, SILTY, VERY  
DENSE, MOIST)

| Depth (ft) | Symbol   | Samples   | Blows per foot | Watercontent % | Soil Type | Depth (ft) | Symbol   | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|----------|-----------|----------------|----------------|-----------|------------|----------|---------|----------------|----------------|-----------|
| 0-4        | (Symbol) |           | 17             | 9.4            | 1         | 0-5        | (Symbol) |         | 16             | 8.4            | 1         |
| 5          | (Symbol) | 50<br>10" | 50<br>10"      | 6.4            | 5         | 5          | (Symbol) |         | 17             | 7.2            | 1         |
| 10         | (Symbol) | 50<br>8"  | 50<br>8"       | 7.8            | 5         | 10         | (Symbol) |         |                |                |           |
| 15         | (Symbol) |           |                |                |           | 15         | (Symbol) |         |                |                |           |
| 20         | (Symbol) |           |                |                |           | 20         | (Symbol) |         |                |                |           |



**TEST BORING LOGS**  
LATIGO TRAILS, FILING NO. 9  
RDMA

JOB NO.  
231802  
**FIG. A-1**

TEST BORING 3  
 DATE DRILLED 4/23/2024

TEST BORING 4  
 DATE DRILLED 4/23/2024

REMARKS

REMARKS

DRY TO 5', 4/23/24

FILL 0-2', SAND, CLAYEY, BROWN,  
 DENSE, MOIST  
 SAND, SILTY, BROWN  
 SANDSTONE, EXTREMELY WEAK,  
 LIGHT BROWN, HIGHLY  
 WEATHERED (SAND, CLAYEY,  
 VERY DENSE, MOIST)

| Depth (ft) | Symbol   | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|----------|---------|----------------|----------------|-----------|
| 0-2        | [Symbol] |         | 31             | 3.9            | 1         |
| 2-3        | [Symbol] |         |                |                | 3         |
| 3-5        | [Symbol] |         | 50<br>10"      | 9.3            | 6         |
| 5          |          |         |                |                |           |
| 10         |          |         |                |                |           |
| 15         |          |         |                |                |           |
| 20         |          |         |                |                |           |

DRY TO 10', 4/23/24

SANDSTONE, EXTREMELY WEAK,  
 TAN, HIGHLY WEATHERED (SAND,  
 WITH SILT, VERY DENSE, MOIST)

| Depth (ft) | Symbol   | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|----------|---------|----------------|----------------|-----------|
| 0-5        | [Symbol] |         | 50<br>11"      | 5.6            | 5         |
| 5          |          |         | 50<br>9"       | 8.4            | 5         |
| 10         |          |         | 50<br>4"       | 8.5            | 5         |
| 15         |          |         |                |                |           |
| 20         |          |         |                |                |           |



**TEST BORING LOGS**  
 LATIGO TRAILS, FILING NO. 9  
 RDMA

JOB NO.  
 231802

**FIG. A-2**

TEST BORING 5  
DATE DRILLED 4/23/2024

TEST BORING 6  
DATE DRILLED 4/23/2024

REMARKS

REMARKS

DRY TO 5', 4/23/24

SANDSTONE, EXTREMELY WEAK,  
TAN, HIGHLY WEATHERED (SAND,  
WITH SILT to SAND, CLAYEY, VERY  
DENSE, MOIST)

| Depth (ft) | Symbol   | Samples  | Blows per foot | Watercontent % | Soil Type |
|------------|----------|----------|----------------|----------------|-----------|
| 5          | [Symbol] | [Sample] | 50<br>11"      | 7.2            | 5         |
| 5          | [Symbol] | [Sample] | 50<br>9"       | 7.2            | 5         |
| 10         | [Symbol] |          |                |                |           |
| 15         | [Symbol] |          |                |                |           |
| 20         | [Symbol] |          |                |                |           |

DRY TO 5', 4/23/24

SANDSTONE, EXTREMELY WEAK,  
TAN, HIGHLY WEATHERED (SAND,  
WITH SILT, VERY DENSE, MOIST)

| Depth (ft) | Symbol   | Samples  | Blows per foot | Watercontent % | Soil Type |
|------------|----------|----------|----------------|----------------|-----------|
| 5          | [Symbol] | [Sample] | 50<br>11"      | 6.5            | 5         |
| 5          | [Symbol] | [Sample] | 50<br>9"       | 12.8           | 5         |
| 10         | [Symbol] |          |                |                |           |
| 15         | [Symbol] |          |                |                |           |
| 20         | [Symbol] |          |                |                |           |



**TEST BORING LOGS**  
LATIGO TRAILS, FILING NO. 9  
RDMA

JOB NO.  
231802

**FIG. A-3**



TEST BORING 7  
 DATE DRILLED 4/23/2024

TEST BORING 8  
 DATE DRILLED 4/23/2024

REMARKS

REMARKS

DRY TO 10', 4/23/24

SANDSTONE, EXTREMELY WEAK,  
 TAN, HIGHLY WEATHERED (SAND,  
 WITH SILT, VERY DENSE, MOIST)

SANDSTONE, VERY WEAK, TAN,  
 MODERATELY WEATHERED  
 (SAND, CLAYEY, VERY DENSE,  
 MOIST)

| Depth (ft) | Symbol   | Samples  | Blows per foot | Watercontent % | Soil Type |
|------------|----------|----------|----------------|----------------|-----------|
| 5          | [Symbol] | [Sample] | 50<br>6"       | 4.1            | 5         |
| 5          | [Symbol] | [Sample] | 50<br>6"       | 5.5            | 5         |
| 10         | [Symbol] | [Sample] | 50<br>6"       | 9.8            | 6         |

DRY TO 5', 4/23/24

SANDSTONE, EXTREMELY WEAK,  
 OLIVE, HIGHLY WEATHERED  
 (SAND, CLAYEY, DENSE to VERY  
 DENSE, MOIST)

| Depth (ft) | Symbol   | Samples  | Blows per foot | Watercontent % | Soil Type |
|------------|----------|----------|----------------|----------------|-----------|
| 5          | [Symbol] | [Sample] | 41             | 8.9            | 6         |
| 5          | [Symbol] | [Sample] | 50<br>11"      | 8.2            | 6         |



**TEST BORING LOGS**  
 LATIGO TRAILS, FILING NO. 9  
 RDMA

JOB NO.  
 231802  
**FIG. A-4**

TEST BORING 9  
DATE DRILLED 4/23/2024

TEST BORING 10  
DATE DRILLED 4/23/2024

REMARKS

REMARKS

DRY TO 5', 4/23/24

SAND, WITH SILT, BROWN, MEDIUM DENSE, MOIST

SANDSTONE, VERY WEAK, LIGHT BROWN, MODERATELY WEATHERED (SAND, SILTY, VERY DENSE, MOIST)

| Depth (ft) | Symbol   | Samples  | Blows per foot | Watercontent % | Soil Type |
|------------|----------|----------|----------------|----------------|-----------|
| 0-5        | (Symbol) |          | 24             | 3.6            | 3         |
| 5          | (Symbol) | 50<br>9" |                | 9.8            | 5         |

DRY TO 5', 4/23/24

FILL 0-4', SAND, CLAYEY, BROWN, MEDIUM DENSE, MOIST

SANDSTONE, EXTREMELY WEAK, LIGHT BROWN, MODERATELY WEATHERED (SAND, CLAYEY, DENSE, MOIST)

| Depth (ft) | Symbol   | Samples | Blows per foot | Watercontent % | Soil Type |
|------------|----------|---------|----------------|----------------|-----------|
| 0-4        | (Symbol) |         | 10             | 9.9            | 2         |
| 5          | (Symbol) | 37      |                | 7.7            | 6         |



**TEST BORING LOGS**  
LATIGO TRAILS, FILING NO. 9  
RDMA

JOB NO.  
231802  
**FIG. A-5**

**TABLE B-1  
SUMMARY OF LABORATORY TEST RESULTS**

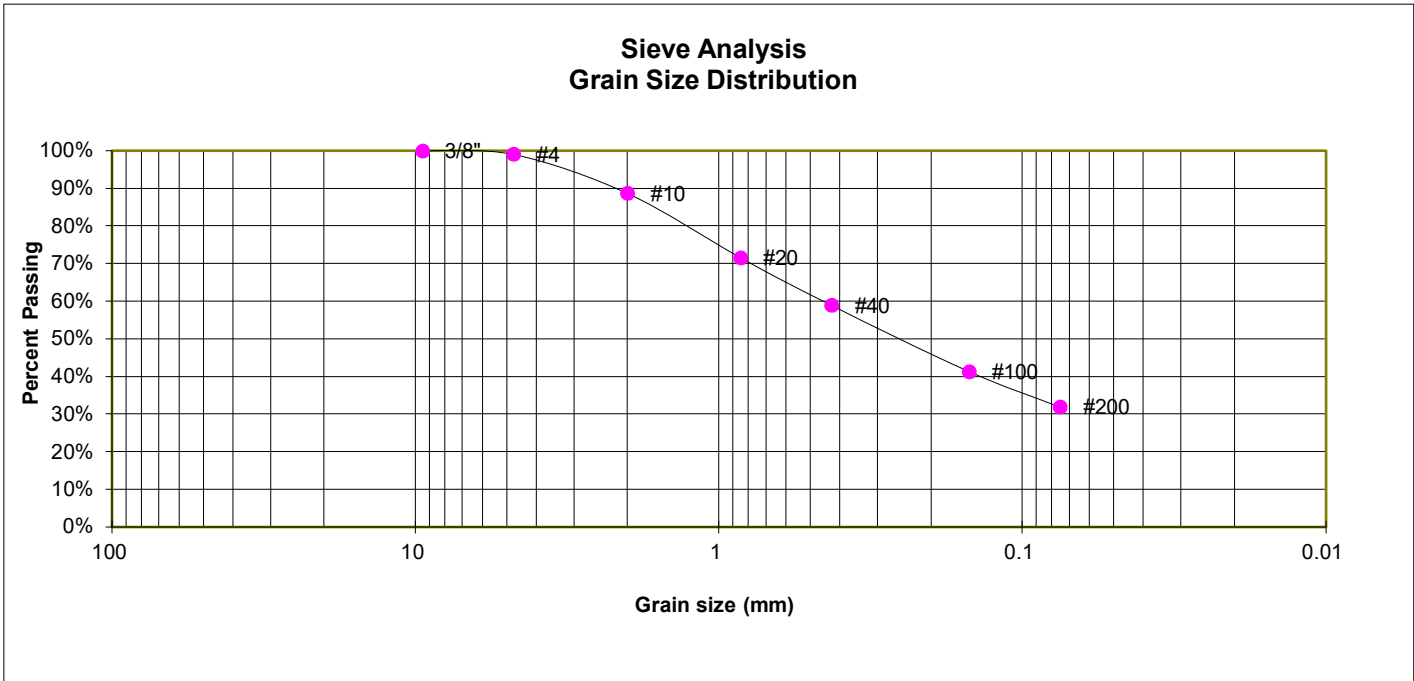
| SOIL TYPE | TEST BORING NO. | DEPTH (FT) | WATER (%) | DRY DENSITY (PCF) | PASSING NO. 200 SIEVE (%) | LIQUID LIMIT | PLASTIC LIMIT | PLASTIC INDEX | SULFATE (WT %) | SWELL/ COLLAPSE (%) | AASHTO CLASS. | USCS  | SOIL DESCRIPTION            |
|-----------|-----------------|------------|-----------|-------------------|---------------------------|--------------|---------------|---------------|----------------|---------------------|---------------|-------|-----------------------------|
| 1, CBR    | 1               | 0-3        | 6.8       |                   | 31.9                      | NV           | NP            | NP            |                |                     | A-2-4         | SM    | FILL, SAND, SILTY           |
| 1         | 1               | 1-2        | 9.1       |                   | 23.1                      | 28           | 22            | 6             |                |                     | A-1-b         | SM    | FILL, SAND, SILTY           |
| 1         | 2               | 1-2        | 8.9       |                   | 20.6                      | 30           | 20            | 10            | <0.01          |                     | A-2-4         | SC    | FILL, SAND, CLAYEY          |
| 1         | 3               | 1-2        | 4.1       |                   | 19.3                      | 28           | 24            | 4             |                |                     | A-1-b         | SM    | FILL, SAND, CLAYEY          |
| 2         | 10              | 1-2        | 10.3      |                   | 40.0                      | 37           | 23            | 14            | <0.01          |                     | A-6           | SC    | FILL, SAND, CLAYEY          |
| 3         | 9               | 1-2        | 3.7       |                   | 8.4                       | NV           | NP            | NP            |                |                     | A-1-b         | SW-SM | SAND, WITH SILT             |
| 3         | 8               | 1-2        | 10.2      |                   | 8.8                       | NV           | NP            | NP            | <0.01          |                     | A-1-b         | SW-SM | SAND, WITH SILT             |
| 4         | 10              | 5          | 8.0       |                   | 37.4                      | 24           | 15            | 9             |                |                     | A-2-6         | SC    | SAND, CLAYEY                |
| 5         | 4               | 1-2        | 6.8       |                   | 7.6                       | NV           | NP            | NP            |                |                     | A-1-b         | SW-SM | SANDSTONE (SAND, WITH SILT) |
| 5         | 5               | 1-2        | 7.0       |                   | 11.6                      | NV           | NP            | NP            |                |                     | A-1-b         | SW-SM | SANDSTONE (SAND, WITH SILT) |
| 5         | 6               | 1-2        | 6.5       |                   | 7.6                       | NV           | NP            | NP            |                |                     | A-1-b         | SW-SM | SANDSTONE (SAND, WITH SILT) |
| 5         | 7               | 1-2        | 4.1       |                   | 8.2                       | NV           | NP            | NP            |                |                     | A-1-b         | SW-SM | SANDSTONE (SAND, WITH SILT) |
| 5         | 1               | 10         | 8.9       |                   | 15.0                      | 31           | 23            | 8             |                |                     | A-1-b         | SM    | SANDSTONE (SAND, SILTY)     |
| 5         | 9               | 5          | 9.4       |                   | 15.7                      | NV           | NP            | NP            |                |                     | A-1-b         | SM    | SANDSTONE (SAND, SILTY)     |
| 6         | 3               | 5          | 10.7      |                   | 31.1                      | 28           | 19            | 9             | <0.01          |                     | A-2-4         | SC    | SANDSTONE (SAND, CLAYEY)    |
| 6         | 8               | 5          | 7.8       |                   | 13.1                      | 41           | 21            | 20            |                |                     | A-2-6         | SC    | SANDSTONE (SAND, CLAYEY)    |
| 6         | 7               | 10         | 14.8      | 85.6              | 35.2                      |              |               |               | <0.01          | -2.8                |               | SC    | SANDSTONE (SAND, CLAYEY)    |



## **APPENDIX B: Laboratory Test Results**

TEST BORING 1  
 DEPTH (FT) 0-3

SOIL DESCRIPTION FILL, SAND, SILTY  
 SOIL TYPE 1, CBR



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         |               |
| 3/8"         | 100.0%        |
| 4            | 99.1%         |
| 10           | 88.7%         |
| 20           | 71.6%         |
| 40           | 58.9%         |
| 100          | 41.3%         |
| 200          | 31.9%         |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | NP |
| Liquid Limit  | NV |
| Plastic Index | NP |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SM  
 AASHTO CLASSIFICATION: A-2-4  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

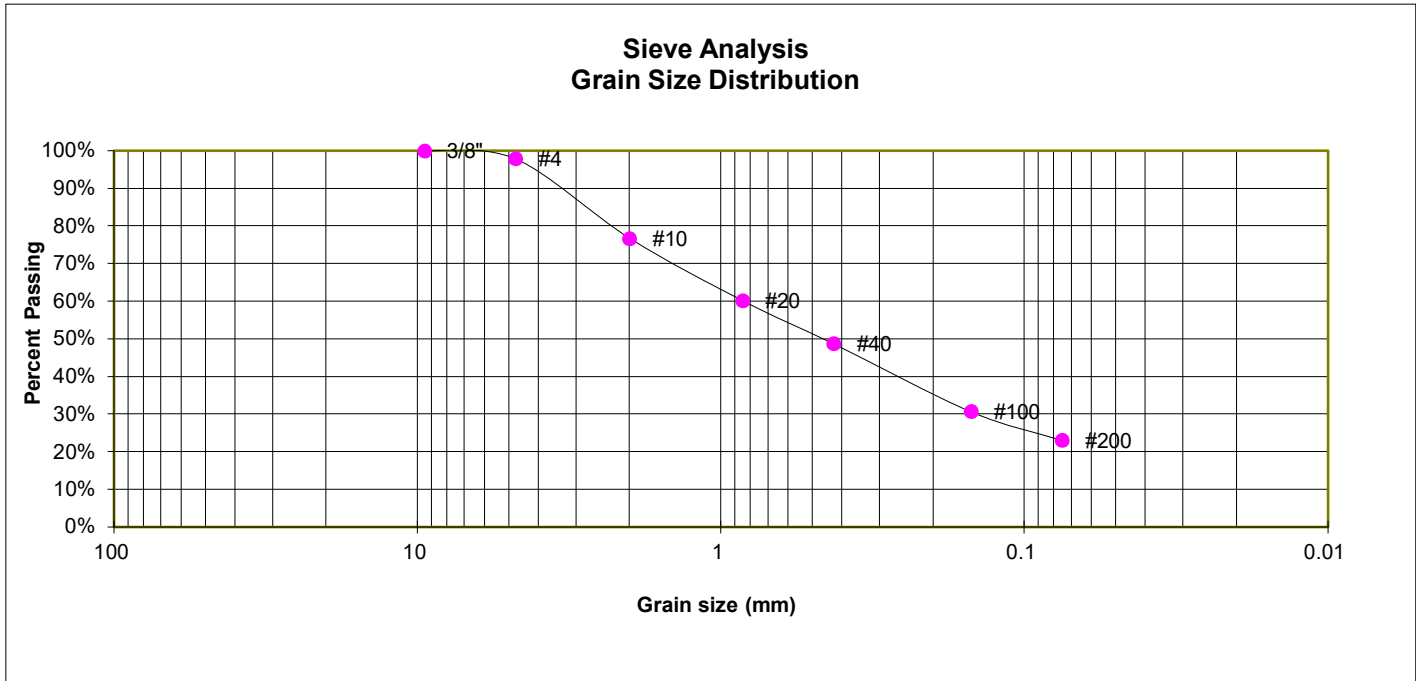
LATIGO TRAILS, FILING NO. 9  
 RDMA

JOB NO.  
 231802

**FIG. B-1**

TEST BORING 1  
 DEPTH (FT) 1-2

SOIL DESCRIPTION FILL, SAND, SILTY  
 SOIL TYPE 1



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         |               |
| 3/8"         | 100.0%        |
| 4            | 97.9%         |
| 10           | 76.7%         |
| 20           | 60.2%         |
| 40           | 48.7%         |
| 100          | 30.7%         |
| 200          | 23.1%         |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | 22 |
| Liquid Limit  | 28 |
| Plastic Index | 6  |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SM  
 AASHTO CLASSIFICATION: A-1-b  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

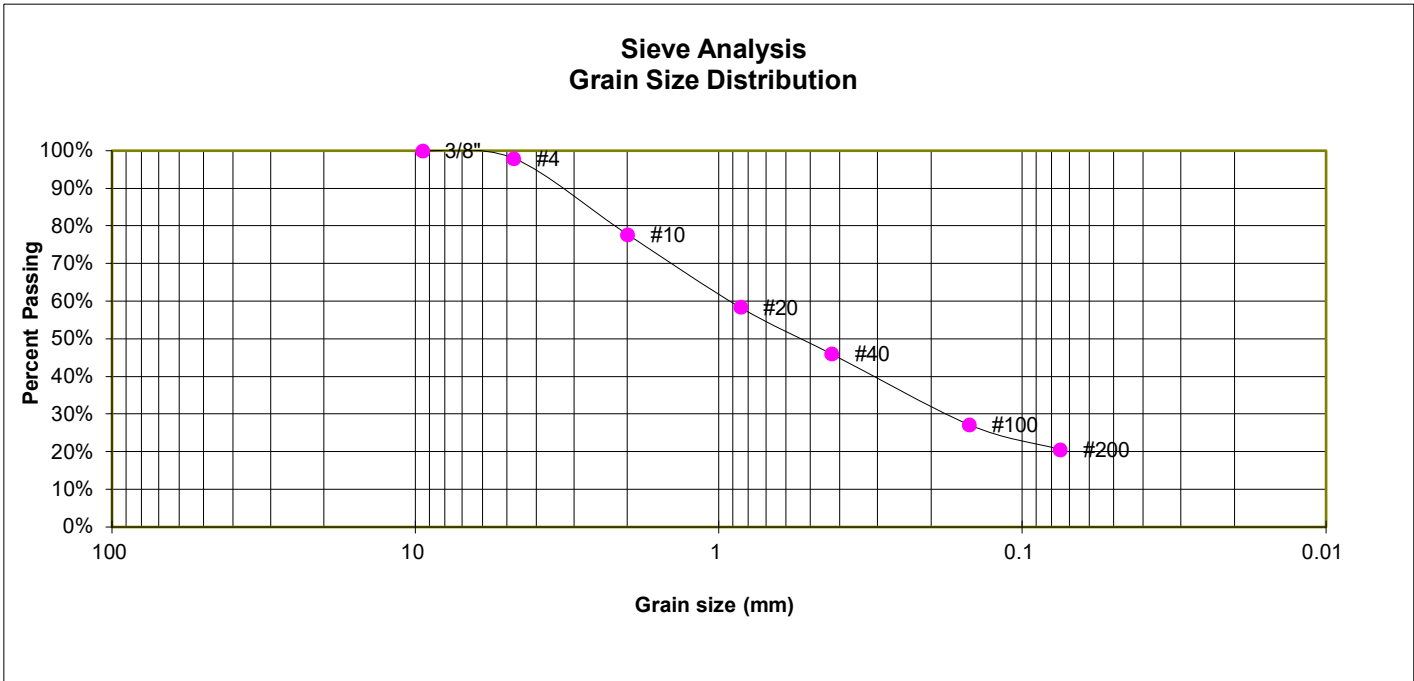
LATIGO TRAILS, FILING NO. 9  
 RDMA

JOB NO.  
 231802

**FIG. B-2**

TEST BORING 2  
 DEPTH (FT) 1-2

SOIL DESCRIPTION FILL, SAND, CLAYEY  
 SOIL TYPE 1



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         |               |
| 3/8"         | 100.0%        |
| 4            | 98.0%         |
| 10           | 77.7%         |
| 20           | 58.5%         |
| 40           | 46.0%         |
| 100          | 27.2%         |
| 200          | 20.6%         |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | 20 |
| Liquid Limit  | 30 |
| Plastic Index | 10 |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SC  
 AASHTO CLASSIFICATION: A-2-4  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

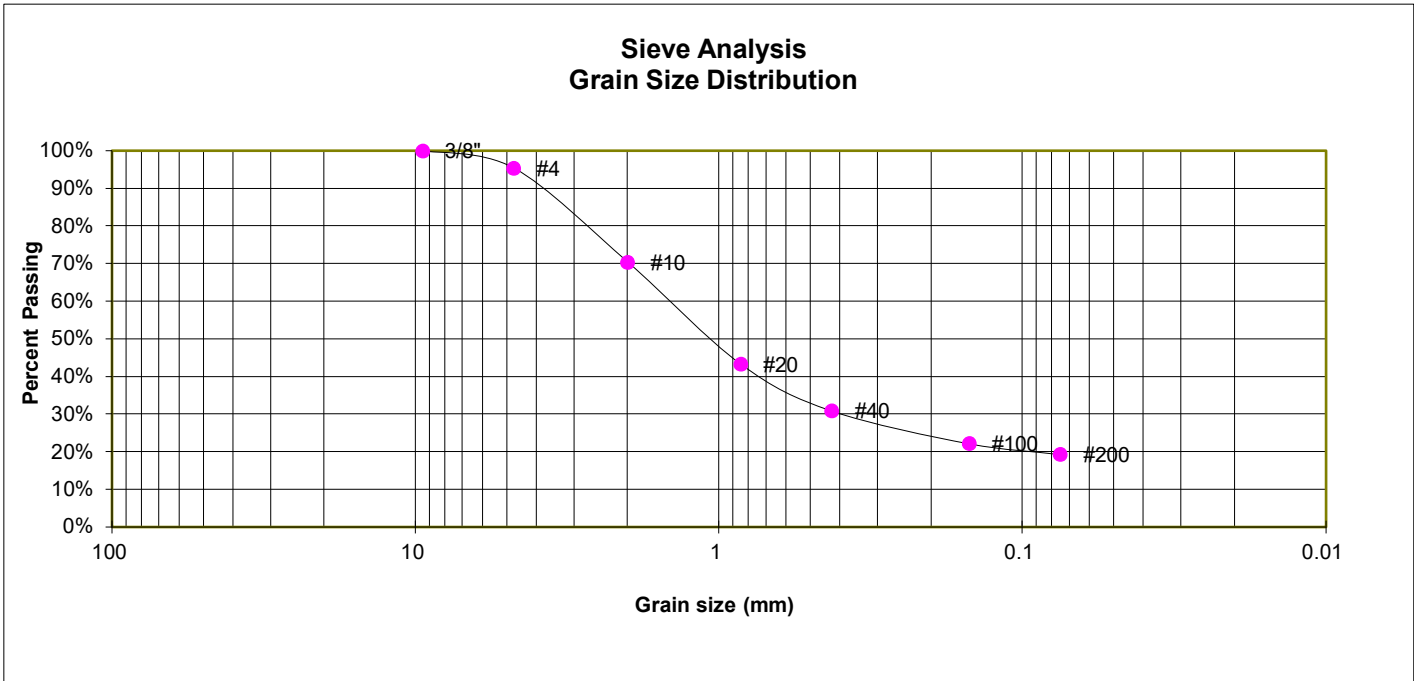
LATIGO TRAILS, FILING NO. 9  
 RDMA

JOB NO.  
 231802

**FIG. B-3**

TEST BORING 3  
 DEPTH (FT) 1-2

SOIL DESCRIPTION FILL, SAND, CLAYEY  
 SOIL TYPE 1



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         |               |
| 3/8"         | 100.0%        |
| 4            | 95.4%         |
| 10           | 70.4%         |
| 20           | 43.3%         |
| 40           | 30.9%         |
| 100          | 22.2%         |
| 200          | 19.3%         |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | 24 |
| Liquid Limit  | 28 |
| Plastic Index | 4  |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SM  
 AASHTO CLASSIFICATION: A-1-b  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

LATIGO TRAILS, FILING NO. 9  
 RDMA

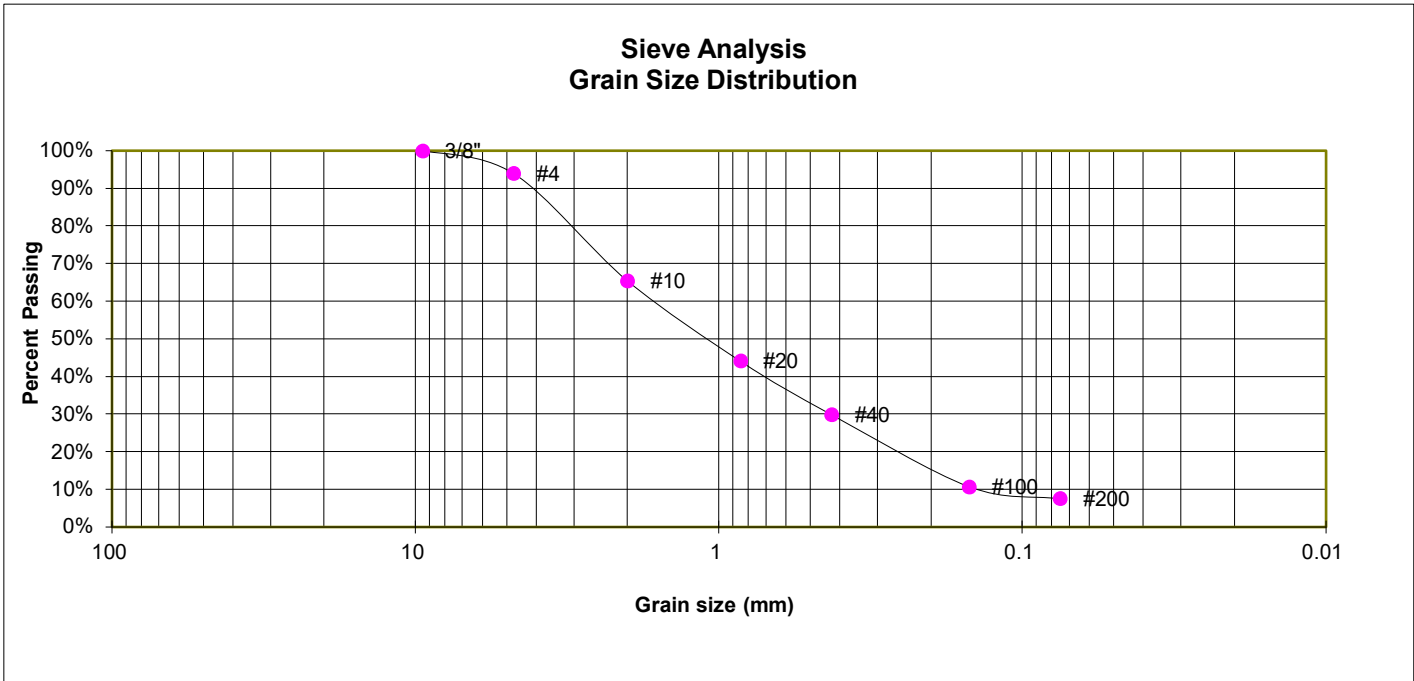
JOB NO.  
 231802

**FIG. B-4**



TEST BORING 4  
 DEPTH (FT) 1-2

SOIL DESCRIPTION SANDSTONE (SAND, WITH SILT)  
 SOIL TYPE 5



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         |               |
| 3/8"         | 100.0%        |
| 4            | 94.0%         |
| 10           | 65.4%         |
| 20           | 44.1%         |
| 40           | 29.9%         |
| 100          | 10.8%         |
| 200          | 7.6%          |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | NP |
| Liquid Limit  | NV |
| Plastic Index | NP |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SW-SM  
 AASHTO CLASSIFICATION: A-1-b  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

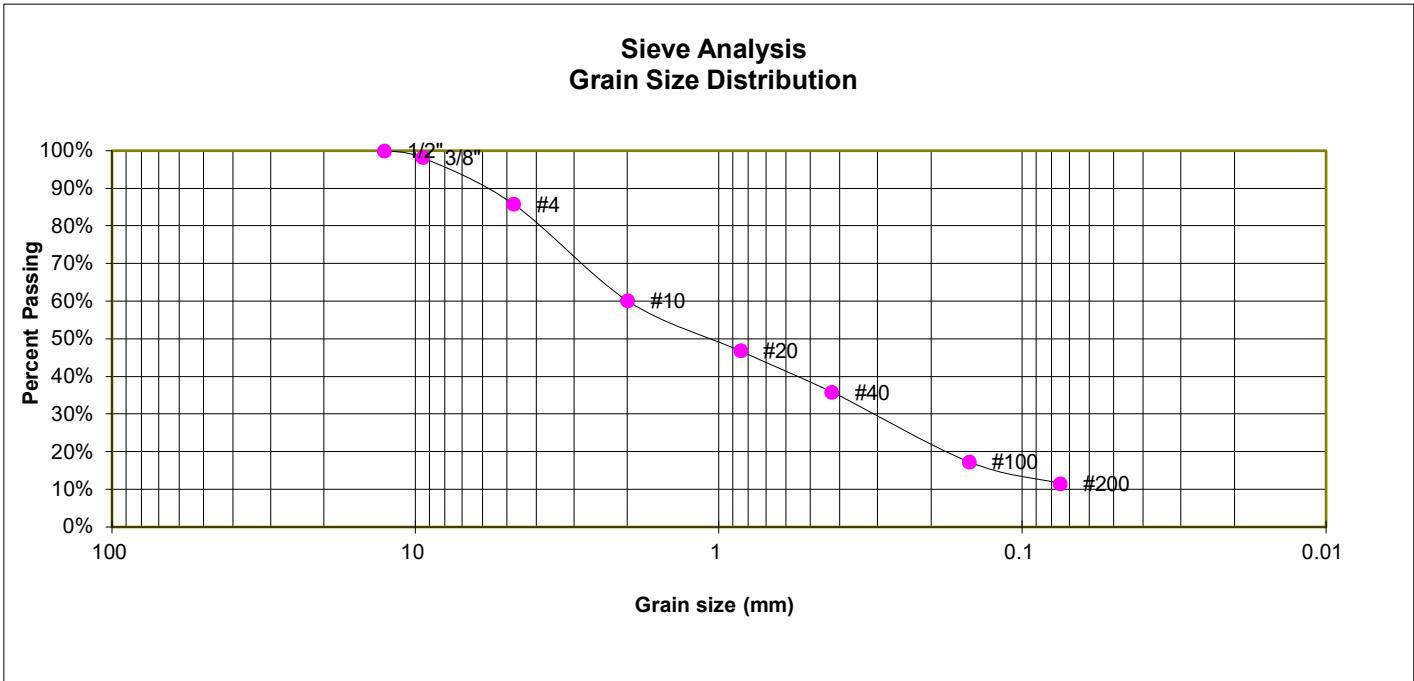
LATIGO TRAILS, FILING NO. 9  
 RDMA

JOB NO.  
 231802

**FIG. B-5**

TEST BORING 5  
 DEPTH (FT) 1-2

SOIL DESCRIPTION SANDSTONE (SAND, WITH SILT)  
 SOIL TYPE 5



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         | 100.0%        |
| 3/8"         | 98.2%         |
| 4            | 85.8%         |
| 10           | 60.2%         |
| 20           | 46.9%         |
| 40           | 35.9%         |
| 100          | 17.4%         |
| 200          | 11.6%         |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | NP |
| Liquid Limit  | NV |
| Plastic Index | NP |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SW-SM  
 AASHTO CLASSIFICATION: A-1-b  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

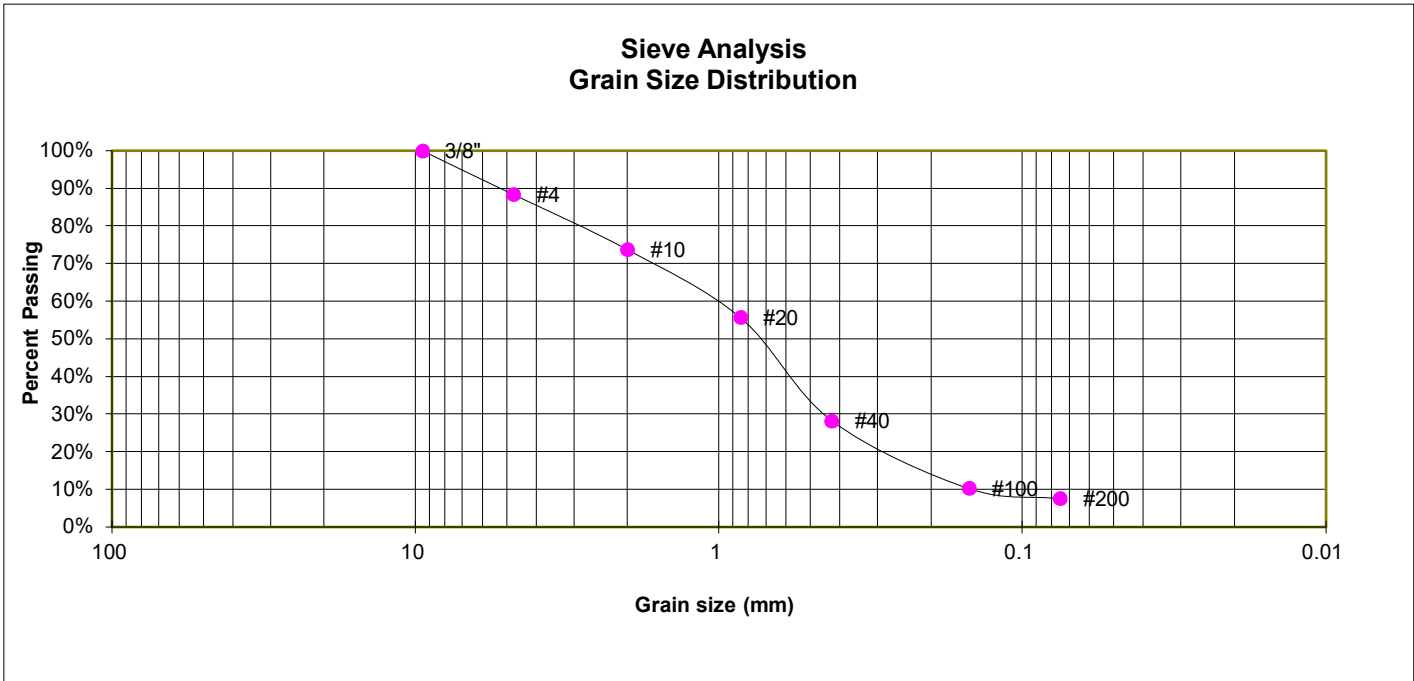
LATIGO TRAILS, FILING NO. 9  
 RDMA

JOB NO.  
 231802

**FIG. B-6**

TEST BORING 6  
 DEPTH (FT) 1-2

SOIL DESCRIPTION SANDSTONE (SAND, WITH SILT)  
 SOIL TYPE 5



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         |               |
| 3/8"         | 100.0%        |
| 4            | 88.4%         |
| 10           | 73.7%         |
| 20           | 55.7%         |
| 40           | 28.3%         |
| 100          | 10.3%         |
| 200          | 7.6%          |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | NP |
| Liquid Limit  | NV |
| Plastic Index | NP |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SW-SM  
 AASHTO CLASSIFICATION: A-1-b  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

LATIGO TRAILS, FILING NO. 9  
 RDMA

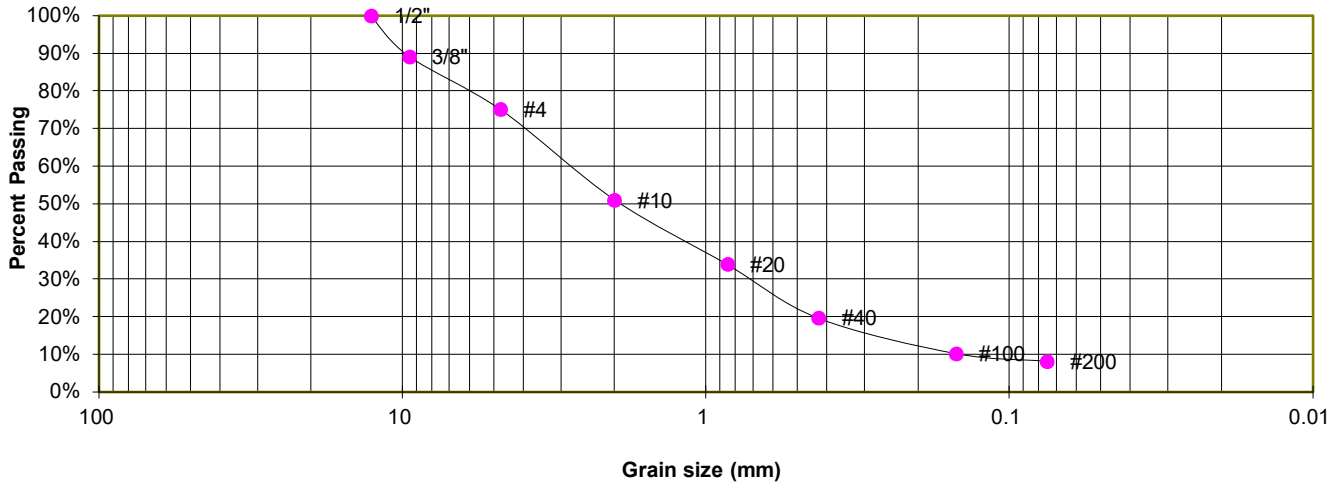
JOB NO.  
 231802

**FIG. B-7**

TEST BORING 7  
 DEPTH (FT) 1-2

SOIL DESCRIPTION SANDSTONE (SAND, WITH SILT)  
 SOIL TYPE 5

**Sieve Analysis  
 Grain Size Distribution**



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         | 100.0%        |
| 3/8"         | 89.2%         |
| 4            | 75.1%         |
| 10           | 51.0%         |
| 20           | 33.9%         |
| 40           | 19.6%         |
| 100          | 10.3%         |
| 200          | 8.2%          |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | NP |
| Liquid Limit  | NV |
| Plastic Index | NP |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SW-SM  
 AASHTO CLASSIFICATION: A-1-b  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

LATIGO TRAILS, FILING NO. 9  
 RDMA

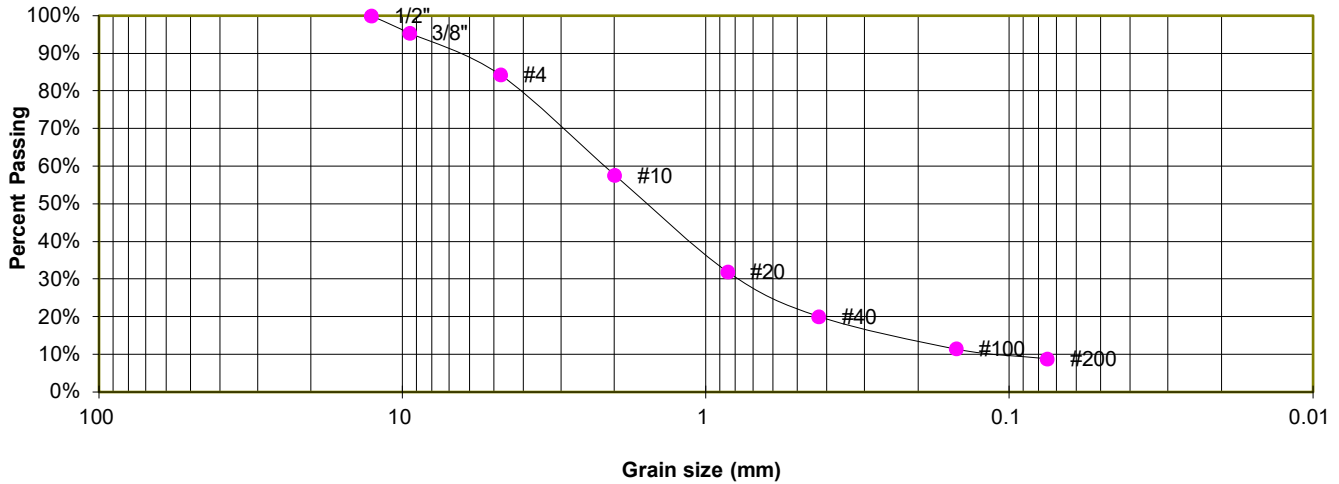
JOB NO.  
 231802

**FIG. B-8**

TEST BORING 8  
 DEPTH (FT) 1-2

SOIL DESCRIPTION SAND, WITH SILT  
 SOIL TYPE 3

**Sieve Analysis  
 Grain Size Distribution**



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         | 100.0%        |
| 3/8"         | 95.5%         |
| 4            | 84.2%         |
| 10           | 57.7%         |
| 20           | 32.0%         |
| 40           | 20.1%         |
| 100          | 11.5%         |
| 200          | 8.8%          |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | NP |
| Liquid Limit  | NV |
| Plastic Index | NP |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SW-SM  
 AASHTO CLASSIFICATION: A-1-b  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

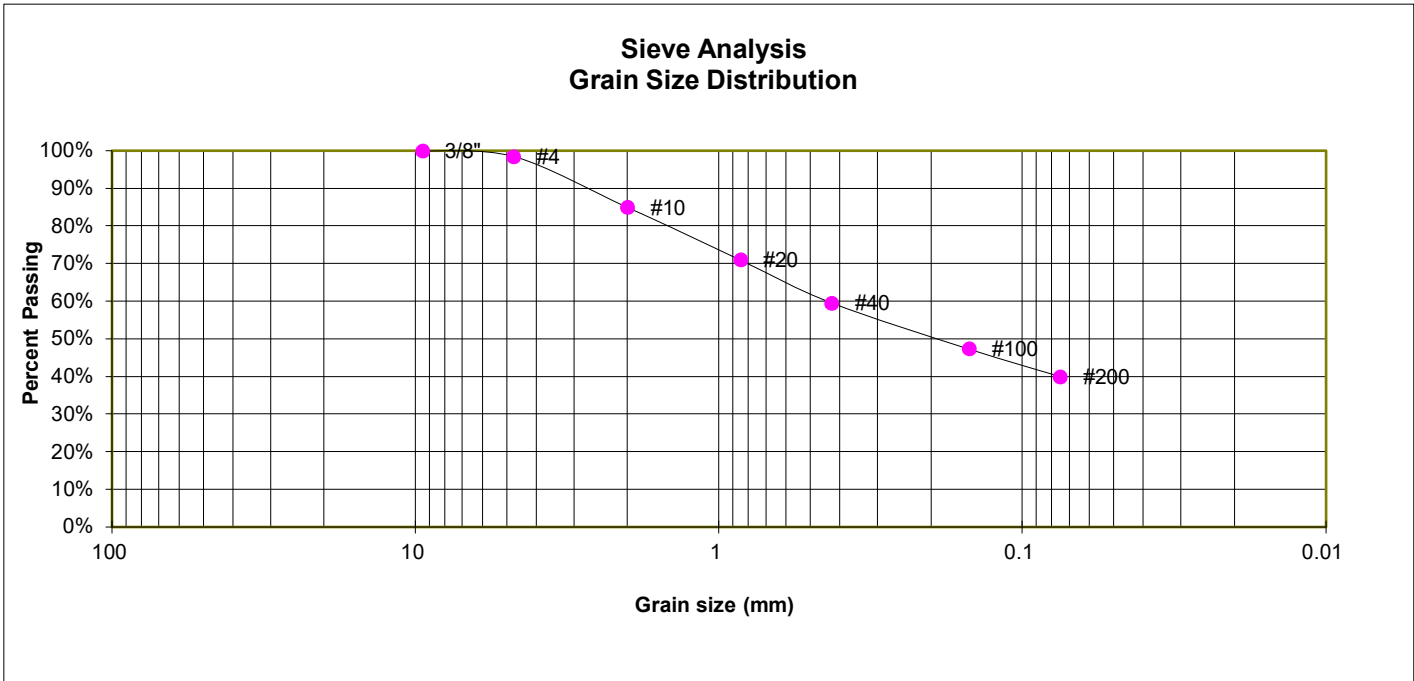
LATIGO TRAILS, FILING NO. 9  
 RDMA

JOB NO.  
 231802

**FIG. B-9**

TEST BORING 10  
 DEPTH (FT) 1-2

SOIL DESCRIPTION FILL, SAND, CLAYEY  
 SOIL TYPE 2



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         |               |
| 3/8"         | 100.0%        |
| 4            | 98.5%         |
| 10           | 85.0%         |
| 20           | 71.0%         |
| 40           | 59.6%         |
| 100          | 47.4%         |
| 200          | 40.0%         |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | 23 |
| Liquid Limit  | 37 |
| Plastic Index | 14 |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SC  
 AASHTO CLASSIFICATION: A-6  
 AASHTO GROUP INDEX: 2



**LABORATORY TEST RESULTS**

LATIGO TRAILS, FILING NO. 9  
 RDMA

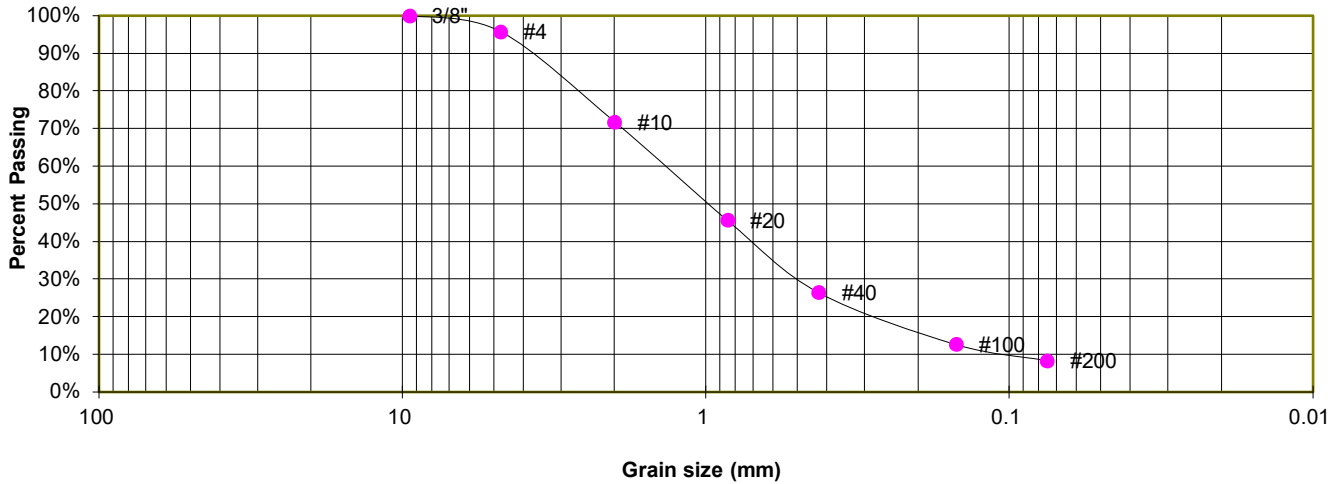
JOB NO.  
 231802

**FIG. B-11**

TEST BORING 9  
 DEPTH (FT) 1-2

SOIL DESCRIPTION SAND, WITH SILT  
 SOIL TYPE 3

**Sieve Analysis  
 Grain Size Distribution**



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         |               |
| 3/8"         | 100.0%        |
| 4            | 95.8%         |
| 10           | 71.8%         |
| 20           | 45.7%         |
| 40           | 26.4%         |
| 100          | 12.7%         |
| 200          | 8.4%          |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | NP |
| Liquid Limit  | NV |
| Plastic Index | NP |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SW-SM  
 AASHTO CLASSIFICATION: A-1-b  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

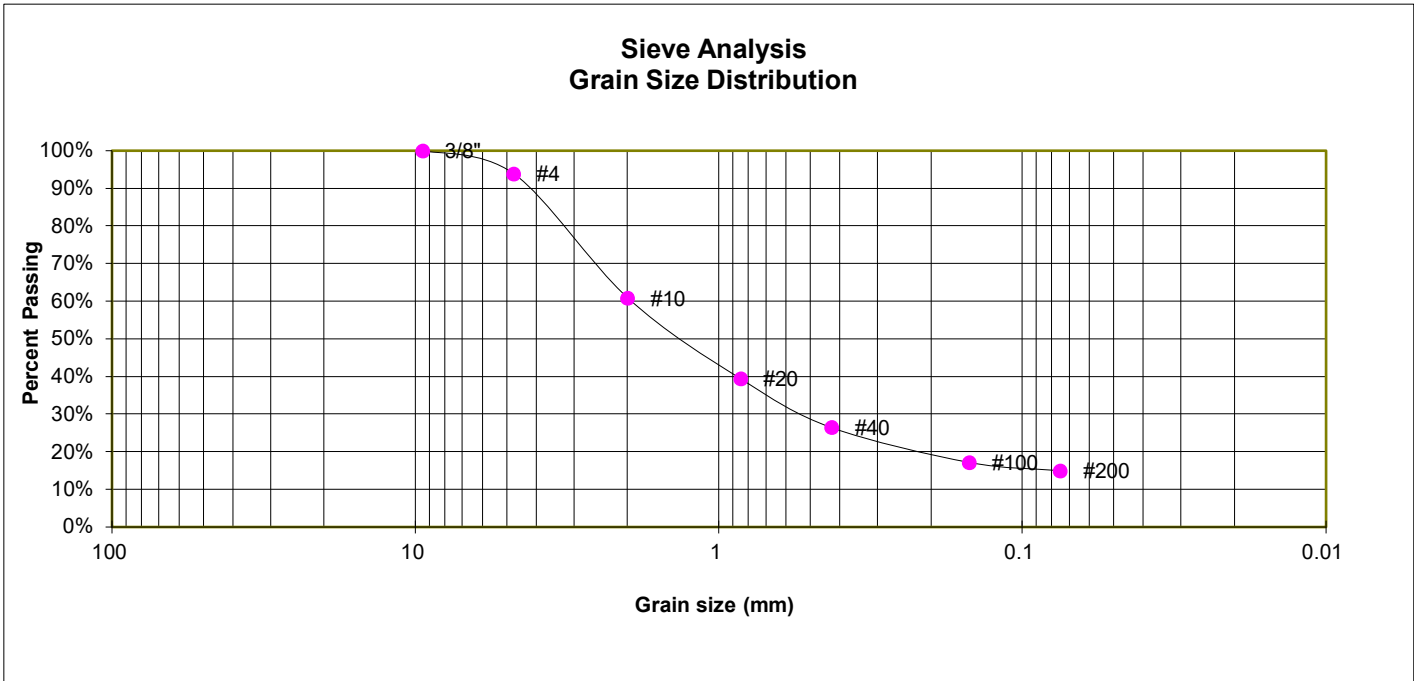
LATIGO TRAILS, FILING NO. 9  
 RDMA

JOB NO.  
 231802

**FIG. B-10**

TEST BORING 1  
 DEPTH (FT) 10

SOIL DESCRIPTION SANDSTONE (SAND, SILTY)  
 SOIL TYPE 5



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         |               |
| 3/8"         | 100.0%        |
| 4            | 93.9%         |
| 10           | 60.9%         |
| 20           | 39.4%         |
| 40           | 26.5%         |
| 100          | 17.2%         |
| 200          | 15.0%         |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | 23 |
| Liquid Limit  | 31 |
| Plastic Index | 8  |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SM  
 AASHTO CLASSIFICATION: A-1-b  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

LATIGO TRAILS, FILING NO. 9  
 RDMA

JOB NO.  
 231802

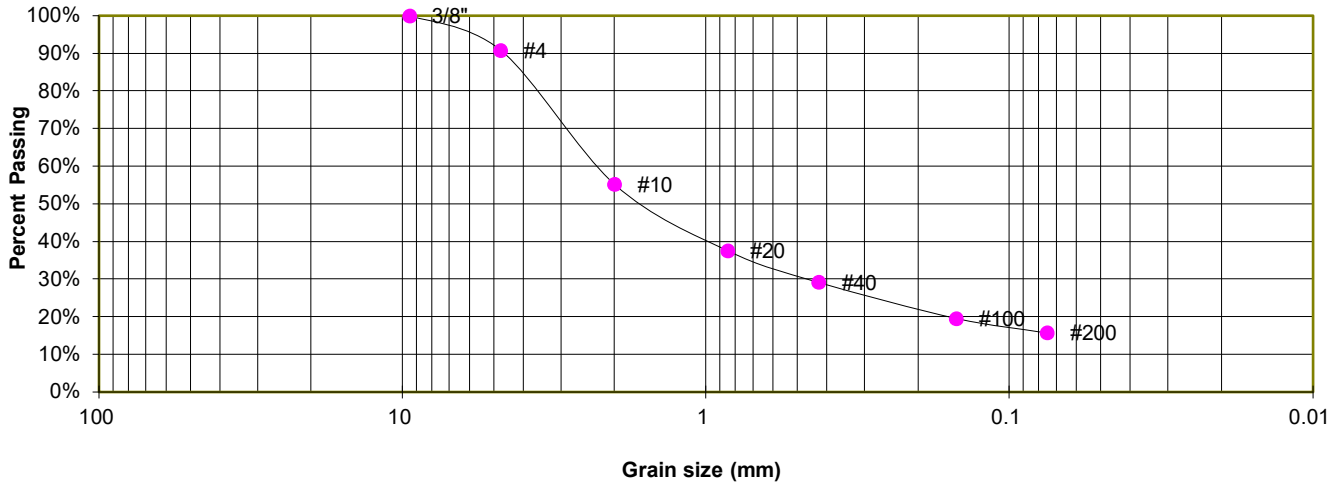
**FIG. B-12**



TEST BORING 9  
 DEPTH (FT) 5

SOIL DESCRIPTION SANDSTONE (SAND, SILTY)  
 SOIL TYPE 5

**Sieve Analysis  
 Grain Size Distribution**



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         |               |
| 3/8"         | 100.0%        |
| 4            | 90.8%         |
| 10           | 55.2%         |
| 20           | 37.6%         |
| 40           | 29.2%         |
| 100          | 19.6%         |
| 200          | 15.7%         |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | NP |
| Liquid Limit  | NV |
| Plastic Index | NP |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SM  
 AASHTO CLASSIFICATION: A-1-b  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

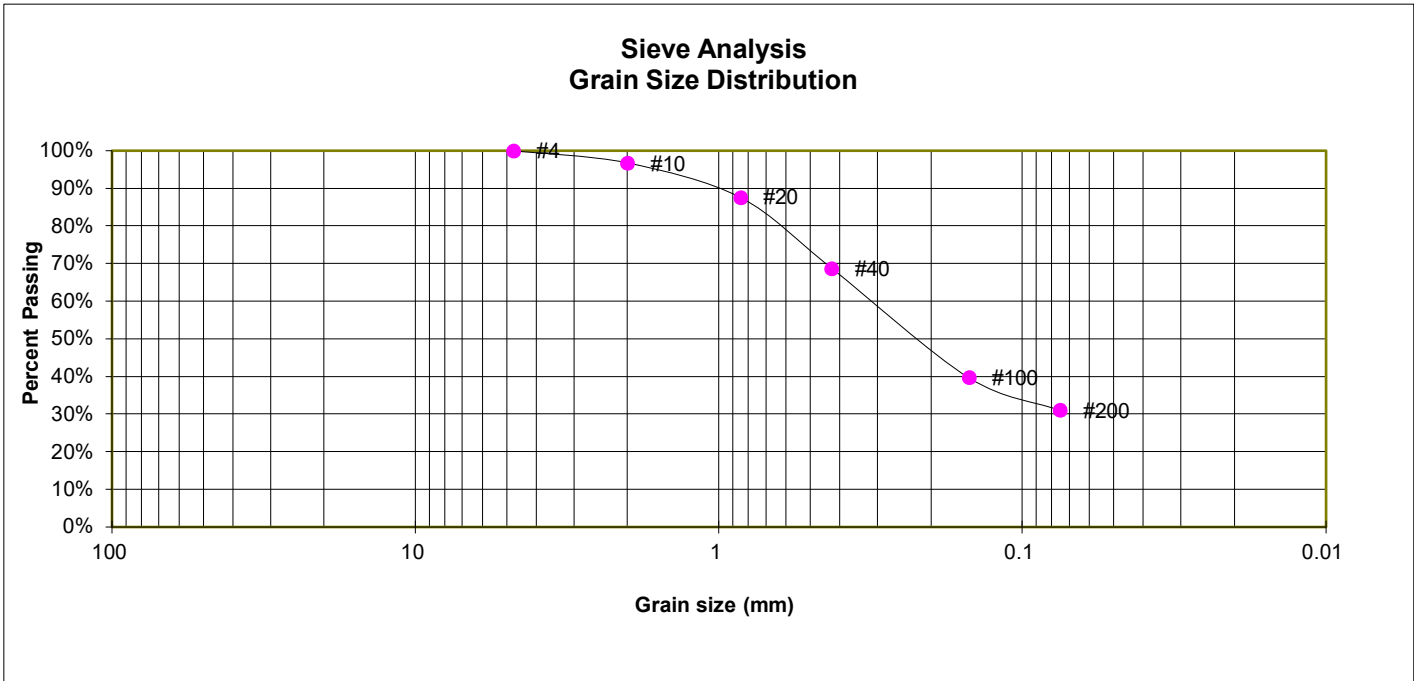
LATIGO TRAILS, FILING NO. 9  
 RDMA

JOB NO.  
 231802

**FIG. B-13**

TEST BORING 3  
 DEPTH (FT) 5

SOIL DESCRIPTION SANDSTONE (SAND, CLAYEY)  
 SOIL TYPE 6



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         |               |
| 3/8"         |               |
| 4            | 100.0%        |
| 10           | 96.8%         |
| 20           | 87.6%         |
| 40           | 68.7%         |
| 100          | 39.7%         |
| 200          | 31.1%         |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | 19 |
| Liquid Limit  | 28 |
| Plastic Index | 9  |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SC  
 AASHTO CLASSIFICATION: A-2-4  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

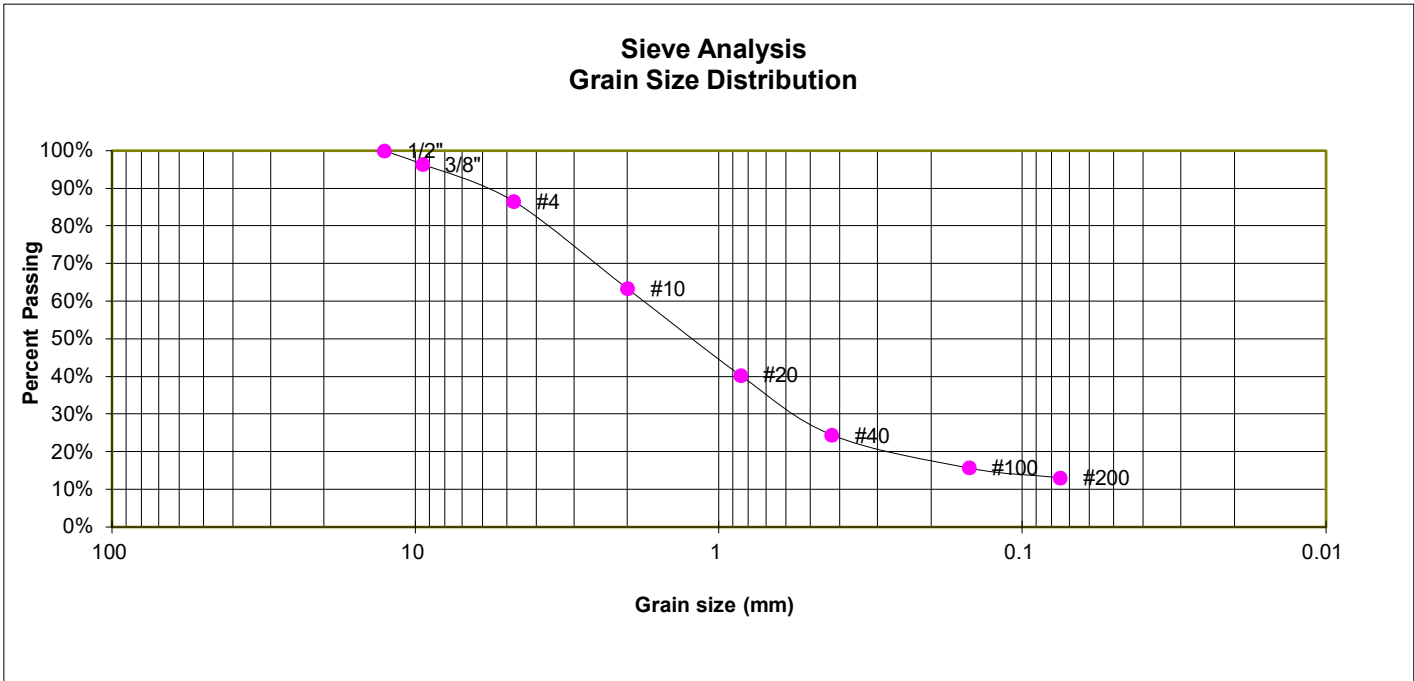
LATIGO TRAILS, FILING NO. 9  
 RDMA

JOB NO.  
 231802

**FIG. B-14**

TEST BORING 8  
 DEPTH (FT) 5

SOIL DESCRIPTION SANDSTONE (SAND, CLAYEY)  
 SOIL TYPE 6



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         | 100.0%        |
| 3/8"         | 96.4%         |
| 4            | 86.6%         |
| 10           | 63.3%         |
| 20           | 40.4%         |
| 40           | 24.5%         |
| 100          | 15.8%         |
| 200          | 13.1%         |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | 21 |
| Liquid Limit  | 41 |
| Plastic Index | 20 |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SC  
 AASHTO CLASSIFICATION: A-2-6  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

LATIGO TRAILS, FILING NO. 9  
 RDMA

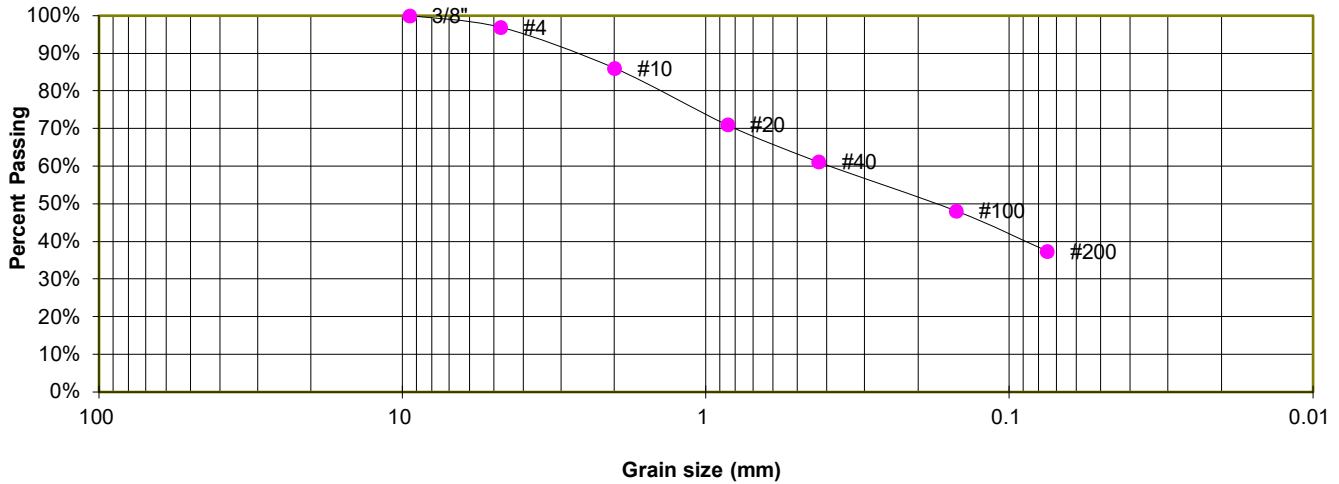
JOB NO.  
 231802

**FIG. B-15**

TEST BORING 10  
 DEPTH (FT) 5

SOIL DESCRIPTION SAND, CLAYEY  
 SOIL TYPE 4

**Sieve Analysis  
 Grain Size Distribution**



**GRAIN SIZE ANALYSIS**

| U.S. Sieve # | Percent Finer |
|--------------|---------------|
| 3"           |               |
| 1 1/2"       |               |
| 3/4"         |               |
| 1/2"         |               |
| 3/8"         | 100.0%        |
| 4            | 96.9%         |
| 10           | 86.1%         |
| 20           | 71.0%         |
| 40           | 61.2%         |
| 100          | 48.2%         |
| 200          | 37.4%         |

**ATTERBERG LIMITS**

|               |    |
|---------------|----|
| Plastic Limit | 15 |
| Liquid Limit  | 24 |
| Plastic Index | 9  |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SC  
 AASHTO CLASSIFICATION: A-2-6  
 AASHTO GROUP INDEX: 0



**LABORATORY TEST RESULTS**

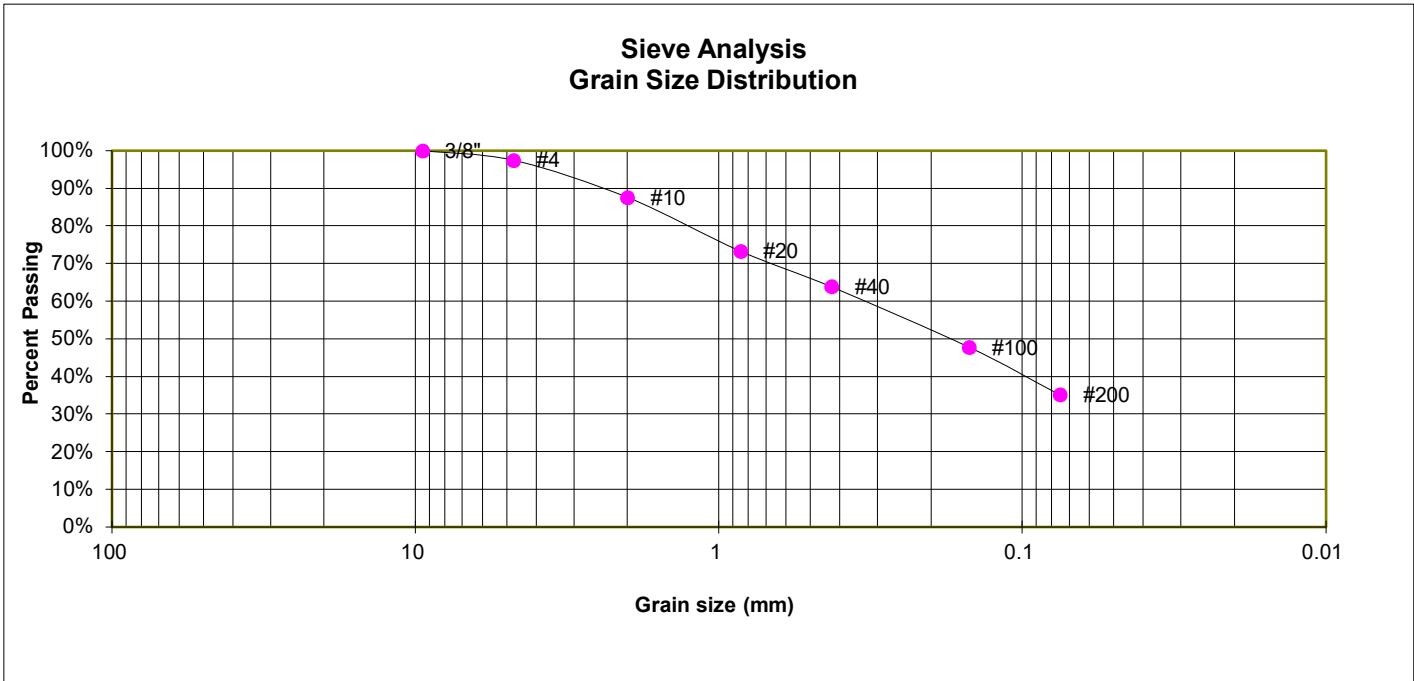
LATIGO TRAILS, FILING NO. 9  
 RDMA

JOB NO.  
 231802

**FIG. B-16**

TEST BORING 7  
DEPTH (FT) 10

SOIL DESCRIPTION SANDSTONE (SAND, CLAYEY)  
SOIL TYPE 6



**GRAIN SIZE ANALYSIS**

| U.S.<br>Sieve # | Percent<br>Finer |
|-----------------|------------------|
| 3"              |                  |
| 1 1/2"          |                  |
| 3/4"            |                  |
| 1/2"            |                  |
| 3/8"            | 100.0%           |
| 4               | 97.5%            |
| 10              | 87.6%            |
| 20              | 73.3%            |
| 40              | 63.9%            |
| 100             | 47.8%            |
| 200             | 35.2%            |

**SOIL CLASSIFICATION**

USCS CLASSIFICATION: SC  
AASHTO CLASSIFICATION:  
AASHTO GROUP INDEX:



**LABORATORY TEST RESULTS**

LATIGO TRAILS, FILING NO. 9  
RDMA

JOB NO.  
231802

**FIG. B-17**

TEST BORING 7  
DEPTH (FT) 10

SOIL DESCRIPTION SANDSTONE (SAND, CLAYEY)  
SOIL TYPE 6



**SWELL/COLLAPSE TEST RESULTS**

NATURAL UNIT DRY WEIGHT (PCF): 86  
NATURAL MOISTURE CONTENT: 14.8%  
SWELL/COLLAPSE (%): -2.8%



**SWELL TEST RESULTS**

LATIGO TRAILS, FILING NO. 9  
RDMA

JOB NO.  
231802

**FIG. B-18**

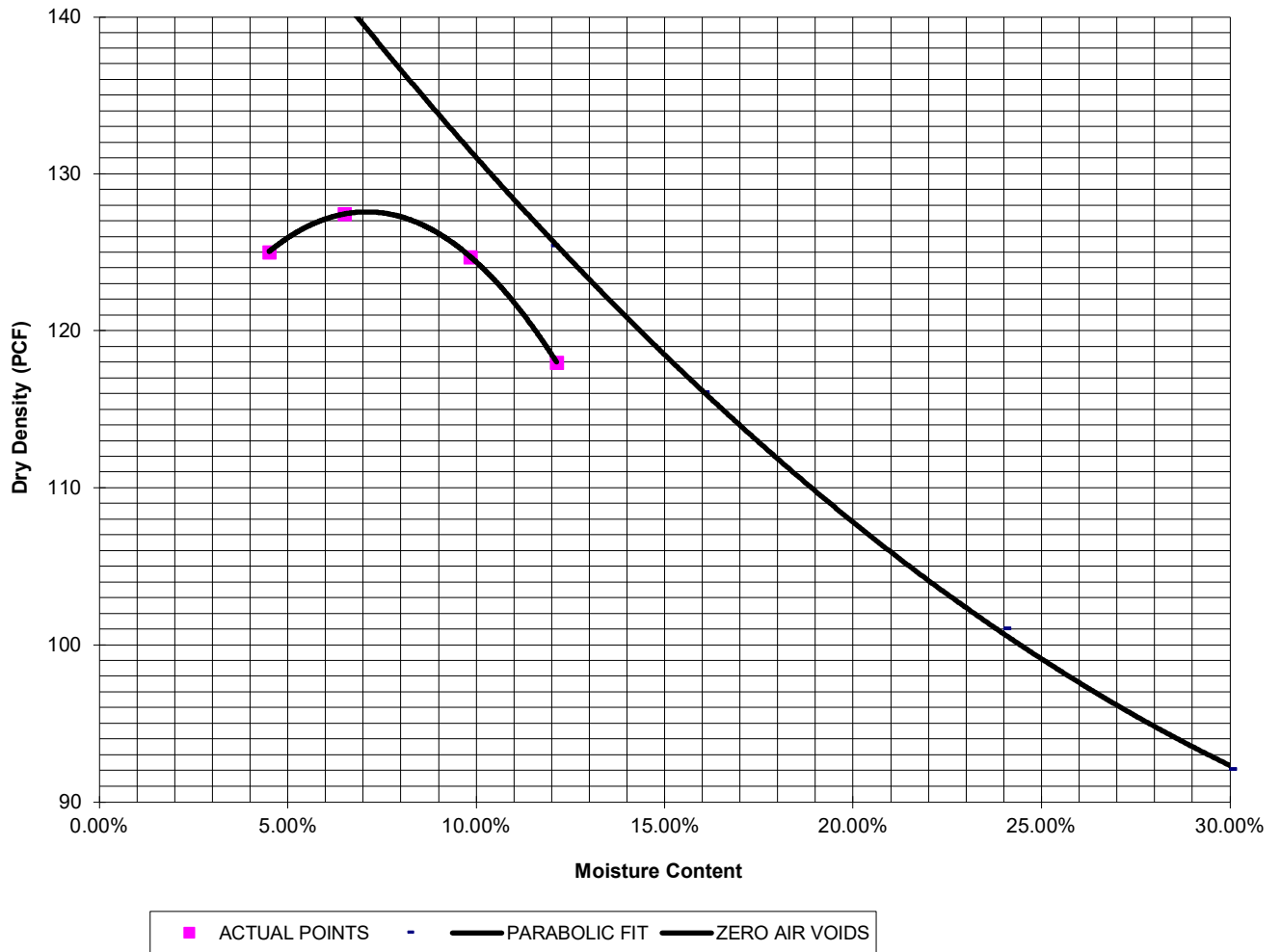
SAMPLE LOCATION TB-1 @ 0-3'

SOIL DESCRIPTION FILL, SAND, SILTY, BROWN  
SOIL TYPE 1

**PROCTOR DATA**

IDENTIFICATION: SM  
PROCTOR TEST #: 1  
TEST BY: DK  
TEST DESIGNATION: ASTM-1557-A  
MAXIMUM DRY DENSITY (PCF): 127.6  
OPTIMUM MOISTURE: 7.1

**Compaction Curve**



**LABORATORY TEST RESULTS**

LATIGO TRAILS, FILING NO. 9  
RDMA

JOB NO.  
231802

**FIG. B-19**

SAMPLE LOCATION TB-1 @ 0-3'

SOIL DESCRIPTION FILL, SAND, SILTY, BROWN  
SOIL TYPE 1

**CBR TEST LOAD DATA**

Piston Diameter (cm): 4.958

Piston Area (in<sup>2</sup>): 2.993

| Penetration<br>Depth<br>(inches) | 10 BLOWS<br>Mold # 1 |                 | 25 BLOWS<br>Mold # 2 |                 | 56 BLOWS<br>Mold # 3 |                 |
|----------------------------------|----------------------|-----------------|----------------------|-----------------|----------------------|-----------------|
|                                  | Load<br>(lbs)        | Stress<br>(psi) | Load<br>(lbs)        | Stress<br>(psi) | Load<br>(lbs)        | Stress<br>(psi) |
| 0.000                            | 0                    | 0.00            | 0                    | 0.00            | 0                    | 0.00            |
| 0.025                            | 437                  | 146.03          | 746                  | 249.29          | 1095                 | 365.91          |
| 0.050                            | 723                  | 241.60          | 1440                 | 481.20          | 2020                 | 675.02          |
| 0.075                            | 881                  | 294.40          | 1855                 | 619.88          | 2826                 | 944.36          |
| 0.100                            | 992                  | 331.49          | 2166                 | 723.81          | 3588                 | 1198.99         |
| 0.125                            | 1062                 | 354.89          | 2410                 | 805.34          | 4150                 | 1386.80         |
| 0.150                            | 1125                 | 375.94          | 2600                 | 868.84          | 4653                 | 1554.88         |
| 0.175                            | 1186                 | 396.32          | 2768                 | 924.98          | 5195                 | 1736.00         |
| 0.200                            | 1239                 | 414.03          | 2916                 | 974.43          | 5740                 | 1918.12         |
| 0.300                            | 1427                 | 476.86          | 3482                 | 1163.57         | 6000                 | 2005.01         |
| 0.400                            | 1565                 | 522.97          | 3813                 | 1274.18         |                      |                 |
| 0.500                            | 1713                 | 572.43          | 4182                 | 1397.49         |                      |                 |

**MOISTURE AND DENSITY DATA**

|                   | Mold # 1 | Mold # 2 | Mold # 3 |
|-------------------|----------|----------|----------|
| Can #             | 350      | 351      | 352      |
| Wt. Can           | 7.99     | 7.97     | 8.12     |
| Wt. Can+Wet       | 239.14   | 232.82   | 196.74   |
| Wt. Can+Dry       | 210.97   | 209.51   | 179.94   |
| Wt. H2O           | 28.17    | 23.31    | 16.8     |
| Wt. Dry Soil      | 202.98   | 201.54   | 171.82   |
| Moisture Content  | 13.88%   | 11.57%   | 9.78%    |
| Wet Density (PCF) | 126.0    | 132.5    | 138.6    |
| Dry Density (PCF) | 117.6    | 123.7    | 129.4    |
| % Compaction      | 92%      | 97%      | 101%     |
| CBR               | 33.15    | 72.38    | 119.90   |

**PROCTOR DATA**

|                               |       |
|-------------------------------|-------|
| Maximum Dry Density (pcf)     | 127.6 |
| Optimum Moisture              | 7.1   |
| 90% of Max. Dry Density (pcf) | 114.8 |
| 95% of Max. Dry Density (pcf) | 121.2 |

CBR at 90% of Max. Density = 15.26 ~ R VALUE 50

CBR at 95% of Max. Density = 56.53 ~ R VALUE 76



**LABORATORY TEST RESULTS**

LATIGO TRAILS, FILING NO. 9  
RDMA

JOB NO.  
231802

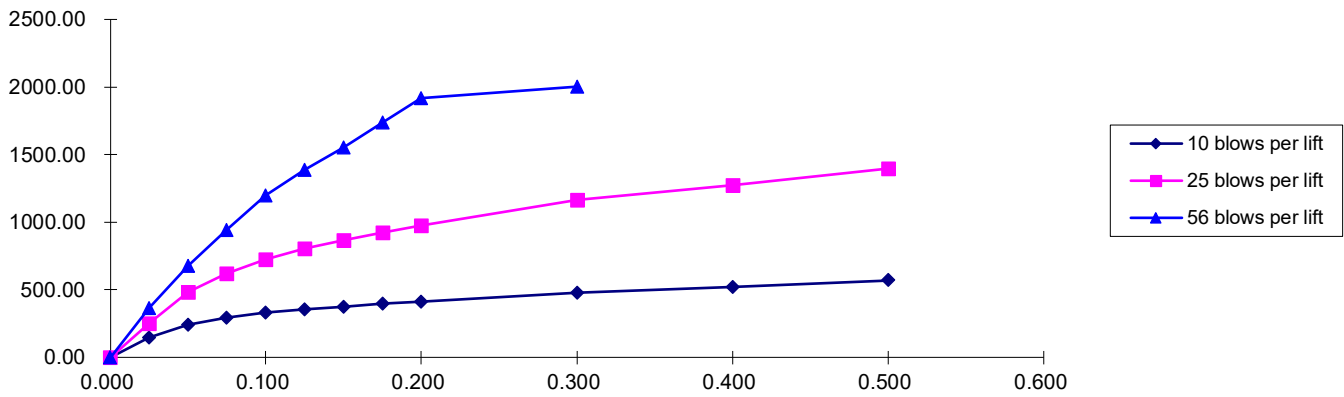
**FIG. B-20**



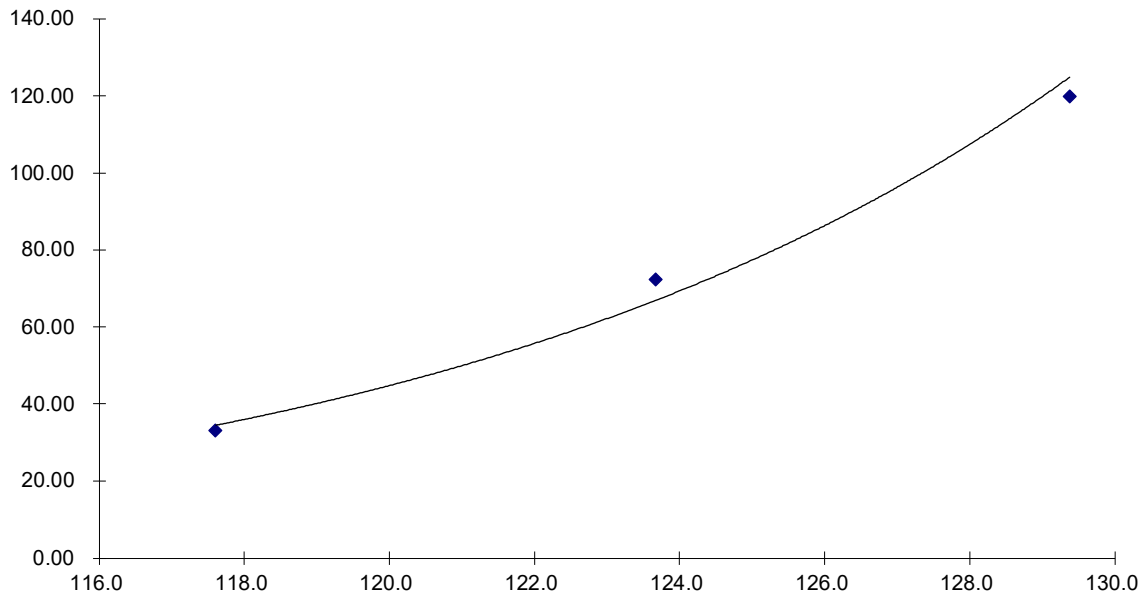
SAMPLE LOCATION TB-1 @ 0-3'

SOIL DESCRIPTION FILL, SAND, SILTY, BROWN  
SOIL TYPE 1

Stress VS Penetration



Bearing Ratio VS Dry Density



LABORATORY TEST RESULTS

LATIGO TRAILS, FILING NO. 9  
RDMA

JOB NO.  
231802

FIG. B-21



## **APPENDIX C: Pavement Design Calculations**

## FLEXIBLE PAVEMENT DESIGN

### PROJECT DATA

Project Location: Latigo Trails Filing No. 9 Local (low volume) Roadways  
 Job Number: 231802

### DESIGN DATA

|                                                           |                     |            |
|-----------------------------------------------------------|---------------------|------------|
| Equivalent (18-kip) Single Axle Load Applications (ESAL): | ESAL ( $W_{18}$ ) = | 36,500     |
| Design CBR                                                | CBR =               | 10         |
| Standard Deviation                                        | $S_o$ =             | 0.44       |
| Loss in Serviceability                                    | $\Delta\psi$ =      | 2.5        |
| Reliability                                               | Reliability =       | 80         |
| Reliability (z-statistic)                                 | $Z_R$ =             | -0.84      |
| Soil Resilient Modulus                                    | $M_R$ =             | 15,000 psi |

Required Structural Number (SN): ➔ SN = 1.38

### DESIGN EQUATIONS

#### Resilient Modulus

If using CBR:

$$M_R = (\text{CBR}) \times 1,500$$

If using R-Value:

$$M_R = 10^{[(S_1 + 18.72) / 6.24]} \text{ where: } S_1 = [(R\text{-value} - 5) / 11.29] + 3$$

#### Required Structural Number

$$\log_{10} W_{18} = Z_R \cdot S_o + 9.36 \cdot \log_{10}(SN+1) - 0.20 + \frac{\log_{10} \left[ \frac{\Delta \text{PSI}}{4.2 - 1.5} \right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 \cdot \log_{10} M_R - 8.07$$

#### Pavement Section Thickness

$$SN^* = C_1 D_1 + C_2 D_2 \quad \text{where:}$$

- $C_1$  = Strength Coefficient - HMA
- $C_2$  = Strength Coefficient - ABC
- $D_1$  = Depth of HMA (inches)
- $D_2$  = Depth of ABC (inches)

### RECOMMENED THICKNESSES

| Layer | Material | Structural Layer | Thickness ( $D^*_i$ ) | $SN^*_i$       | SN   |
|-------|----------|------------------|-----------------------|----------------|------|
| 1     | HMA      | $C_1 = 0.44$     | 4.0 inches            | 1.760          | -    |
| 2     | ABC      | $C_2 = 0.11$     | 4.0 inches            | 0.440          |      |
|       |          |                  |                       | $SN^* = 2.200$ | 1.38 |

Pavement SN > Required SN, Design is Acceptable

FIG. C-1