

# Geotechnical Engineering Pavement Thickness Design Report

Centennial Boulevard Reconstruction  
West Fillmore Street to Garden of the Gods Road  
Colorado Springs, Colorado

April 4, 2016

Terracon Project No. 23155014

**Prepared for:**

Wilson & Company, Inc.  
Colorado Springs, Colorado

**Prepared by:**

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Colorado Springs, Colorado

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Environmental



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Materials



April 4, 2016

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Attn: Mr. Dale Ekberg, P.E.

Re: Geotechnical Engineering Pavement Thickness Design Report  
Centennial Boulevard Reconstruction  
West Fillmore Street to Garden of the Gods Road  
Colorado Springs, Colorado  
Terracon Project Number: 23155014

Mr. Ekberg:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering exploration for the above referenced project. This study was performed in general accordance with our proposal number D2315037 dated April 7, 2015. This report presents the findings of the subsurface exploration and provides geotechnical recommendations needed to aid in the design and construction of pavements for this project.

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

Sincerely,  
**Terracon Consultants, Inc.**

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## EXECUTIVE SUMMARY

A geotechnical engineering exploration and pavement thickness design analysis has been performed for the Centennial Boulevard Reconstruction from West Fillmore Avenue to Garden of the Gods Road in Colorado Springs, Colorado. Based on the information obtained from our subsurface exploration and the laboratory testing completed, the following geotechnical considerations were identified and should be considered for the proposed roadway construction:

- The subgrade soils varying along the alignment from A-1-a, A-2-4, A-4, A-2-6, A-6, A-7-5 and A-7-6 according to the AASHTO classification system. The weaker subgrade soils (A-6 and A-7-6) are generally at the southern and central portions of the alignment. We have provided several pavement thickness designs and subgrade mitigation as part of our recommendations.
- Expansive and potentially low strength clay soils were encountered within the influence of the pavement section in portions of the Centennial Boulevard alignment. These areas will potentially require mitigation by removal and replacement, moisture conditioning, and/or chemical stabilization.
- Low strength soils are expected to be locally present. Consequently, the soils, where encountered, will require removal or localized stabilization prior to pavement installation.
- We recommend edge drains be installed, particularly in portions of the roadway alignment that encounter clay subgrade soils.
- Compaction and importation of pavement supporting soils should follow the recommendations outlined in the “Earthwork” section of this report.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and this report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

**GEOTECHNICAL ENGINEERING  
PAVEMENT THICKNESS DESIGN REPORT  
CENTENNIAL BOULEVARD RECONSTRUCTION  
WEST FILLMORE AVENUE TO GARDEN OF THE GODS ROAD  
COLORADO SPRINGS, COLORADO**

Terracon Project No. 23155014

April 4, 2016

## **1.0 INTRODUCTION**

A geotechnical engineering exploration and pavement thickness design has been performed for Centennial Boulevard from West Fillmore Avenue to Garden of the Gods Road in Colorado Springs, Colorado. A total of 62 borings (Borings B-1 through B-63 and B-101 through B-103) were advanced to a depths of 5 to 10 feet below the existing ground surface below the existing site ground surface along the eastbound and westbound lanes of the roadway. Borings B-12, B-14, B-16 and B-35 were not performed due to utility/access conflicts encountered during our subsurface exploration. Boring Logs along with a Boring Location Plan are included in Appendix A of this report.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- existing pavement thickness
- subsurface soil conditions
- groundwater conditions
- earthwork
- pavement performance
- pavement thickness design and construction
- below grade drainage

The field and laboratory testing, and pavement thickness recommendations presented herein, were performed in general accordance with the guidelines outlined by the *City of Colorado Springs Engineering Criteria Manual: Section II Pavement Design Criteria Manual*, dated July 1, 2010, the *City of Colorado Springs Engineering Standard Specifications Manual*, dated February 2, 2014, and the *Pikes Peak Region Asphalt Paving Specification, Version 2* dated April 1, 2008, referred to hereafter as the Standards.

## **2.0 PROJECT INFORMATION**

### **2.1 Project Description**

Item	Description
<b>Site Layout</b>	<ul style="list-style-type: none"> <li>■ See Site and Boring Location Plans in Appendix A, Exhibit A-2 and A-3.</li> </ul> Roadway Stations (STA) were not provided for the project. Approximate stationing was created for the roadway by

Item	Description
	Terracon, with STA 0+00 beginning at the intersection of Centennial Boulevard and West Fillmore Avenue and ending at STA 78+80 at the intersection of Garden of the Gods Road.
<b>Proposed Construction</b>	We understand that the proposed roadway improvements along this section of Centennial Boulevard may consist of improvements or mitigation methods such as mill and inlay, chemical stabilization of subgrade, replacement with full depth reclamation material for subgrade. We have provided options for asphalt and concrete pavement.
<b>Roadway Construction</b>	The existing roadway consist of asphalt concrete roads with concrete curb and gutter.
<b>Grading</b>	Cut and fills, less than about 1 foot (+/-) max to match the existing grades
<b>Traffic Data</b>	Traffic data consisting of one 24-hour traffic volume count was obtained by the City of Colorado Springs on June 25, 2015.

### 3.0 SUBSURFACE CONDITIONS

#### 3.1 Typical Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Description	Material Encountered	Approximate Depth to Bottom of Stratum*	Consistency/Density
Stratum 1 <sup>3</sup>	Asphalt	About 1¾ to 9 inches	N/A
Stratum 2 <sup>1,3</sup>	Apparent Base Course	About 6 to 16 inches	N/A
Stratum 3 <sup>2,3</sup>	Fill materials consisting of sand and clay with varying amounts of silt and gravel	About 3 to 5 feet	Clay: medium stiff Sand: loose to dense
Stratum 4	Native soils consisting of sand and clay with varying amounts of silt and gravel	About 2½ to 10 feet	Clay: medium stiff to hard Sand: loose to medium dense

Description	Material Encountered	Approximate Depth to Bottom of Stratum*	Consistency/Density
Stratum 5 <sup>4</sup>	Bedrock consisting of claystone and sandstone	About 5 to 10 feet	Weathered to very hard

1. Encountered only in Borings B-2 to B-5, Borings B-8 to B-10, Borings B-15 to B-33, Borings B-51 through B-63, and B-103.
2. Encountered only in Borings B-3, B-6, B-7, B-11, B-30 to 32, B-38, B-42, B-54 to B-56, B-101 to B-103.
3. Borings B-6, B-7, B-11, B-13, B-38 and B-56 terminated on concrete potentially associated with unmarked buried utilities around 7 inches to 4 feet below the pavement surface.

Subsurface conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the logs represent the approximate depths of changes in soil type; the transition between materials may be gradual. The Boring Logs are presented in Appendix A of this report.

### 3.2 Laboratory Testing Summary

Laboratory test results indicate that the subgrade materials classified as A-1-a, A-2-4, A-4, A-2-6, A-6, A-7-5 and A-7-6 soil types according to the AASHTO classification system. The A-1-a, A-2-4, A-4 and A-2-6 soils have a range of group indexes from about 0 to 4 while the A-6 soil type has a range of group indexes of about 2 to 16. The A-7-5 and A-7-6 soil have a range of group indexes of about 5 to 41. The soil types of the near surface soils are shown on the Soil Type and Traffic Loading (Exhibits A-5 to A-7) presented in Appendix A. The details of the laboratory test results are presented in Appendix B.

R-value tests were performed on bulk samples from the upper 5 feet of Boring Nos. B-1, B-9, and B-49. Results are listed in the table below:

Boring Location	AASHTO Classification	Tested R-value
B-1	A-2-4	14
B-9	A-2-6	11
B-49	A-2-6	12

Standard Proctor laboratory moisture-density relationship and a gradation test were performed on bulk samples obtained from Borings B-9, B-17, B-41, B-49, B-43, and B-53 between depths of 0 to 5 feet below the ground surface. Results of the laboratory testing are shown in Appendix B.

#### 3.2.1 Corrosion Considerations

The table below lists the results of laboratory soluble sulfate, soluble chloride, electrical resistivity, and pH testing. The results can also be found in Appendix B, Exhibits B-52 and B-

53. These values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Boring	Sample Depth (feet)	Soluble Sulfate (Percent)	Soluble Chloride (Percent)	Electrical Resistivity (ohm.cm)	pH
B-1	0-5	0.002	0.0625	591	7.3
B-41	0-5	0.008	0.0777	272	7.8
B-49	0-5	0.615	0.0358	422	7.6
B-53	0-5	0.005	0.0267	639	7.7
B-63	0-5	0.005	0.0391	885	7.7

Results of soluble sulfate testing indicate that samples of the on-site soils tested possess negligible to severe sulfate concentrations when classified in accordance with Table 4.3.1 of the ACI Design Manual. Concrete should be designed in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 4.

### 3.3 Groundwater

The borings were observed during drilling for the presence and level of groundwater. After completion of the drilling operations, the borings were backfilled with grout and patched with asphalt; therefore, supplemental groundwater measurements are not available.

Ground water was only encountered at a depth of 9½ feet in Boring B-25. This observation represents groundwater conditions at the time of the field exploration, and may not be indicative of other times, or at other locations. Groundwater levels can be expected to fluctuate with varying seasonal and weather conditions.

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

Zones of perched and/or trapped groundwater may also occur at times in the subsurface soils overlying bedrock, on top of the bedrock surface or within permeable fractures in the bedrock materials. The location and amount of perched water is dependent upon several factors, including hydrologic conditions, type of site development, irrigation demands on or adjacent to the site, fluctuations in water features, seasonal and weather conditions. A comprehensive groundwater study was not included within or scope of services.

### 3.4 Pavement Condition Index

Terracon visited the subject site between May 06 to July 15, 2015 to observe the existing condition of the pavements to delineate areas and types of pavement distress. In general, the existing pavement was in moderate condition, with stretches of varying lengths considered to be in moderate to poor condition. Areas considered to be in moderate to poor condition are presented in the tables at the end of the “Pavement Distress” section of this report. Distress observed in the pavement surface can be grouped into two broad categories including:

- structural distress
- climate/durability related distress

Terracon followed the general procedures outlined in ASTM D 6433-11, with certain limitations, specifically only major distress types common to roadways were addressed. The roadway was divided into appropriate sections based on severity, type and quantity of distress, location, traffic and apparent condition. Observations were made within the sections that include a general assessment of the type, amount and severity of the existing pavement distress, as well as general observations regarding overall pavement drainage and evidence of prior pavement repairs and maintenance.

Based on the type, amount and severity of distress in the sections, an approximate Pavement Condition Index (PCI) was calculated. The PCI is a numerical rating of pavement condition that ranges from 0 to 100. The pavement condition rating, a verbal description of the pavement condition that is a function of the PCI value, is shown in the following table.

PCI	Pavement Condition Rating
86 - 100	Good
71 - 85	Satisfactory
56 – 70	Fair
41 – 55	Poor
26 – 40	Very Poor
11 – 25	Serious
0 – 10	Failed

The results of the survey for the roadway sections and the corresponding PCI values and pavement condition ratings are shown in the following table. Additional details of the survey can be found in the Asphalt Pavement Condition Index Plan, Exhibit A-4.

Roadway Section	PCI Values	Pavement Condition Rating
Centennial Boulevard – Garden of the Gods Road to Intel Way (Approximate Station 69+70 to 78+90)	68 – 69	Fair
Centennial Boulevard – Intel Way to 3470 Centennial Boulevard (Approximate Station 16+30 to 69+70)	61 – 62	Fair
Centennial Boulevard – 3470 Centennial Boulevard to West Fillmore Avenue (Approximate Station 0+00 to 16+30)	72 – 78	Satisfactory

### 3.5 Deflection Testing

Falling Weight Deflectometer testing (FWD) was also performed to evaluate subgrade and asphaltic concrete modulus values. The deflection tests were performed using a JILS 20 FWD. The FWD is an impulse-loading device that applies a load to the pavement simulating a moving truck wheel and measures the pavement response (deflection) due to the applied load. A test consists of:

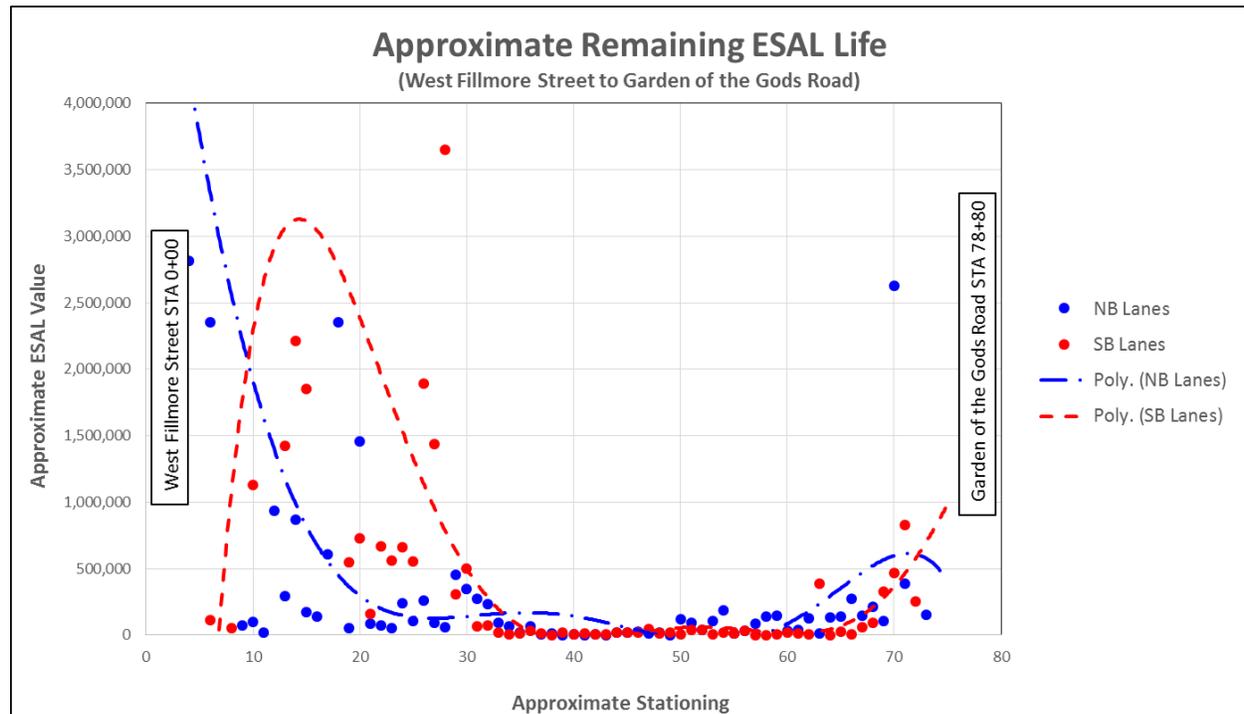
- Lowering a circular steel plate and a bar holding a series of seven seismic deflection transducers, or surface deflection measurement devices, to the pavement surface.
- Applying a load by raising and dropping a set of “falling weights” onto the load plate.
- Measuring and recording the impulse load and deflection response of the pavement at each sensor location.

Changing the drop height, the number of weights or the load plate size can vary the load magnitude and characteristics. The load plate used for this project was 12 inches in diameter. The deflection sensors were spaced at distances of 0, 8, 12, 18, 24, 36, and 60 inches from the center of the load plate. The seven measured deflections, and their distances from the applied load, define a deflection basin from which the structural characteristics of the pavement section can be evaluated.

As the tests were performed, the FWD operator observed and made a preliminary evaluation of the deflection data before recording it and the load data on disk with the on-board computer. Deflection tests were performed each direction within the outside wheel path in the outside and inside lanes. Tests within the outside lanes were performed at approximate 200-foot intervals, staggering directions, resulting in an approximate 100-foot interval coverage of the outside and inside lanes. Once the test data were collected, the remaining service life of the roadway was determined by others by back-calculating the remaining Equivalent Single-Axle Loads (ESALs) with respect to the intended 20-year design life of the pavement.

The remaining ESAL life of the roadway is shown in the following graph. Based on the results, the remaining ESALs varied significantly, but tended to be greater from approximate Station 0+00 to 30+00. The ESAL values were then consistently lower than the previous values to approximate Station 70+00. The results of the FWD testing are presented in Appendix F.

Arbitrary stationing was assigned to the roadway section by Terracon, with STA 0+00 beginning at the intersection of West Fillmore Street to STA 78+80 at the intersection of Garden of the Gods Road. The following graph indicates the remaining ESAL life of the roadway based on structural numbers.



## 4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

### 4.1 Geotechnical Considerations

#### 4.1.1 Low Strength Subgrade Soils

Based on our exploration and laboratory testing, the lower strength, near-surface soil types encountered were primarily A-7 soils, as well as some of the A-6 soils with group indexes of 10 or greater. A majority of these soil types consisted of claystone bedrock, which has low to moderate expansion potential based on laboratory testing. Based on the standards, some swell mitigation of the claystone will be required. Some of the lower strength soils present at subgrade were low strength clay soils based on test boring data. Areas where low strength soils are encountered at subgrade elevation will require some localized stabilization.

The City of Colorado Springs Engineering Criteria Manual: Section II Pavement Design Criteria Manual (CSPDCM) specifies treated subgrade thicknesses in order to create a separation layer between potentially expansive and lower strength materials (lean to fat clay and claystone bedrock). We understand that the separation thicknesses specified in the CSPDCM are

generally for new roadway construction. Full depth removal and replacement, or treatment of low strength and potentially expansive soils may not be practical within an existing roadway with near surface utilities. Therefore, we have provided pavement thickness designs supported on these materials. We have also provided recommendations for providing an edge drain collection system in order to reduce the risk of standing water within the base course layer.

#### **4.1.2 Existing Utilities Needing Repair**

An approximate 4-foot corrugated metal culvert is generally situated in the southbound lanes of Centennial Boulevard, between Garden of the Gods Road and Douglas Creek. We understand that the top of the pipe is approximately 3 to 5 feet below existing pavement grade. In the summer of 2015, a portion of the culvert collapsed causing a sinkhole within Centennial Boulevard. It is our understanding that the collapse was a result of deterioration of the pipe. We recommend a comprehensive assessment be performed to determine the extents of the deterioration and repair as necessary prior to installation of the new pavement.

#### **4.1.3 Near Surface Groundwater and Seepage Water**

Several natural springs with running surface water were observed on the hillside to the west of Centennial Boulevard across the street from the Camelback Apartments (about 2000 feet north of Fillmore Street). We recommend the surface water be collected and discharged through concrete gutters to the storm sewer system to reduce the risk of infiltration behind the back of curb.

We also observed seepage water surfacing through the perimeter crack of an asphalt patch within the northbound lanes, just north of Vondelpark Drive. It appears the patch may have been associated with a previous waterline replacement project. We anticipate that the water is associated with an underground spring, or perhaps a leaking utility line. In addition, there are stretches of the roadway that have landscaping adjacent to the back of curb. With the potential for clay soils at subgrade level along portions of the roadway and sources of natural and man-made water, we recommend the soil subgrade be crowned and sloped to drain to the edge of pavements. We also recommend installation of edge drains, consisting of a rigid PVC pipe surrounded by gravel and wrapped in filter fabric, be installed behind the curbs (see Exhibit C-4, Pavement Edge Drain Detail). The invert of the edge drain should be several inches lower than the soil subgrade elevation and sloped to outlet to the existing storm water collection system.

#### **4.1.4 Existing Utility Trench Backfill**

It has been our experience that trench backfill associated with utilities, particularly utilities installed after roadways are constructed, have a higher potential for settlement, if not properly compacted. In areas where trench-style settlement has occurred at the pavement surface or is observed during reconstruction/proofrolling, we recommend the low density material be removed and replaced as compacted fill for a minimum depth of 2 feet below soil subgrade level. Additional removal and replacement may be necessary in order to provide a stable

subgrade adequate for supporting the pavement section. The depth of removal and replacement can be determined on a site specific basis during construction.

## **4.2 Earthwork**

The following presents recommendations for site preparation, excavation and subgrade preparation. All earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include overexcavation operations, observation and testing of subgrade preparation, and other geotechnical conditions exposed during the construction of the project.

### **4.2.1 Subgrade Preparation**

Remove existing asphalt, concrete, and other deleterious materials from proposed pavement areas. All exposed surfaces should be free of mounds and depressions which could prevent uniform compaction.

Subgrade preparation will likely consist of a combination of the following: reconditioning existing subgrade soils; replacing existing soils with higher R-value material, or chemical stabilization of existing subgrade soils.

Provided the soil subgrade will be reconditioned without the use of chemical stabilization, we recommend, all exposed subgrade areas, once properly cleared, should be scarified to a minimum depth of 9 inches, conditioned to near optimum moisture content and compacted to reduce the risk of local discontinuities. Subgrade soils exposed to the elements for more than 24 hours should be checked for density and moisture content prior to placing additional fill and/or pavements.

Evidence of utilities was observed during our exploration. If encountered, abandoned utilities should be removed and the excavation thoroughly cleaned prior to backfill placement. Any abandoned or old utilities left in place below pavements should be properly abandoned to reduce the risk of settlement or collapse below the roadway.

We anticipate that groundwater may be encountered within intermittent and isolated portions of the roadway reconstruction project. Temporary dewatering may be required during construction.

### **4.2.2 Subgrade Mitigation**

Laboratory testing indicates the clay soils have a low expansion potential, and the claystone bedrock has low to moderate expansion potential. The sand soils are considered to have nil to low expansion potential. Up to 2 feet of high plasticity clay and claystone bedrock (all A-7 soil types and A-6 soils with group indexes of 10 or greater) encountered at subgrade should be replaced with approved imported materials, or as an alternative can be modified by

incorporating lime into the soil. Due to existing, near surface utilities, removal and replacement of potentially expansive clay and claystone may not be practical. As an alternative with

In order to improve the design R-value of subgrade soils, we recommend supporting new pavement sections on a minimum of 2 feet of higher R-value material, or chemically stabilized to a depth of 12 inches. If the over-excavation and replacement option is considered, the geotechnical engineer or his authorized representative should observe the extent of the removal and replacement of unsuitable soils. In addition, we encourage the top of soil subgrades be crowned at a minimum of 2 percent to an edge drain as shown in the Edge Drain Detail, Exhibit C-4 in an effort to reduce the risk of water becoming trapped in the predominantly clay soil profile.

The subgrade should be stabilized by scarifying the subgrade soils to a minimum depth of 9 inches and processing the scarified subgrade soils as described previously. If drying of the subgrade is required, several sunny, dry days may be necessary before the subgrade is stable enough for recompaction and paving, depending on the weather. However, the contractor should be prepared to perform more aggressive stabilization methods such as removal and replacement or by other means, such as over-excavation of wet zones and mixing these soils with crushed gravel or recycled concrete and recompaction. Use of lime, fly ash, kiln dust, cement or geotextiles could also be considered as a stabilization technique. Laboratory evaluation is recommended to determine the effect of chemical stabilization on subgrade soils prior to construction. Lightweight excavation equipment may be required to reduce subgrade pumping.

It has been our experience that portions of subgrade materials below existing pavements will likely be relatively moist to nearly saturated and yielding to unstable due to the presents of low strength clay soils. This is typically due to moisture collecting in the subgrade through cracks or seams in the pavements and not drying due to the presence of the pavements/hardscape. After removal of pavements, the contractor should expect unstable subgrade materials that will need to be locally stabilized prior to construction of new pavements.

Lime treatment rates and incorporation process should be evaluated in the laboratory prior to construction, and Terracon can provide suggested specifications for chemical treatment of the expansive soils upon request. Chemical treatment of the pavement subgrade should occur just prior to paving operations to limit disturbance from weather and construction activities. The use of chemical agents can impact the operation of adjacent facilities (e.g., windblown dust), and this should be considered by the designer and contractor.

Based on the subsurface exploration, and the recommendations in the Standards, subgrade mitigation has been broken into three types of mitigation labeled Subgrade Mitigation A, B, and C. These mitigation recommendations are described in the following table.

**Subgrade Mitigation Recommendations**

<b>Subgrade Mitigation Type</b>	<b>Mitigation</b>
A	Existing R-value of 20: scarify, water condition, and recompact the upper 9 inches of the soil subgrade as outlined in the Earthwork section of this report
B	Existing R-value of 11: scarify, water condition, and recompact the upper 9 inches of the soil subgrade as outlined in the Earthwork section of this report
C	Existing R-value of 5: replace upper 2 feet of pavement subgrade with A-2-4 soils or better (Minimum R-value = 20), OR Chemically treat the upper 12 inches of soil subgrade, OR Accept a higher risk of subgrade deterioration/softening and install a thicker pavement section on existing clay soils

The approximate limits of the recommended mitigation recommendations are presented in the following table and in the Subgrade Stabilization Plans, Exhibits A-8 to A-10.

<b>Approximate Beginning Station No.</b>	<b>Approximate Ending Station No.</b>	<b>Subgrade Mitigation Type</b>
0+00	9+00	C <sup>1</sup>
9+00	21+00	B <sup>1</sup>
21+00	29+00	A <sup>1</sup>
29+00	33+20	B
33+20	53+10	A
53+10	70+00	B
70+00	78+80	A

1. Mill and inlay option appears to be suitable for roadway section from approximate station 0+00 to 30+00.

Transitions zones at least 20 feet in length should be prepared between areas of different subgrade mitigation type to make changes in subgrade preparation more gradual along the roadway. Once the subgrade has been properly treated, it should be proofrolled to assess any unstable areas. If unstable areas are noted, the geotechnical engineer should be notified to provide supplemental recommendations.

**4.2.3 Full-Depth Reclamation**

Full Depth Reclamation (FDR) is a rehabilitation or reconstruction technique in which the full thickness of the asphalt pavement, and underlying base course and a portion of the soil

subgrade are, without heat, uniformly pulverized and blended to create a homogenous material. We recommend the asphalt be pulverized sufficiently such that 90 percent of the asphalt is less than about 1½ inches in diameter. This material may be used to improve the underlying R-Value of the clayey soil subgrades. We used an R-value of 40 for our design purposes. The field blended material should be tested for R-value to confirm a minimum of 40 prior to use below the pavement section.

#### 4.2.4 Import Material Specifications

Clean on-site soils or approved imported materials may be used as fill material. Imported soils should meet the following material property requirements:

Gradation	Percent finer by weight (ASTM C136)
3"	100
No. 4 Sieve	50-100
No. 200 Sieve	< 35 <sup>1</sup>

- We recommend an edge drain be installed in areas where relatively permeable material (sand) will be installed in a predominately clay soil and claystone bedrock profile.

- Liquid Limit .....30 (max)
- Plastic Limit ..... 10 (max)
- Maximum Expansive Potential (%)..... 1.0\*
- R-Value..... 20 Minimum

\*Measured on a sample compacted to approximately 95 percent of the AASHTO T99 maximum dry density at optimum water content. The sample is confined under a 200 psf surcharge and submerged.

#### 4.2.5 Compaction Requirements

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift.

Item	Description
<b>Fill Lift Thickness</b>	9-inches or less in loose thickness
<b>Compaction Requirements A-6 &amp; A-7 soils</b>	Minimum of 95% of the materials standard Proctor maximum dry density (AASHTO T99)
<b>Compaction Requirements A-1 thru A-5 soils</b>	Minimum of 95% of the materials modified Proctor maximum dry density (AASHTO T180)
<b>Moisture Content A-6 &amp; A-7 soils</b>	0 to +2 percent above the optimum moisture content

Item	Description
<b>Moisture Content</b> <b>Cohesionless Soil</b> <b>A-1 thru A-5 soils</b>	-2 to +2 percent of the optimum moisture content

1. We recommend engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the fill material pumping when proofrolled.
3. Subgrade soils exposed to the elements for more than 24 hours should be checked for density and moisture content prior to placing additional fills and/or paving.

#### **4.2.6 Excavation and Trench Construction**

Excavations into the on-site fill materials and native soils may encounter caving soils, depending upon the final depth of excavation. The individual contractor(s) 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. The exposed slope face should be protected against the elements.

Soils penetrated by the proposed excavations may vary significantly across the site. The soil classifications are based solely on the materials encountered in the exploratory test borings. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are encountered at the time of construction, the actual conditions should be evaluated to determine any excavation modifications necessary to maintain safe conditions.

### **4.3 Pavement Design and Construction**

#### **4.3.1 Design Traffic**

Design of pavements for the project has been based on the guidelines outlined by the *City of Colorado Springs Engineering Criteria Manual: Section II Pavement Design Criteria Manual*, dated July 1, 2010, the *City of Colorado Springs Engineering Standard Specifications Manual*, dated February 2, 2014, and the *Pikes Peak Region Asphalt Paving Specification, Version 2* dated April 1, 2008, as well as procedures outlined in the 1993 Guideline for Design of Pavement Structures by the American Association of State Highway and Transportation Officials (AASHTO).

Asphalt concrete pavement recommendations have been requested for the roadway, including alternates of Portland cement concrete sections and mill and overlay sections for Centennial Boulevard from West Fillmore Avenue to Garden of the Gods Road.

Based on the existing pavement conditions and the subgrade soils, full depth pavement reconstruction is recommended for the project. However, we understand that the City may desire to improve pavements along a portion of Centennial Boulevard by milling the existing pavements and inlaying new asphalt concrete, until funding and scheduling allow for full depth reconstruction in this area. This report contains recommendations for mill and inlay for a portion of Centennial Boulevard.

The following parameters were used to calculate the design Equivalent Single-Axel Loads (ESAL's) for Centennial Boulevard based on 24-hour volume traffic count provided by the City:

- Centennial Boulevard is classified as a Principal Arterial
- Growth factor of 2 percent
- Design life of 20 years
- Lane distribution factor of 0.9
- CDOT truck distribution factors were applied for ESAL conversions.

ADT values provided by the City and the date the studies were performed are shown in the following table.

Section of Roadway	Direction	Date of Study	Provided One Way 24-Hr Traffic	20-Year Average ADT with Lane Dist. Factor
Centennial Boulevard – West Fillmore Avenue to Garden of the Gods Road	NB	June 25, 2015	7105	7948
	SB		5044	5643

The breakdown of our ESAL calculations is presented in the following tables:

**Centennial Boulevard ESAL Calculation with a 20-Year Average ADT of 7948 – Flexible**

Vehicle Type	Percent Class Vehicle	Passes	EDLA Factor	EDLA
Passenger Cars	95.55	7594	0.003	22.78
Busses	0.22	17	0.249	4.35
Single Unit Trucks (SUT)	2-axle	162	0.249	40.37
	3-axle	65	0.249	16.23
	4-axle+	2	0.249	0.59
Single Trailer Trucks (STT)	4-axle max	26	1.087	28.51
	5-axle	75	1.087	81.21
	6-axle+	3	1.087	3.46
Multi Trailer Trucks (MTT)	5-axle max	2	1.087	1.73
	6-axle	1	1.087	0.86
	7-axle+	0	1.087	0.00
<b>Total EDLA =</b>				<b><u>200</u></b>
<b>Total ESAL =</b>				<b><u>1,460,733</u></b>

**Centennial Boulevard ESAL Calculation with a 20-Year Average ADT of 7948 – Rigid**

Vehicle Type	Percent Class Vehicle	Passes	EDLA Factor	EDLA
Passenger Cars	95.55	7594	0.003	22.78
Busses	0.22	17	0.285	4.98
Single Unit Trucks (SUT)	2-axle	162	0.285	46.21
	3-axle	65	0.285	18.57
	4-axle+	2	0.285	0.68
Single Trailer Trucks (STT)	4-axle max	26	1.692	44.38
	5-axle	75	1.692	126.41
	6-axle+	3	1.692	5.38
Multi Trailer Trucks (MTT)	5-axle max	2	1.692	2.69
	6-axle	1	1.692	1.34
	7-axle+	0	1.692	0.00
<b>Total EDLA =</b>				<b><u>273</u></b>
<b>Total ESAL =</b>				<b><u>1,996,064</u></b>

The following table includes the calculated ADT value for Centennial Boulevard along with the calculated flexible and rigid ESAL values. The highest ADT value was used for our analysis. We also adjusted the ADT value using a 2 percent growth factor in order to calculate the current 20-year design ESAL values.

**Traffic Design Criteria – Centennial Avenue**

Description	Calculated 20-Year Average ADT Value	Calculated Flexible Pavement ESALs	Calculated Rigid Pavement ESALs
Centennial Boulevard – West Fillmore Avenue to Garden of the Gods Road (highest value)	7948	1,500,000*	2,000,000 <sup>1</sup>

1. Minimum design ESALs for a Major Arterial of **4,500,000 for flexible pavements and 6,250,000 for rigid pavements** will be applied if the calculated value is less.

Based on the Standards, the minimum ESAL values based on Table 4 within the CSPDCM are used for pavement thickness design.

**4.3.2 Pavement Design Parameters**

The following design parameters are based on the Standards and were utilized for pavement thickness design.

Based upon AASHTO criteria, Colorado is located within Climatic Region VI of the United States. This region is characterized as being dry, with hard ground freeze and spring thaw. The spring thaw condition typically results in saturated or near-saturated subgrade soil moisture conditions. The AASHTO criteria suggest that these moisture conditions are prevalent for approximately 12½ percent of the annual moisture variation cycle.

Local drainage characteristics of proposed pavements areas are considered to vary from poor to fair. For purposes of this design analysis, poor drainage characteristics are considered to control the design. These characteristics, coupled with the approximate duration of saturated subgrade conditions, results in a design drainage coefficient of 1.0 when applying the AASHTO criteria for design.

**Pavement Thickness Design Parameters**

Input Parameter	Flexible (asphalt)	Rigid (concrete)
Reliability	95%	95%
Serviceability Loss	2.0	2.0
Standard Deviation	0.44	0.34
Asphalt Layer Coefficient	0.44	N/A
Aggregate Base Coefficient	0.12	N/A
Lime or Cement Treated Soils with a compressive strength between 160 and 350 psi	0.14	N/A
Concrete Elastic Modulus(Ec)	N/A	3,500,000 psi
Concrete Modulus of Rupture (S'c)	N/A	650 psi

Input Parameter	Flexible (asphalt)	Rigid (concrete)
Load Transfer Coefficient (J)	N/A	3.6*

\*The Load Transfer Coefficient value provided is based on jointed plain concrete pavement with dowelled longitudinal and expansion joints at a spacing interval no greater than 15 feet. Also dowelled into the concrete curb and gutter.

#### Design Subgrade Values

Upper 2 feet of Subgrade Soils, AASHTO Classification	Design R-Value	Resilient Modulus, $M_r$ (psi)	Modulus of Subgrade Reaction, $k$ (pci)	Corrected Modulus of Subgrade Reaction, $k$ (pci) <sup>1</sup>
A-6 and A-7	5	3025	80	14
A-2-6 and A-6 (GI<10)	11	3680	100	17
A-2-4	20	4939	150	19
Full depth reclamation	40	9497	200	26

1. Loss of Support equals 2.0

Based on the results of test borings, laboratory testing and recommended soil treatments, design subgrade values for the soil types above were used in our analysis to calculate design pavement thicknesses.

#### 4.3.3 Recommended Minimum Pavement Sections and Materials

Pavement Thickness Design Nomographs provided in CSPDCM were used to generate design structural numbers. We have provided tables that reflect the use of untreated and chemically treated subgrade soils. The nomographs used for design are presented in Appendix D. Based on calculated structural numbers and corresponding R-Values, we recommend the following minimum pavement sections for Centennial Boulevard between the intersections at West Fillmore Street and Garden of the Gods Road (STA 0+00 and STA 78+80). Additionally, we have provided the following tables that reflect the mitigation measures to stabilize the subgrade soils.

**Pavement Thickness Sections (STA 0+00 and STA 78+80)**

Design Value	Structural Number (SN)	Pavement Option	Recommended Pavement Section Thicknesses (inches)				
			Hot Mix Asphalt	Aggregate Base Course	Portland Cement Concrete Pavement	Subgrade Preparation	Total Section
R Value = 5	5.85	Flexible	10	12	---	9 <sup>1</sup>	31
		Rigid	---	4	11		24
R Value = 11	5.60	Flexible	9½	12	---	9 <sup>1</sup>	30½
		Rigid	---	4	11		24
R Value = 20	5.0	Flexible	8½	11	---	9 <sup>1</sup>	28½
		Rigid	---	---	11		19½
Chemical Stabilization (Underlying R-value = 5)	5.85	Flexible	8½	4	---	12 <sup>2</sup>	24½
Chemical Stabilization (Underlying R-value = 11)	5.60	Flexible	8	4	---	12 <sup>2</sup>	24
<b>With 24 inches of FDR mixed and compacted subgrade</b>							
R Value = 40	4.1	Flexible	7	9	---	24	40
		Rigid	---	---	10½		34½

1. Compacted soil subgrade as outlined in Section 4.2 Earthwork
2. Chemically stabilized subgrade with minimum 7-day compressive strength of 160 psi
3. **R-Value of 5, Mitigation:** Scarify, water condition, and recompact the upper 9 inches of the soil subgrade as outlined in the **4.2 Earthwork Section** of this report and installation of an edge drain system; or replace upper 2 feet of pavement subgrade with minimum R-value of 20, or better material; or replace 1 foot of existing subgrade with a soil-lime mix;
4. **R-Value of 11 and 20, Mitigation:** Scarify, water condition, and recompact the upper 9 inches of the soil subgrade as outlined in the **4.2 Earthwork Section** of this report.

If chemical stabilization is considered, we recommend a soil-lime mix for cohesive soils and a soil-cement mix for granular soils. A stabilization design will need to be performed prior to construction to determine the necessary lime or cement content. For preliminary cost analysis purposes, lime contents on the order of 6 to 8 percent by weight are considered suitable. Consideration can be given to the use of a lime-soil-cement mixture should the minimum compressive strength not be achieved by the mixing of lime alone. Cement contents on the order of 3 to 7 percent by weight for granular soils are considered suitable for preliminary cost analysis.

Results of soluble sulfate testing indicate that samples of the on-site materials tested possess negligible to severe sulfate concentrations (0.002 to 0.615 percent) when classified in accordance with Table 4.3.1 of the ACI Design Manual. In general the high plasticity clay and claystone bedrock have higher sulfate contents. We recommend additional sulfate testing be performed if consideration is given to chemical stabilization. A double treatment application of

lime or cement within a 7-day mellowing period for chemically treated subgrade soils is required for sulfate concentrations from 0.2 to 0.6 percent. A single application mellowing period is considered suitable with sulfate concentrations of less than 0.2 percent. Concrete should be designed in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 4.

The placement of a partial pavement thickness for use during construction is not suggested without a detailed pavement analysis incorporating construction traffic.

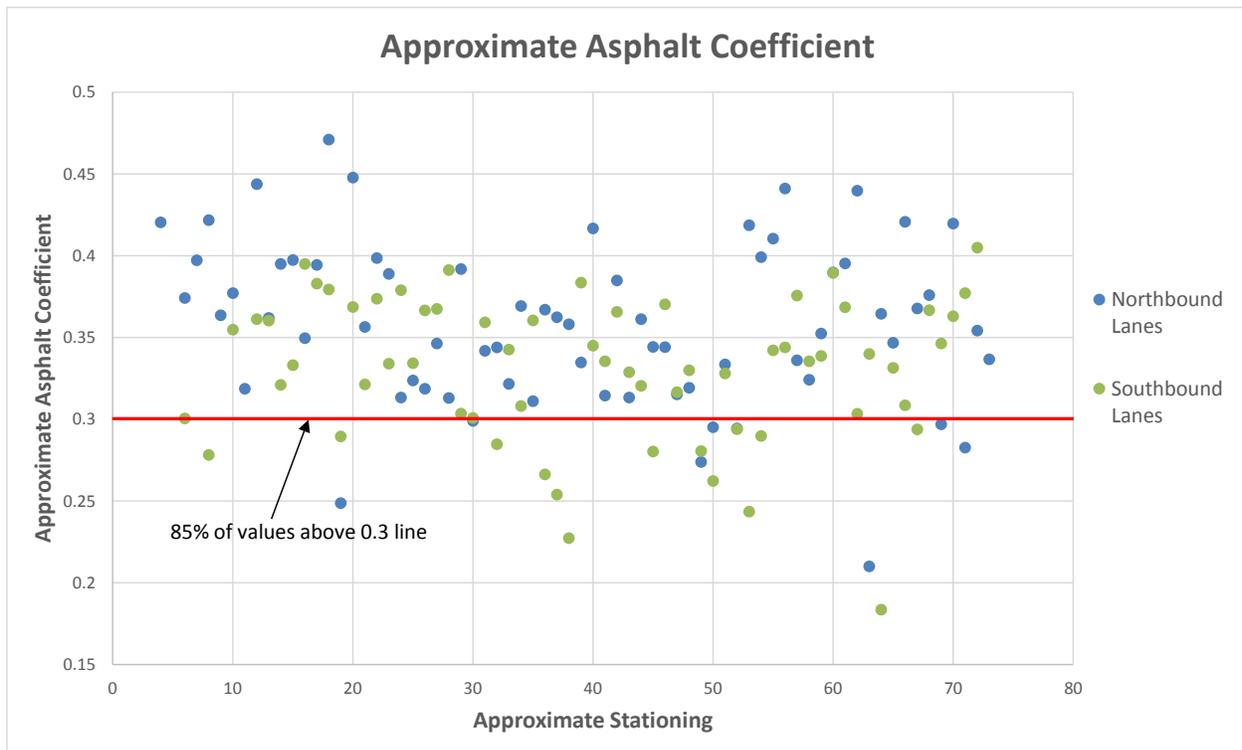
It is imperative that the subgrade be protected from a loss of moisture. A significant loss of moisture of the pavement supporting materials could result in a highly expansive subgrade. Pavement materials placed on moderate to highly expansive materials will most likely result in distress and movement of the pavement surface if the subgrade becomes elevated in moisture content.

**Mill and Inlay:** An asphalt concrete mill and inlay option has been requested by the City for a portion of Centennial Boulevard. Because the existing concrete curb and gutter elevations and driveway entrance elevations are expected to remain the same, mill and inlay improvements will be required to match the existing pavement surface grades. Based on a pavement condition survey and Falling Weight Deflectometer (FWD) testing performed along Centennial Boulevard, the portion of the roadway most suitable for mill and inlay improvements appears to be between West Fillmore Avenue, or approximate Station 0+00 and approximate Station 29+00.

Because full depth replacement is recommended, the mill and inlay improvements were analyzed to determine a probable pavement lifetime extension based on the current condition of the roadway, and equal mill depths and replacement thicknesses. The calculated ESALs based on the provided 24-hour traffic count was used for the mill and replacement analysis. The following table includes the calculated ADT value for Centennial Boulevard along with the calculated flexible ESAL value.

Description	Calculated 20-Year Average ADT Value	Calculated Flexible Pavement ESALs
Centennial Boulevard – Approx. STA 0+00 to Approx. STA 29+00	7948	1,500,000

The Standards indicate that a maximum asphalt coefficient of 0.24 should be used for existing asphalt pavements, unless a higher value is supported by testing. An asphalt coefficient was calculated by others for the existing asphalt using the FWD data. The following graph outlines the approximate calculated asphalt coefficient data.



Approximately 85 percent of the coefficient data from the FWD testing indicated coefficient values of 0.3. This asphalt coefficient of 0.3 was selected to represent the existing asphalt pavement for design of the mill and inlay.

Based on the above data, an analysis of asphalt concrete mill and inlay thicknesses of 2 and 3 inches was performed to determine the potential pavement life extension if the mill and inlay option was implemented. The results of the analysis are presented in the following table.

Mill and Inlay Thickness (in)	Calculated Increase in ESAL Values	Estimated Pavement Life Extension (yrs)
2	210,000	2.8
3	280,000	3.7

**Material Specifications:** Material specifications as outlined in the Standards should be followed. These specifications are generally summarized below.

**Aggregate Base Course:** Aggregate base course (if used) should consist of a blend of sand and gravel which meets strict specifications for quality and gradation. Use of materials

meeting Colorado Department of Transportation (CDOT) Class 5 or 6 specifications may be used, as follows:

<u>Standard Sieve Size</u>	<u>Percent Passing by Weight</u>	
	<u>Class 5</u>	<u>Class 6</u>
1-1/2" .....	100	--
1" .....	95-100	--
3/4" .....	--	100
No. 4 .....	30-70	30-65
No. 8 .....	--	25-55
No. 200 .....	3-15	3-12
■ Liquid Limit .....	30 Maximum	
■ Plasticity Index.....	6 Maximum	
■ Los Angeles Abrasion (AASHTO T 96) .....	45 Maximum	
■ R-Value.....	77 Minimum	

In addition, the base course material should be moisture stable. Moisture stability is determined by R-value testing which shows a maximum 12-point difference in R-values between exudation pressures of 300 psi and 100 psi. Aggregate base course material should be tested to determine compliance with these specifications prior to importation to the site.

Apparent base course encountered in the borings may or may not consist of materials meeting Colorado Department of Transportation (CDOT) Class 5 or 6 specifications. If the existing base course is to be reused for the project, it must be tested to determine compliance with these specifications prior to use.

Aggregate base course should be placed in lifts not exceeding 6 inches and should be compacted to a minimum of 95 percent of modified Proctor density (ASTM D1557), within a moisture content range of 2 percent below to 2 percent above optimum. Where base course thickness exceeds 6 inches, the material should be placed and compacted in two or more lifts of equal thickness.

**Asphalt Concrete:** Asphalt concrete should be obtained from an approved mix design stating the Hveem properties, optimum asphalt content, job mix formula (JMF), and recommended mixing and placing temperatures. Traffic Level 'Moderate' should be specified. Aggregate used in asphalt concrete should meet a particular gradation.

Use of materials meeting the Standards is recommended as outlined in the following table:

Sieve Size	Grading SX 1/2" nominal	Grading S 3/4" nominal
	Master Range & Control Points	Master Range & Control Points
1-1/2"		
1"		100
3/4"	100	90-100
1/2"	90-100	JMF <sup>2</sup>
3/8"	JMF <sup>2</sup>	JMF <sup>2</sup>
#4	JMF <sup>2</sup>	JMF <sup>2</sup>
#8	28-58	23-49
#16	--	--
#30	JMF <sup>2</sup>	JMF <sup>2</sup>
#50	JMF <sup>2</sup>	JMF <sup>2</sup>
#100	--	--
#200**	2.0-8.0	2.0-7.0

Notes:

1. Mix designs shall be reworked if mixes segregate in the field and field procedures cannot correct the problem. The Engineer shall determine segregation.
2. These additional screens shall have a % passing initially established from the Mix Design JMF. Tolerances shall then be applied to establish the AMPR.
3. These limits shall include the weight of lime at 1.0%.

Additional aggregate requirements are outlined below:

**Coarse Aggregate (retained on #4 sieve):**

- Two Fractured Faces (CP-45)  
     SX and S mixes .....70% Minimum
- Los Angeles Abrasion (AASHTO T 96)..... 45% Maximum
- Flat and Elongated, Ratio 5:1 (AASHTO M 283) ..... 10% Maximum

**Fine Aggregate (retained on #4 sieve):**

- Fine Aggregate Angularity, C-L 5113 Method A
  - Traffic Level Low, Moderate, Trails and Pathways .....40% Minimum
  - Traffic Level 3 to 5 Moderate, High, Parking Lots .....45% Minimum
- Sand Equivalent (AASHTO T 176) ..... 45% Minimum

All mixes shall meet the minimum voids in mineral aggregate (VMA) specified in the following table, below. VMA shall be based on the most recent tests of the Bulk Specific Gravity of the Compacted Mix (CP-L 5103) and Aggregate (T 84 & T 85), and calculated according to CP-48.

Reclaimed Asphalt Pavement material (RAP) shall be used only where specifically allowed and shall be of uniform quality and gradation with a maximum size no greater than the nominal aggregate size of the mix. Reclaimed Asphalt Pavement (RAP) is allowed in hot mix asphalt (HMA) up to a maximum of 20 percent for all lifts other than the top lift, unless approved by the City Engineer. In no case shall RAP exceed 25%, provided all specifications for HMA are met. Fine Aggregate Angularity requirements shall apply only to the virgin fraction of the fine aggregate. The RAP shall not contain clay balls, vegetable matter, or other deleterious substances. Mixtures with RAP shall not be used in the top lift of any asphalt pavement.

Nominal Maximum Particle Size	Mixture Air Voids, %		
	3.0	4.0	5.0
½"	13.7	14.7	15.7
¾"	12.7	13.7	14.7
1"	11.7	12.7	13.7

1. Minimum VMA criteria apply to both design and plant produced mix. The VMA minimum shall be interpolated based on actual air voids.
2. The Nominal Maximum Particle Size is defined as one sieve size larger than the first sieve to retain more than 10%, but shall not exceed the 100% passing size. The Nominal Maximum Particle Size can vary during mix production even when the 100% passing size is constant.

Aggregates should not contain clay balls, organic matter, or other deleterious substances. After the job mix formula is established, all mix furnished for the project should conform within the following range of tolerances:

**Mix Tolerances:**

- Passing 1 inch.....0% pts. Action Limit (AL), 0% pts. Suspension Limit (SL)
- Passing 3/4 inch.....± 6% pts. AL, ± 8% pts. SL
- Passing 1/2 inch.....± 6% pts. AL, ± 8% pts. SL
- Passing 3/8 inch.....± 6% pts. AL, ± 8% pts. SL
- Passing No. 4.....± 5% pts. AL, ± 7% pts. SL
- Passing No. 8.....± 5% pts. AL, ± 7% pts. SL
- Passing No. 30.....± 4% pts. AL, ± 6% pts. SL
- Passing No. 200.....± 2% pts. AL, ± 3% pts. SL
- Air Voids..... ± 1.2 percent
- VMA ..... ± 1.2 percent
- Asphalt Binder Content ..... ± 0.4 percentage points
- Lottman Tensile Strength ..... 70 minimum
- Stability ..... Applicable minimum

If a Marshall mix is to be used for the proposed improvements, the asphalt mix should be performed in general accordance with the Standards.

If a Superpave mix is to be used for the proposed improvements, the asphalt cement used should be Performance Graded Binder PG 58-28. The mix design should be performed using the Superpave procedures as outlined in the Standards, the CDOT 2016 pavement design manual or the Asphalt Institute manual. The Superpave mixture properties are generally summarized below:

If Superpave mix design procedures are used, the mix design may be performed following recommendations outlined in the Standards or the Colorado Department of Transportation recommendations. The Superpave mixture properties are summarized below:

Design Item	Value	
Traffic Level	Low, Moderate, Trails, Parking Lots	High
Air Voids @ $N_{ini}$	>9.5	>11.0
$N_{des}$	75 <sup>1</sup>	100
Hveem Stability, CP-L 5106	28 minimum	30 minimum
Voids in Mineral Aggregate, % (VMA) (test method is CDOT CP 48)	see table	
Voids Filled with Asphalt, % (VFA)	65 – 78	65 – 75
Lottman, Tensile Strength Ratio, min. % retained CP-L 5109 (Optimum AC)	80 minimum <sup>2</sup>	80 minimum <sup>2</sup>

Design Item	Value	
Dry Tensile Strength, min. psi	30 minimum	30 minimum

<sup>1</sup> Unless otherwise specified by the Engineer.

<sup>2</sup>Lottman requirement is 80 minimum for mix design and 70 minimum for field acceptance.

The mix design should be submitted prior to construction to verify its adequacy. The asphalt concrete should be placed in maximum 3-inch lifts and compacted to between 92 and 96 percent of the maximum theoretical density.

**Portland Cement Concrete:** Where rigid pavements are used, the concrete should be obtained from an approved mix design conforming to CDOT Class P with the following minimum properties:

- Compressive Strength @ 28 days..... 4,000 psi minimum
- Strength Requirements.....ASTM C-94
- Cement Type.....Type V Portland
- Entrained Air Content (ASTM C-260) .....6% (-1/+2)
- Maximum Allowable Slump ..... 4 inches

**Fine Aggregates for Portland Cement Concrete:** Fine aggregates should meet ASTM C-33 requirements and gradation as shown below.

<u>Standard Sieve Size</u>	<u>Percent Passing by Weight</u>
3/8" .....	100
No. 4.....	95-100
No. 8.....	80-100
No. 16.....	50-85
No. 30.....	25-60
No. 50.....	5-30
No. 100.....	0-10
No. 200.....	0-3

- Friable Particles, % by weight ..... 1.0 maximum
- Coal and Lignite, % by weight ..... 1.0 maximum
- Deleterious Material (AASHTO T11), % by weight..... 3.0 maximum
- Sand Equivalent (AASHTO T176), %..... 75 minimum
- Fineness Modulus ..... 2.30-3.10
- Sodium Sulfate Soundness, %..... 10.0 maximum

**Coarse Aggregates for Portland Cement Concrete:** Coarse aggregates should meet ASTM C-136 requirements and gradation as shown below.

<u>Standard Sieve Size</u>	<u>Percent Passing by Weight or Test Requirement</u>		
	<b>No. 357</b>	<b>No. 467</b>	<b>No. 57</b>
2 1/2" .....	100	--	--
2".....	95-100	100	--
1 1/2".....	--	95-100	100
1".....	35-70	--	95-100
3/4".....	--	35-70	--
1/2".....	10-30	--	25-60
3/8".....	--	10-30	--
No. 4.....	0-5	0-5	0-10
No. 8.....	--	--	0-5
No. 200.....	1.0 max.	1.0 max.	1.0 max.

- % Abrasion ..... 50 maximum
- Clay Lumps & Friable Particles, % ..... 3.0 maximum
- Coal & Lignites, % ..... 0.5 maximum
- Sum of Clay Lumps, Friable Particles & Chert, %..... 5.0 maximum
- Sodium Sulfate Soundness, %..... 12 maximum

Concrete should be deposited by truck mixers or agitators and placed a maximum of 90 minutes from the time the water is added to the mix. Other specifications outlined by the Standards should be followed.

Longitudinal and transverse joints should be provided as needed in concrete pavements for expansion/contraction and isolation. The location and extent of joints should be based upon the final pavement geometry. All joints should be sealed to prevent entry of foreign material and doweled where necessary for load transfer.

#### **4.3.4 Edge Drainage Adjacent to Pavements**

The clay subgrade materials will expand and/or lose stability with increases in moisture content. In order to reduce pavement distress due to wetting of the subgrade, we recommend edge drains. The drain system should consist of a properly sized pipe embedded in free-draining material directed to a suitable outfall such as an underdrain or storm sewer.

It is anticipated that the alligator cracking within 5 feet of the outside edge of pavement is associated with water infiltration at the edge of the asphalt pavement and the concrete curb and gutter. Another source of water infiltration can be irrigation water or storm water infiltrating behind the curb, but a majority of the water appeared to come from the road surface drainage. Consideration should be given to the installation of edge drains to reduce the potential for water to impact pavement subgrade. An edge drain typically consists of an approximate 8-inch wide by a minimum 1½-foot deep trench filled with ¾-inch diameter washed aggregate wrapped in Mirafi 140N filter fabric. We also recommend installing a 3-inch diameter perforated rigid PVC pipe within the gravel at the base of the trench. The pipe should be sloped at a minimum of ½ percent to a gravity outlet or storm sewer. An Edge Drain Detail is provided as Exhibit C-4 in Appendix C of this report.

#### **4.3.5 Pavement Performance**

Future performance of pavements constructed on the subgrade soils at this site will be dependent upon several factors, including:

- maintaining stable moisture content of the subgrade soils.
- providing for a planned program of preventative maintenance.

Since the clay subgrade materials have shrink/swell characteristics, pavements could crack in the future primarily because of expansion of the soils when subjected to an increase in moisture content to the subgrade. The cracking, while not desirable, does not necessarily constitute structural failure of the pavement.

The performance of all pavements can be enhanced by minimizing excess moisture which can reach the subgrade soils. The following recommendations should be considered at minimum:

- site grading at a minimum 2 percent grade onto or away from the pavements (water should not be allowed to pond behind curbs).
- the subgrade and the pavement surface have a minimum 1/4 inch per foot slope to promote proper surface drainage.
- consider appropriate edge drainage and pavement underdrain systems.
- install pavement drainage surrounding areas anticipated for frequent wetting (e.g., garden centers, wash racks).
- install joint sealant and seal cracks immediately.

- compaction of any utility trenches for landscaped areas to the same criteria as the pavement subgrade.
- seal all landscaped areas in or adjacent to pavements to minimize or prevent moisture migration to subgrade soils.
- place compacted, low permeability backfill against the exterior side of curb and gutter.
- place curb, gutter and/or sidewalk directly on subgrade soils without the use of base course materials.

#### **4.3.6 Construction Considerations**

Site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed due to construction traffic, desiccation, or rainfall. As a result, the pavement subgrade may not be suitable for pavement construction and corrective action will be required. The subgrade should be carefully evaluated at the time of pavement construction for signs of disturbance or excessive rutting. If disturbance has occurred, pavement subgrade areas should be reworked, moisture conditioned, and properly compacted to the recommendations in this report immediately prior to paving.

We recommend the pavement areas be rough graded and then thoroughly proof rolled with a loaded tandem axle dump truck prior to final grading and paving. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected areas with gravel. The use of chemical stabilization could also be considered as a means of stabilizing the affected area and could also increase the strength of the subgrade. We are available to discuss chemical stabilization with you at your request.

All pavement areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to paving.

The placement of a partial pavement thickness for use during construction is not recommended without a detailed pavement analysis incorporating construction traffic. In addition, if the actual traffic varies from the assumptions outlined above, we should be contacted to confirm and/or modify the pavement thickness recommendations outlined above.

## **5.0 GENERAL COMMENTS**

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon should also be retained to provide testing and observation during the over excavation (if performed), grading, and construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include, either specifically or by implication, any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the City is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes are planned in the nature, design, or location of the project as outlined in this report, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes, and either verifies or modifies the conclusions of this report in writing.

**APPENDIX A**  
**FIELD EXPLORATION**

## **Field Exploration Description**

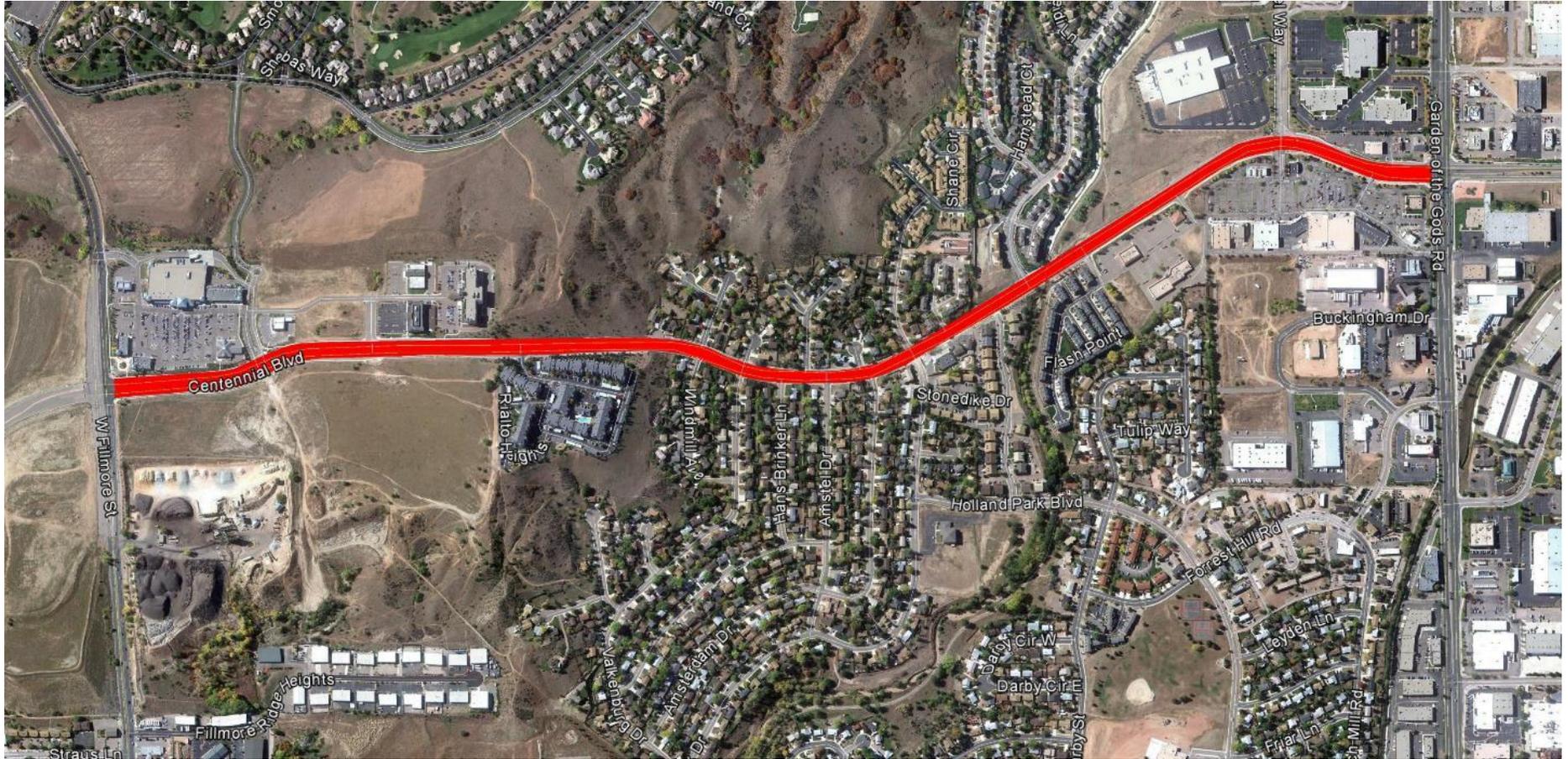
The borings were located in the field by measuring with a measuring wheel from existing property lines and site features. Locations of the borings were recorded with a handheld GPS device. The accuracy of the handheld GPS is typically on the order of about  $\pm 25$  feet. The accuracy of the boring locations should only be assumed to the level implied by the methods used.

The borings were drilled with a CME-75 truck-mounted rotary drill rig with solid-stem augers. During the drilling operations, lithologic logs of the borings were recorded by the field engineer. Relatively undisturbed samples were obtained at selected intervals utilizing a 3-inch outside diameter ring barrel sampler (RS). Disturbed bulk samples (BS) were obtained from auger cuttings. Penetration resistance values were recorded in a manner similar to the standard penetration test (SPT). This test consists of driving the sampler into the ground with a 140-pound hammer free-falling through a distance of 30 inches. The number of blows required to advance the ring-barrel sampler 12 inches (18-inches for standard split-spoon samplers, final 12-inches are recorded) or the interval indicated, is recorded and can be correlated to the standard penetration resistance value (N-value). The blow count values are indicated on the boring logs at the respective sample depths, ring barrel sample blow counts are not considered N-values.

An automatic SPT hammer was used to advance the sampler in the borings performed on this site. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between the ring barrel blow counts, SPT values, and soil properties are based on the lower efficiency cathead and rope method. This higher efficiency affects the standard penetration resistance blow count value by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

The standard penetration test provides a reasonable indication of the in-place density of sandy type materials, but only provides an indication of the relative stiffness of cohesive materials since the blow count in these soils may be affected by the soils moisture content. In addition, considerable care should be exercised in interpreting the N-values in gravelly soils, particularly where the size of the gravel particle exceeds the inside diameter of the sampler.

Groundwater measurements were obtained in the borings at the time of site exploration. Upon completion of the drilling operations, the borings were backfilled with auger cuttings, and patched with asphalt. Some settlement of the backfill and asphalt patches may occur and should be repaired as soon as possible.



**LEGEND**

**GRAPHIC SCALE**



Approximate Location of Improvements

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

Project Manager:	RWF
Drawn by:	JNH
Checked by:	RWF
Approved by:	RWF
Project No.	23155014
Scale:	AS SHOWN
File Name:	23155014/A-2
Date:	10/14/15

**Terracon**  
 Consulting Engineers & Scientists  
 10625 W. 170 Frontage Rd. N. Wheat Ridge, Colorado 80033  
 PH. (303) 423-3300 FAX. (303) 423-3353

<b>SITE PLAN</b>
<b>CENTENNIAL BOULEVARD RECONSTRUCTION</b> WEST FILLMORE STREET TO GARDEN OF THE GODS ROAD COLORADO SPRINGS, COLORADO

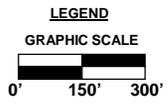
Exhibit
<b>A-2</b>



MATCHLINE  
SEE PLAN LOWER LEFT THIS SHEET



MATCHLINE  
SEE PLAN UPPER RIGHT THIS SHEET



B=1  
Approximate Boring Location

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

Project Manager:	RWF	Project No.	23155014
Drawn by:	JNH	Scale:	AS SHOWN
Checked by:	RWF	File Name:	23155014/A-3
Approved by:	RWF	Date:	10/14/15

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Consulting Engineers & Scientists

10625 W. 170 Frontage Rd. N. Wheat Ridge, Colorado 80033  
PH. (303) 423-3300 FAX. (303) 423-3353

<b>BORING LOCATION PLAN</b>
<b>CENTENNIAL BOULEVARD RECONSTRUCTION</b> WEST FILLMORE STREET TO GARDEN OF THE GODS ROAD COLORADO SPRINGS, COLORADO

Exhibit
<b>A-3</b>





**LEGEND**

**GRAPHIC SCALE**



- Rating: Satisfactory (PCI values of 72 to 78)
- Rating: Fair (PCI values of 61 to 69)

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

Project Manager:	RWF
Drawn by:	JNH
Checked by:	RWF
Approved by:	RWF
Project No.	23155014
Scale:	AS SHOWN
File Name:	23155014/A-2
Date:	10/14/15

**Terracon**  
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 10625 W. 170 Frontage Rd. N. Wheat Ridge, Colorado 80033  
 PH. (303) 423-3300 FAX. (303) 423-3353

**PAVEMENT CONDITION INDEX PLAN**

**CENTENNIAL BOULEVARD RECONSTRUCTION**  
 WEST FILLMORE STREET TO GARDEN OF THE GODS ROAD  
 COLORADO SPRINGS, COLORADO

Exhibit

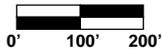
A-4





**LEGEND**

**GRAPHIC SCALE**



B-1  
Approximate Boring Location

- |  |             |  |                      |
|--|-------------|--|----------------------|
|  | A-1-a Soils |  | A-2-6 Soils          |
|  | A-2-4 Soils |  | A-6(<10) Soils       |
|  | A-4 Soils   |  | A-7 & A-6(>10) Soils |

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

Section of Roadway	Direction	Date of Study	Provided One Way 24-Hr Traffic	20-Year Average ADT with Lane Dist. Factor
Centennial Boulevard – West Fillmore Avenue to Garden of the Gods Road	NB	June 25,	7105	7948
	SB	2015	5044	5643

Description	Calculated 20-Year Average ADT Value	Calculated Flexible Pavement ESALs	Calculated Rigid Pavement ESALs
Centennial Boulevard – West Fillmore Avenue to Garden of the Gods Road (highest value)	7948	1,500,000*	2,000,000*

\*Minimum design ESAL's for a Major Arterial of 4,500,000 for flexible pavements and 6,250,000 for rigid pavements will be applied if the calculated value is less.



Project Manager:	RWF	Project No.	23155014
Drawn by:	JNH	Scale:	AS SHOWN
Checked by:	RWF	File Name:	23155014/A-3
Approved by:	RWF	Date:	10/14/15

**Terracon**  
Consulting Engineers & Scientists

10625 W. 170 Frontage Rd. N. Wheat Ridge, Colorado 80033  
PH. (303) 423-3300 FAX. (303) 423-3353

<b>SOIL TYPE AND TRAFFIC LOADING</b>
<b>CENTENNIAL BOULEVARD RECONSTRUCTION WEST FILLMORE STREET TO GARDEN OF THE GODS ROAD COLORADO SPRINGS, COLORADO</b>

Exhibit
<b>A-5</b>



**LEGEND**

**GRAPHIC SCALE**



B-1  
Approximate Boring Location

- |  |             |  |                      |
|--|-------------|--|----------------------|
|  | A-1-a Soils |  | A-2-6 Soils          |
|  | A-2-4 Soils |  | A-6(<10) Soils       |
|  | A-4 Soils   |  | A-7 & A-6(>10) Soils |

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

Section of Roadway	Direction	Date of Study	Provided One Way 24-Hr Traffic	20-Year Average ADT with Lane Dist. Factor
Centennial Boulevard – West Fillmore Avenue to Garden of the Gods Road	NB	June 25,	7105	7948
	SB	2015	5044	5643

Description	Calculated 20-Year Average ADT Value	Calculated Flexible Pavement ESALs	Calculated Rigid Pavement ESALs
Centennial Boulevard – West Fillmore Avenue to Garden of the Gods Road (highest value)	7948	1,500,000*	2,000,000*

\*Minimum design ESAL's for a Major Arterial of 4,500,000 for flexible pavements and 6,250,000 for rigid pavements will be applied if the calculated value is less.



Project Manager:	RWF	Project No.	23155014
Drawn by:	JNH	Scale:	AS SHOWN
Checked by:	RWF	File Name:	23155014/A-3
Approved by:	RWF	Date:	10/14/15

**Terracon**  
Consulting Engineers & Scientists

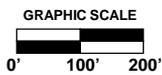
10625 W. 170 Frontage Rd. N. Wheat Ridge, Colorado 80033  
PH. (303) 423-3300 FAX. (303) 423-3353

<b>SOIL TYPE AND TRAFFIC LOADING</b>
<b>CENTENNIAL BOULEVARD RECONSTRUCTION WEST FILLMORE STREET TO GARDEN OF THE GODS ROAD COLORADO SPRINGS, COLORADO</b>

Exhibit
<b>A-6</b>



**LEGEND**



B-1  
Approximate Boring Location

- |  |             |  |                      |
|--|-------------|--|----------------------|
|  | A-1-a Soils |  | A-2-6 Soils          |
|  | A-2-4 Soils |  | A-6(<10) Soils       |
|  | A-4 Soils   |  | A-7 & A-6(>10) Soils |

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

Section of Roadway	Direction	Date of Study	Provided One Way 24-Hr Traffic	20-Year Average ADT with Lane Dist. Factor
Centennial Boulevard – West Fillmore Avenue to Garden of the Gods Road	NB	June 25,	7105	7948
	SB	2015	5044	5643

Description	Calculated 20-Year Average ADT Value	Calculated Flexible Pavement ESALs	Calculated Rigid Pavement ESALs
Centennial Boulevard – West Fillmore Avenue to Garden of the Gods Road (highest value)	7948	1,500,000*	2,000,000*

\*Minimum design ESAL's for a Major Arterial of 4,500,000 for flexible pavements and 6,250,000 for rigid pavements will be applied if the calculated value is less.



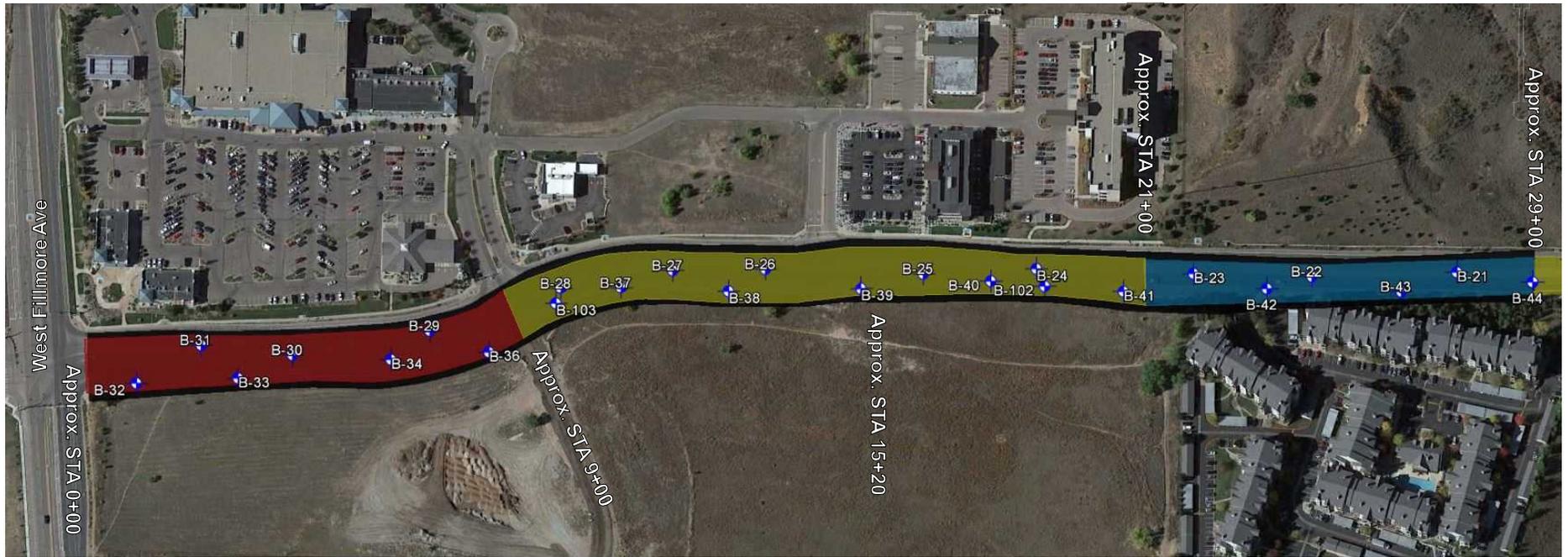
Project Manager: RWF	Project No. 23155014
Drawn by: JNH	Scale: AS SHOWN
Checked by: RWF	File Name: 23155014/A-3
Approved by: RWF	Date: 10/14/15

**Terracon**  
Consulting Engineers & Scientists

10625 W. 170 Frontage Rd. N. Wheat Ridge, Colorado 80033  
PH. (303) 423-3300 FAX. (303) 423-3353

<b>SOIL TYPE AND TRAFFIC LOADING</b>
<b>CENTENNIAL BOULEVARD RECONSTRUCTION WEST FILLMORE STREET TO GARDEN OF THE GODS ROAD COLORADO SPRINGS, COLORADO</b>

Exhibit
<b>A-7</b>



**LEGEND**

-  Mill & inlay option (Approx. STA 0+00 to 30+00)
  -  Existing R-value of 20: Mitigation A: Scarification, moisture condition and recompaction of upper 9" of subgrade\*
  -  Existing R-value of 11: Mitigation B: Scarification, moisture condition and recompaction of upper 9" of subgrade\*
  -  Existing R-value of 5, Mitigation C: Replace upper 2 feet of pavement subgrade with A-2-4 soils or better (Minimum R-value = 20) OR chemically treat the upper 12 inches of soil subgrade
- \*possible local stabilization due to low strength soils that may be present at subgrade elevation

 B-1  
Approximate Boring Location



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

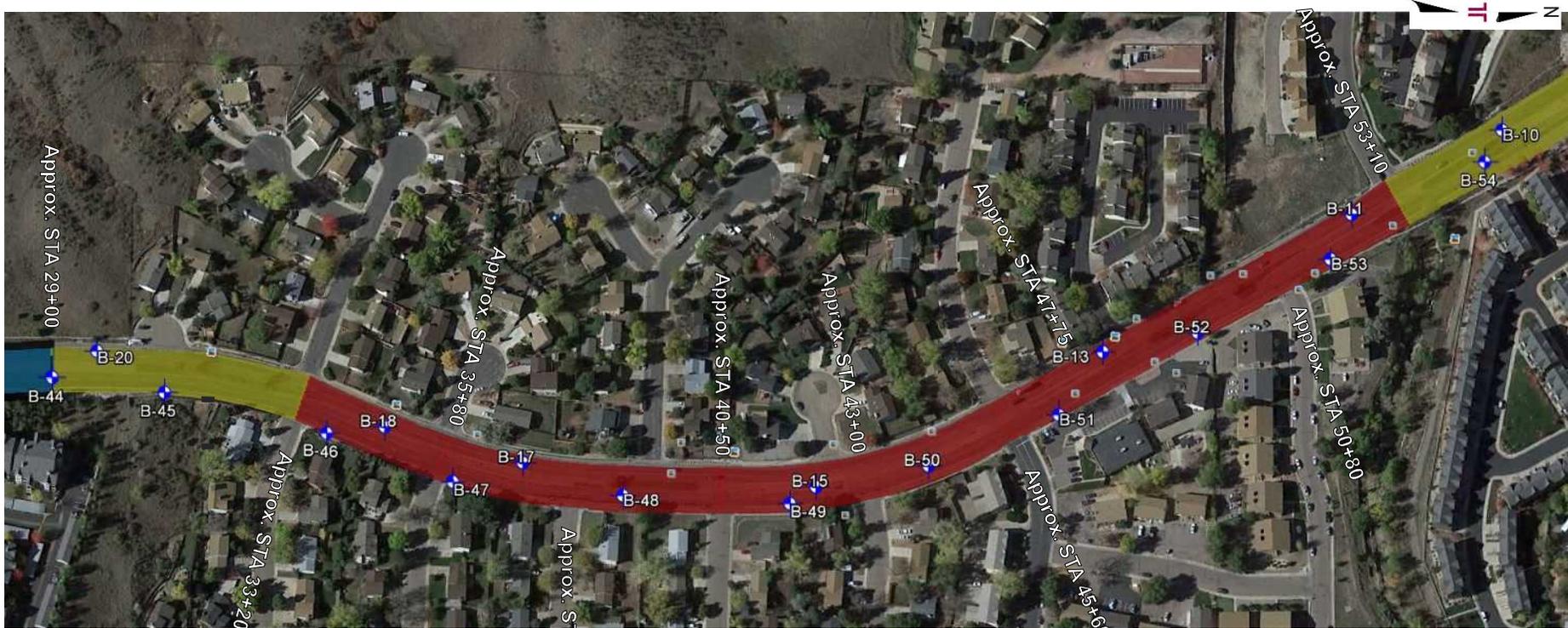
Project Manager:	RWF	Project No.	23155014
Drawn by:	JNH	Scale:	AS SHOWN
Checked by:	RWF	File Name:	23155014/A-3
Approved by:	RWF	Date:	4/1/16

**Terracon**  
Consulting Engineers & Scientists

10625 W. 170 Frontage Rd. N. Wheat Ridge, Colorado 80033  
PH. (303) 423-3300 FAX. (303) 423-3353

<b>SUBGRADE STABILIZATION PLAN</b>
<b>CENTENNIAL BOULEVARD RECONSTRUCTION</b> WEST FILLMORE STREET TO GARDEN OF THE GODS ROAD COLORADO SPRINGS, COLORADO

Exhibit
<b>A-8</b>



**LEGEND**

-  Mill & inlay option (Approx. STA 0+00 to 30+00)
  -  Existing R-value of 20: Mitigation A: Scarification, moisture condition and recompaction of upper 9" of subgrade\*
  -  Existing R-value of 11: Mitigation B: Scarification, moisture condition and recompaction of upper 9" of subgrade\*
  -  Existing R-value of 5, Mitigation C: Replace upper 2 feet of pavement subgrade with A-2-4 soils or better (Minimum R-value = 20) OR chemically treat the upper 12 inches of soil subgrade
- \*possible local stabilization due to low strength soils that may be present at subgrade elevation

 B-1  
Approximate Boring Location

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

Project Manager:	RWF
Drawn by:	JNH
Checked by:	RWF
Approved by:	RWF
Project No.	23155014
Scale:	AS SHOWN
File Name:	23155014/A-3
Date:	4/1/16

**Terracon**  
Consulting Engineers & Scientists

10625 W. 170 Frontage Rd. N. Wheat Ridge, Colorado 80033  
PH. (303) 423-3300 FAX. (303) 423-3353

<b>SUBGRADE STABILIZATION PLAN</b>
<b>CENTENNIAL BOULEVARD RECONSTRUCTION</b> WEST FILLMORE STREET TO GARDEN OF THE GODS ROAD COLORADO SPRINGS, COLORADO

Exhibit
<b>A-9</b>



**LEGEND**

-  Mill & inlay option (Approx. STA 0+00 to 30+00)
  -  Existing R-value of 20; Mitigation A: Scarification, moisture condition and recompaction of upper 9" of subgrade\*
  -  Existing R-value of 11; Mitigation B: Scarification, moisture condition and recompaction of upper 9" of subgrade\*
  -  Existing R-value of 5; Mitigation C: Replace upper 2 feet of pavement subgrade with A-2-4 soils or better (Minimum R-value = 20) OR chemically treat the upper 12 inches of soil subgrade
- \*possible local stabilization due to low strength soils that may be present at subgrade elevation

 B-1  
Approximate Boring Location



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

Project Manager:	RWF	Project No.	23155014
Drawn by:	JNH	Scale:	AS SHOWN
Checked by:	RWF	File Name:	23155014/A-3
Approved by:	RWF	Date:	4/1/16

**Terracon**  
Consulting Engineers & Scientists

10625 W. 170 Frontage Rd. N. Wheat Ridge, Colorado 80033  
PH. (303) 423-3300 FAX. (303) 423-3353

<b>SUBGRADE STABILIZATION PLAN</b>
<b>CENTENNIAL BOULEVARD RECONSTRUCTION</b> WEST FILLMORE STREET TO GARDEN OF THE GODS ROAD COLORADO SPRINGS, COLORADO

Exhibit
<b>A-10</b>

# BORING LOG NO. B-01

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8962° Longitude: -104.8512°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
	DEPTH									
	0.2' <b>ASPHALT CONCRETE</b> , approximately 1¾ inches thick.									
	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, brown, loose			✕	10	8-10	6	118	24-16-8	14
			5		✕	12	5-4	9	114	
				✕	12	4-3	7	111		
	<b>Boring Terminated at 10 Feet</b>									

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

Hammer Type: Automatic

Advancement Method: 4" solid stem auger	See Exhibit A-1 for description of field procedures See Appendix B for description of laboratory procedures and additional data (if any). See Appendix C for explanation of symbols and abbreviations.
Abandonment Method: Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.	
<b>WATER LEVEL OBSERVATIONS</b> <i>No free water observed during drilling.</i>	

Boring Started: 5/6/2015	Boring Completed: 5/6/2015
Drill Rig: CME-75	Driller: Denver
Project No.: 23155014	Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED - 23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-02

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8956° Longitude: -104.8512°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
	DEPTH									
0.5	<b>ASPHALT CONCRETE</b> , approximately 6½ inches thick.									
1.1	<b>BASE COURSE</b> , approximately 11 inches thick.									
1.5	<b>SILTY CLAYEY SAND WITH GRAVEL (SC-SM)</b> , fine to coarse grained, reddish-brown, loose			9		7-8	6	128	19-12-7	24
3.0	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, brown, medium dense									
5.0	<b>Boring Terminated at 5 Feet</b>	5			10.5	11-11	9	121		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/15/2015

Boring Completed: 5/15/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-12

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-03

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8948° Longitude: -104.8515°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH								LL-PL-PI	
0.5	<b>ASPHALT CONCRETE</b> , approximately 5 inches thick.									
1.5	<b>BASE COURSE</b> , approximately 10 inches thick.									
4.0	<b>FILL - WELL GRADED SAND WITH SILTY CLAY &amp; GRAVEL (SW-SC)</b> , fine to coarse grained, reddish-brown, medium dense			X	12	11-12	4	118	23-16-7	8
5.0	<b>CORRUGATED STEEL PIPE</b> , encountered void at 4 feet containing unmarked corrugated steel pipe during sampling.	5		X						
7.0	<b>POORLY GRADED GRAVEL WITH SAND (GP)</b> , fine to coarse grained, dark brown, medium dense			X	7	12-9	10	116		
8.0	<b>Boring Terminated at 8 Feet</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/15/2015

Boring Completed: 5/15/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-13

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-04

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8944° Longitude: -104.8516°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.5	<b>ASPHALT CONCRETE</b> , approximately 5½ inches thick.									
1.5	<b>BASE COURSE</b> , approximately 12 inches thick.									
5.0	<b>SILTY CLAYEY SAND WITH GRAVEL (SC-SM)</b> , fine to coarse grained, dark brown, medium dense  color change to reddish brown below 3 feet.	5		11		9-11	8	113	23-16-7	16
	<b>Boring Terminated at 5 Feet</b>			12		14-16	4	120		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/15/2015

Boring Completed: 5/15/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-14

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-05

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8936° Longitude: -104.8517°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
	DEPTH									
0.4	<b>ASPHALT CONCRETE</b> , approximately 5 inches thick.									
1.0	<b>BASE COURSE</b> , approximately 10 inches thick.									
1.0	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, dark brown, loose			X	10	5-6	9	114	32-16-16	23
5.0		5		Hand						
5.0		5		X	10	3-4	16	104		
10.0		10		X	12	5-8	15	106		
10.0	<b>Boring Terminated at 10 Feet</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/15/2015

Boring Completed: 5/15/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-15

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-06

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.893° Longitude: -104.8513°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.5	<b>ASPHALT CONCRETE</b> , approximately 6½ inches thick.									
4.2	<b>FILL - CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, brown, medium dense			8		10-12	9	121	28-16-12	25
	encountered concrete at 4 feet; utility markings not observed at ground surface; abandoned boring due to concern of unmarked utility. <b>Boring Terminated at 4.2 Feet</b>			2		50/2"	8	110		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**  
*No free water observed during drilling.*



Boring Started: 5/6/2015

Boring Completed: 5/6/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-16

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-07

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8924° Longitude: -104.8507°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.4	<b>ASPHALT CONCRETE</b> , approximately 5 inches thick.									
4.0	<b>FILL - SILTY CLAYEY SAND WITH GRAVEL (SC-SM)</b> , fine to coarse grained, brown, medium dense			☒	12	14-14	7	118	25-18-6	21
	encountered concrete at 4 feet; utility markings not observed at ground surface; abandoned boring due to concern of unmarked utility. <b>Boring Terminated at 4 Feet</b>			☐						

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/6/2015

Boring Completed: 5/6/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-17

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-08

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8918° Longitude: -104.8502°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	0.3 <b>ASPHALT CONCRETE</b> , approximately 4 inches thick. <b>BASE COURSE</b> , approximately 16 inches thick.									
	1.5 <b>WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)</b> , fine to coarse grained, reddish-brown, medium dense			9		12-17	4	116	24-22-2	9
	5.0 <b>Boring Terminated at 5 Feet</b>	5		12		17-21	4	124		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/15/2015

Boring Completed: 5/15/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-18

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-09

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8912° Longitude: -104.8498°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	DEPTH									
0.3	<b>ASPHALT CONCRETE</b> , approximately 4 inches thick.									
1.0	<b>BASE COURSE</b> , approximately 6 inches thick.									
1.0	<b>CLAYEY SAND (SC)</b> , fine to coarse grained, brown, loose			X	12	6-6	14	113	34-16-18	41
5.0				Hand					31-16-15	35
5.0				X	12	6-5	11	109		
10.0				X	12	3-5	18	106		
10.0	<b>Boring Terminated at 10 Feet</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/15/2015

Boring Completed: 5/15/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-19

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED - 23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-10

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8906° Longitude: -104.8492°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH								LL-PL-PI	
0.2	<b>ASPHALT CONCRETE</b> , approximately 2 inches thick.									
1.0	<b>BASE COURSE</b> , approximately 6 inches thick.									
5.0	<b>SANDY LEAN CLAY (CL)</b> , brown, medium stiff to stiff	5		X	12	3-6	19	104	33-18-15	51
5.0	<b>Boring Terminated at 5 Feet</b>			Hand	10	5-8	22	100		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/15/2015

Boring Completed: 5/15/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-20

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-11

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8899° Longitude: -104.8487°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	DEPTH									
0.5	<b>ASPHALT CONCRETE</b> , approximately 6½ inches thick.									
1.0	<b>FILL - CLAYEY SAND (SC)</b> , fine grained, brown, loose			X X Hand	10	4-6	14	107	32-17-15	49
3.5	encountered concrete at 3½ feet; utility markings not observed at ground surface; abandoned boring due to concern of unmarked utility. <b>Boring Terminated at 3.5 Feet</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).  
See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/6/2015

Boring Completed: 5/6/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-21

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-13

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8888° Longitude: -104.8479°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.6	<b>ASPHALT CONCRETE</b> , approximately 7 inches thick.									
	encountered concrete at base of asphalt; utility markings not observed at ground surface; abandoned boring due to concern of unmarked utility. <b>Boring Terminated at 0.58 Foot</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/6/2015

Boring Completed: 5/6/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-22

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-15

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8875° Longitude: -104.847°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.4	<b>ASPHALT CONCRETE</b> , approximately 5 inches thick.									
1.0	<b>BASE COURSE</b> , approximately 6 inches thick.									
5.0	<b>SANDY FAT CLAY (CH)</b> , gray, stiff to very stiff, with iron staining.  trace calcium deposits at 4 feet.	5		X	10	7-8	22	98	51-20-31	65
5.0	<b>Boring Terminated at 5 Feet</b>			Hand						
5.0				X	12	9-17	17	104		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/15/2015

Boring Completed: 5/15/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-23

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-17

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8861° Longitude: -104.8471°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	DEPTH									
0.3	<b>ASPHALT CONCRETE</b> , approximately 4 inches thick.									
0.8	<b>BASE COURSE</b> , approximately 6 inches thick.									
5.0	<b>SANDY LEAN CLAY (CL)</b> , brown, stiff to very stiff, varies to clayey sand (SC).  with iron staining at 4 feet.	5		X	10	5-8	18	100	38-18-20	68
6.0				Hand			13	108	30-16-14	47
6.0	<b>CLAYSTONE</b> , gray, hard, with iron staining, trace calcium deposits.			X	7	11-15	16	110		
10.0	<b>Boring Terminated at 10 Feet</b>	10		X	5	50/5"	15	112		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-24

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-18

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8855° Longitude: -104.8473°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	DEPTH									
0.6	<b>ASPHALT CONCRETE</b> , approximately 7 inches thick.									
1.0	<b>BASE COURSE</b> , approximately 8 inches thick.									
5.0	<b>WEATHERED CLAYEY SANDSTONE</b> , fine grained, gray, weathered to medium, with iron staining.	9		9		5-11	15	110	43-20-23	43
5.0	<b>Boring Terminated at 5 Feet</b>	12		12		19-21	20	107		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-25

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-19

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8848° Longitude: -104.8477°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
DEPTH										
0.3	<b>ASPHALT CONCRETE</b> , approximately 4 inches thick.									
1.0	<b>BASE COURSE</b> , approximately 8 inches thick.									
5.0	<b>SANDY LEAN CLAY (CL)</b> , grayish-brown, stiff	5		X	12	7-10	18	102	39-17-22	53
5.0	<b>Boring Terminated at 5 Feet</b>			Hand	10	10-8	19	104		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/15/2015

Boring Completed: 5/15/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-26

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-20

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8842° Longitude: -104.8478°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
	DEPTH									
0.5	<b>ASPHALT CONCRETE</b> , approximately 6 inches thick.									
1.0	<b>BASE COURSE</b> , approximately 8 inches thick.									
5.0	<b>SANDY LEAN CLAY (CL)</b> , grayish-brown, stiff	5		11		7-11	20	99	40-21-19	56
	<b>Boring Terminated at 5 Feet</b>			9		6-9	22	101		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/15/2015

Boring Completed: 5/15/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-27

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-21

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8835° Longitude: -104.8478°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH								LL-PL-PI	
	<b>ASPHALT CONCRETE</b> , approximately 8.5 inches thick.									
	<b>BASE COURSE</b> , approximately 12 inches thick.	0.8								
	<b>SILTY CLAYEY SAND (SC-SM)</b> , fine to coarse grained, reddish-brown, medium dense	1.7			12	17-24	6	124	23-16-7	13
	<b>WEATHERED SANDY CLAYSTONE</b> , grayish-brown, hard, with calcium deposits	4.5			12	18-36	16	110	40-22-18	80
	<b>CLAYSTONE</b> , dark gray, very hard, trace calcium deposits and iron staining	8.0			11	50/4"	14	107		
	<b>Boring Terminated at 10 Feet</b>	10.0								

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 6/11/2015

Boring Completed: 6/11/2015

Drill Rig: CME-75

Driller: Vine

Project No.: 23155014

Exhibit: A-28

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-22

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8828° Longitude: -104.8478°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.5	<b>ASPHALT CONCRETE</b> , approximately 6.5 inches thick.									
1.5	<b>BASE COURSE</b> , approximately 13 inches thick.									
3.5	<b>WELL GRADED SAND W/CLAY &amp; GRAVEL (SW-SC)</b> , fine to coarse grained, reddish-brown, medium dense			X	10	16-18	5	126	22-12-10	10
5.0	<b>WEATHERED CLAYSTONE</b> , dark gray, weathered, trace calcium deposits			X	12	8-14	13	108		
<b>Boring Terminated at 5 Feet</b>		5								

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 6/11/2015

Boring Completed: 6/11/2015

Drill Rig: CME-75

Driller: Vine

Project No.: 23155014

Exhibit: A-29

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-23

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8821° Longitude: -104.8478°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
	DEPTH									
0.5	<b>ASPHALT CONCRETE</b> , approximately 6.5 inches thick.									
1.5	<b>BASE COURSE</b> , approximately 12 inches thick.									
2.5	<b>CLAYEY SAND (SC)</b> , fine to coarse grained, reddish-brown, medium dense			X	10	12-15	7	123	24-15-9	15
5.0	<b>SANDY SILTSTONE</b> , dark gray, hard, trace calcium deposits			X	12	50/6"	24	97	84-45-38	84
	<b>Boring Terminated at 5 Feet</b>	5								

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 6/11/2015

Boring Completed: 6/11/2015

Drill Rig: CME-75

Driller: Vine

Project No.: 23155014

Exhibit: A-30

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-24

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8814° Longitude: -104.8478°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH								LL-PL-PI	
0.6	<b>ASPHALT CONCRETE</b> , approximately 7 inches thick.									
0.6 1.5	<b>BASE COURSE</b> , approximately 10 inches thick.									
1.5 5.0	<b>CLAYEY SAND (SC)</b> , fine to coarse grained, reddish-brown, medium dense			X	11	14-14	8	128	31-15-16	24
5.0	<b>Boring Terminated at 5 Feet</b>	5		X	10	14-16	9	128		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 6/11/2015

Boring Completed: 6/11/2015

Drill Rig: CME-75

Driller: Vine

Project No.: 23155014

Exhibit: A-31

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16



# BORING LOG NO. B-26

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.88° Longitude: -104.8478°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH								LL-PL-PI	
0.0	<b>ASPHALT CONCRETE</b> , approximately 8 inches thick.									
0.8	<b>BASE COURSE</b> , approximately 14 inches thick.									
2.0	<b>WELL GRADED SAND W/CLAY &amp; GRAVEL (SW-SC)</b> , fine to coarse grained, reddish-brown, medium dense				10	21-16	7	128	27-15-12	12
5.0	<b>Boring Terminated at 5 Feet</b>	5			12	20-22	10	123		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 6/11/2015

Boring Completed: 6/11/2015

Drill Rig: CME-75

Driller: Vine

Project No.: 23155014

Exhibit: A-33

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-27

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8793° Longitude: -104.8478°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	DEPTH									
	<b>ASPHALT CONCRETE</b> , approximately 7 inches thick.	0.6								
	<b>BASE COURSE</b> , approximately 10 inches thick.	1.5								
	<b>CLAYEY SAND (SC)</b> , fine to coarse grained, reddish-brown, medium dense	5.0		X	10	12-15	8	125	25-16-9	13
	<b>Boring Terminated at 5 Feet</b>	5		X	9	18-25	7	123		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 6/11/2015

Boring Completed: 6/11/2015

Drill Rig: CME-75

Driller: Vine

Project No.: 23155014

Exhibit: A-34

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-28

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8787° Longitude: -104.8476°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.8	<b>ASPHALT CONCRETE</b> , approximately 8 inches thick.									
2.0	<b>BASE COURSE</b> , approximately 12 inches thick.									
5.0	<b>SILTY CLAYEY SAND (SC-SM)</b> , fine to coarse grained, reddish-brown, medium dense			X	10	14-21	8	125	22-15-7	15
5.0	<b>Boring Terminated at 5 Feet</b>	5		X	10.5	14-24	8	118		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 6/11/2015

Boring Completed: 6/11/2015

Drill Rig: CME-75

Driller: Vine

Project No.: 23155014

Exhibit: A-35

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-29

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8781° Longitude: -104.847°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
DEPTH										
0.6	<b>ASPHALT CONCRETE</b> , approximately 7 inches thick.									
2.0	<b>BASE COURSE</b> , approximately 12 inches thick.									
10.0	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, reddish-brown, medium dense	5		10		9-12	11	117	31-14-17	37
		5		12		19-26	8	127		
		10		12		18-21	10	123		
	<b>Boring Terminated at 10 Feet</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/15/2015

Boring Completed: 5/15/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-36

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED - 23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-30

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8774° Longitude: -104.847°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
	DEPTH									
0.5	<b>ASPHALT CONCRETE</b> , approximately 8 inches thick.									
1.5	<b>BASE COURSE</b> , approximately 2 feet thick.			X	10	18-16	8	124		
5.0	<b>FILL - CLAYEY SAND (SC)</b> , grayish-brown, loose, with calcium deposits.			Hand						
5.0	<b>Boring Terminated at 5 Feet</b>	5		X	8	7-10	14	108	41-22-19	48

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

<b>WATER LEVEL OBSERVATIONS</b>
<i>No free water observed during drilling.</i>

4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 8/6/2015	Boring Completed: 8/6/2015
Drill Rig: CME-55	Driller: Vine
Project No.: 23155014	Exhibit: A-37

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-31

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8767° Longitude: -104.8471°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS		PERCENT FINES
	DEPTH								LL-PL-PI		
0.5	<b>ASPHALT CONCRETE</b> , approximately 7½ inches thick.										
1.5	<b>BASE COURSE</b> , approximately 2 feet thick.										
5.0	<b>FILL - SANDY LEAN CLAY (CL)</b> , brown, medium stiff			11		16-22	4	128			
5.0	<b>Boring Terminated at 5 Feet</b>	5		11		4-4	16	104	33-15-18	57	

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 8/6/2015

Boring Completed: 8/6/2015

Drill Rig: CME-55

Driller: Vine

Project No.: 23155014

Exhibit: A-38

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-32

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8765° Longitude: -104.8466°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.5	<b>ASPHALT CONCRETE</b> , approximately 7½ inches thick.									
2.0	<b>BASE COURSE</b> , approximately 14 inches thick.									
5.0	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, reddish-brown, loose to medium dense	8		8		10-9	8	116	28-15-13	32
5.0	<b>Boring Terminated at 5 Feet</b>	12		12		4-5	9			

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 6/11/2015

Boring Completed: 6/11/2015

Drill Rig: CME-75

Driller: Vine

Project No.: 23155014

Exhibit: A-39

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-33

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8771° Longitude: -104.8468°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH								LL-PL-PI	
0.8	<b>ASPHALT CONCRETE</b> , approximately 9 inches thick.									
2.0	<b>BASE COURSE</b> , approximately 16 inches thick.									
10.0	<b>SANDY LEAN CLAY (CL)</b> , grayish-brown, stiff to very stiff			9		10-9	14	108	41-20-21	54
		5		12		9-12	11	114		
		10		8		6-8	14	107		
	<b>Boring Terminated at 10 Feet</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 6/11/2015

Boring Completed: 6/11/2015

Drill Rig: CME-75

Driller: Vine

Project No.: 23155014

Exhibit: A-40

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED - 23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-34

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8779° Longitude: -104.8468°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
	DEPTH									
0.5	<b>ASPHALT CONCRETE</b> , approximately 6¼ inches thick.									
0.5	<b>SANDY LEAN CLAY (CL)</b> , brown, very stiff			X	12	16-14	7	120		
				Hand						
5.0		5		X	10	9-10	13	115	39-19-21	59
	<b>Boring Terminated at 5 Feet</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Boring moved from inside to outside lane due to underground gas line conflict.

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).  
See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-41

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-36

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8784° Longitude: -104.8469°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	DEPTH									
0.7	<b>ASPHALT CONCRETE</b> , approximately 8 inches thick.									
5.0	<b>WELL GRADED SAND WITH CLAY AND GRAVEL (SW-SC)</b> , fine to coarse grained, brown, loose to medium dense			X	12	22-23	5	126	26-17-9	10
				Hand						
				X	10	8-10	10	118		
	<b>Boring Terminated at 5 Feet</b>	5								

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-42

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-37

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8791° Longitude: -104.8474°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH								LL-PL-PI	
	0.5 <b>ASPHALT CONCRETE</b> , approximately 6½ inches thick.									
	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, reddish-brown, medium dense			X	8	15-10	12	117	35-17-19	42
		5		Hand						
				X	12	10-13	4	111		
				X	10	10-13	7	123		
	<b>Boring Terminated at 10 Feet</b>	10								

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-43

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED - 23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-38

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8797° Longitude: -104.8474°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.7	<b>ASPHALT CONCRETE</b> , approximately 8 inches thick.									
3.5	<b>FILL - CLAYEY GRAVEL W/SAND (GC)</b> , fine to coarse grained, brown, medium dense			X	10	23-25	5	128	24-16-8	14
	encountered concrete at 3½ feet; utility markings not observed at ground surface; abandoned boring due to concern of unmarked utility. <b>Boring Terminated at 3.5 Feet</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-44

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-39

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8804° Longitude: -104.8474°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.7	<b>ASPHALT CONCRETE</b> , approximately 8 inches thick.									
5.0	<b>WELL GRADED SAND WITH CLAY AND GRAVEL (SW-SC)</b> , fine to coarse grained, reddish-brown, medium dense			X	9	15-14	5	124	24-15-8	10
5.0				Hand						
5.0				X	11	16-23	8	125		
	<b>Boring Terminated at 5 Feet</b>	5								

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-45

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-40

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8811° Longitude: -104.8475°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.5	<b>ASPHALT CONCRETE</b> , approximately 6½ inches thick.									
1.0	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, light brown, medium dense			X	12	15-14	11	117	32-16-16	38
2.0				Hand						
3.0										
4.0										
5.0		5		X	10	22-25	7	128		
	<b>Boring Terminated at 5 Feet</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-46

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-41

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8818° Longitude: -104.8474°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
	DEPTH									
	<b>ASPHALT CONCRETE</b> , approximately 8 inches thick.	0.7								
	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, brown, medium dense, varies to sandy lean clay (CL).			☒	8	11-12	7	117	25-17-8	15
				☞			9	120	27-16-11	21
				☒	12	23-35	17	111	47-25-22	50
	<b>CLAYSTONE</b> , dark gray, hard to very hard	4.5								
				☒	4	50/4"	18	109		
	<b>Boring Terminated at 10 Feet</b>	10.0								

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-47

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-42

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8825° Longitude: -104.8475°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH								LL-PL-PI	
0.5	<b>ASPHALT CONCRETE</b> , approximately 6¼ inches thick.									
1.0	<b>FILL - CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, brown, dense			X	12	12-13	8	125	26-17-10	22
3.0	<b>CLAYSTONE</b> , dark gray, very hard			Hand						
5.0	<b>Boring Terminated at 5 Feet</b>	5		X	5	50/5"	28	99		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-48

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-43

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8833° Longitude: -104.8475°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
	<b>ASPHALT CONCRETE</b> , approximately 9 inches thick.									
0.8	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, brown, medium dense			X	12	21-22	11	118	36-19-18	35
3.0	<b>SANDY CLAYSTONE</b> , dark gray, very hard, trace calcium deposits.			Hand						
5.0	<b>Boring Terminated at 5 Feet</b>	5		X	9	50/5"	12	111	38-20-18	58

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-49

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-44

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.884° Longitude: -104.8476°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
DEPTH										
0.8	<b>ASPHALT CONCRETE</b> , approximately 9 inches thick.									
3.0	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, reddish-brown, medium dense			☒	10	12-14	7	121	22-14-8	17
5.0	<b>SANDY CLAYSTONE</b> , dark gray, very hard, trace calcium deposits and iron staining.			☐						
5.0	<b>Boring Terminated at 5 Feet</b>	5		☐	6	50/6"	15	115	40-22-18	66

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**  
*No free water observed during drilling.*



Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-50

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-45

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8845° Longitude: -104.8475°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	DEPTH									
0.6	<b>ASPHALT CONCRETE</b> , approximately 7 inches thick.									
	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, brown, loose to medium dense	5		11		11-14	19	97	38-19-19	48
			Hand							
		5		12		8-9	21	103		
		10		12		12-16	8	122		
	<b>Boring Terminated at 10 Feet</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-51

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED - 23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-46

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8852° Longitude: -104.8473°	DEPTH (Ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
	DEPTH									
0.4	<b>ASPHALT CONCRETE</b> , approximately 5¼ inches thick.									
2.0	<b>SANDY SILT (ML)</b> , fine to coarse grained, reddish-brown, very stiff, very stiff			X	5	10-15	19	106	34-24-11	59
5.0	<b>SANDY LEAN CLAY (CL)</b> , dark gray, very stiff, very stiff, with iron staining  trace calcium deposits.			Hand						
	<b>Boring Terminated at 5 Feet</b>	5		X	10	9-11	21	106		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-52

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-47

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8858° Longitude: -104.847°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
	DEPTH									
	0.3 <b>ASPHALT CONCRETE</b> , approximately 4 inches thick.									
	<b>LEAN CLAY WITH SAND (CL)</b> , brown, stiff to very stiff			X	6	5-12	20	104	40-18-22	76
				Hand						
	gray, color change to gray, with iron staining below 4 feet.			X	12	18-26	16	111		
	5.0 <b>Boring Terminated at 5 Feet</b>	5								

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-53

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-48

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8866° Longitude: -104.8469°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	DEPTH									
0.3	<b>ASPHALT CONCRETE</b> , approximately 4 inches thick.									
CLAYEY SAND (SC)	<b>CLAYEY SAND (SC)</b> , grayish-brown, medium dense, fine grained.			X	6	10-12	14	116	27-17-10	48
3.0	<b>SANDY LEAN CLAY (CL)</b> , gray, very stiff			Hand						
5.0	<b>Boring Terminated at 5 Feet</b>	5		X	12	8-8	20	100		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 5/7/2015

Boring Completed: 5/7/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-54

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-49

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8874° Longitude: -104.8468°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
	DEPTH									
0.5	<b>ASPHALT CONCRETE</b> , approximately 6 inches thick.									
X	<b>WEATHERED CLAYSTONE</b> , dark gray to gray, firm to very hard, trace calcium deposits and iron staining.			X	11	10-20	19	109	38-20-18	56
X				Hand			14	105	37-16-21	59
X		5		X	12	28-37	18	106	48-24-24	52
X				X	5	50/5"	25	98		
X	<b>Boring Terminated at 10 Feet</b>	10								

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 5/8/2015

Boring Completed: 5/8/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-55

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED - 23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-50

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.888° Longitude: -104.847°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	DEPTH									
	0.5 <b>ASPHALT CONCRETE</b> , approximately 6 inches thick.									
	<b>SANDY LEAN CLAY (CL)</b> , dark brown, very stiff			X	12	8-12	23	99	48-19-29	61
	3.0 <b>CLAYEY SAND WITH GRAVEL (SC)</b> , brown, medium dense			Hand						
	5.0 <b>Boring Terminated at 5 Feet</b>	5		X	6.5	8-14	12	111		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



4172 Center Park Dr  
Colorado Springs, CO

Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-56

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-51

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8886° Longitude: -104.8475°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH								LL-PL-PI	
0.8	<b>ASPHALT CONCRETE</b> , approximately 8½ inches thick.									
1.3	<b>BASE COURSE</b> , approximately 6 inches thick.									
5.0	<b>SANDY LEAN CLAY (CL)</b> , dark gray, stiff, trace iron-staining and calcium deposits.	7		7		9-13	18	106	35-24-11	55
5.0	<b>Boring Terminated at 5 Feet</b>	8		8		6-10	15	110		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-57

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-52

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8892° Longitude: -104.8479°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	DEPTH									
	0.5	<b>ASPHALT CONCRETE</b> , approximately 6 inches thick.								
	1.0	<b>BASE COURSE</b> , approximately 6 inches thick.								
	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, brown, medium dense, trace calcium deposits.			X	12	9-12	6	119	35-17-18	17
				Hand						
				X	12	15-10	9	118		
	<b>Boring Terminated at 5 Feet</b>	5								

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-58

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-53

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8898° Longitude: -104.8483°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH								LL-PL-PI	
0.3	<b>ASPHALT CONCRETE</b> , approximately 3.5 inches thick.									
1.0	<b>BASE COURSE</b> , approximately 9 inches thick.									
5	<b>WEATHERED CLAYEY SANDSTONE</b> , grayish-brown, firm to medium hard, varies to weathered sandy claystone, with iron staining.			X	12	16-22	20	104	38-18-20	36
			Hand				15	107	38-18-20	73
				X	11	19-35	19	105		
10				X	11	20-39	19	109		
	<b>Boring Terminated at 10 Feet</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-59

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-54

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8905° Longitude: -104.849°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS		PERCENT FINES
	DEPTH								LL-PL-PI		
0.5	<b>ASPHALT CONCRETE</b> , approximately 8.5 inches thick.										
1.5	<b>BASE COURSE</b> , approximately 1.5 feet thick.										
5.0	<b>FILL - CLAYEY SAND (SC)</b> , medium to coarse grained, reddish-brown to dark brown, medium dense			8		14-14	5	112			
5.0	<b>Boring Terminated at 5 Feet</b>	5		7		8-12	16	100	38-17-22	50	

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

Hammer Type: Automatic

Advancement Method: 4" solid stem auger	See Exhibit A-1 for description of field procedures  See Appendix B for description of laboratory procedures and additional data (if any).  See Appendix C for explanation of symbols and abbreviations.	Notes:
Abandonment Method: Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.		
<b>WATER LEVEL OBSERVATIONS</b>		
<i>No free water observed during drilling.</i>		



Boring Started: 8/6/2015	Boring Completed: 8/6/2015
Drill Rig: CME-55	Driller: Vine
Project No.: 23155014	Exhibit: A-60

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-55

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8911° Longitude: -104.8494°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	<b>ASPHALT CONCRETE</b> , approximately 3.5 inches thick.									
1.0	<b>BASE COURSE</b> , approximately 8 inches thick.									
5.0	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, brown, loose  trace calcium deposits at 3 feet.	5		11		9-8	6	112	28-16-12	14
<b>Boring Terminated at 5 Feet</b>										

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-61

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-56

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8915° Longitude: -104.8497°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
0.4	<b>ASPHALT CONCRETE</b> , approximately 5 inches thick.									
1.0	<b>BASE COURSE</b> , approximately 8 inches thick.									
3.0	<b>FILL - CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, brown, medium dense			⚡	10	8-12	12	108	24-15-9	30
	encountered concrete at 3 feet; utility markings not observed at ground surface; abandoned boring due to concern of unmarked utility. <b>Boring Terminated at 3 Feet</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-62

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-57

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8923° Longitude: -104.8503°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS		PERCENT FINES
	DEPTH								LL-PL-PI		
	0.4 <b>ASPHALT CONCRETE</b> , approximately 5 inches thick.										
	1.0 <b>BASE COURSE</b> , approximately 8 inches thick.										
	<b>CLAYEY SAND (SC)</b> , brown, loose to medium dense, fine to medium grained.	5		10	9-15	6	93				
		5		9.5	9-10	9	111	26-15-12	47		
		10		11	10-5	3	127				
	<b>Boring Terminated at 10 Feet</b>										

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-63

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED - 23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-58

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8928° Longitude: -104.8508°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.5	<b>ASPHALT CONCRETE</b> , approximately 6 inches thick.									
1.2	<b>BASE COURSE</b> , approximately 8 inches thick.									
1.2	<b>WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)</b> , fine to coarse grained, reddish-brown, medium dense			X	12	7-11	4	104	NP	8
5.0	<b>Boring Terminated at 5 Feet</b>	5		X	12	19-22	5	117		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-64

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-59

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8933° Longitude: -104.8512°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
DEPTH										
0.4	<b>ASPHALT CONCRETE</b> , approximately 5 inches thick.									
1.2	<b>BASE COURSE</b> , approximately 8 inches thick.									
3.0	<b>WELL GRADED SAND WITH SILTY CLAY &amp; GRAVEL (SW-SC)</b> , fine to coarse grained, reddish-brown, medium dense	9.5		X		10-17	4	127	25-19-6	9
5.0	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, brown, loose	10		Hand		7-9	10	113		
<b>Boring Terminated at 5 Feet</b>		5								

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).  
See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-65

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-60

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8939° Longitude: -104.8514°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.6	<b>ASPHALT CONCRETE</b> , approximately 7 inches thick.									
1.5	<b>BASE COURSE</b> , approximately 12 inches thick.									
5.0	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, reddish-brown, medium dense, trace calcium deposits.	5		X	12	4-9	7	117	23-15-8	21
5.0	<b>Boring Terminated at 5 Feet</b>			X	10	10-22	3	109		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-66

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16



# BORING LOG NO. B-62

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8951° Longitude: -104.8511°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.5	<b>ASPHALT CONCRETE</b> , approximately 5.5 inches thick.									
1.0	<b>BASE COURSE</b> , approximately 10 inches thick.									
1.5	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, reddish-brown, medium dense			SC	17	22-26	7	125	27-16-11	13
5.0	<b>Boring Terminated at 5 Feet</b>	5		SC	12	12-8	5	122		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-68

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-63

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.896° Longitude: -104.8508°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.6	<b>ASPHALT CONCRETE</b> , approximately 7.5 inches thick.									
1.5	<b>BASE COURSE</b> , approximately 10 inches thick.									
5.0	<b>WELL GRADED SAND WITH SILTY CLAY &amp; GRAVEL (SW-SC)</b> , fine to coarse grained, brown, loose to medium dense	5		X	10	11-14	4	121	21-14-7	9
5.0	<b>Boring Terminated at 5 Feet</b>			X	12	5-6	6	108		

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 5/14/2015

Boring Completed: 5/14/2015

Drill Rig: CME-75

Driller: Denver

Project No.: 23155014

Exhibit: A-69

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-101

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8919° Longitude: -104.8501°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
DEPTH										
0.5	<b>ASPHALT CONCRETE</b> , approximately 6 inches thick.									
3.0	<b>FILL - CLAYEY SAND WITH GRAVEL (SC)</b> , fine to coarse grained, reddish-brown to brown, medium dense			X	9	15-21	5	121		
5.0	<b>SILTY SAND (SM)</b> , fine to coarse grained, reddish-brown to brown, medium dense			X	11	21-22	2		17-15-2	15
	<b>Boring Terminated at 5 Feet</b>	5								

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 8/6/2015

Boring Completed: 8/6/2015

Drill Rig: CME-55

Driller: Vine

Project No.: 23155014

Exhibit: A-70

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-102

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8814° Longitude: -104.8475°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH								LL-PL-PI	
0.5	<b>ASPHALT CONCRETE</b> , approximately 7 inches thick.									
5.0	<b>FILL - SILTY CLAYEY SAND WITH GRAVEL (SC-SM)</b> , fine to coarse grained, reddish-brown, medium dense, trace gravel, trace wooden fibers.	5		11		14-20	7	121		
5.0				12		13-24	4	120	21-16-5	13
<b>Boring Terminated at 5 Feet</b>										

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).  
See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

*No free water observed during drilling.*



Boring Started: 8/6/2015

Boring Completed: 8/6/2015

Drill Rig: CME-55

Driller: Vine

Project No.: 23155014

Exhibit: A-71

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

# BORING LOG NO. B-103

**PROJECT:** Centennial Blvd. Pavement Evaluation

**CLIENT:** Wilson & Company, Inc.  
Colorado Springs, Colorado

**SITE:** Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado

GRAPHIC LOG	LOCATION Exhibit A-3 Latitude: 38.8797° Longitude: -104.8474°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
	LL-PL-PI									
DEPTH										
0.5	<b>ASPHALT CONCRETE</b> , approximately 7 inches thick.									
1.5	<b>BASE COURSE</b> , approximately 2.5 feet thick.			X	12	13-15	5	126		
4.5	<b>FILL - LEAN CLAY WITH SAND (CL)</b> , reddish-brown									
5.0	<b>CLAYSTONE</b> , dark gray to black, very stiff, with calcium deposits.	5		X	12	24-32	14	109	36-17-19	73
	<b>Boring Terminated at 5 Feet</b>									

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

Hammer Type: Automatic

Advancement Method:  
4" solid stem auger

See Exhibit A-1 for description of field procedures

Notes:

Abandonment Method:  
Borings backfilled with cement-bentonite grout and patched with asphalt upon completion.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**  
*No free water observed during drilling.*



Boring Started: 8/6/2015

Boring Completed: 8/6/2015

Drill Rig: CME-55

Driller: Vine

Project No.: 23155014

Exhibit: A-72

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL REVISED -23155014.GPJ TERRACON2015.GDT 3/31/16

**APPENDIX B**  
**LABORATORY TESTING**

## Laboratory Testing

Samples retrieved during the field exploration were returned to the laboratory for observation by the project geotechnical engineer, and were classified in general accordance with the Unified Soil Classification System and Description of Rock Properties described in Appendix C.

At this time, an applicable laboratory-testing program was formulated to determine engineering properties of the subsurface materials. Following the completion of the laboratory testing, the field descriptions were confirmed or modified as necessary, and Logs of Borings were prepared. These logs are presented in Appendix A.

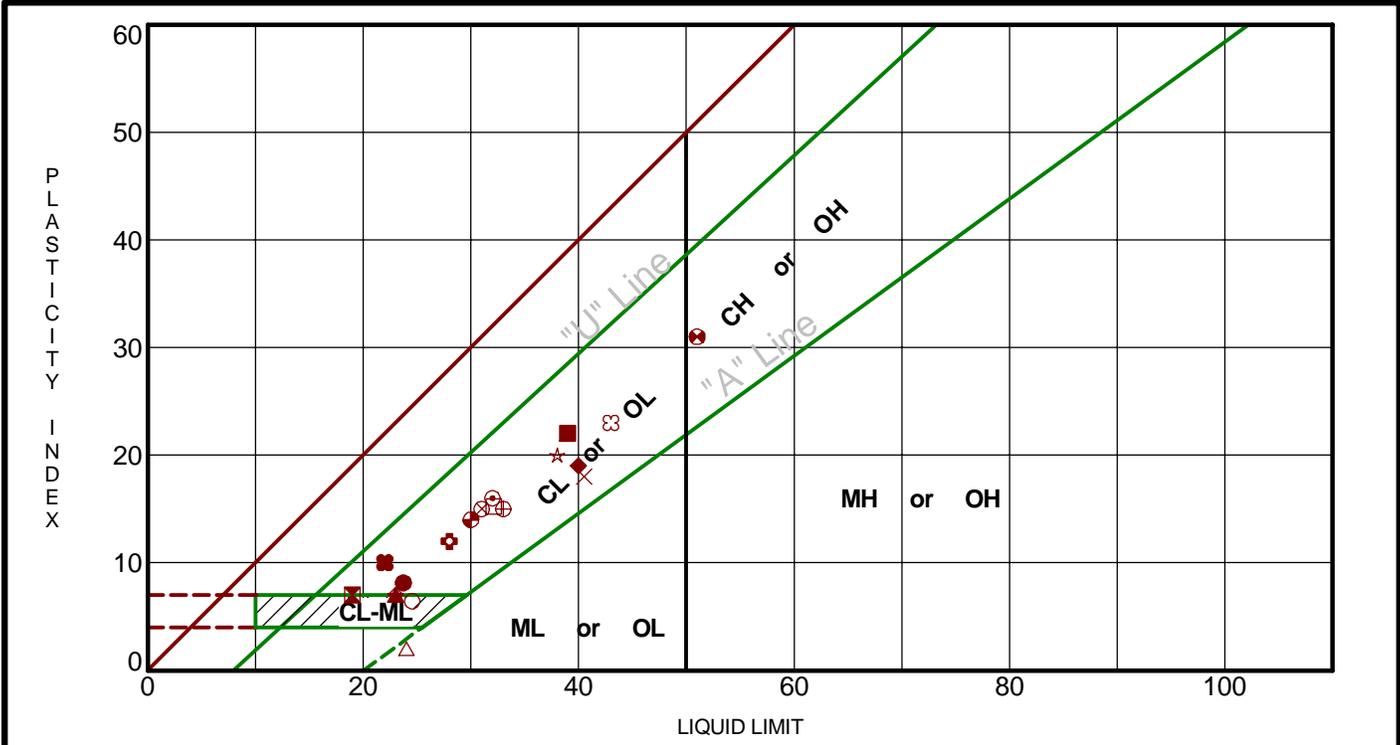
Laboratory test results are presented in Appendix B. These results were used for the geotechnical engineering analyses and to aid in the design and construction of pavements for this project. All laboratory tests were performed in general accordance with the applicable local or other accepted standards.

Selected soil samples were tested for the following engineering properties:

- Water content
- Dry density
- Grain size
- Atterberg Limits
- Consolidation/expansion
- Moisture-density relationship
- R-value
- Water soluble sulfate content
- Water soluble chloride content
- pH
- Electrical resistivity

# ATTERBERG LIMITS RESULTS

ASTM D4318



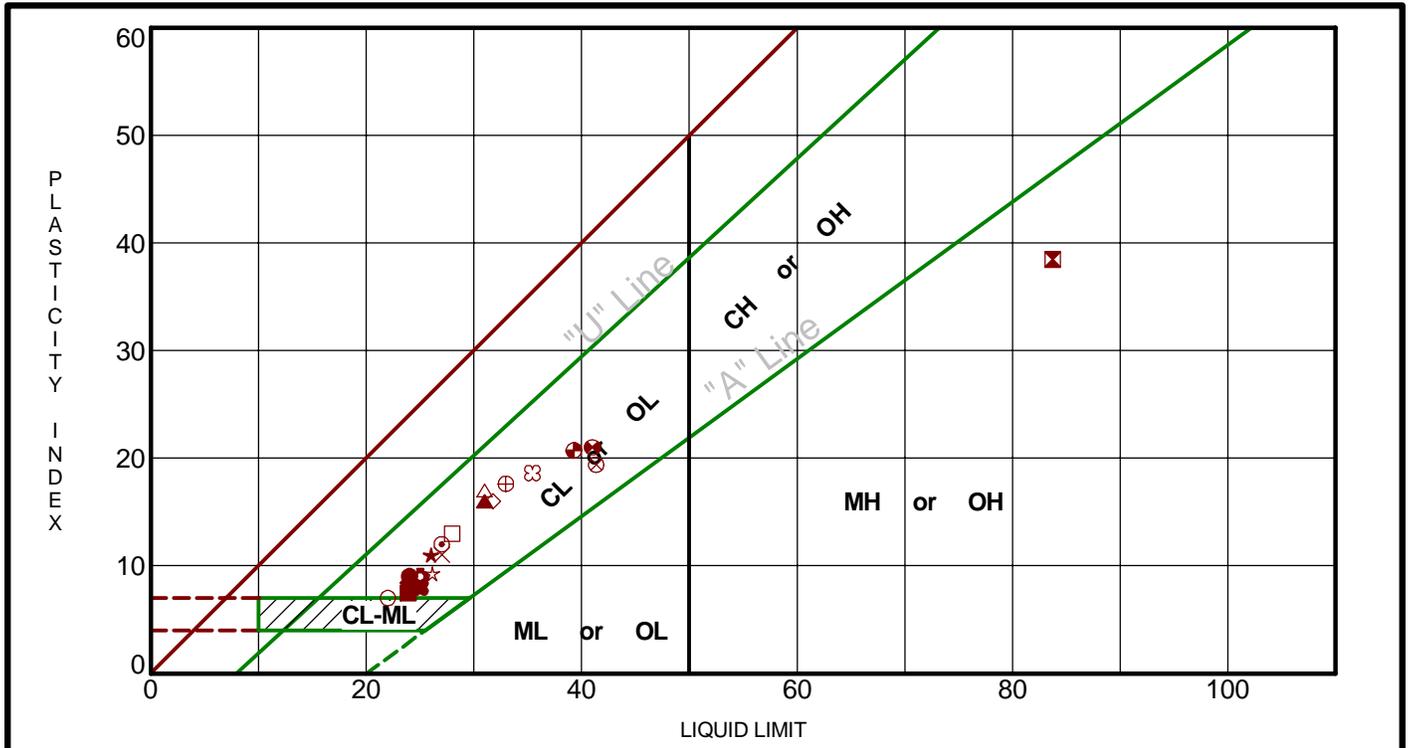
Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
● B-01	0.15 - 1.2	24	16	8	14	SC	CLAYEY SAND with GRAVEL
⊠ B-02	1.5 - 2.5	19	12	7	24	SC-SM	SILTY, CLAYEY SAND with GRAVEL
▲ B-03	1.5 - 2.5	23	16	7	8	SW-SC	WELL-GRADED SAND with SILTY CLAY and GRAVEL
★ B-04	1.5 - 2.5	23	16	7	16	SC-SM	SILTY, CLAYEY SAND with GRAVEL
⊙ B-05	1 - 2	32	16	16	23	SC	CLAYEY SAND with GRAVEL
⊕ B-06	0.5 - 1.5	28	16	12	25	SC	CLAYEY SAND with GRAVEL
○ B-07	0.42 - 1.4	25	18	7	21	SC-SM	SILTY, CLAYEY SAND with GRAVEL
△ B-08	1.5 - 2.5	24	22	2	9	SW-SM	WELL-GRADED SAND with SILT and GRAVEL
⊗ B-09	1 - 2	31	16	15	35	SC	CLAYEY SAND
⊕ B-10	1 - 2	33	18	15	51	CL	SANDY LEAN CLAY
□ B-11	0.5 - 1.5	32	17	15	49	SC	CLAYEY SAND
⊕ B-15	1 - 2	51	20	31	65	CH	SANDY FAT CLAY
⊕ B-17	0 - 5	30	16	14	47	SC	CLAYEY SAND
★ B-17	0.8 - 1.8	38	18	20	68	CL	SANDY LEAN CLAY
⊗ B-18	1 - 2	43	20	23	43	---	WEATHERED CLAYEY SANDSTONE
■ B-19	1 - 2	39	17	22	53	CL	SANDY LEAN CLAY
◆ B-20	1 - 2	40	21	19	56	CL	SANDY LEAN CLAY
◇ B-21	1.7 - 2.7	23	16	7	13	SC-SM	SILTY, CLAYEY SAND with GRAVEL
× B-21	4 - 5	40	22	18	80	---	WEATHERED SANDY CLAYSTONE
■ B-22	1.5 - 2.5	22	12	10	10	SW-SC	WELL-GRADED SAND with CLAY and GRAVEL

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. ATTERBERG LIMITS REVISED - 23155014.GPJ TERRACON2015.GDT 3/7/16

PROJECT: Centennial Blvd. Pavement Evaluation SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado	<p style="color: #8B0000; font-weight: bold;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014 CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado EXHIBIT: B-2
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# ATTERBERG LIMITS RESULTS

ASTM D4318



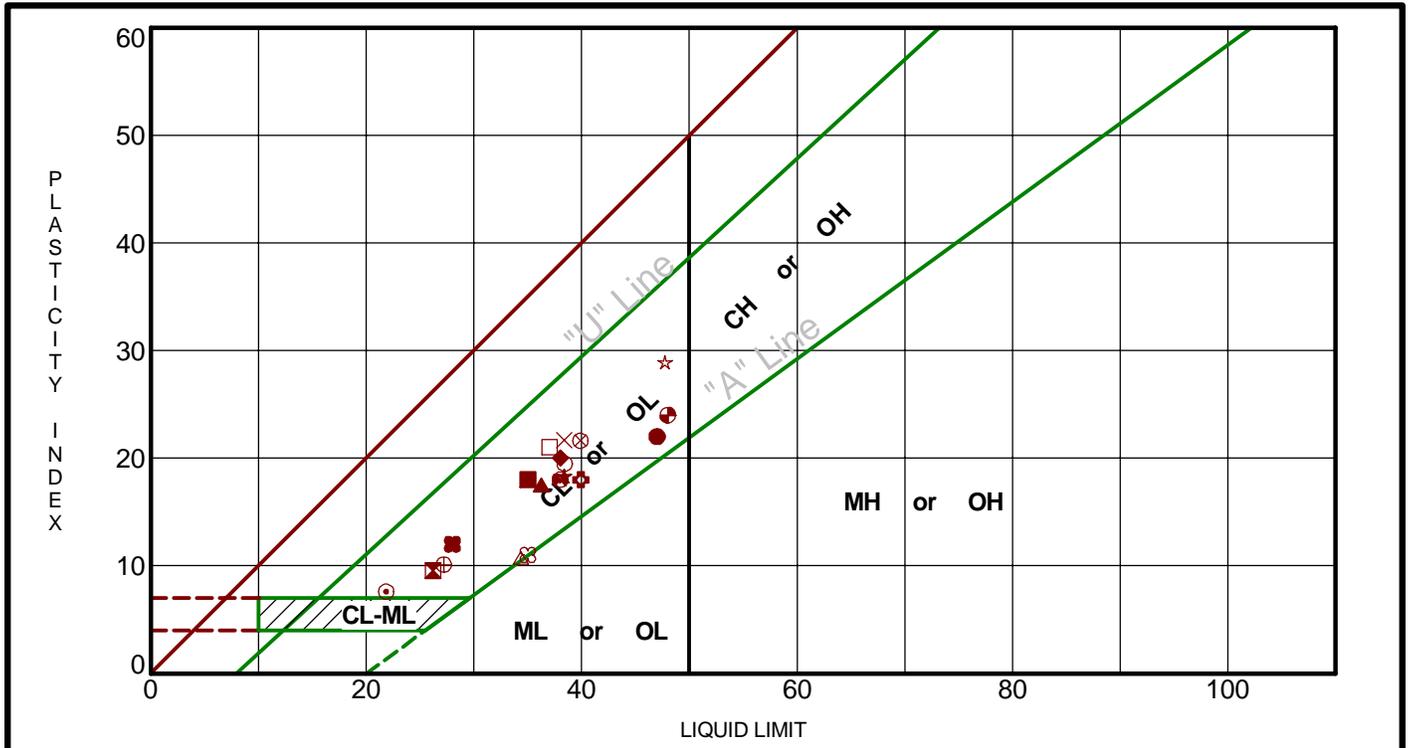
Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
● B-23	1.5 - 2.5	24	15	9	15	SC	CLAYEY SAND with GRAVEL
⊠ B-23	4 - 5	84	45	39	84	---	SANDY SILTSTONE
▲ B-24	1.5 - 2.5	31	15	16	24	SC	CLAYEY SAND with GRAVEL
★ B-25	1.5 - 2.5	26	15	11	16	SC	CLAYEY SAND with GRAVEL
⊙ B-26	2 - 3	27	15	12	12	SW-SC	WELL-GRADED SAND with CLAY and GRAVEL
⊕ B-27	1.5 - 2.5	25	16	9	13	SC	CLAYEY SAND with GRAVEL
○ B-28	2 - 3	22	15	7	15	SC-SM	SILTY, CLAYEY SAND with GRAVEL
△ B-29	2 - 3	31	14	17	37	SC	CLAYEY SAND with GRAVEL
⊗ B-30	4 - 5	41	22	19	48	SC	CLAYEY SAND
⊕ B-31	4 - 5	33	15	18	57	CL	SANDY LEAN CLAY
□ B-32	2 - 3	28	15	13	32	SC	CLAYEY SAND
⊕ B-33	2 - 3	41	20	21	54	CL	SANDY LEAN CLAY
⊕ B-34	4 - 5	39	19	20	59	CL	SANDY LEAN CLAY
★ B-36	0.67 - 1.7	26	17	9	10	SW-SC	WELL-GRADED SAND with CLAY and GRAVEL
⊗ B-37	0.5 - 1.5	35	17	18	42	SC	CLAYEY SAND with GRAVEL
■ B-38	0.67 - 1.7	24	16	8	14	GC	CLAYEY GRAVEL with SAND
◆ B-39	0.67 - 1.7	24	15	9	10	SW-SC	WELL-GRADED SAND with CLAY and GRAVEL
◇ B-40	0.5 - 1.5	32	16	16	38	SC	CLAYEY SAND with GRAVEL
× B-41	0 - 5	27	16	11	21	SC	CLAYEY SAND with GRAVEL
■ B-41	0.67 - 1.7	25	17	8	15	SC	CLAYEY SAND with GRAVEL

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. ATTERBERG LIMITS REVISED - 23155014.GPJ TERRACON2015.GDT 3/7/16

PROJECT: Centennial Blvd. Pavement Evaluation SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado	<p style="color: #8B0000; font-weight: bold; font-size: 0.8em;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014 CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado EXHIBIT: B-3
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# ATTERBERG LIMITS RESULTS

ASTM D4318



LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. ATTERBERG LIMITS REVISED - 23155014.GPJ TERRACON2015.GDT 3/7/16

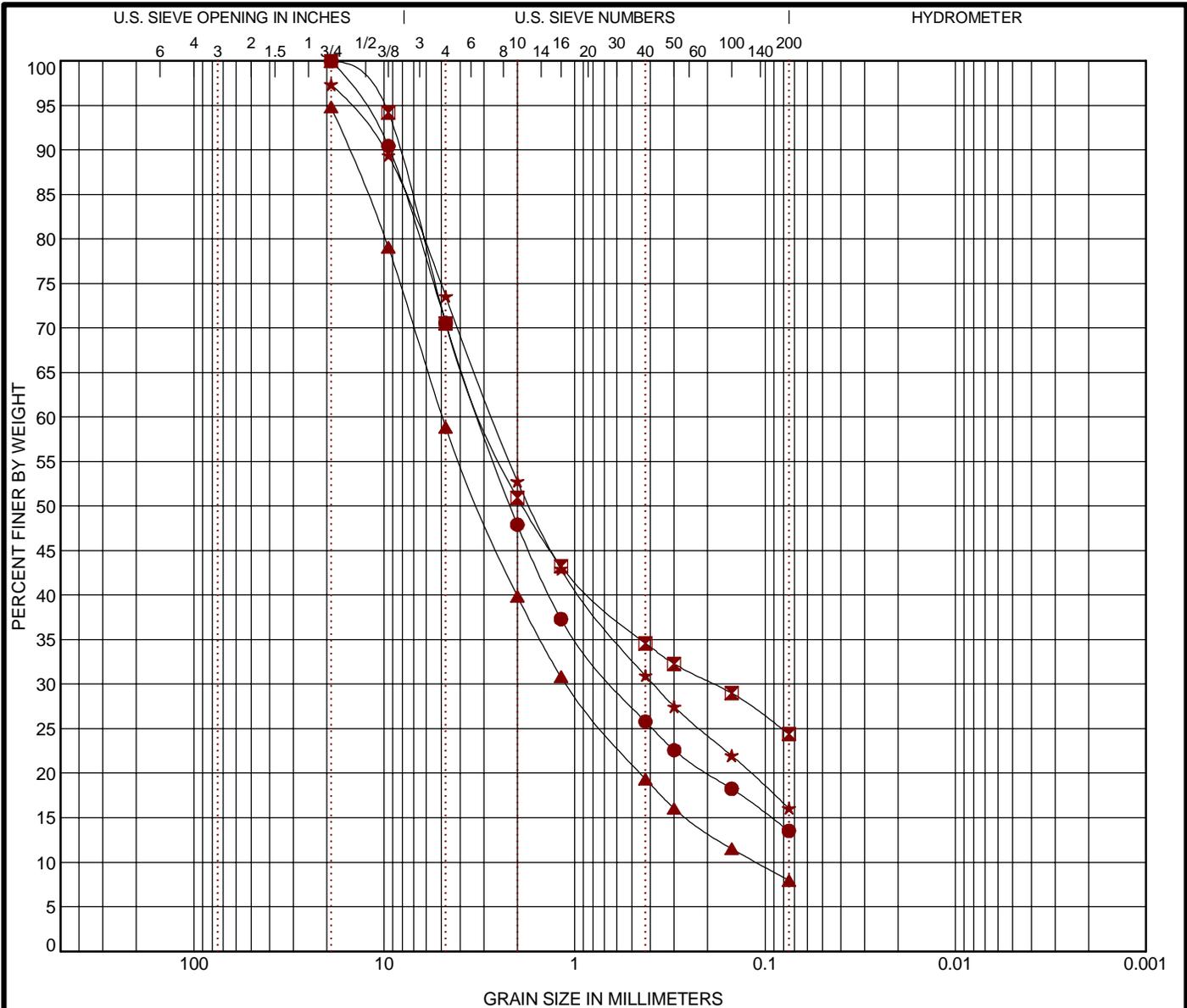
Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
● B-41	4 - 5	47	25	22	50	CL	SANDY LEAN CLAY
⊠ B-42	0.5 - 1.5	26	17	9	22	SC	CLAYEY SAND with GRAVEL
▲ B-43	0.75 - 1.8	36	19	17	35	SC	CLAYEY SAND with GRAVEL
★ B-43	4 - 5	38	20	18	58	---	SANDY CLAYSTONE
⊕ B-44	0.75 - 1.8	22	14	8	17	SC	CLAYEY SAND with GRAVEL
⊕ B-44	4 - 5	40	22	18	66	---	SANDY CLAYSTONE
○ B-45	0.58 - 1.6	38	19	19	48	SC	CLAYEY SAND
△ B-46	0.44 - 1.4	34	24	10	59	ML	SANDY SILT
⊗ B-47	0.33 - 1.3	40	18	22	76	CL	LEAN CLAY with SAND
⊕ B-48	0.33 - 1.3	27	17	10	48	SC	CLAYEY SAND
□ B-49	0 - 5	37	16	21	59	---	SANDY CLAYSTONE
⊕ B-49	0.5 - 1.5	38	20	18	56	---	WEATHERED CLAYSTONE
⊕ B-49	4 - 5	48	24	24	52	---	SANDY CLAYSTONE
★ B-50	0.5 - 1.5	48	19	29	61	CL	SANDY LEAN CLAY
⊗ B-51	1.3 - 2.3	35	24	11	55	CL	SANDY LEAN CLAY
■ B-52	1 - 2	35	17	18	17	SC	CLAYEY SAND with GRAVEL
◆ B-53	0 - 5	38	18	20	73	---	WEATHERED SANDY CLAYSTONE
◇ B-53	1 - 2	38	18	20	36	---	WEATHERED CLAYEY SANDSTONE
⊗ B-54	4 - 5	38	17	21	50	SC	CLAYEY SAND
■ B-55	1 - 2	28	16	12	14	SC	CLAYEY SAND with GRAVEL

PROJECT: Centennial Blvd. Pavement Evaluation SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado	<p style="color: #8B0000; font-weight: bold; margin-top: 5px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014 CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado EXHIBIT: B-4
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# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY			
	coarse	fine	coarse	medium	fine				

	Boring ID	Depth	USCS Classification	AASHTO Classification	LL	PL	PI	Cc	Cu	
●	B-01	0.15 - 1.2	CLAYEY SAND with GRAVEL (SC)	A-2-4(0)	24	16	8			
■	B-02	1.5 - 2.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	A-2-4(0)	19	12	7			
▲	B-03	1.5 - 2.5	WELL-GRADED SAND with SILTY CLAY and GRAVEL (SW-SC)	A-2-4(0)	23	16	7	2.18	44.20	
★	B-04	1.5 - 2.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	A-2-4(0)	23	16	7			
	Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay
●	B-01	0.15 - 1.2	19	3.173	0.617		29.4	57.0	13.5	
■	B-02	1.5 - 2.5	19	2.983	0.185		29.5	46.2	24.4	
▲	B-03	1.5 - 2.5	19	4.939	1.096	0.112	36.0	50.9	8.0	
★	B-04	1.5 - 2.5	19	2.7	0.386		23.8	57.5	16.1	

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado



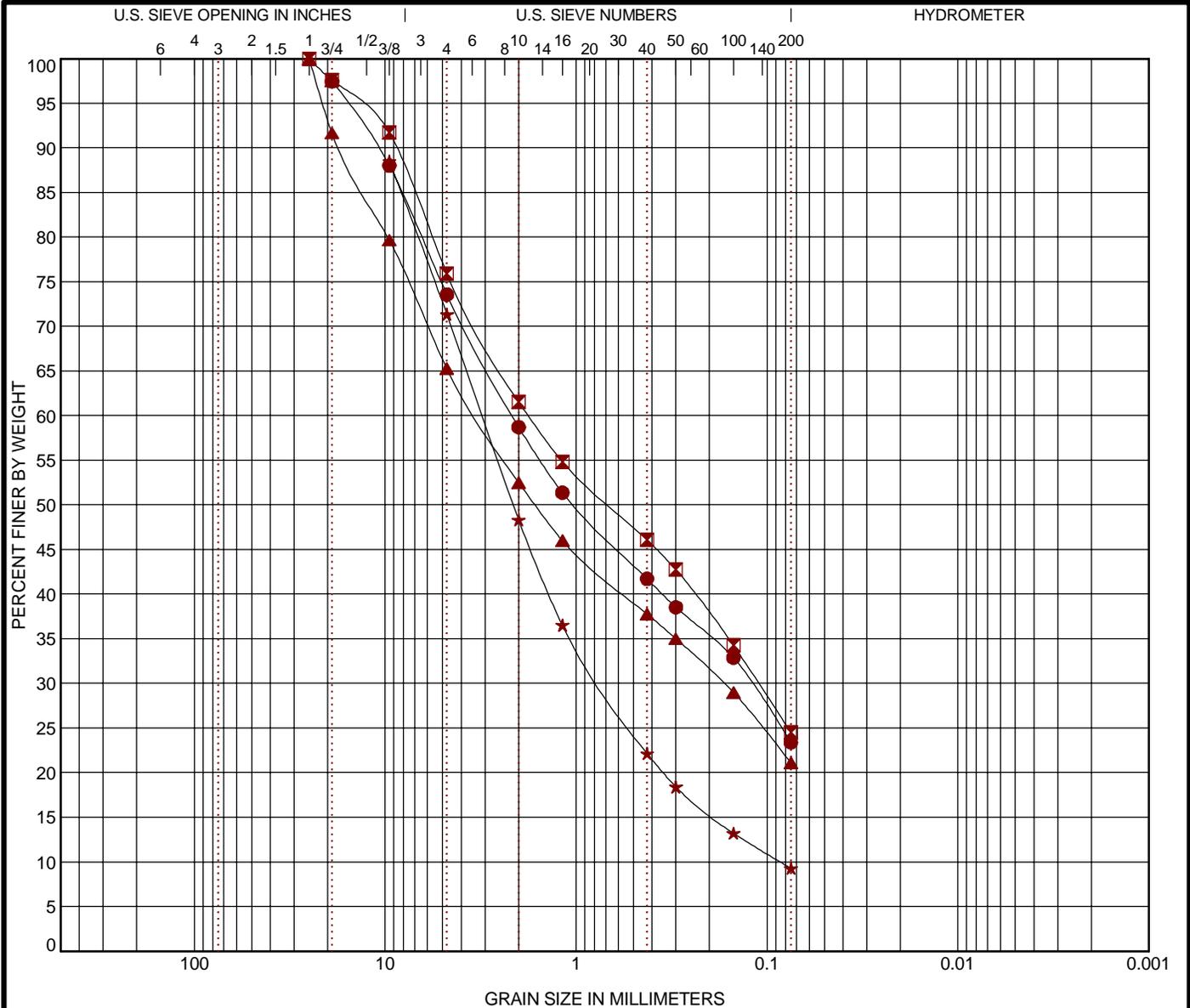
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado

EXHIBIT: B-6

# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY	
	coarse	fine	coarse	medium	fine		

Boring ID	Depth	USCS Classification	AASHTO Classification		LL	PL	PI	Cc	Cu
● B-05	1 - 2	CLAYEY SAND with GRAVEL (SC)	A-2-6(0)		32	16	16		
■ B-06	0.5 - 1.5	CLAYEY SAND with GRAVEL (SC)	A-2-6(0)		28	16	12		
▲ B-07	0.42 - 1.4	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	A-2-4(0)		25	18	7		
★ B-08	1.5 - 2.5	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	A-1-a(0)		24	22	2	2.09	36.44
Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay
● B-05	1 - 2	19	2.156	0.122		23.9	50.2	23.4	
■ B-06	0.5 - 1.5	25	1.773	0.111		24.1	51.4	24.5	
▲ B-07	0.42 - 1.4	25	3.326	0.169		34.7	44.2	21.1	
★ B-08	1.5 - 2.5	9.5	3.101	0.743	0.085	17.1	62.1	9.3	

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado



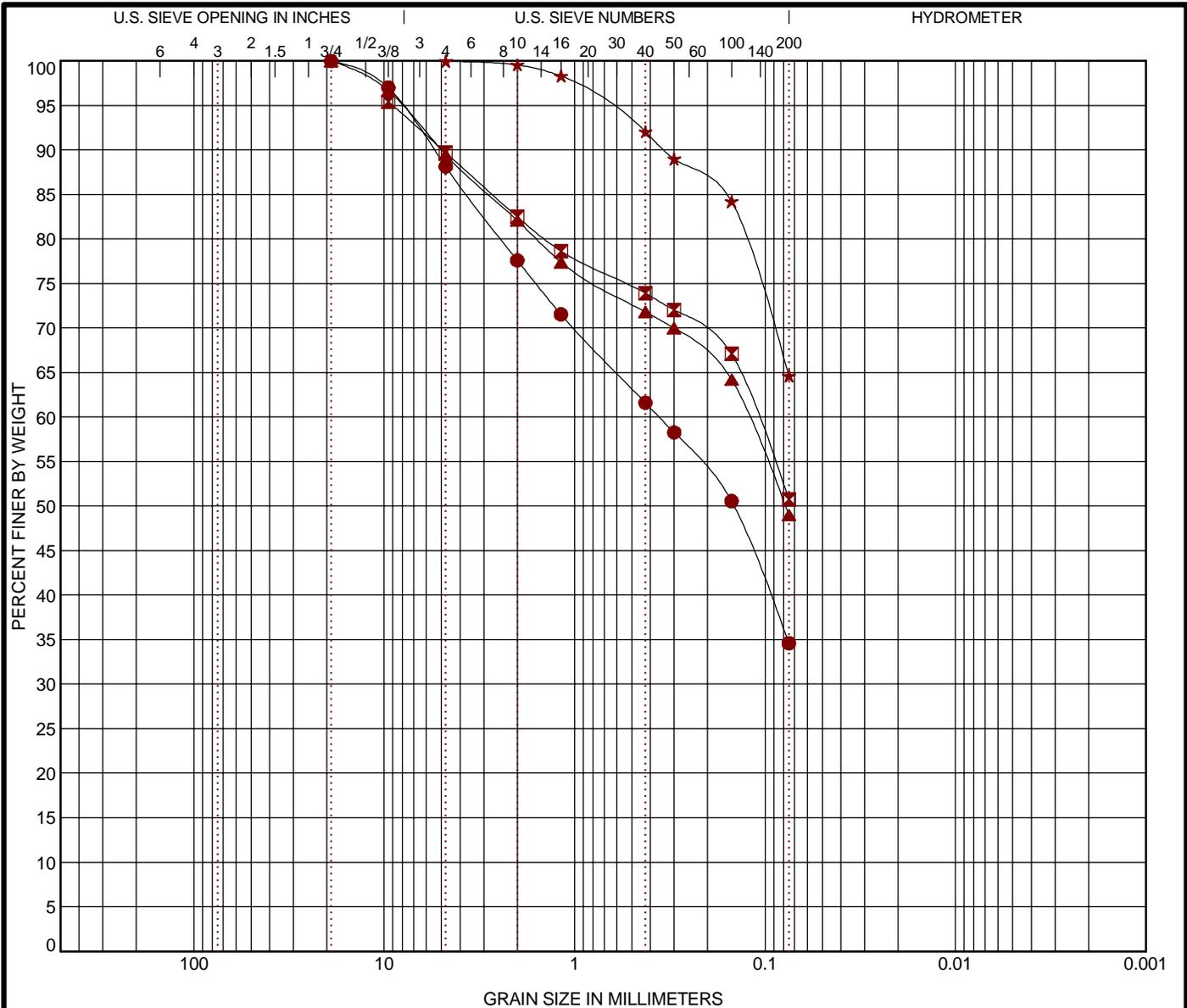
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado

EXHIBIT: B-7

# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification		AASHTO Classification		LL	PL	PI	Cc	Cu
● B-09	1 - 2	CLAYEY SAND (SC)		A-2-6(1)		31	16	15		
■ B-10	1 - 2	SANDY LEAN CLAY (CL)		A-6(4)		33	18	15		
▲ B-11	0.5 - 1.5	CLAYEY SAND (SC)		A-6(4)		32	17	15		
★ B-15	1 - 2	SANDY FAT CLAY (CH)		A-7-6(18)		51	20	31		
Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay	
● B-09	1 - 2	19	0.359			11.8	53.6	34.6		
■ B-10	1 - 2	9.5	0.111			5.7	39.0	50.8		
▲ B-11	0.5 - 1.5	19	0.124			10.5	40.5	49.0		
★ B-15	1 - 2	4.75				0.0	35.3	64.6		

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado



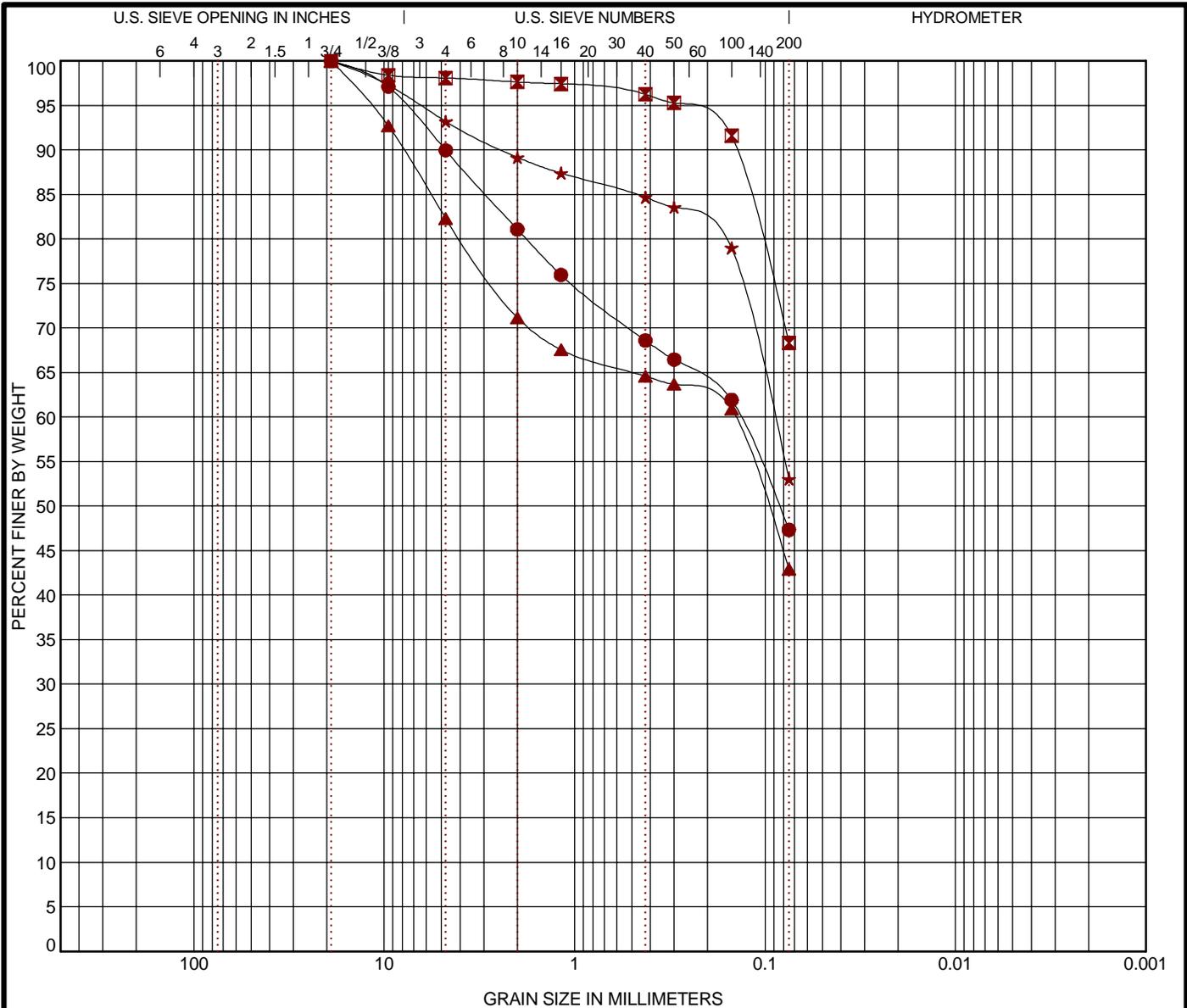
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc.  
Colorado Springs, Colorado

EXHIBIT: B-8

# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY			
	coarse	fine	coarse	medium	fine				

	Boring ID	Depth	USCS Classification	AASHTO Classification	LL	PL	PI	Cc	Cu	
●	B-17	0 - 5	CLAYEY SAND (SC)	A-6(3)	30	16	14			
☒	B-17	0.8 - 1.8	SANDY LEAN CLAY (CL)	A-6(12)	38	18	20			
▲	B-18	1 - 2	WEATHERED CLAYEY SANDSTONE	---	43	20	23			
★	B-19	1 - 2	SANDY LEAN CLAY (CL)	A-6(8)	39	17	22			
	Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay
●	B-17	0 - 5	19	0.137			10.0	42.6	47.3	
☒	B-17	0.8 - 1.8	19				1.9	29.8	68.3	
▲	B-18	1 - 2	19	0.145			17.7	39.4	42.9	
★	B-19	1 - 2	19	0.09			6.8	40.2	53.0	

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado



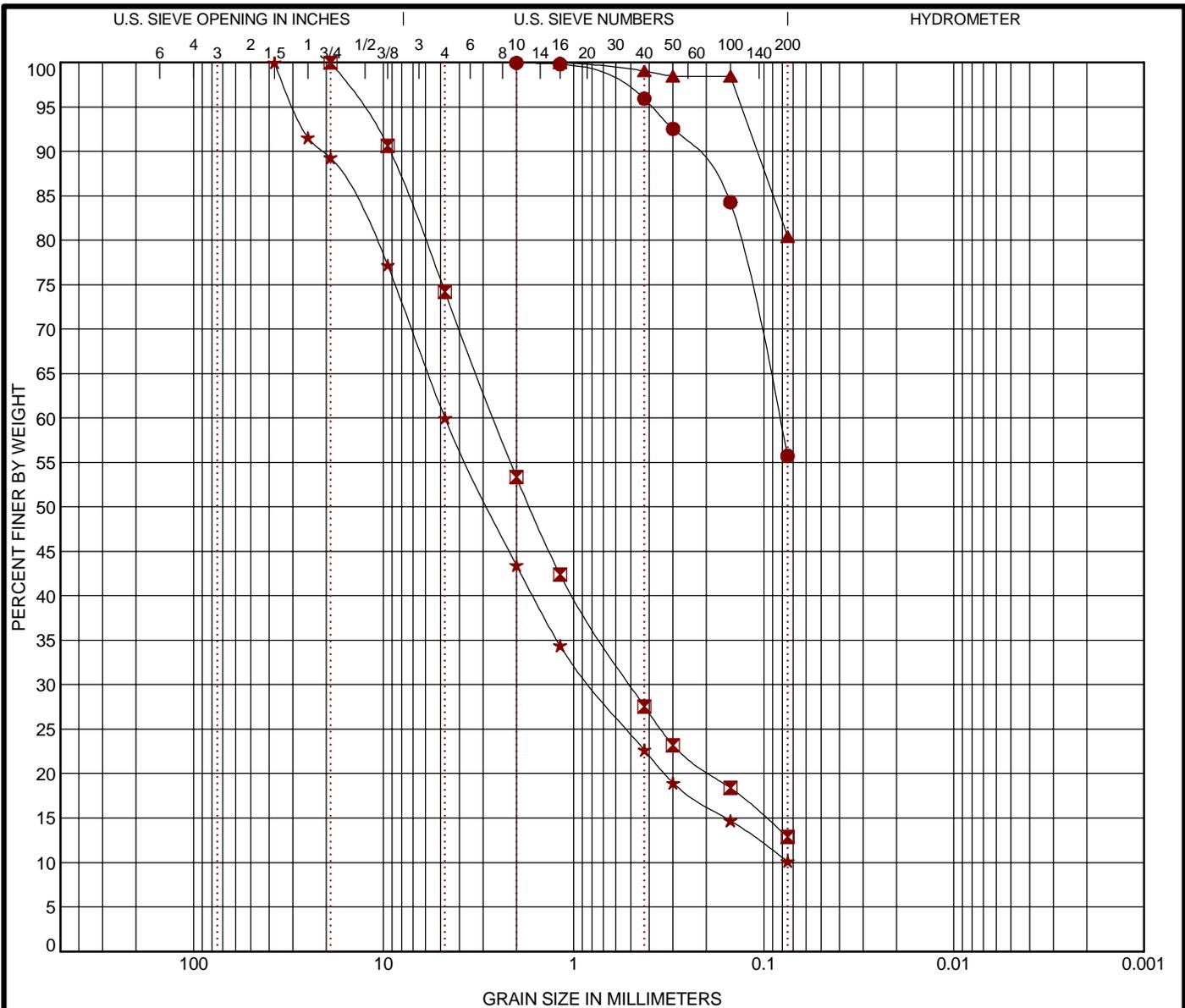
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado

EXHIBIT: B-9

# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY	
	coarse	fine	coarse	medium	fine		

	Boring ID	Depth	USCS Classification	AASHTO Classification	LL	PL	PI	Cc	Cu	
●	B-20	1 - 2	SANDY LEAN CLAY (CL)	A-6(8)	40	21	19			
☒	B-21	1.7 - 2.7	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	A-2-4(0)	23	16	7			
▲	B-21	4 - 5	WEATHERED SANDY CLAYSTONE	---	40	22	18			
★	B-22	1.5 - 2.5	WELL-GRADED SAND with CLAY and GRAVEL (SW-SC)	A-2-4(0)	22	12	10	1.85	64.38	
	Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay
●	B-20	1 - 2	2	0.083			0.0	44.2	55.7	
☒	B-21	1.7 - 2.7	19	2.635	0.503		25.8	61.4	12.9	
▲	B-21	4 - 5	1.18				0.0	19.6	80.4	
★	B-22	1.5 - 2.5	37.5	4.747	0.805		40.0	49.9	10.1	

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado



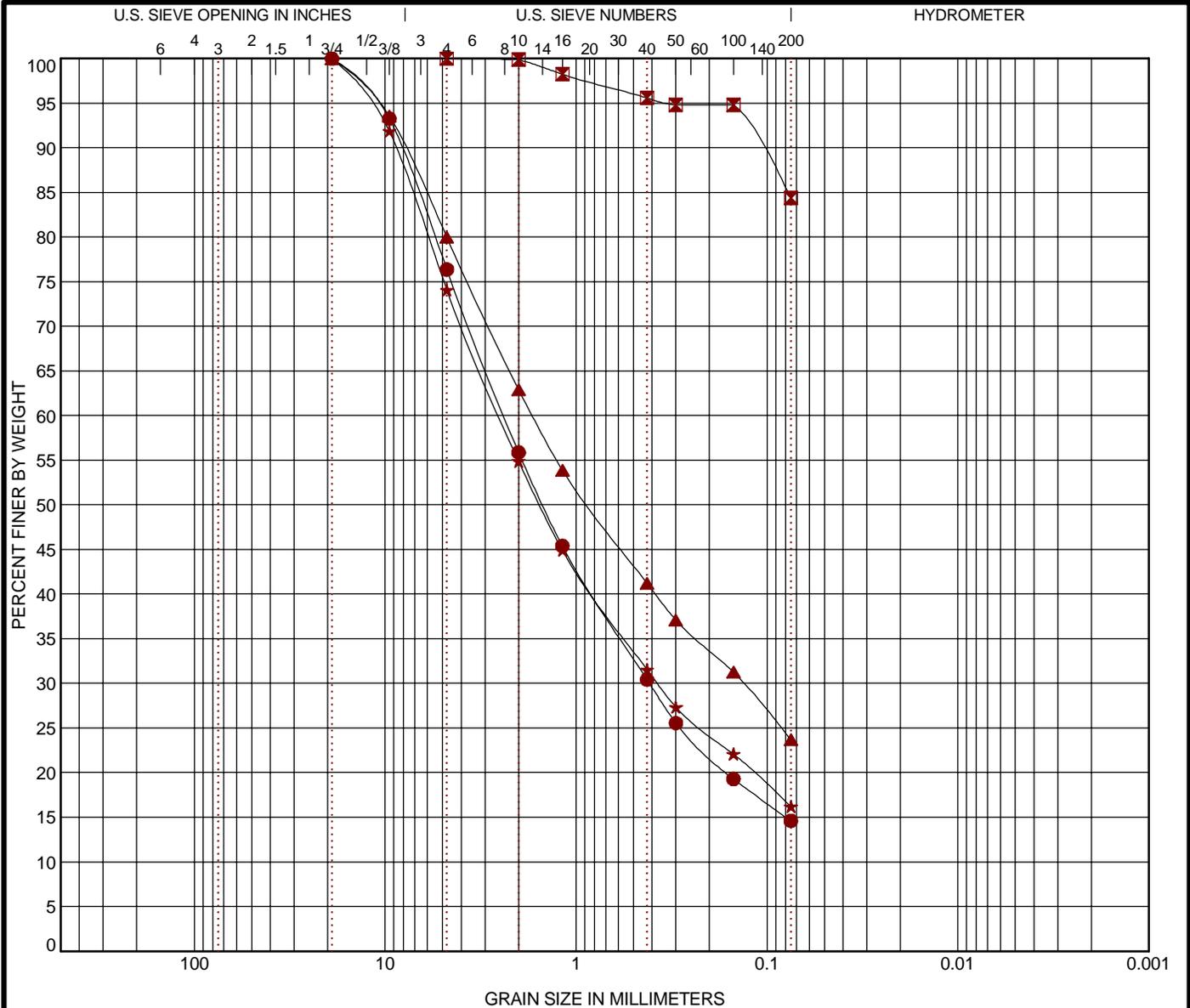
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado

EXHIBIT: B-10

# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY			
	coarse	fine	coarse	medium	fine				

	Boring ID	Depth	USCS Classification	AASHTO Classification	LL	PL	PI	Cc	Cu	
●	B-23	1.5 - 2.5	CLAYEY SAND with GRAVEL (SC)	A-2-4(0)	24	15	9			
☒	B-23	4 - 5	SANDY SILTSTONE	---	84	45	39			
▲	B-24	1.5 - 2.5	CLAYEY SAND with GRAVEL (SC)	---	31	15	16			
★	B-25	1.5 - 2.5	CLAYEY SAND with GRAVEL (SC)	A-2-6(0)	26	15	11			
	Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay
●	B-23	1.5 - 2.5	19	2.381	0.412		23.6	61.8		14.6
☒	B-23	4 - 5	4.75				0.0	15.6		84.4
▲	B-24	1.5 - 2.5	19	1.687	0.134		20.0	56.3		23.7
★	B-25	1.5 - 2.5	19	2.519	0.374		25.9	57.9		16.2

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado



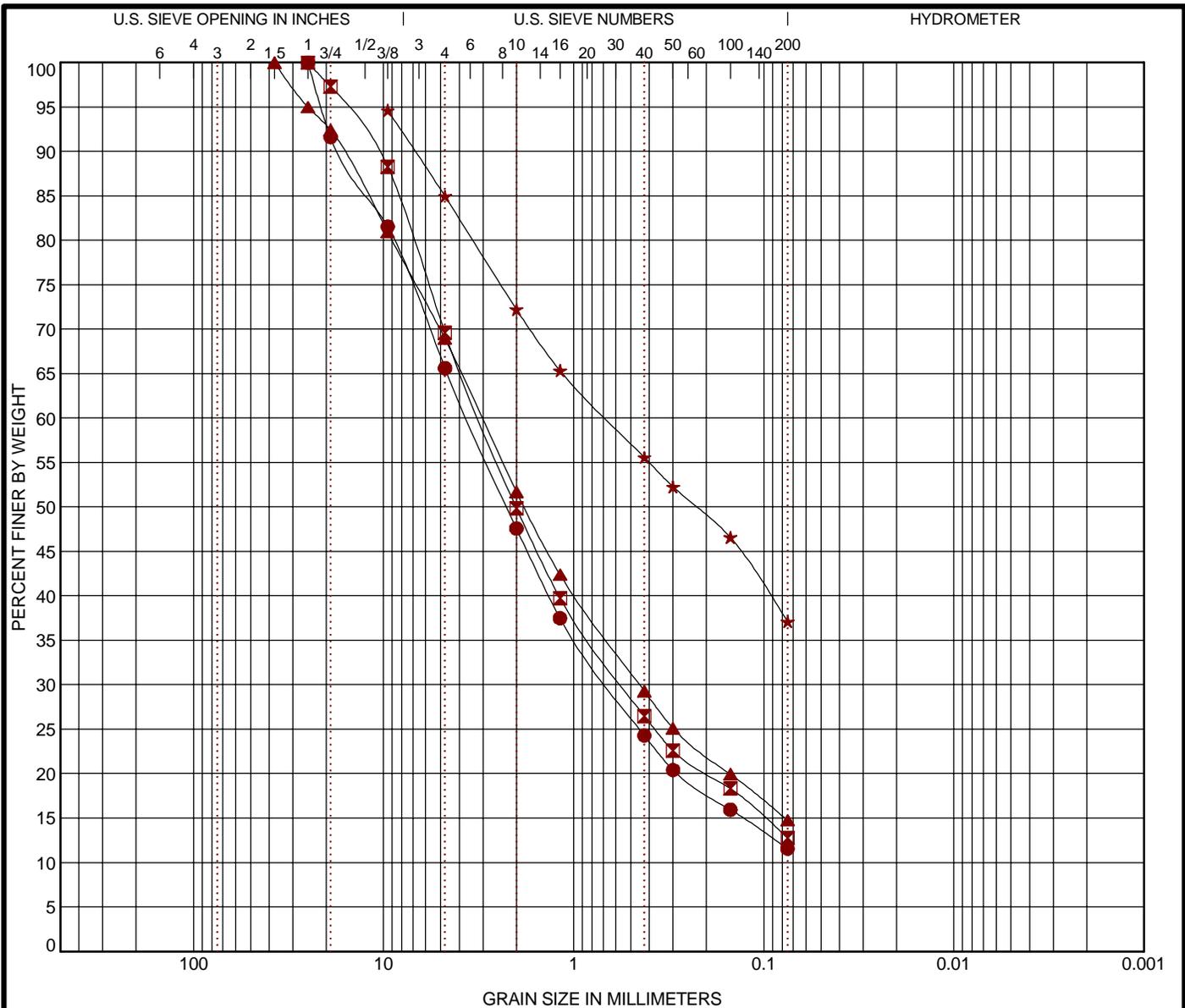
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc.  
Colorado Springs, Colorado

EXHIBIT: B-11

# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY			
	coarse	fine	coarse	medium	fine				

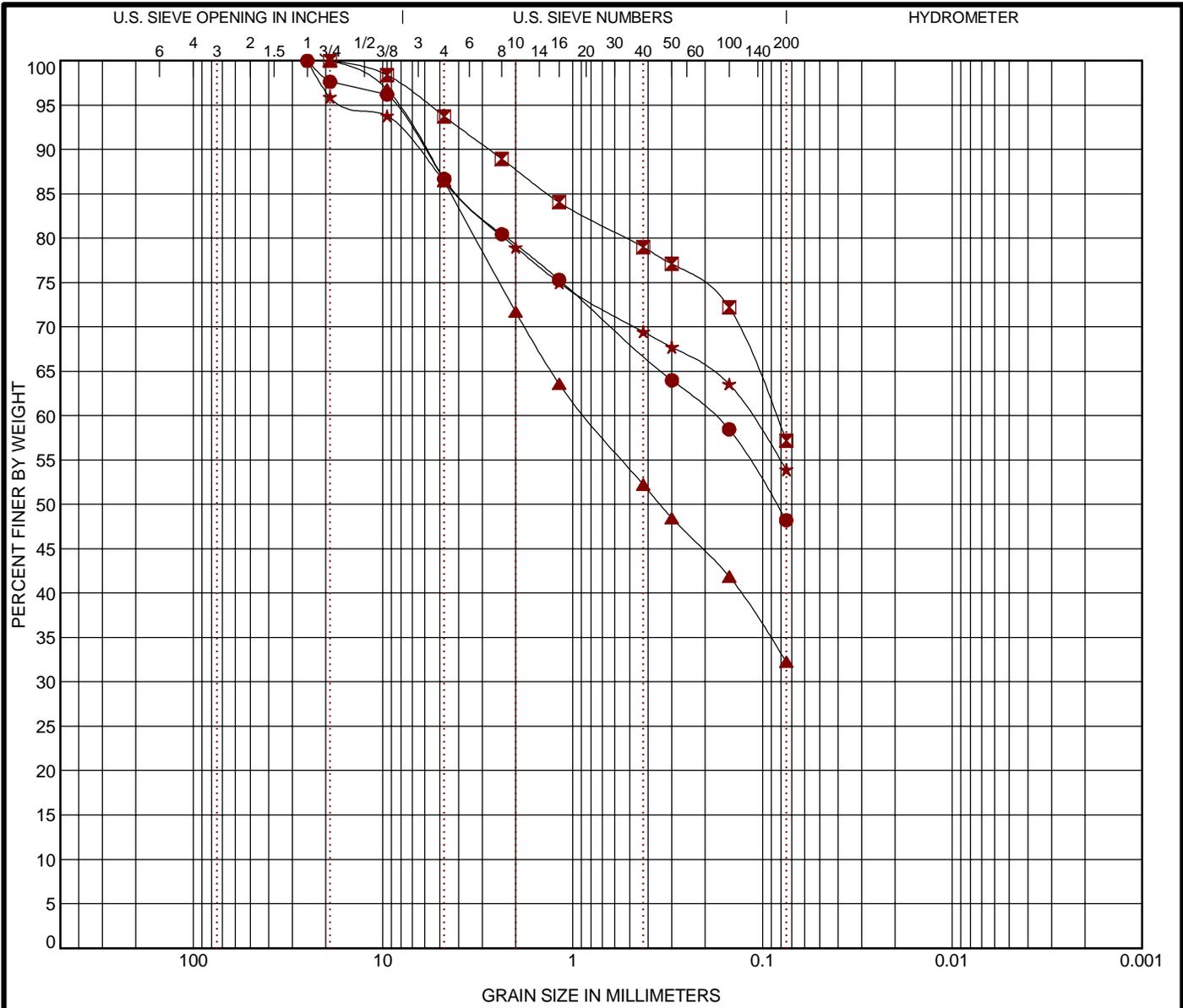
	Boring ID	Depth	USCS Classification	AASHTO Classification	LL	PL	PI	Cc	Cu	
●	B-26	2 - 3	WELL-GRADED SAND with CLAY and GRAVEL (SW-SC)	A-2-6(0)	27	15	12	2.06	61.96	
☒	B-27	1.5 - 2.5	CLAYEY SAND with GRAVEL (SC)	A-2-4(0)	25	16	9			
▲	B-28	2 - 3	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	A-2-4(0)	22	15	7			
★	B-29	2 - 3	CLAYEY SAND with GRAVEL (SC)	A-6(2)	31	14	17			
	Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay
●	B-26	2 - 3	25	3.627	0.662		34.4	54.1		11.6
☒	B-27	1.5 - 2.5	25	3.119	0.558		30.4	56.8		12.7
▲	B-28	2 - 3	37.5	3.033	0.45		31.1	54.2		14.8
★	B-29	2 - 3	9.5	0.675			9.7	47.9		37.1

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation  SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado	<p style="color: #8B0000; font-weight: bold; margin-top: 5px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014  CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado  EXHIBIT: B-12
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# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY	
	coarse	fine	coarse	medium	fine		

	Boring ID	Depth	USCS Classification	AASHTO Classification	LL	PL	PI	Cc	Cu	
●	B-30	4 - 5	CLAYEY SAND (SC)	A-7-6(6)	41	22	19			
☒	B-31	4 - 5	SANDY LEAN CLAY (CL)	A-6(7)	33	15	18			
▲	B-32	2 - 3	CLAYEY SAND (SC)	A-2-6(1)	28	15	13			
★	B-33	2 - 3	SANDY LEAN CLAY (CL)	A-7-6(8)	41	20	21			
	Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay
●	B-30	4 - 5	25	0.182			13.3	38.5	48.2	
☒	B-31	4 - 5	19	0.085			6.3	36.5	57.2	
▲	B-32	2 - 3	19	0.853			13.5	54.2	32.3	
★	B-33	2 - 3	25	0.116			13.6	32.5	53.9	

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado



PROJECT NUMBER: 23155014

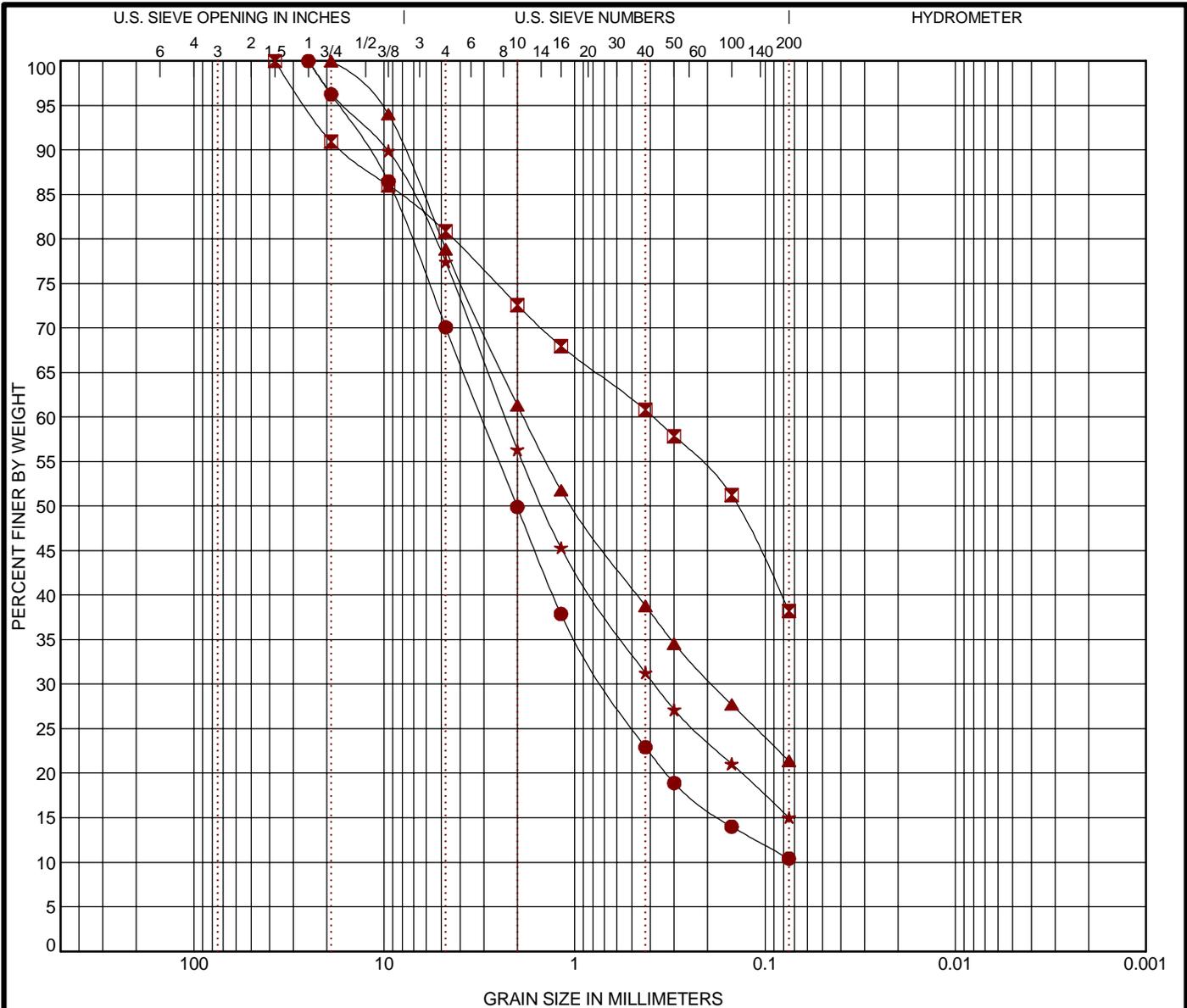
CLIENT: Wilson & Company, Inc.  
Colorado Springs, Colorado

EXHIBIT: B-13



# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY	
	coarse	fine	coarse	medium	fine		

Boring ID	Depth	USCS Classification	AASHTO Classification			LL	PL	PI	Cc	Cu	
●	B-39	0.67 - 1.7	WELL-GRADED SAND with CLAY and GRAVEL (SW-SC)			A-2-4(0)	24	15	9	2.22	44.51
☒	B-40	0.5 - 1.5	CLAYEY SAND with GRAVEL (SC)			A-6(2)	32	16	16		
▲	B-41	0 - 5	CLAYEY SAND with GRAVEL (SC)			A-2-6(0)	27	16	11		
★	B-41	0.67 - 1.7	CLAYEY SAND with GRAVEL (SC)			A-2-4(0)	25	17	8		
Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay		
●	B-39	0.67 - 1.7	25	3.083	0.689	29.9	59.7	10.4			
☒	B-40	0.5 - 1.5	37.5	0.386		19.1	42.7	38.2			
▲	B-41	0 - 5	19	1.856	0.189	21.1	57.5	21.4			
★	B-41	0.67 - 1.7	25	2.323	0.382	22.6	62.4	15.0			

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado



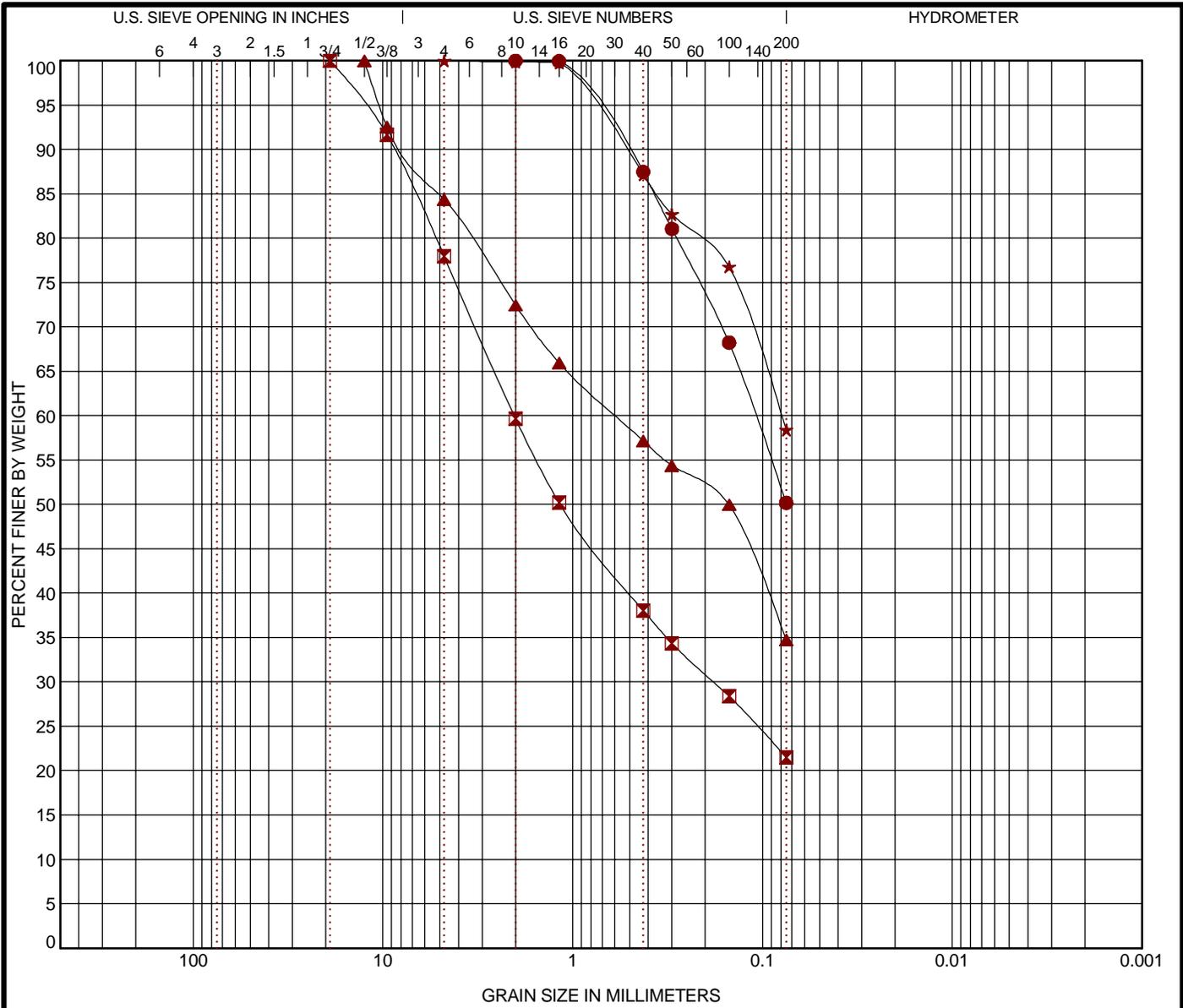
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado

EXHIBIT: B-15

# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY	
	coarse	fine	coarse	medium	fine		

	Boring ID	Depth	USCS Classification	AASHTO Classification	LL	PL	PI	Cc	Cu	
●	B-41	4 - 5	SANDY LEAN CLAY (CL)	A-7-6(8)	47	25	22			
☒	B-42	0.5 - 1.5	CLAYEY SAND with GRAVEL (SC)	A-2-4(0)	26	17	9			
▲	B-43	0.75 - 1.8	CLAYEY SAND with GRAVEL (SC)	A-2-6(1)	36	19	17			
★	B-43	4 - 5	SANDY CLAYSTONE	---	38	20	18			
●	Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay
●	B-41	4 - 5	2	0.109			0.0	49.8	50.2	
☒	B-42	0.5 - 1.5	19	2.032	0.181		22.1	56.4	21.5	
▲	B-43	0.75 - 1.8	12.5	0.591			15.6	49.6	34.7	
★	B-43	4 - 5	4.75	0.08			0.0	41.6	58.4	

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado



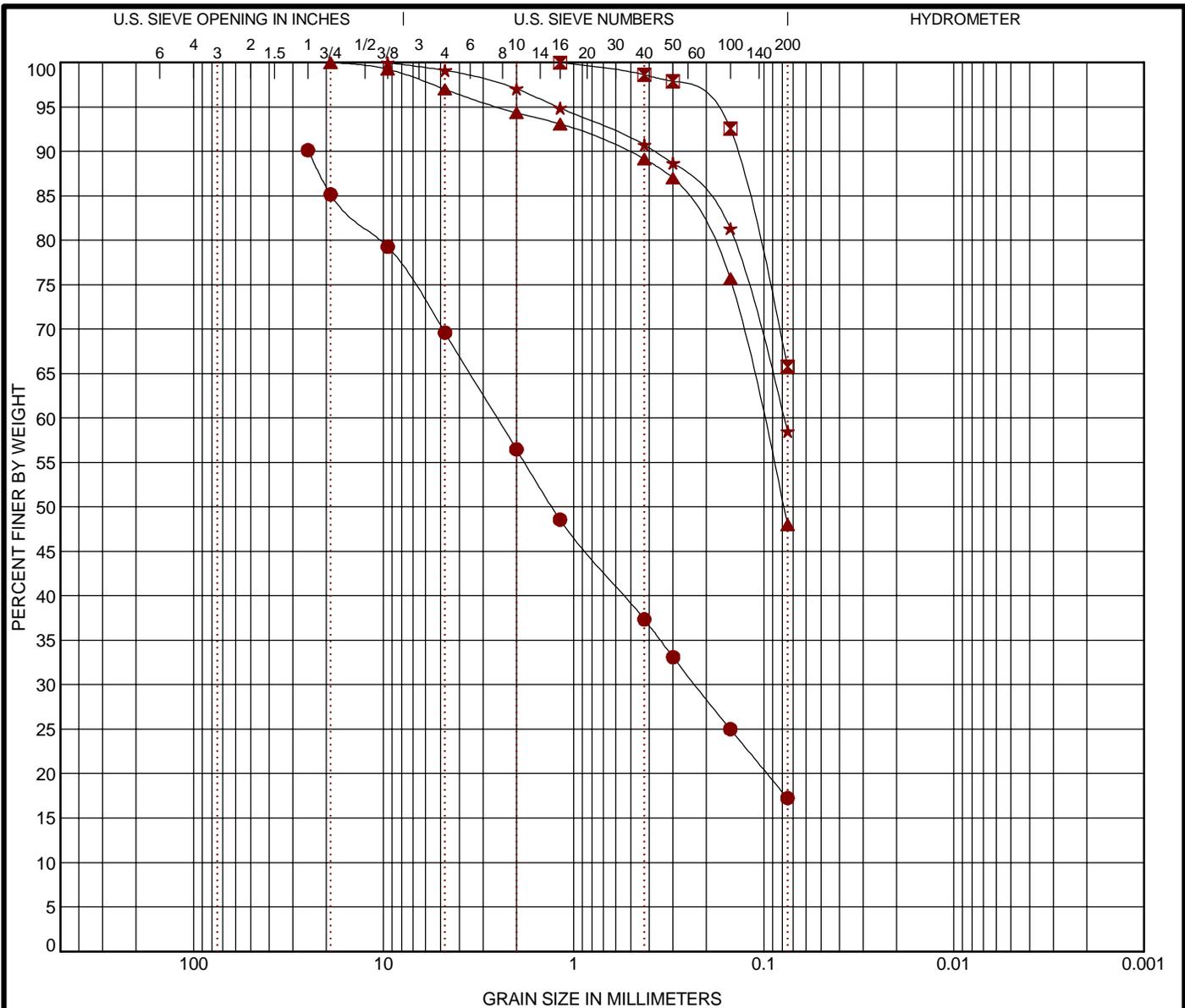
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc.  
Colorado Springs, Colorado

EXHIBIT: B-16

# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY			
	coarse	fine	coarse	medium	fine				

Boring ID	Depth	USCS Classification	AASHTO Classification			LL	PL	PI	Cc	Cu
● B-44	0.75 - 1.8	CLAYEY SAND with GRAVEL (SC)	A-2-4(0)			22	14	8		
☒ B-44	4 - 5	SANDY CLAYSTONE	---			40	22	18		
▲ B-45	0.58 - 1.6	CLAYEY SAND (SC)	---			38	19	19		
★ B-46	0.44 - 1.4	SANDY SILT (ML)	A-4(4)			34	24	10		
Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay	
● B-44	0.75 - 1.8	25	2.521	0.23		20.5	52.4	17.2		
☒ B-44	4 - 5	1.18				0.0	34.2	65.8		
▲ B-45	0.58 - 1.6	19	0.101			3.0	49.0	48.0		
★ B-46	0.44 - 1.4	9.5	0.078			0.9	40.6	58.5		

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado



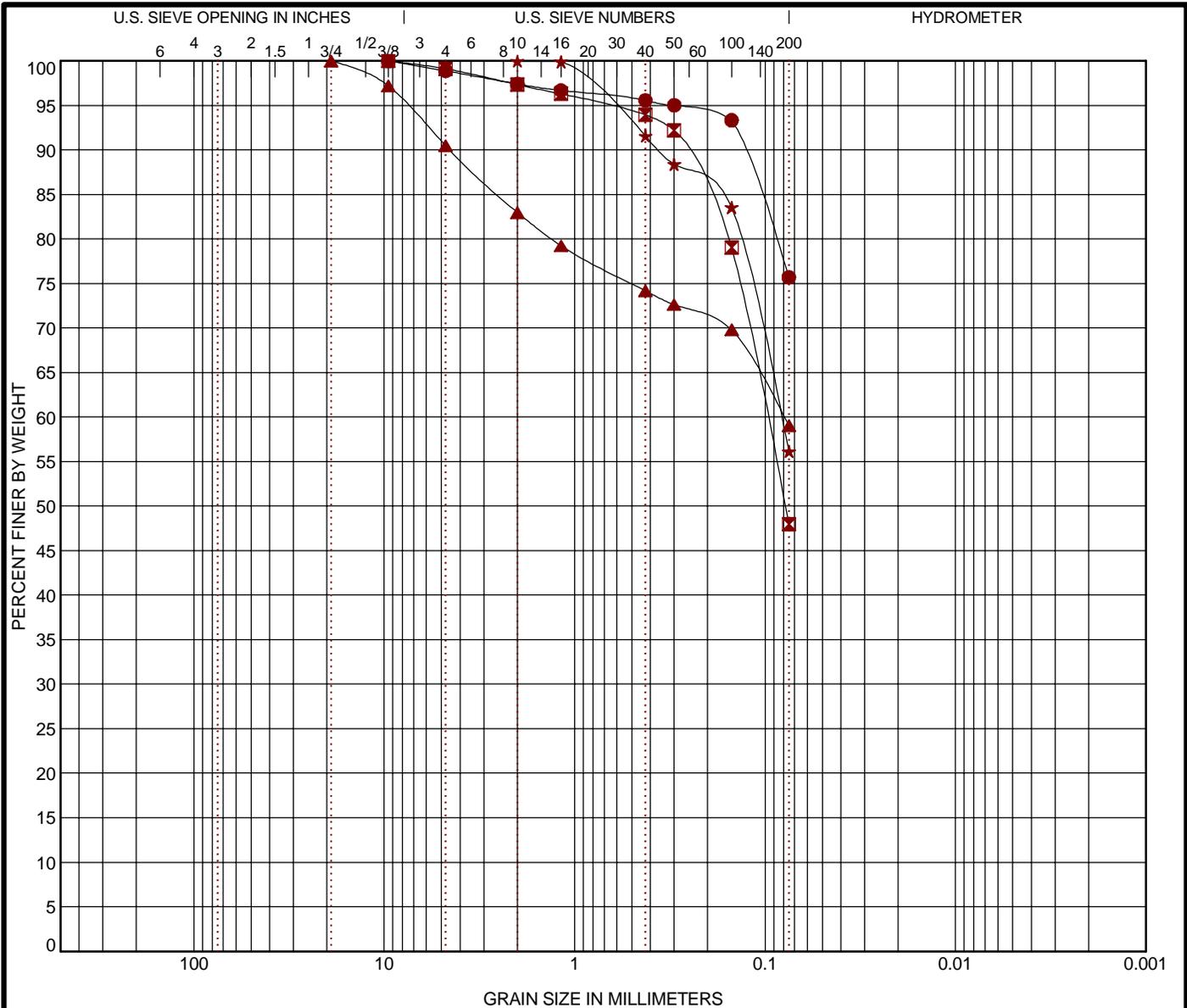
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc.  
Colorado Springs, Colorado

EXHIBIT: B-17

# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY			
	coarse	fine	coarse	medium	fine				

	Boring ID	Depth	USCS Classification	AASHTO Classification	LL	PL	PI	Cc	Cu	
●	B-47	0.33 - 1.3	LEAN CLAY with SAND (CL)	A-6(16)	40	18	22			
☒	B-48	0.33 - 1.3	CLAYEY SAND (SC)	A-4(2)	27	17	10			
▲	B-49	0 - 5	SANDY CLAYSTONE	---	37	16	21			
★	B-49	0.5 - 1.5	WEATHERED CLAYSTONE	---	38	20	18			
	Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay
●	B-47	0.33 - 1.3	9.5				1.1	23.2	75.7	
☒	B-48	0.33 - 1.3	9.5	0.098			0.9	51.2	48.0	
▲	B-49	0 - 5	19	0.08			9.5	31.5	59.0	
★	B-49	0.5 - 1.5	2	0.083			0.0	43.9	56.1	

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado



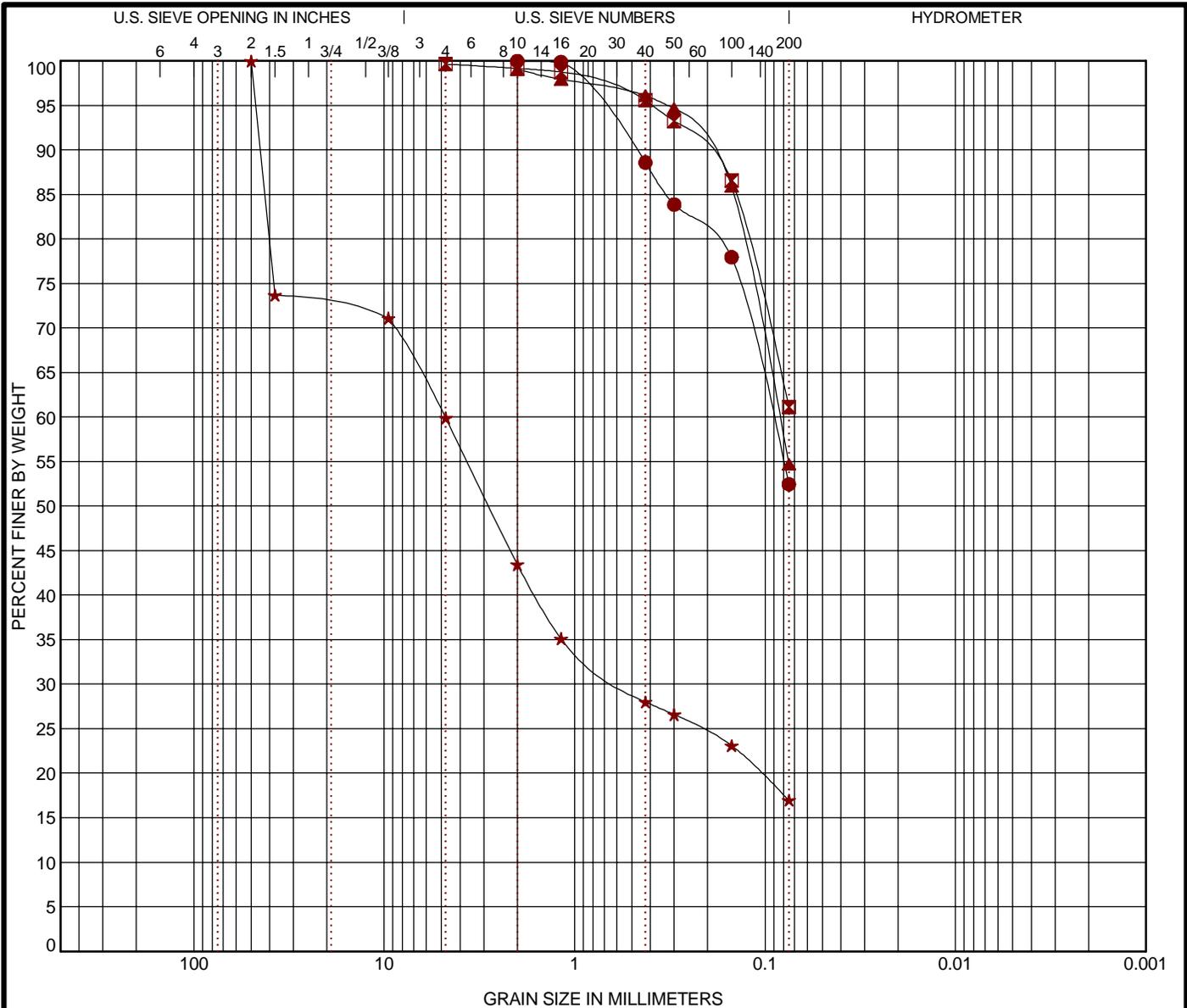
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc.  
Colorado Springs, Colorado

EXHIBIT: B-18

# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY			
	coarse	fine	coarse	medium	fine				

Boring ID	Depth	USCS Classification	AASHTO Classification			LL	PL	PI	Cc	Cu
● B-49	4 - 5	SANDY CLAYSTONE	---			48	24	24		
◻ B-50	0.5 - 1.5	SANDY LEAN CLAY (CL)	A-7-6(15)			48	19	29		
▲ B-51	1.3 - 2.3	SANDY LEAN CLAY (CL)	A-6(4)			35	24	11		
★ B-52	1 - 2	CLAYEY SAND with GRAVEL (SC)	A-2-6(0)			35	17	18		
Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay	
● B-49	4 - 5	2	0.092			0.0	47.5	52.5		
◻ B-50	0.5 - 1.5	4.75				0.0	38.5	61.1		
▲ B-51	1.3 - 2.3	2	0.084			0.0	44.4	54.7		
★ B-52	1 - 2	50	4.779	0.567		40.1	42.9	17.0		

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St.  
Colorado Springs, Colorado



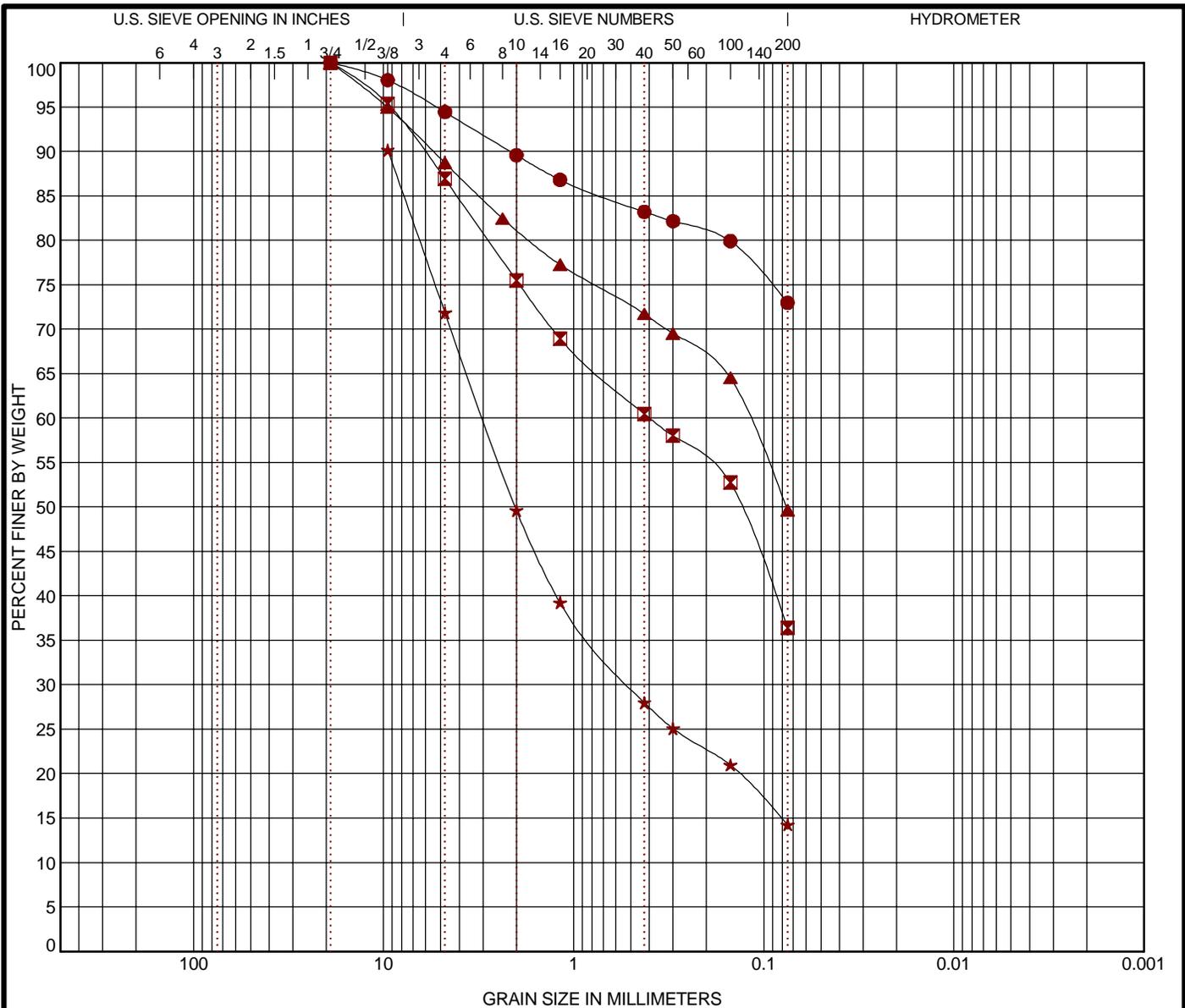
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc.  
Colorado Springs, Colorado

EXHIBIT: B-19

# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY			
	coarse	fine	coarse	medium	fine				

	Boring ID	Depth	USCS Classification	AASHTO Classification	LL	PL	PI	Cc	Cu	
●	B-53	0 - 5	WEATHERED SANDY CLAYSTONE	---	38	18	20			
☒	B-53	1 - 2	WEATHERED CLAYEY SANDSTONE	---	38	18	20			
▲	B-54	4 - 5	CLAYEY SAND (SC)	A-6(7)	38	17	21			
★	B-55	1 - 2	CLAYEY SAND with GRAVEL (SC)	A-2-6(0)	28	16	12			
	Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay
●	B-53	0 - 5	19				5.6	21.5	73.0	
☒	B-53	1 - 2	19	0.398			13.1	50.5	36.4	
▲	B-54	4 - 5	19	0.121			11.3	39.1	49.6	
★	B-55	1 - 2	9.5	2.996	0.511		18.3	57.6	14.3	

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado



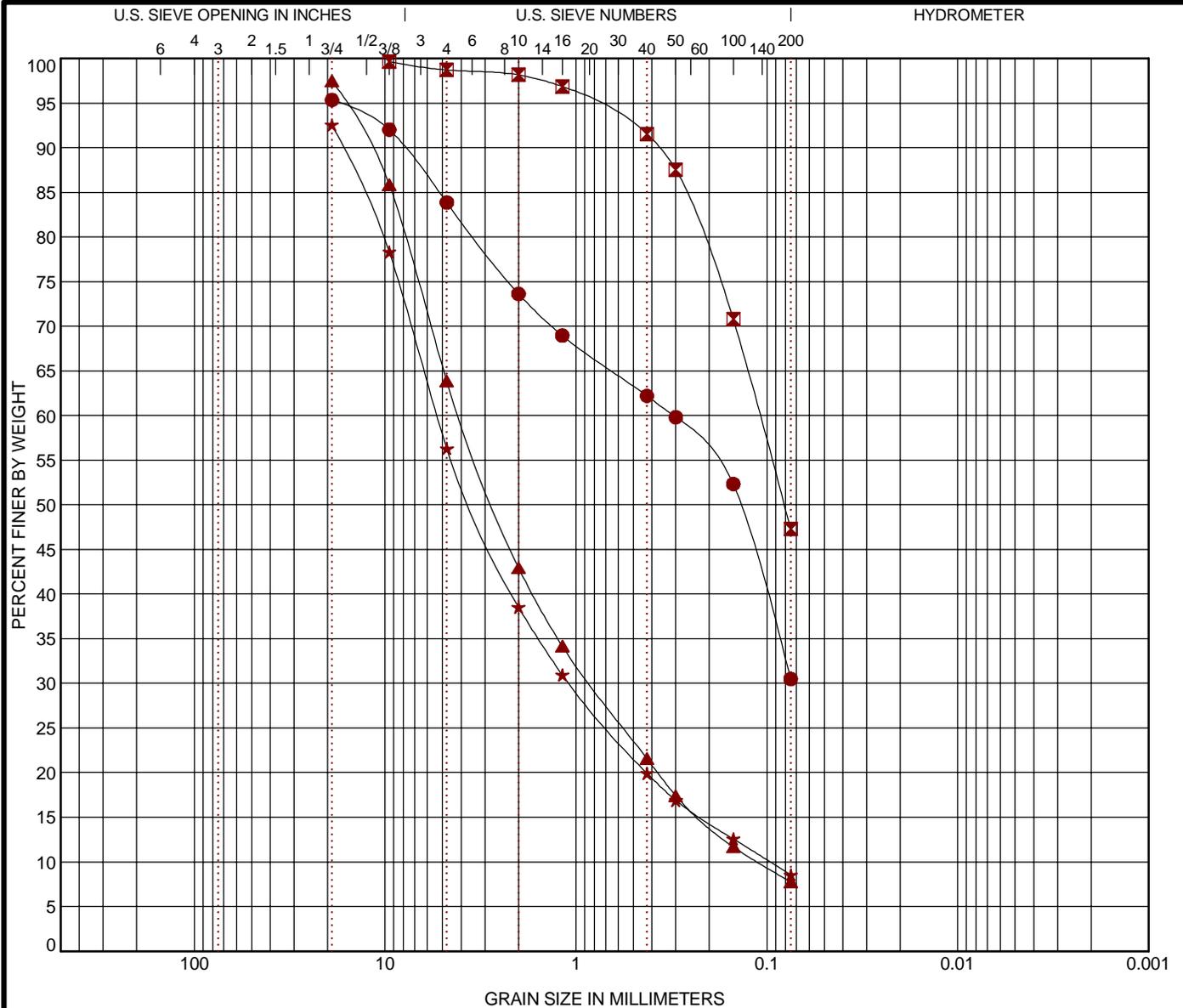
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado

EXHIBIT: B-20

# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY			
	coarse	fine	coarse	medium	fine				

	Boring ID	Depth	USCS Classification	AASHTO Classification	LL	PL	PI	Cc	Cu	
●	B-56	1 - 2	CLAYEY SAND with GRAVEL (SC)	A-2-4(0)	24	15	9			
☒	B-57	4 - 5	CLAYEY SAND (SC)	A-6(2)	26	15	11			
▲	B-58	1.2 - 2.2	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	A-1-a(0)	NP	NP	NP	1.57	36.34	
★	B-59	1.2 - 2.2	WELL-GRADED SAND with SILTY CLAY and GRAVEL (SW-SC)	A-1-a(0)	25	19	6	2.28	55.39	
	Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay
●	B-56	1 - 2	19	0.308			11.5	53.4	30.5	
☒	B-57	4 - 5	9.5	0.109			0.9	51.5	47.3	
▲	B-58	1.2 - 2.2	19	4.05	0.842	0.111	33.6	56.1	7.8	
★	B-59	1.2 - 2.2	19	5.334	1.081	0.096	36.3	47.8	8.5	

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado



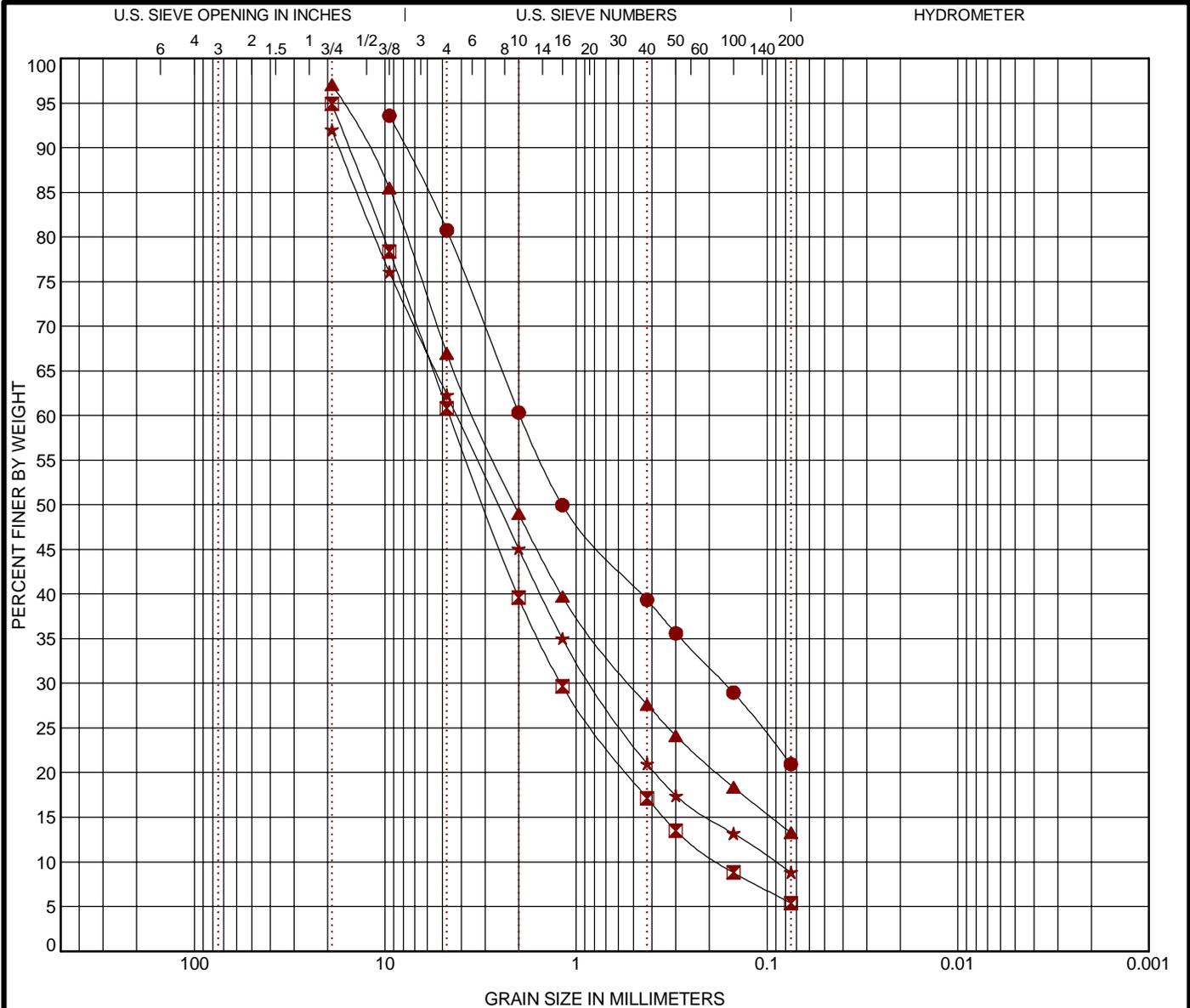
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado

EXHIBIT: B-21

# GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	LL	PL	PI	Cc	Cu	
●	B-60	1.5 - 2.5	CLAYEY SAND with GRAVEL (SC)	A-2-4(0)	23	15	8			
☒	B-61	1.5 - 2.5	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	A-1-a(0)	NP	NP	NP	1.75	25.60	
▲	B-62	1.5 - 2.5	CLAYEY SAND with GRAVEL (SC)	A-2-6(0)	27	16	11			
★	B-63	1.5 - 2.5	WELL-GRADED SAND with SILTY CLAY and GRAVEL (SW-SC)	A-2-4(0)	21	14	7	1.75	46.74	
	Boring ID	Depth	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Gravel	%Sand	%Silt	%Clay
●	B-60	1.5 - 2.5	9.5	1.966	0.167		12.8	59.8	20.9	
☒	B-61	1.5 - 2.5	19	4.593	1.2	0.179	34.1	55.4	5.4	
▲	B-62	1.5 - 2.5	19	3.395	0.52		30.1	53.7	13.3	
★	B-63	1.5 - 2.5	19	4.227	0.819	0.09	29.7	53.5	8.8	

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO COMBINED REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado



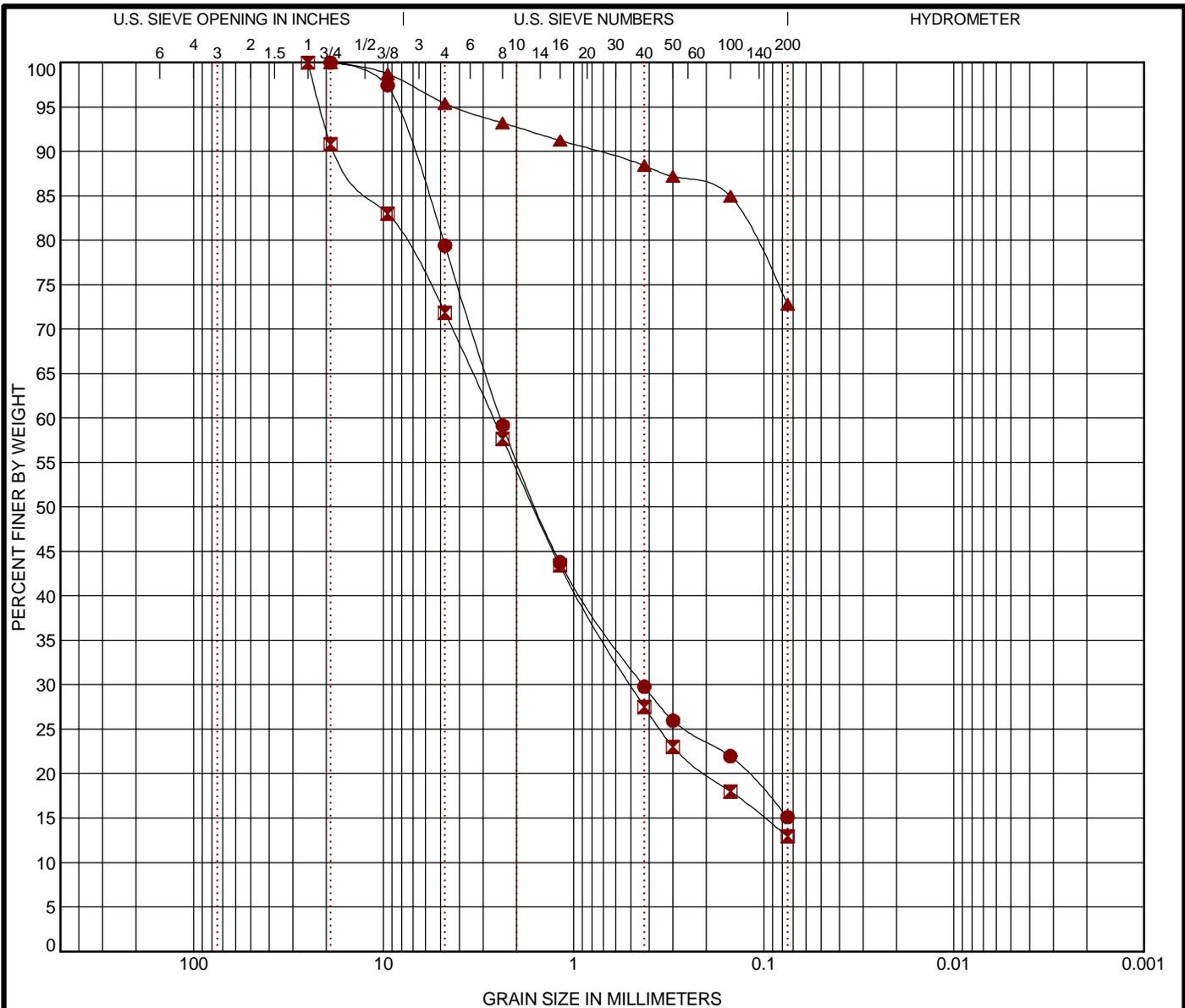
PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado

EXHIBIT: B-22

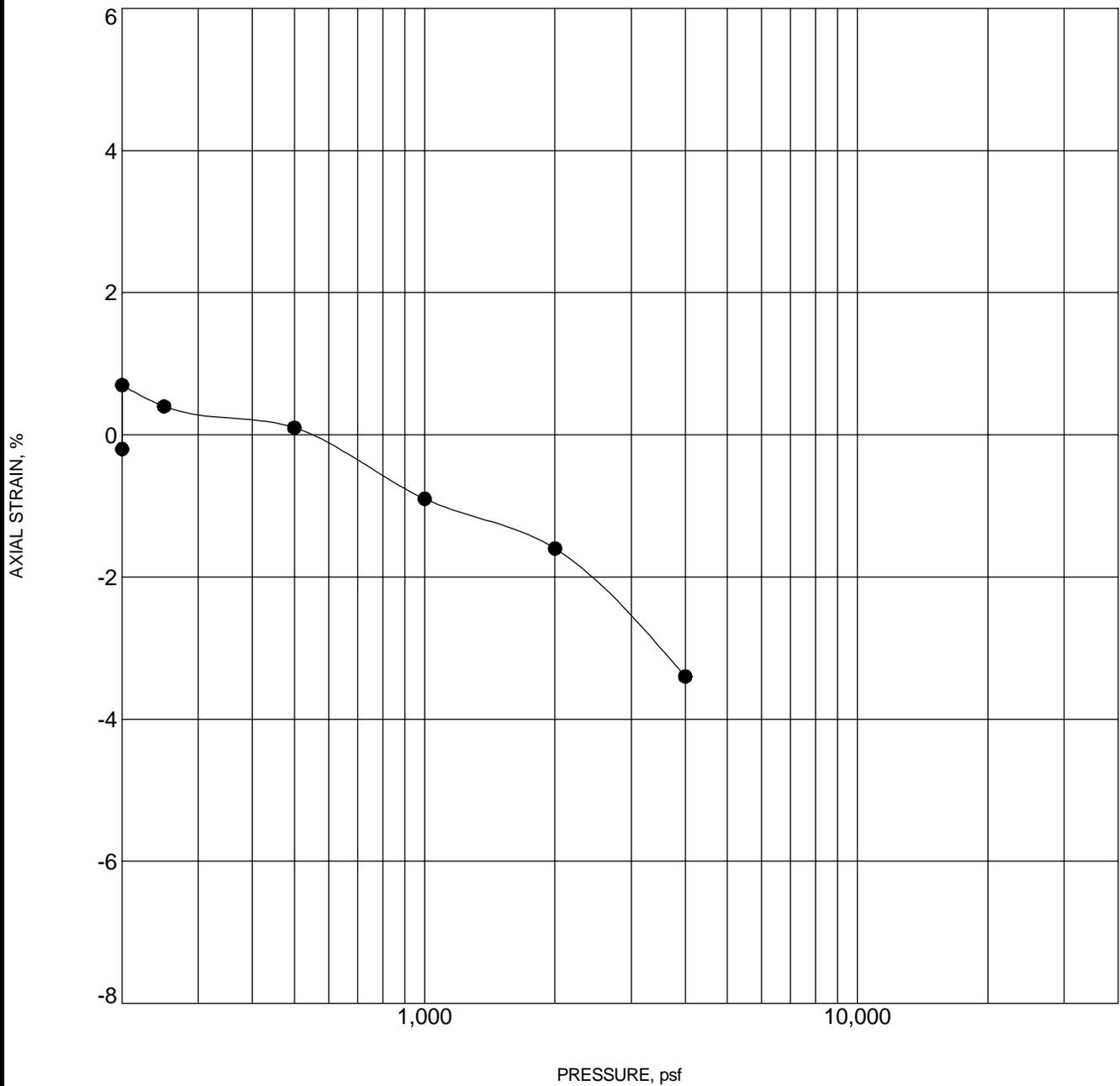
# GRAIN SIZE DISTRIBUTION

ASTM D422



# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-09 1 - 2 ft	CLAYEY SAND(SC)	110	12

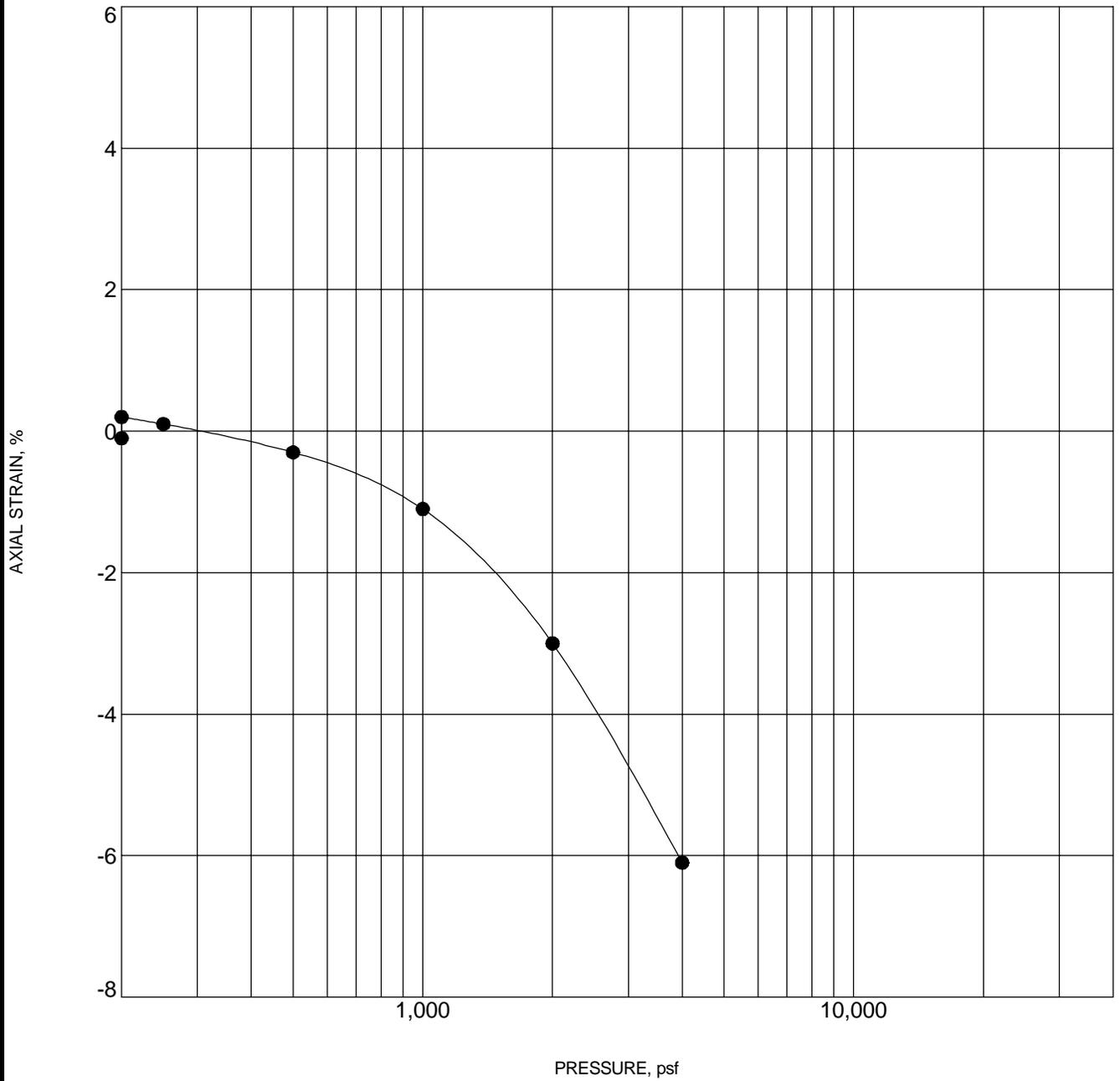
NOTES: Sample remolded to 95 percent of ASTM D698 at optimum water content.  
 Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 5px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-24

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-09 4 - 5 ft	CLAYEY SAND (SC)	109	11

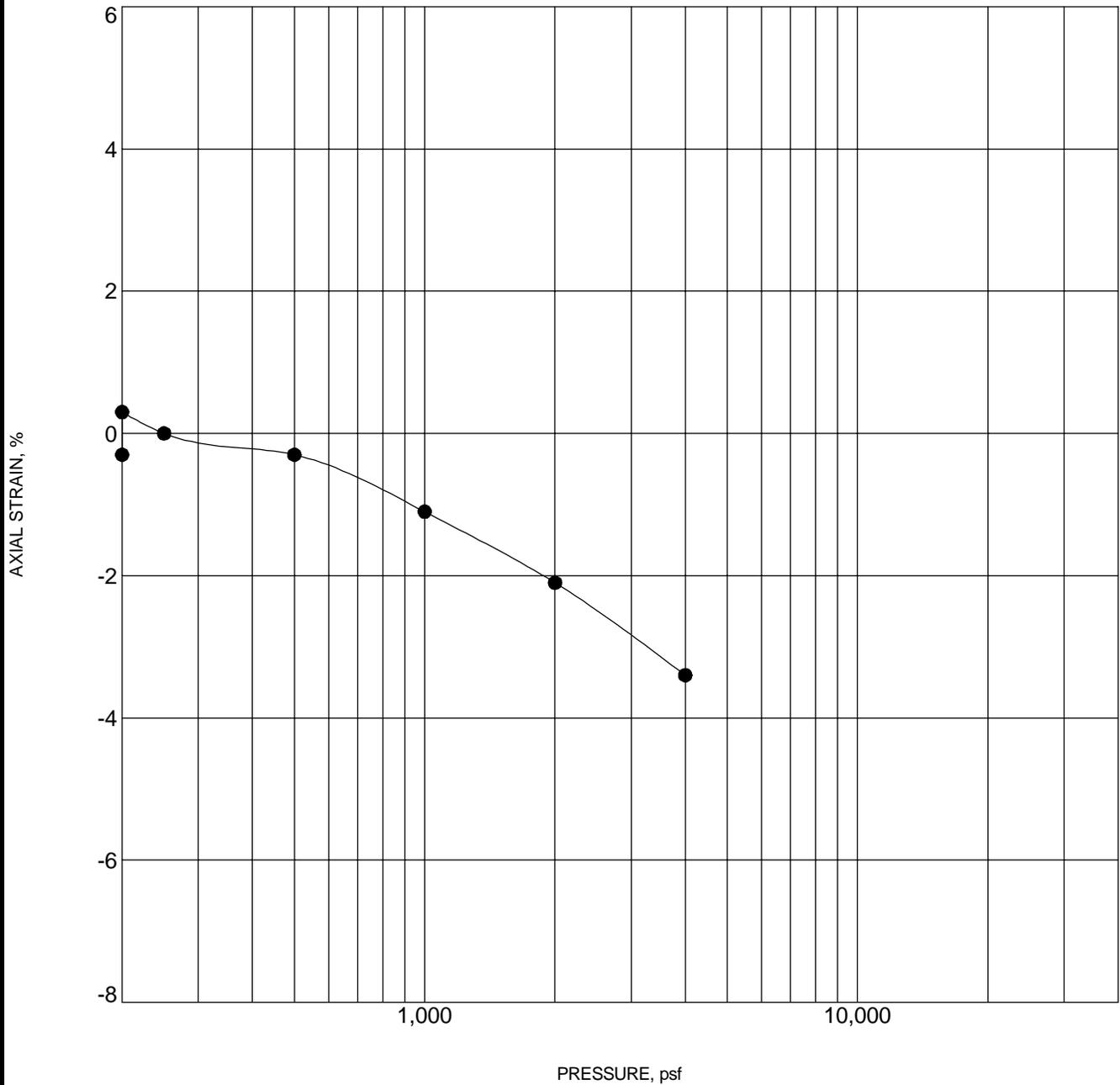
NOTES: Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 5px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-25

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-17 0 - 5 ft	CLAYEY SAND(SC)	108	13

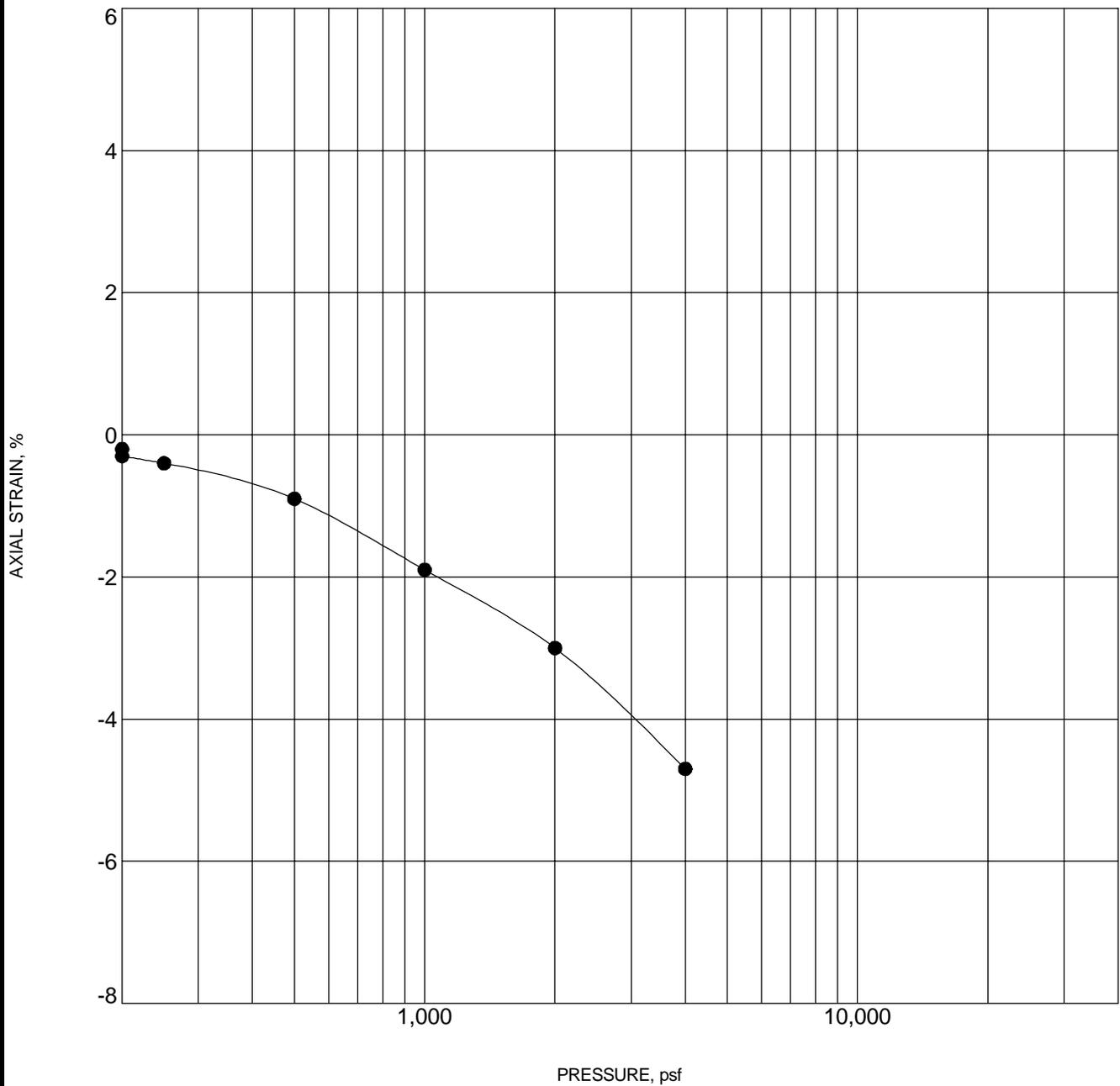
NOTES: Sample remolded to 95 percent of ASTM D698 at optimum water content.  
 Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 5px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-26

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-17 4 - 5 ft	SANDY LEAN CLAY (CL)	110	16

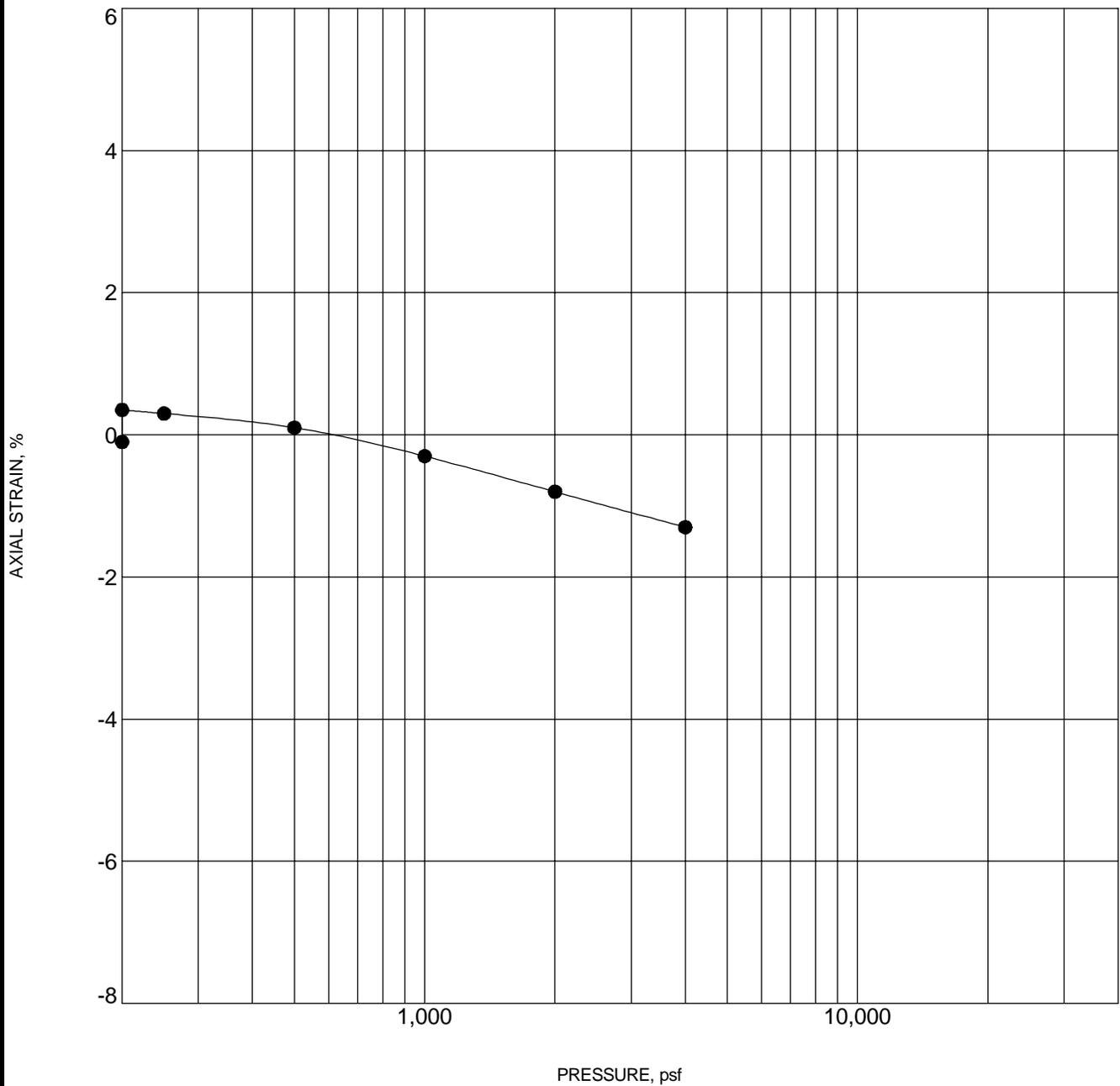
NOTES: Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 5px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-27

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-41      0 - 5 ft	CLAYEY SAND with GRAVEL(SC)	120	9

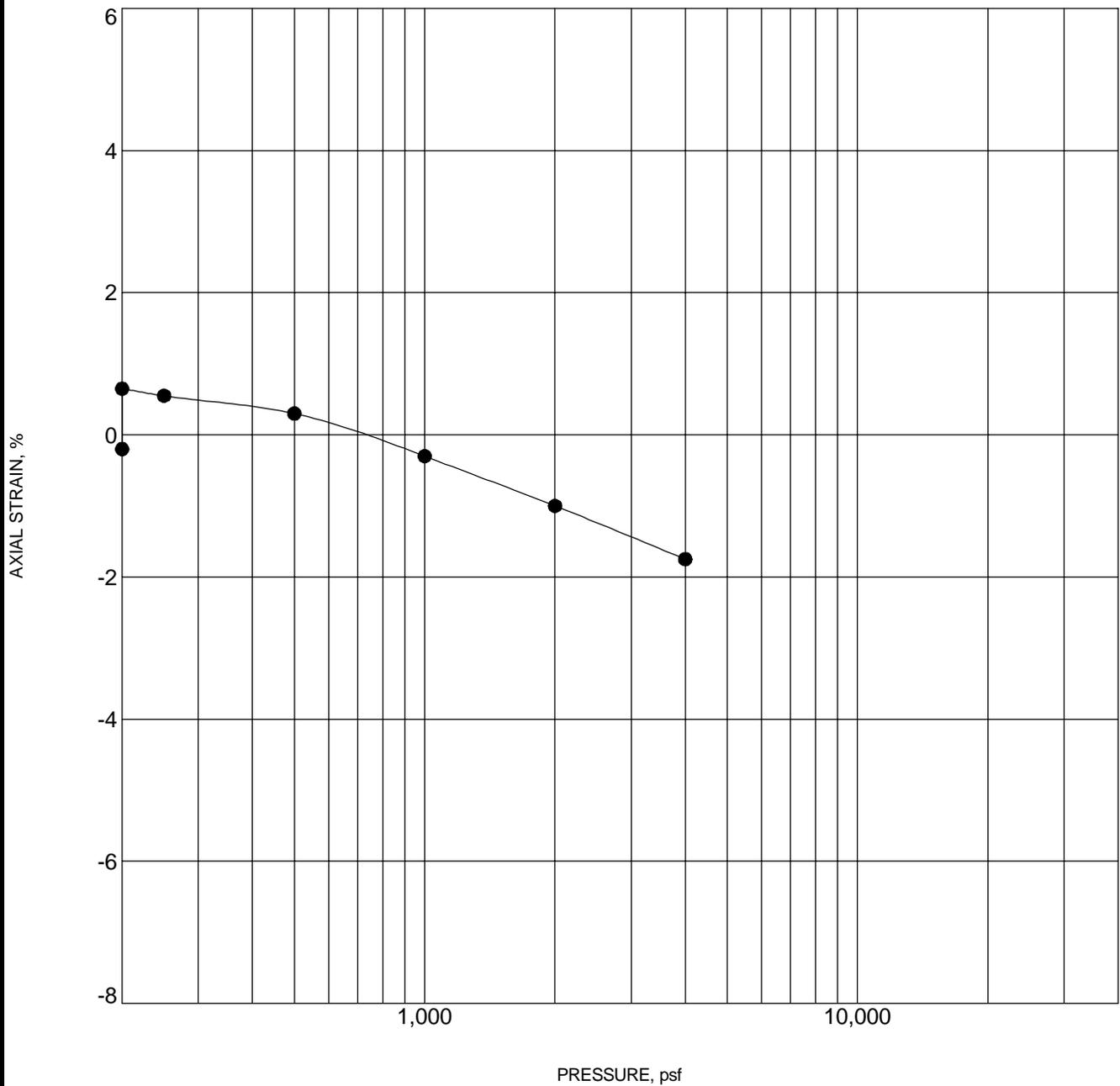
NOTES: Sample remolded to 95 percent of ASTM D698 at optimum water content.  
 Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 5px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-28

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-41      4 - 5 ft	SANDY LEAN CLAY(CL)	111	17

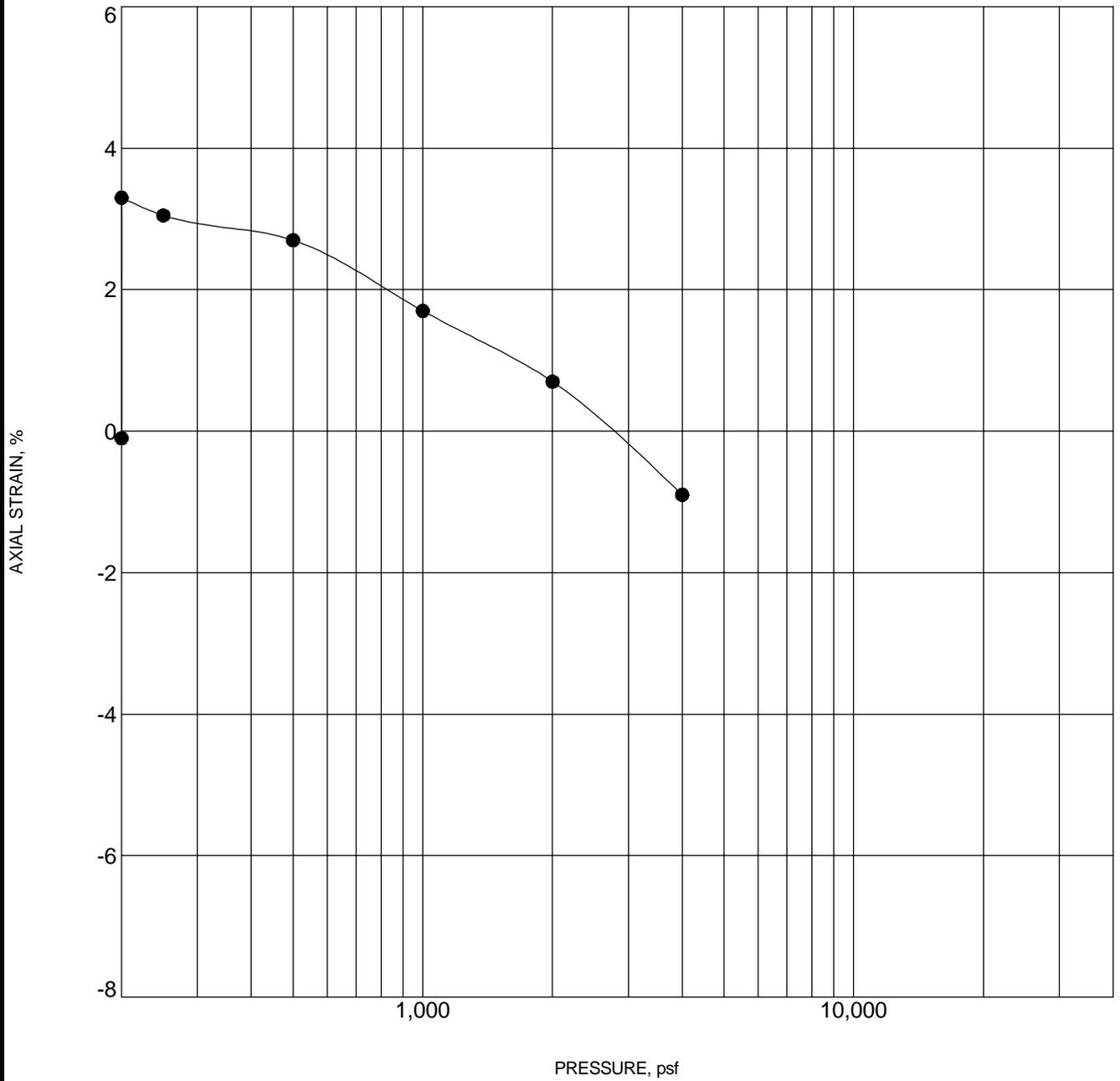
NOTES: Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 5px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-29

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-42      4 - 5 ft	CLAYSTONE	99	28

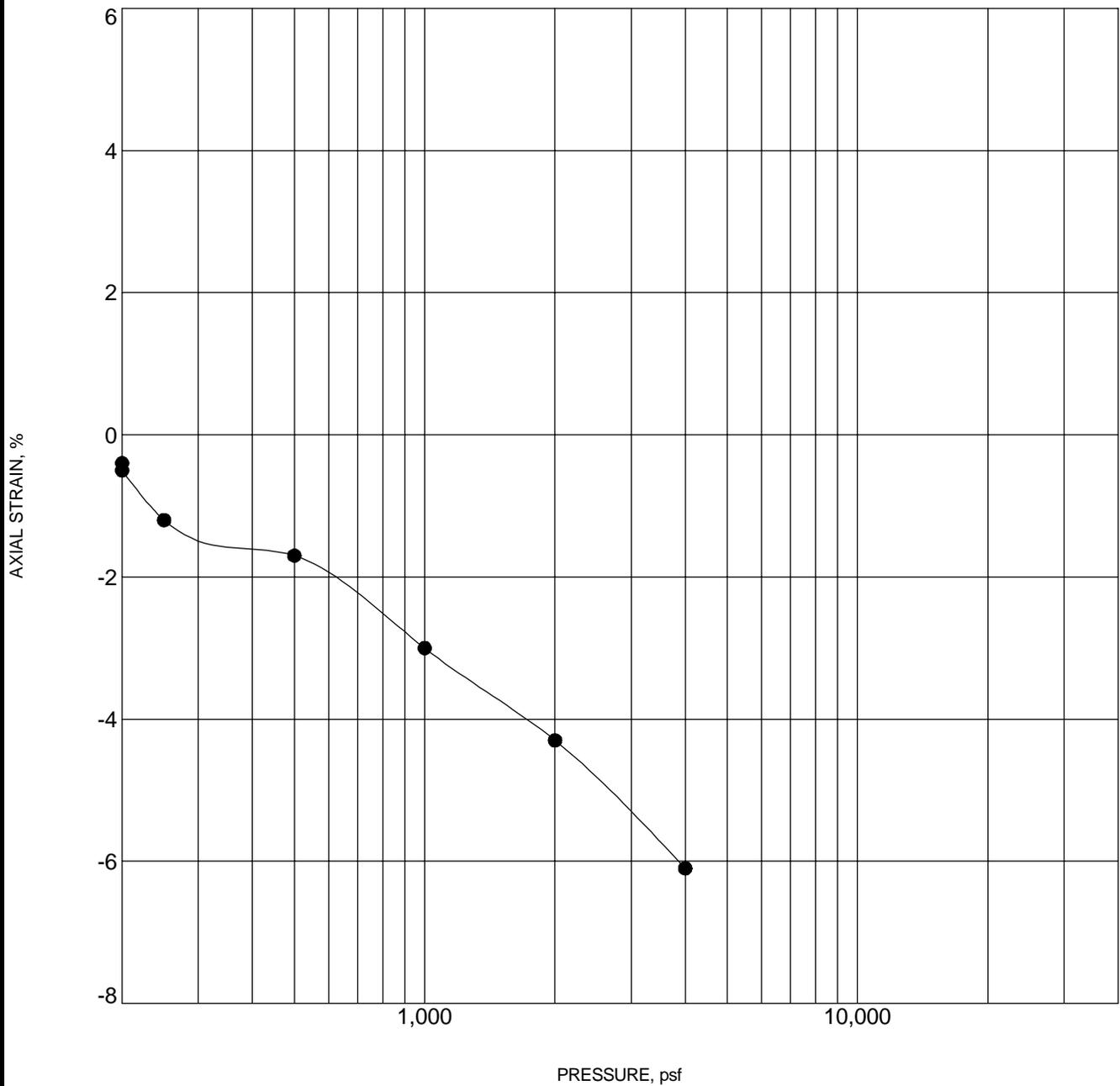
NOTES: Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<b style="font-size: 1.5em; color: #8B0000;">Terracon</b> 4172 Center Park Drive Colorado Springs, Colorado	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-30

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-43      4 - 5 ft	SANDY CLAYSTONE	111	12

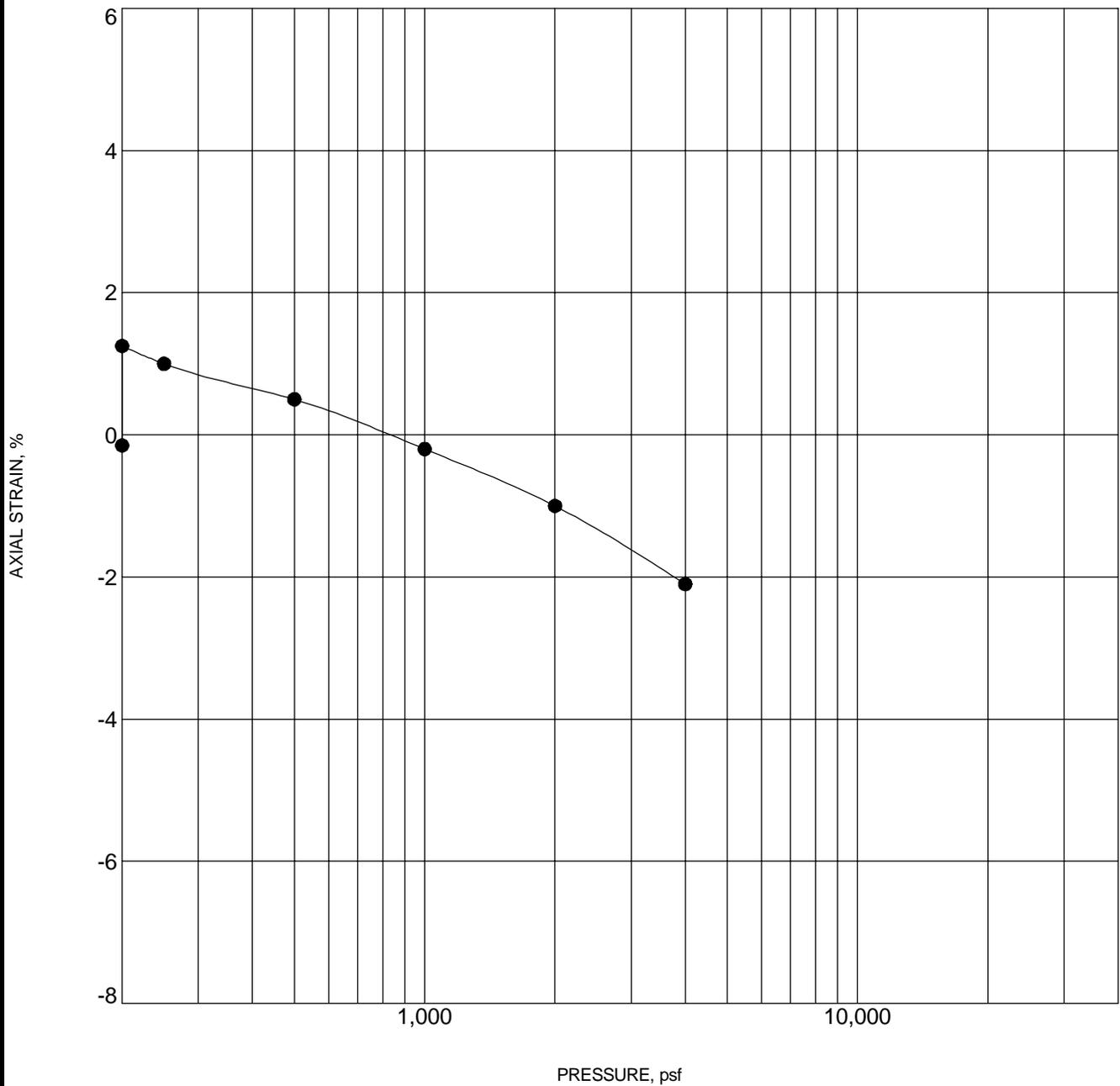
NOTES: Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 10px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-31

# SWELL CONSOLIDATION TEST

ASTM D4546



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-44      4 - 5 ft	SANDY CLAYSTONE	115	15

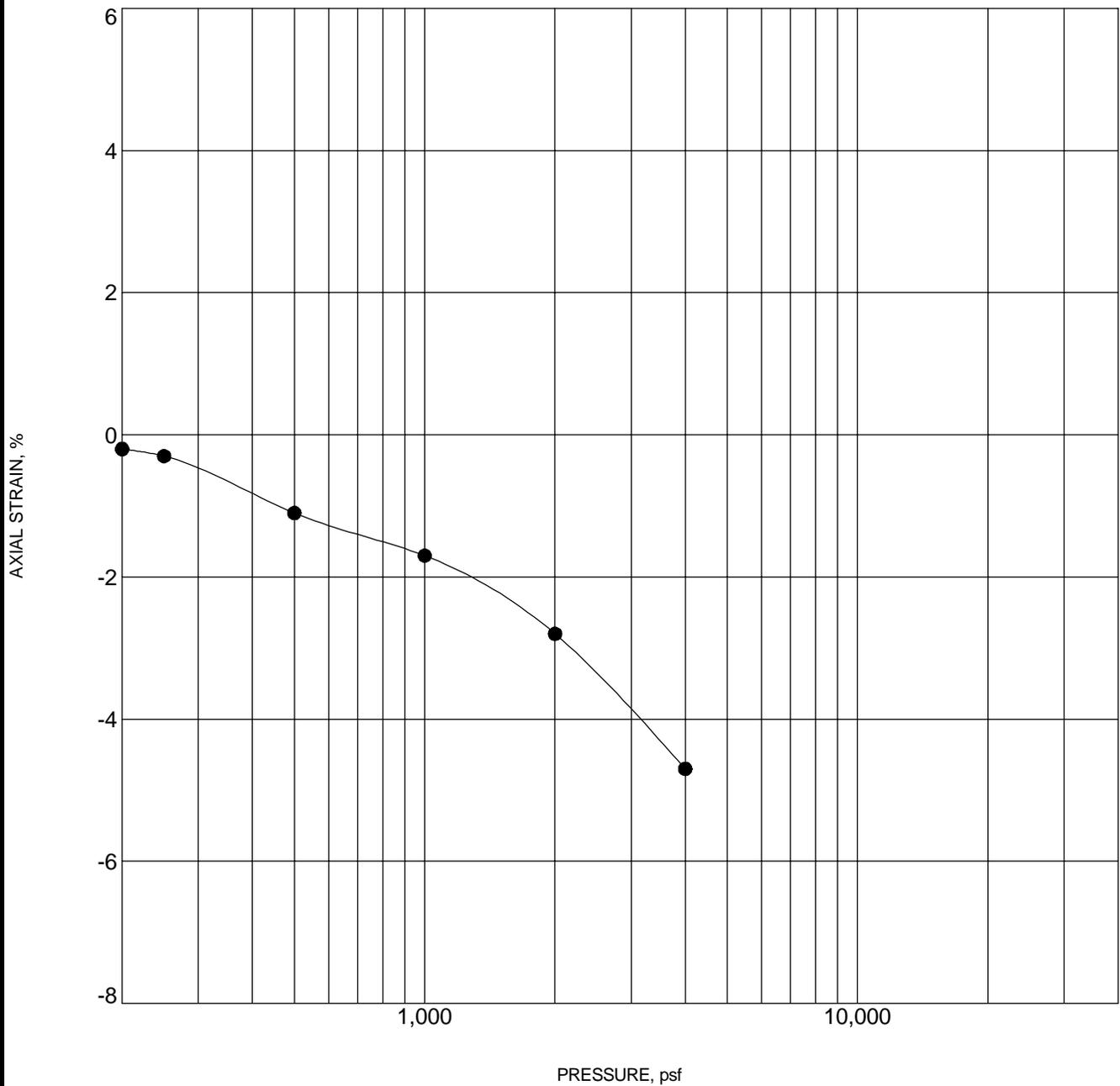
NOTES: Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-32

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-47 0.33 - 1.33 ft	LEAN CLAY with SAND(CL)	104	20

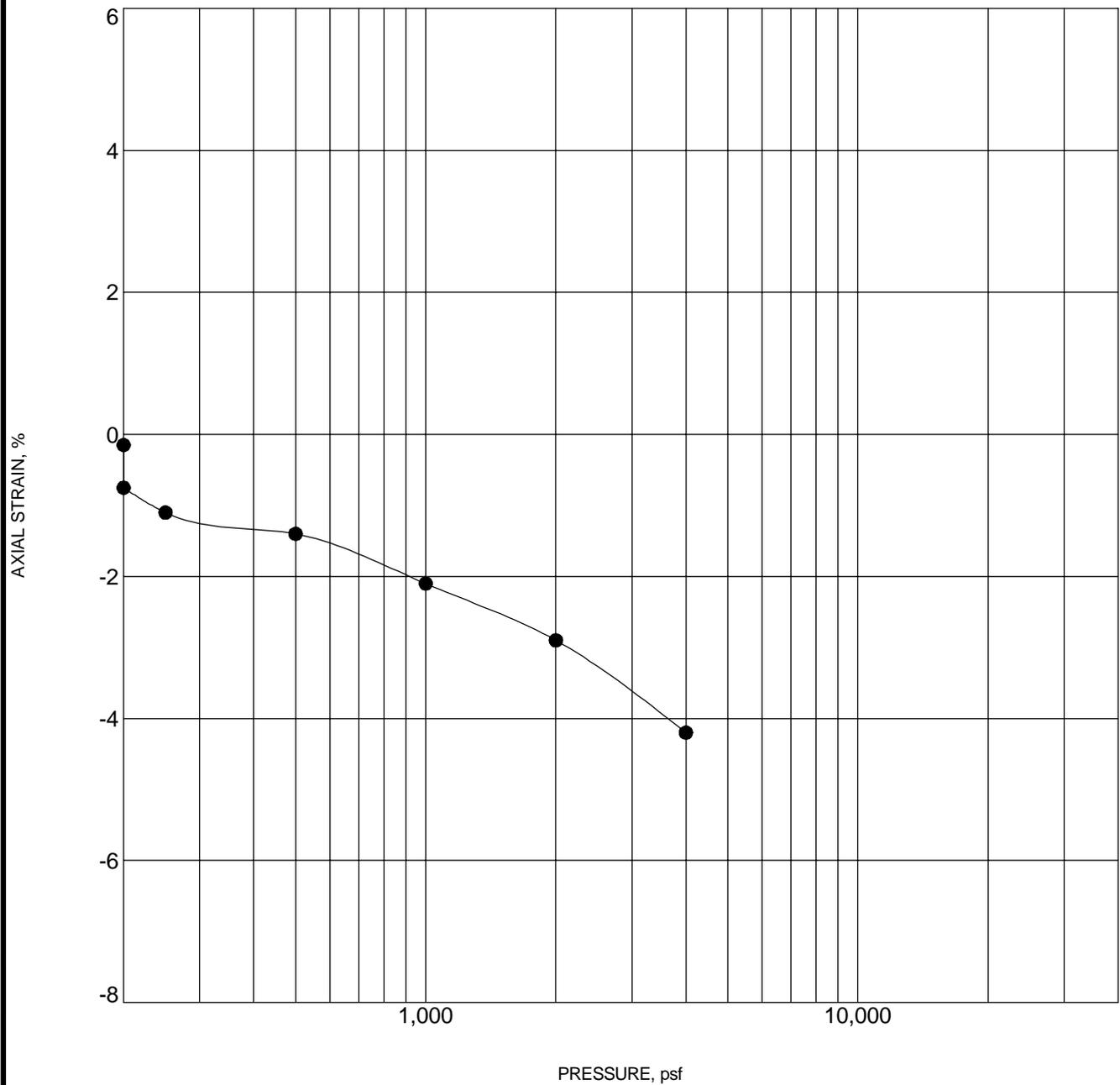
NOTES: Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 5px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-33

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-48 0.33 - 1.33 ft	CLAYEY SAND(SC)	116	14

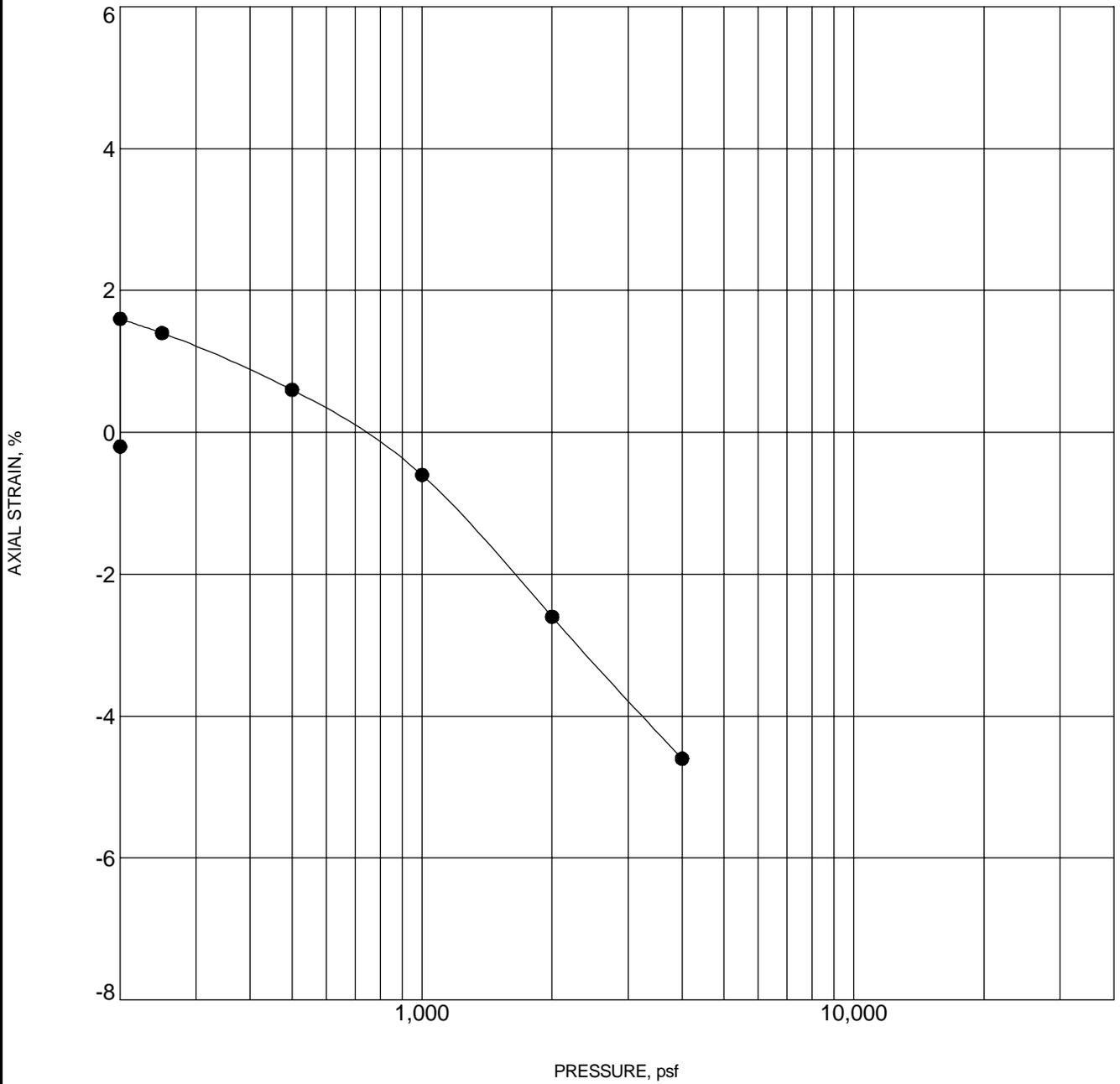
NOTES: Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 5px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-34

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-49      0 - 5 ft	SANDY CLAYSTONE	105	14

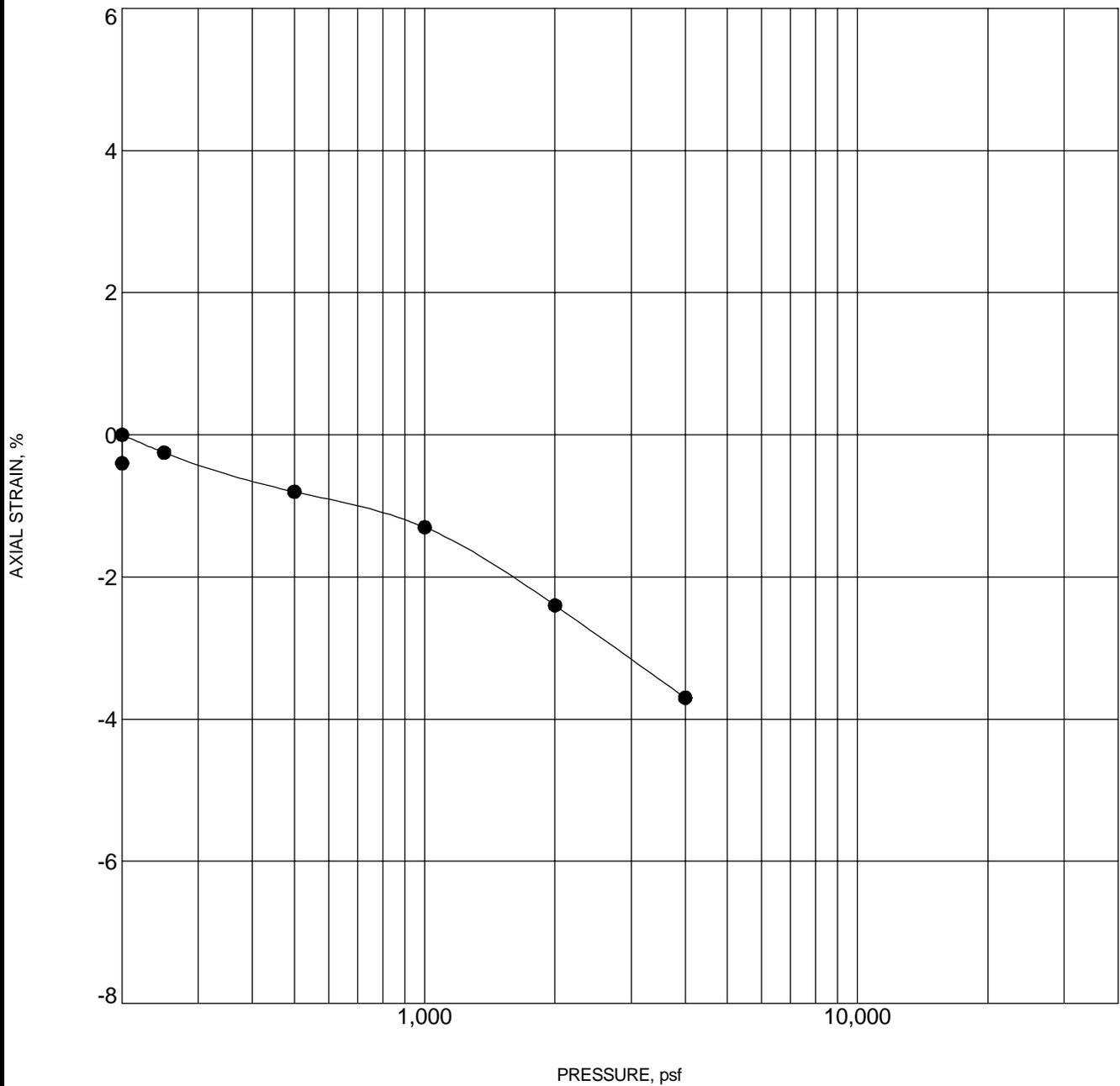
NOTES: Sample remolded to 95 percent of ASTM D698 at optimum water content.  
 Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 5px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-35

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-49      4 - 5 ft	SANDY CLAYSTONE	106	18

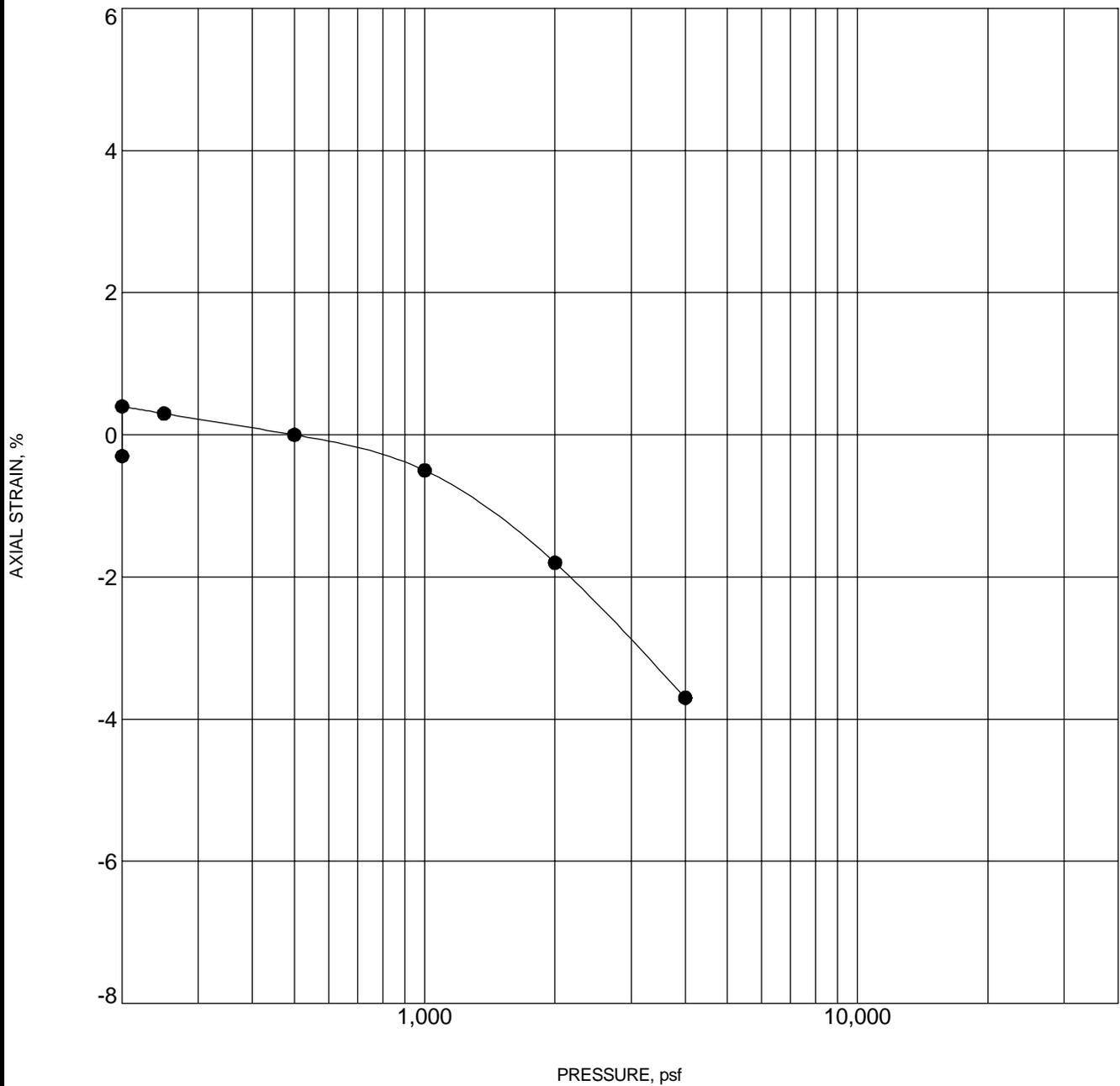
NOTES: Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 5px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-36

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-50 0.5 - 1.5 ft	SANDY LEAN CLAY(CL)	99	23

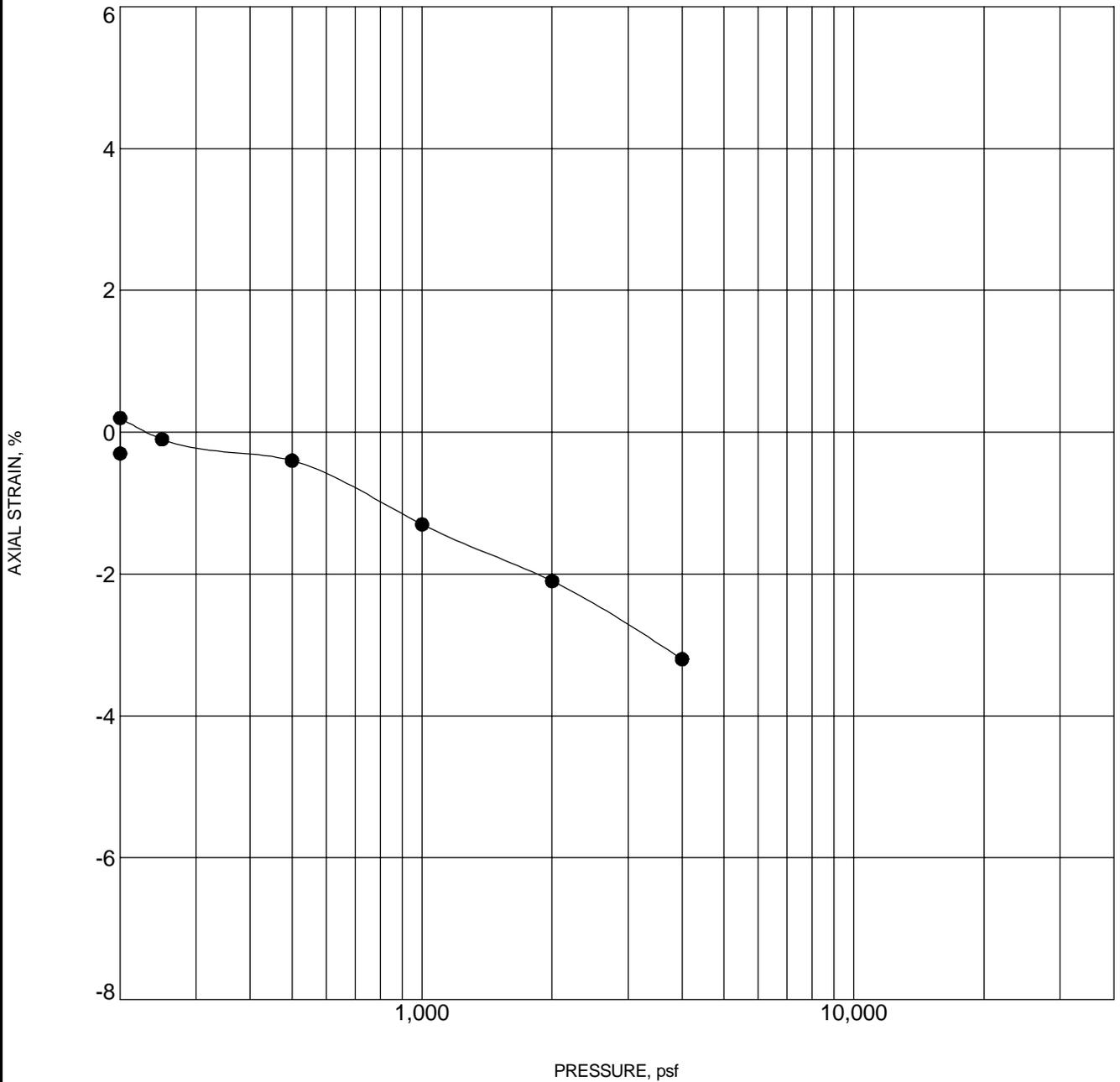
NOTES: Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 5px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-37

# SWELL CONSOLIDATION TEST

ASTM D4546



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-51 1.3 - 2.3 ft	SANDY LEAN CLAY	106	18

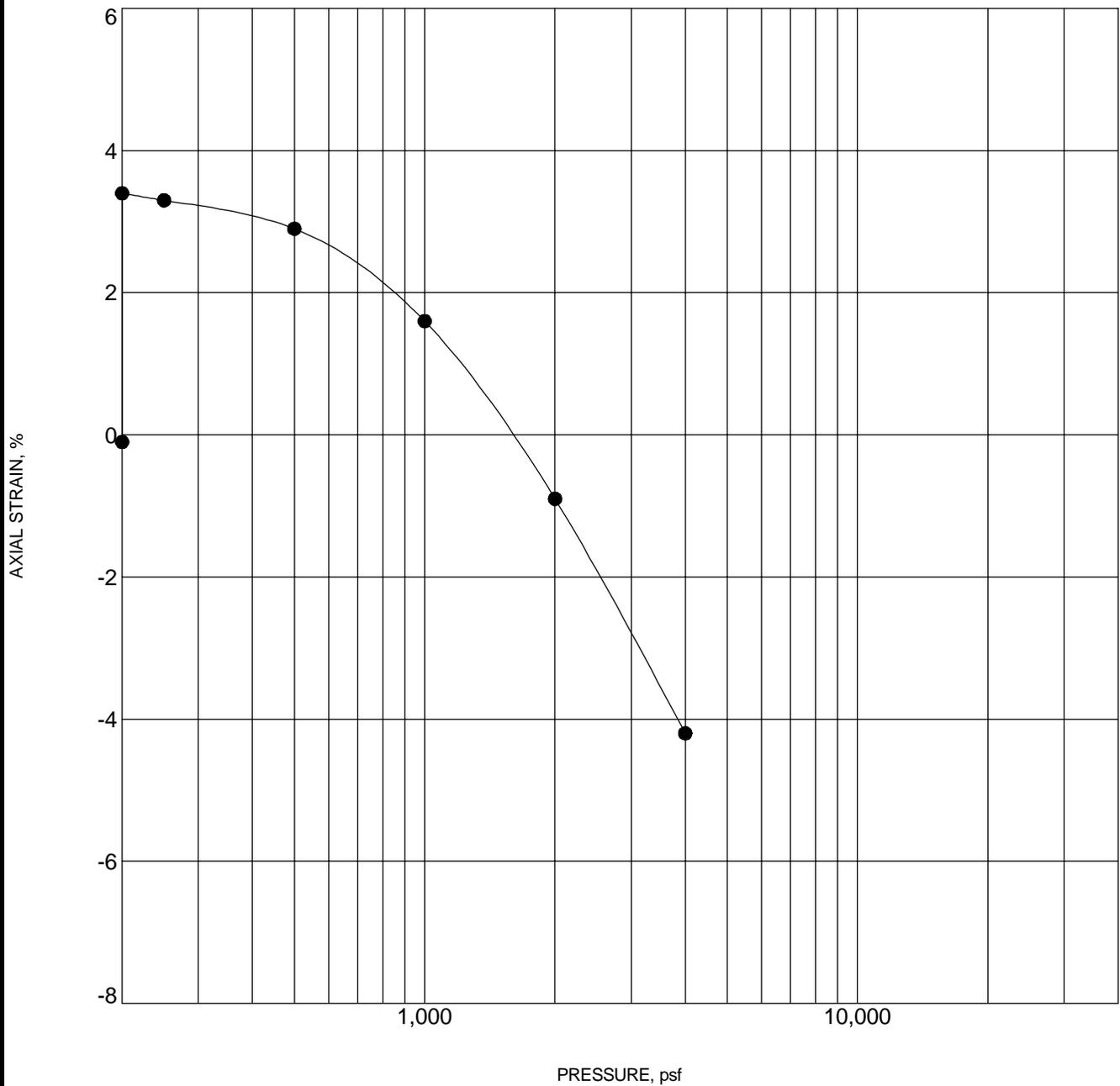
NOTES: Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 10px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-38

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-53      0 - 5 ft	WEATHERED SANDY CLAYSTONE	107	15

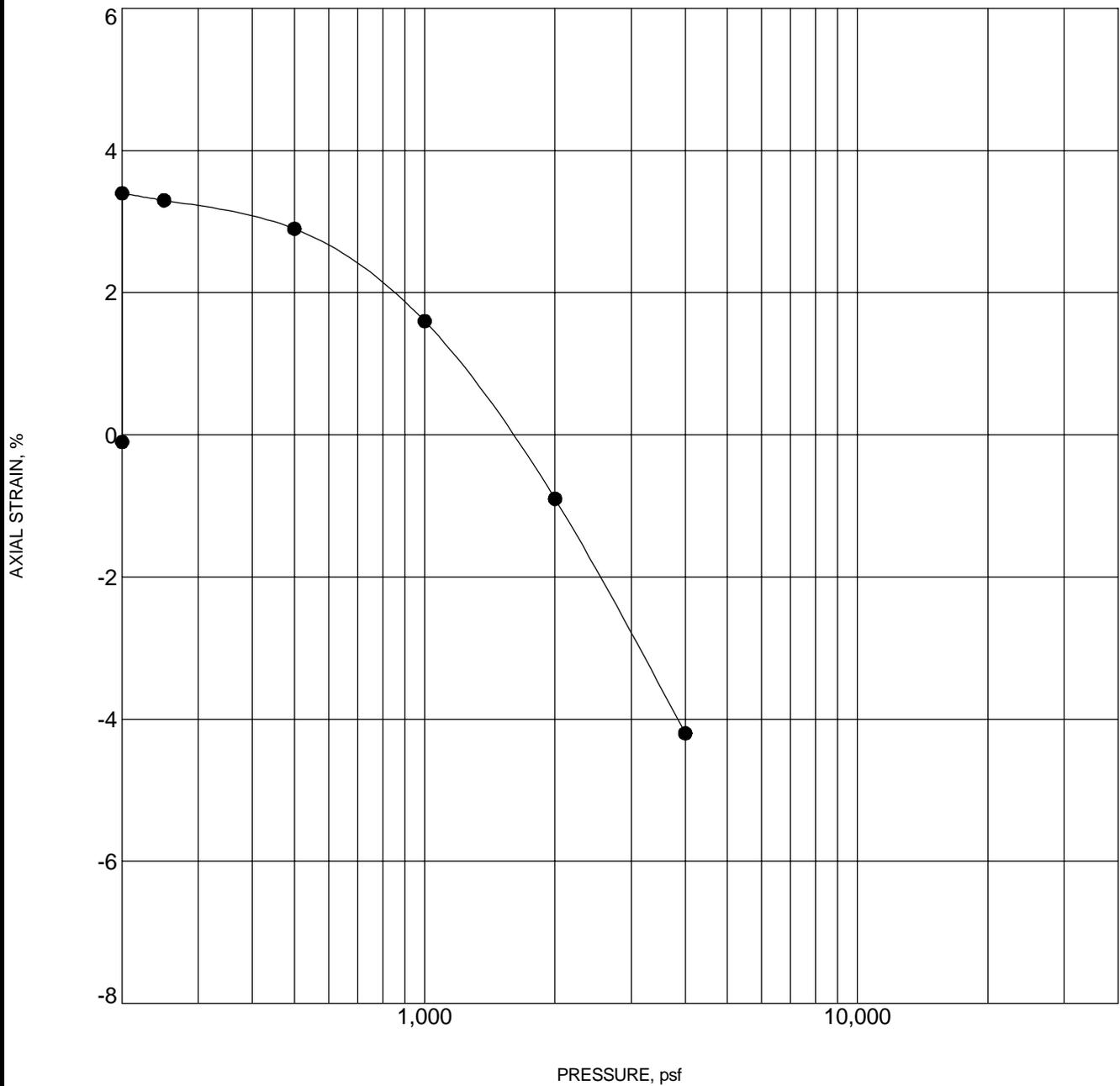
NOTES: Sample remolded to 95 percent of ASTM D698 at optimum water content.  
 Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	4172 Center Park Drive Colorado Springs, Colorado	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-39

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-53      1 - 2 ft	WEATHERED CLAYEY SANDSTONE	107	15

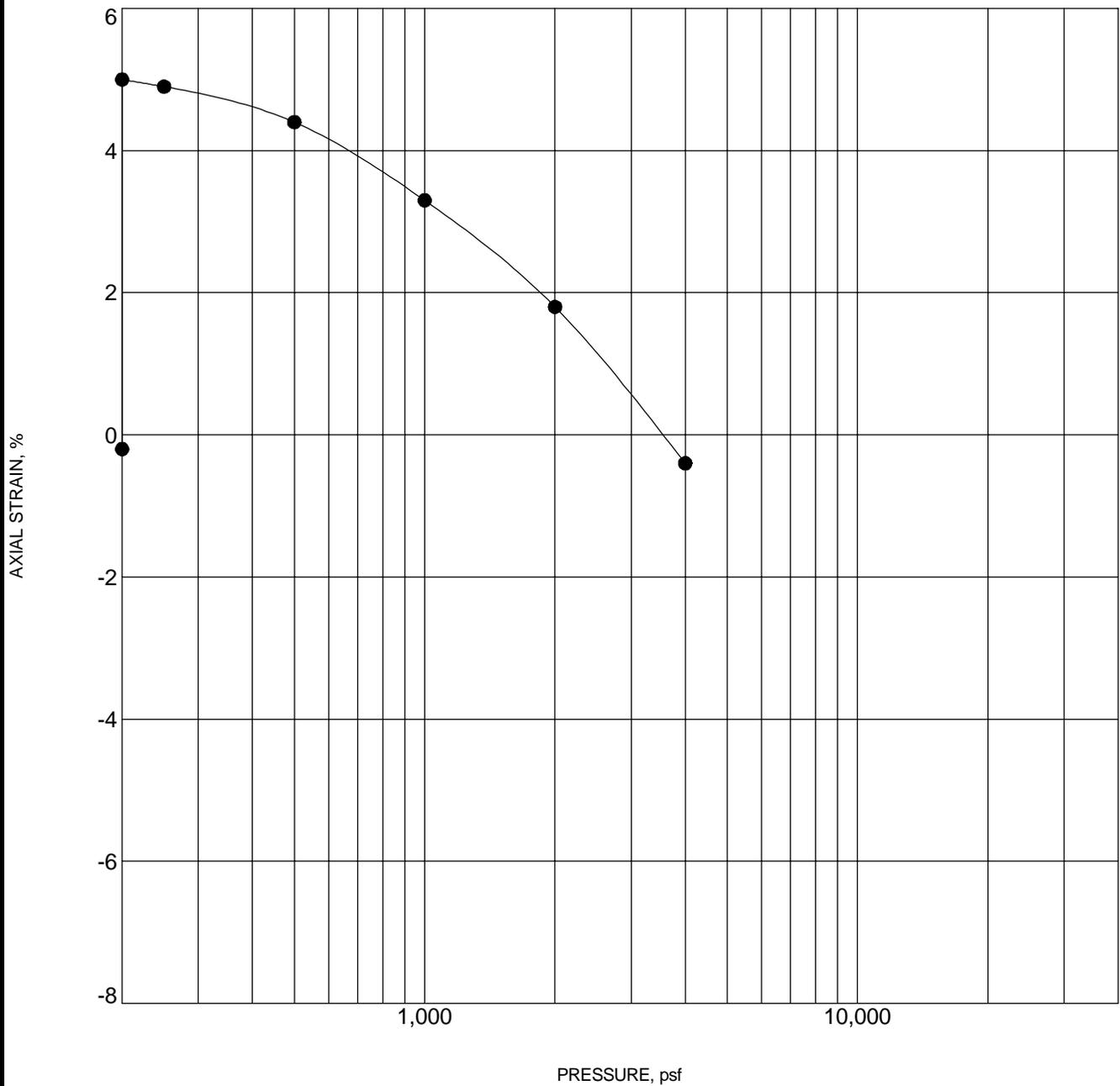
NOTES: Sample remolded to 95 percent of ASTM D698 at optimum water content.  
 Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 10px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-40

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-53      4 - 5 ft	WEATHERED CLAYEY SANDSTONE	105	19

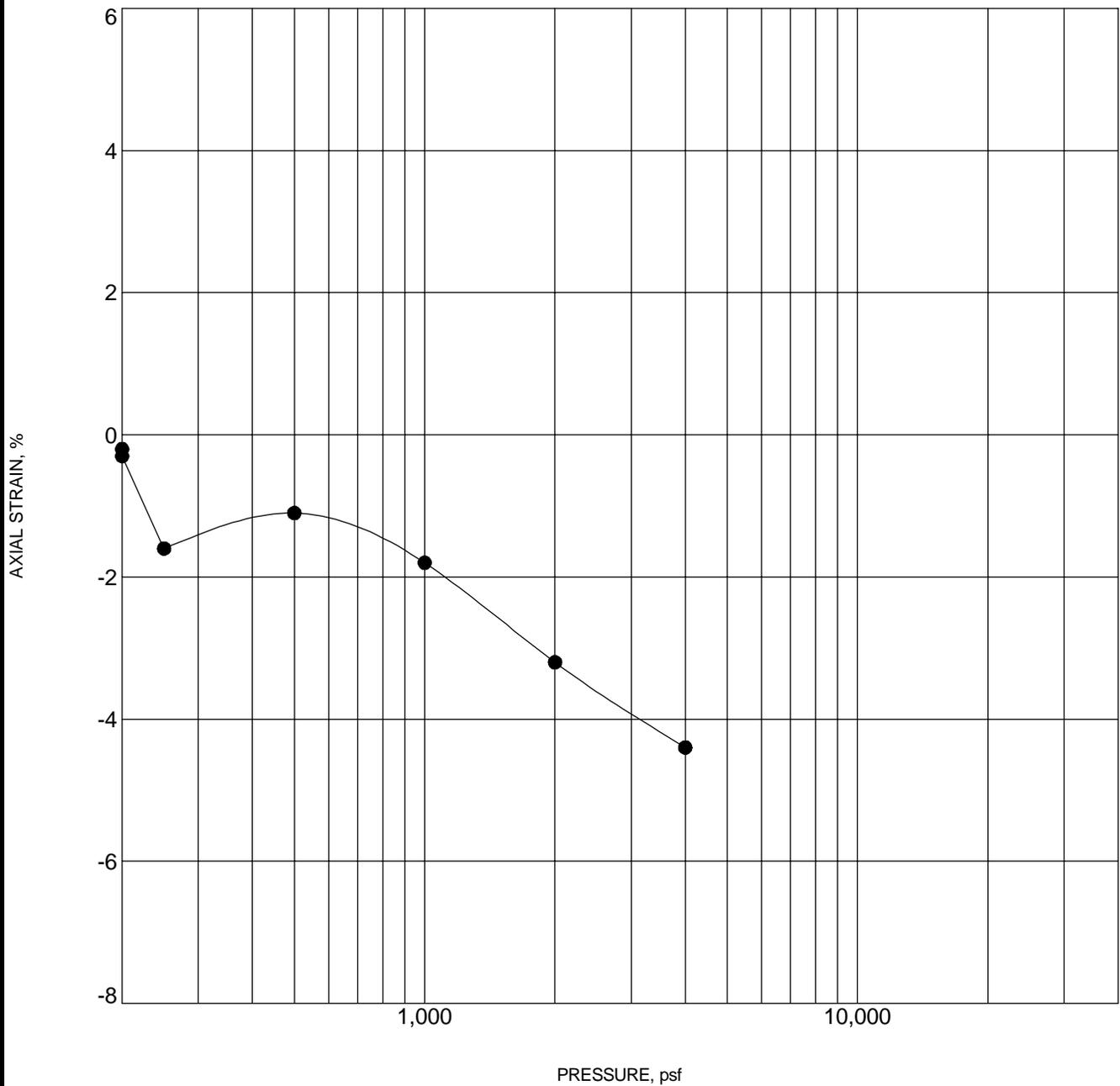
NOTES: Sample inundated with water at 200 pounds per square foot (psf.)

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 10px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-41

# SWELL CONSOLIDATION TEST

ASTM D4348



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-57      4 - 5 ft	CLAYEY SAND(SC)	111	9

NOTES: Sample inundated with water at 200 pounds per square foot (psf.)

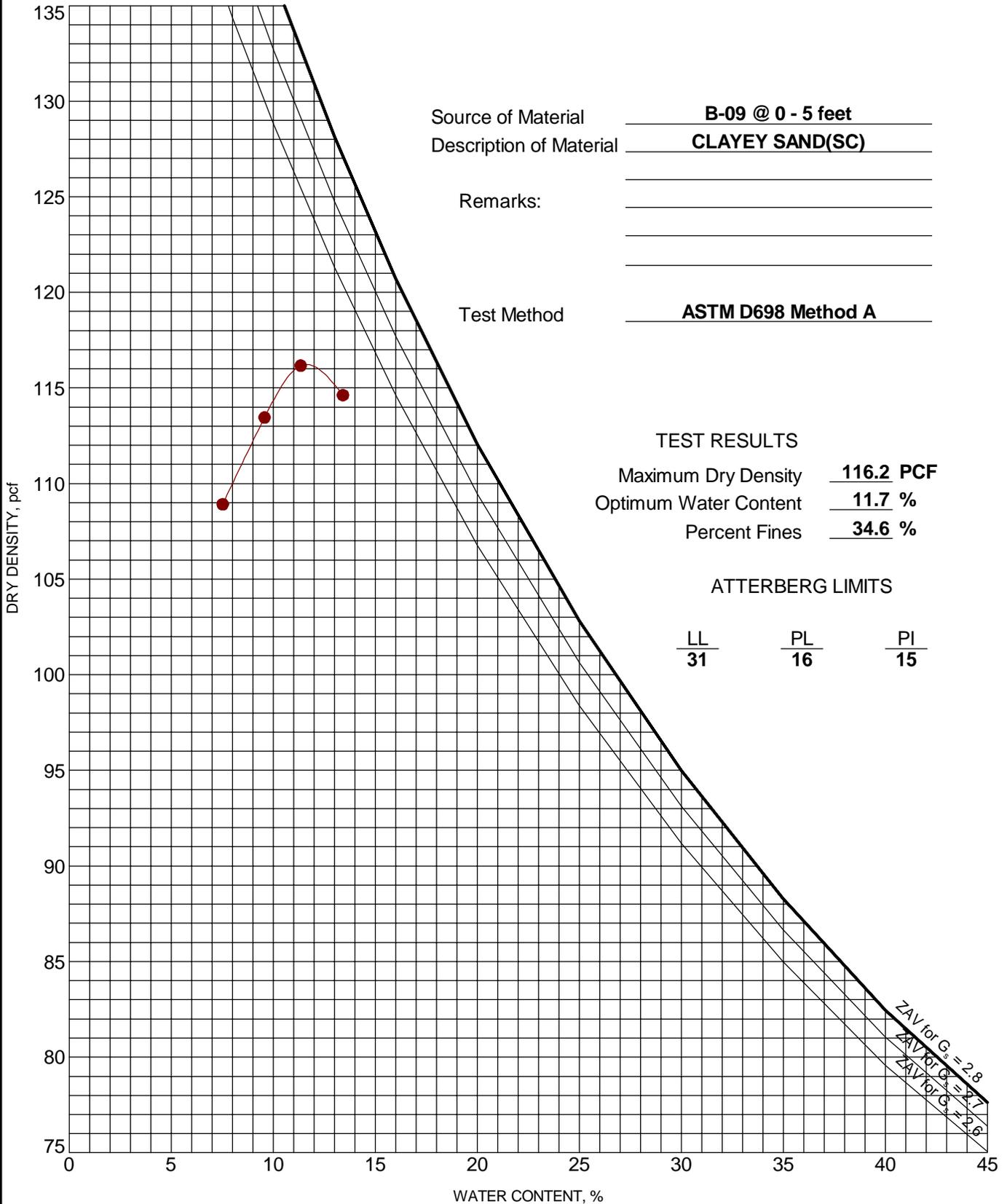
LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16

PROJECT: Centennial Blvd. Pavement Evaluation	<p style="color: #8B0000; font-weight: bold; margin-top: 10px;">4172 Center Park Drive Colorado Springs, Colorado</p>	PROJECT NUMBER: 23155014
SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado		CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado
		EXHIBIT: B-42

# MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTON - V2 REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16



Source of Material B-09 @ 0 - 5 feet  
 Description of Material CLAYEY SAND(SC)  
 Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 Test Method ASTM D698 Method A

**TEST RESULTS**  
 Maximum Dry Density 116.2 PCF  
 Optimum Water Content 11.7 %  
 Percent Fines 34.6 %

**ATTERBERG LIMITS**

LL	PL	PI
<u>31</u>	<u>16</u>	<u>15</u>

PROJECT: Centennial Blvd. Pavement Evaluation  
 SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado

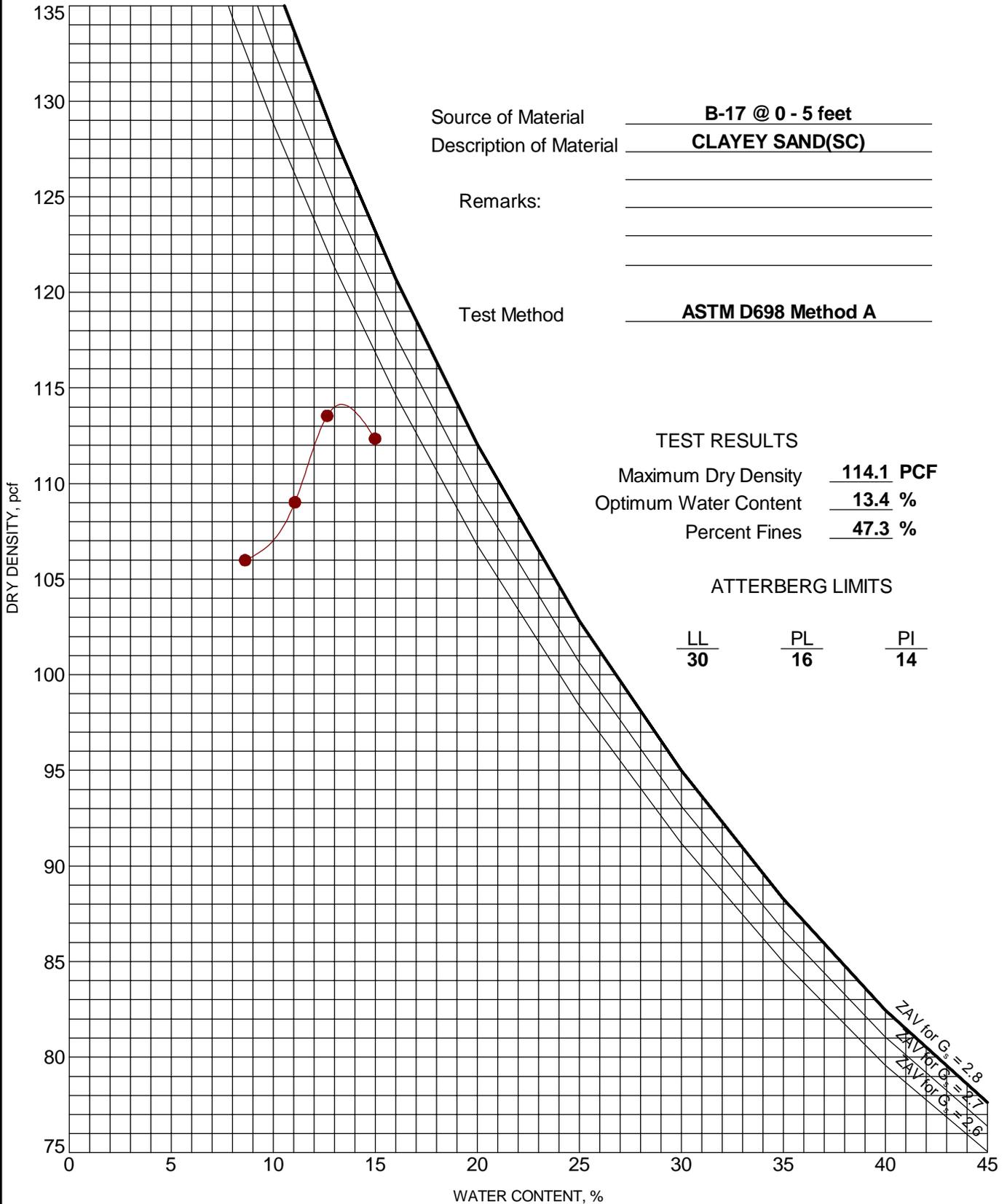


PROJECT NUMBER: 23155014  
 CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado  
 EXHIBIT: B-43

# MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTON - V2 REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16



Source of Material B-17 @ 0 - 5 feet  
 Description of Material CLAYEY SAND(SC)  
 Remarks: \_\_\_\_\_  
 Test Method ASTM D698 Method A

PROJECT: Centennial Blvd. Pavement Evaluation  
 SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado

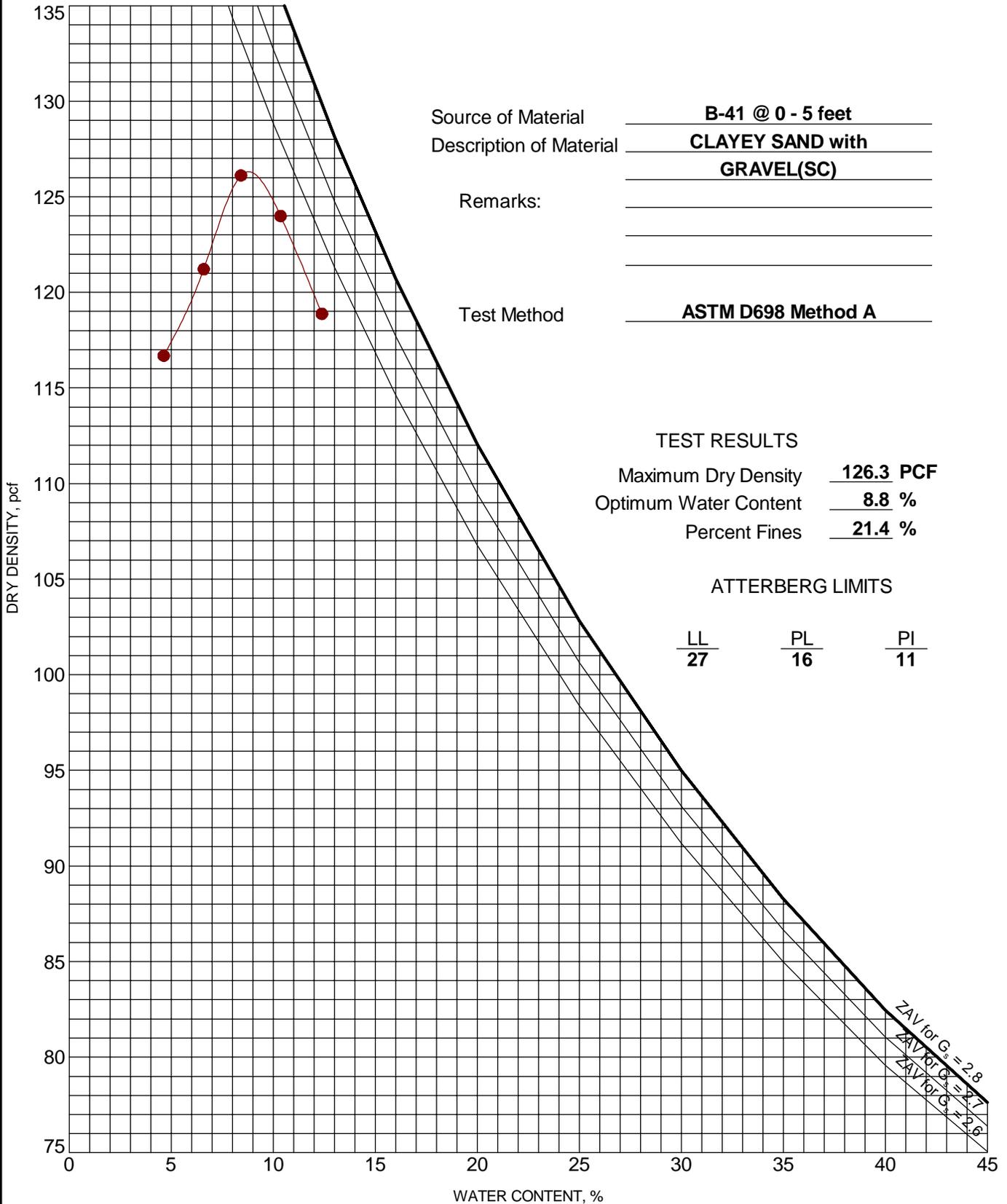


PROJECT NUMBER: 23155014  
 CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado  
 EXHIBIT: B-44

# MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTON - V2 REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16



Source of Material B-41 @ 0 - 5 feet  
 Description of Material CLAYEY SAND with GRAVEL(SC)  
 Remarks: \_\_\_\_\_  
 Test Method ASTM D698 Method A

**TEST RESULTS**  
 Maximum Dry Density 126.3 PCF  
 Optimum Water Content 8.8 %  
 Percent Fines 21.4 %

**ATTERBERG LIMITS**

LL	PL	PI
27	16	11

PROJECT: Centennial Blvd. Pavement Evaluation  
 SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado

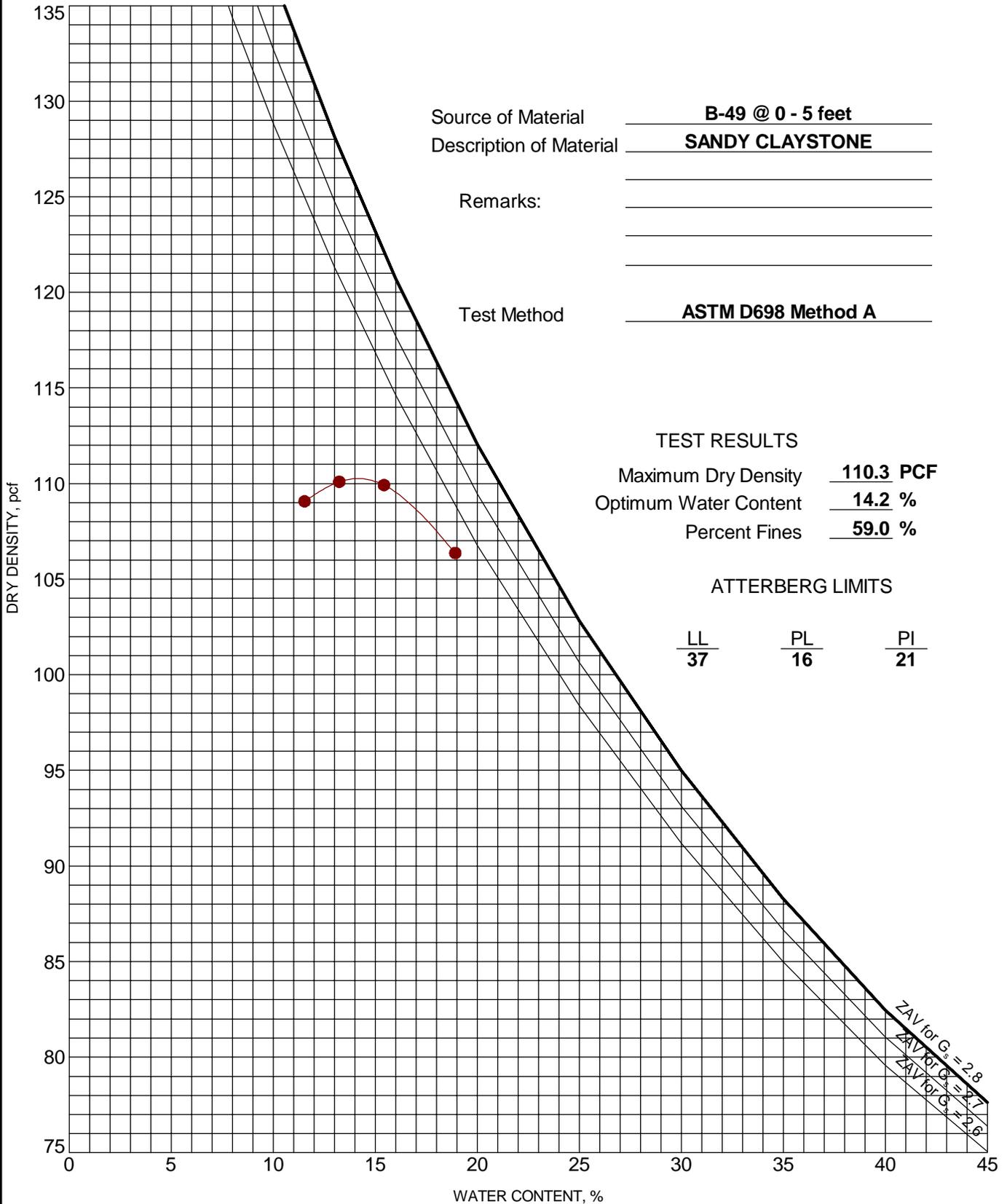


PROJECT NUMBER: 23155014  
 CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado  
 EXHIBIT: B-45

# MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTON - V2 REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16



Source of Material B-49 @ 0 - 5 feet  
 Description of Material SANDY CLAYSTONE  
 Remarks: \_\_\_\_\_  
 Test Method ASTM D698 Method A

PROJECT: Centennial Blvd. Pavement Evaluation  
 SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado

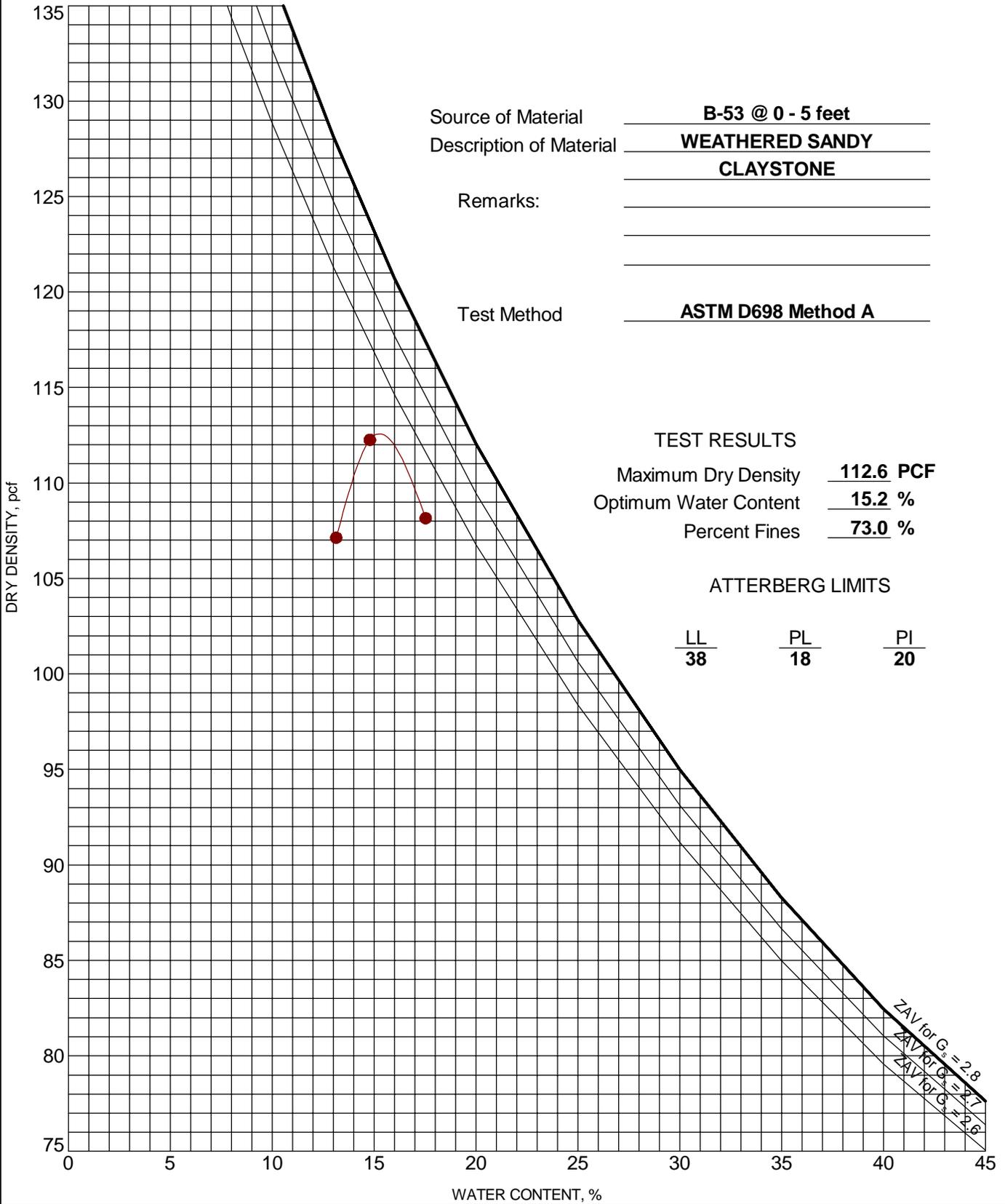


PROJECT NUMBER: 23155014  
 CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado  
 EXHIBIT: B-46

# MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTON - V2 REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16



Source of Material B-53 @ 0 - 5 feet  
 Description of Material WEATHERED SANDY CLAYSTONE  
 Remarks: \_\_\_\_\_  
 Test Method ASTM D698 Method A

PROJECT: Centennial Blvd. Pavement Evaluation  
 SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado

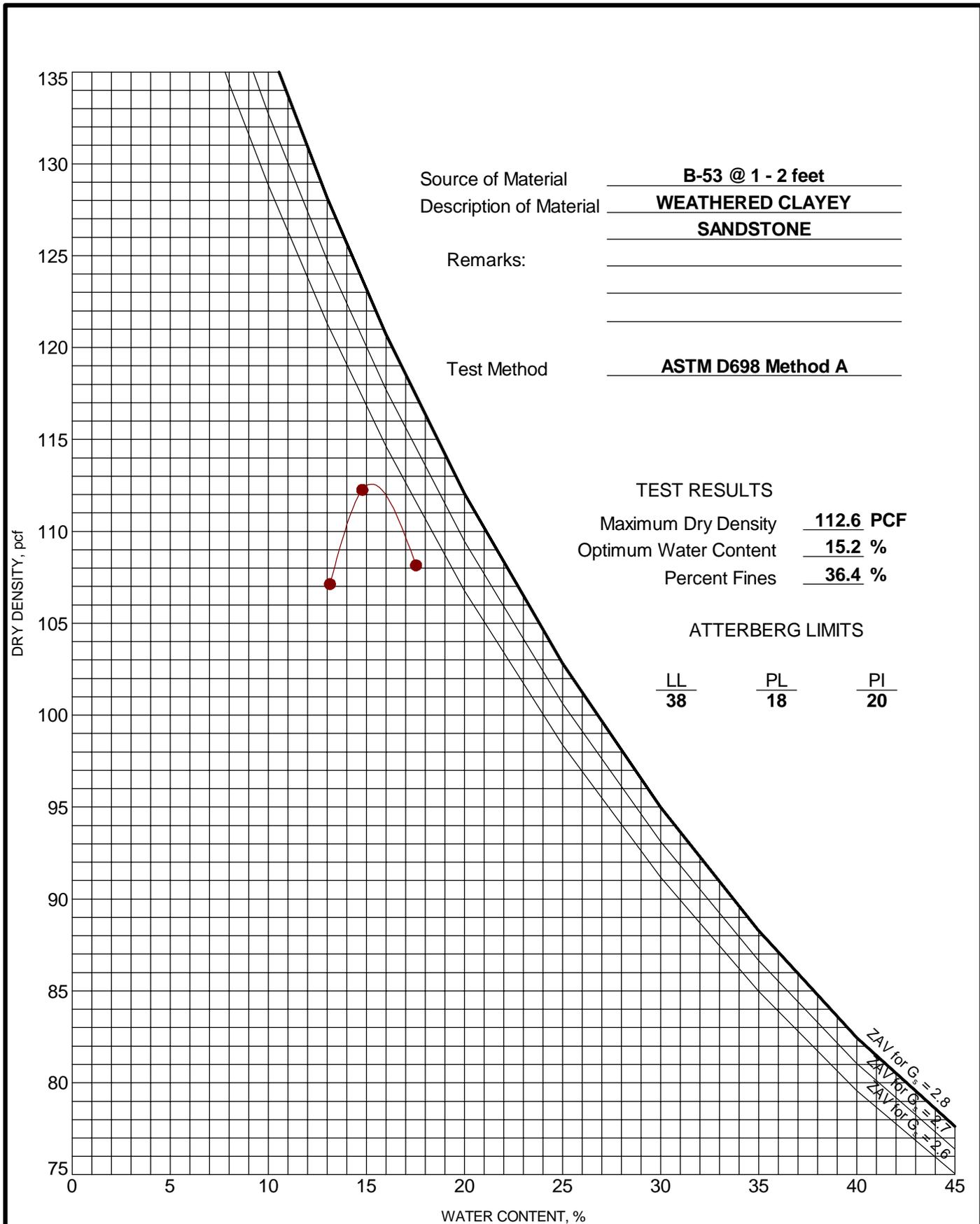


PROJECT NUMBER: 23155014  
 CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado  
 EXHIBIT: B-47

# MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTON - V2 REVISED - 23155014.GPJ TERRACON2012.GDT 3/1/16



PROJECT: Centennial Blvd. Pavement Evaluation

SITE: Garden of the Gods Rd. to W. Fillmore St. Colorado Springs, Colorado



PROJECT NUMBER: 23155014

CLIENT: Wilson & Company, Inc. Colorado Springs, Colorado

EXHIBIT: B-48



1901 Sharp Point Drive, Suite C  
Fort Collins, Colorado 80525  
(970) 484-0359 FAX (970) 484-0454

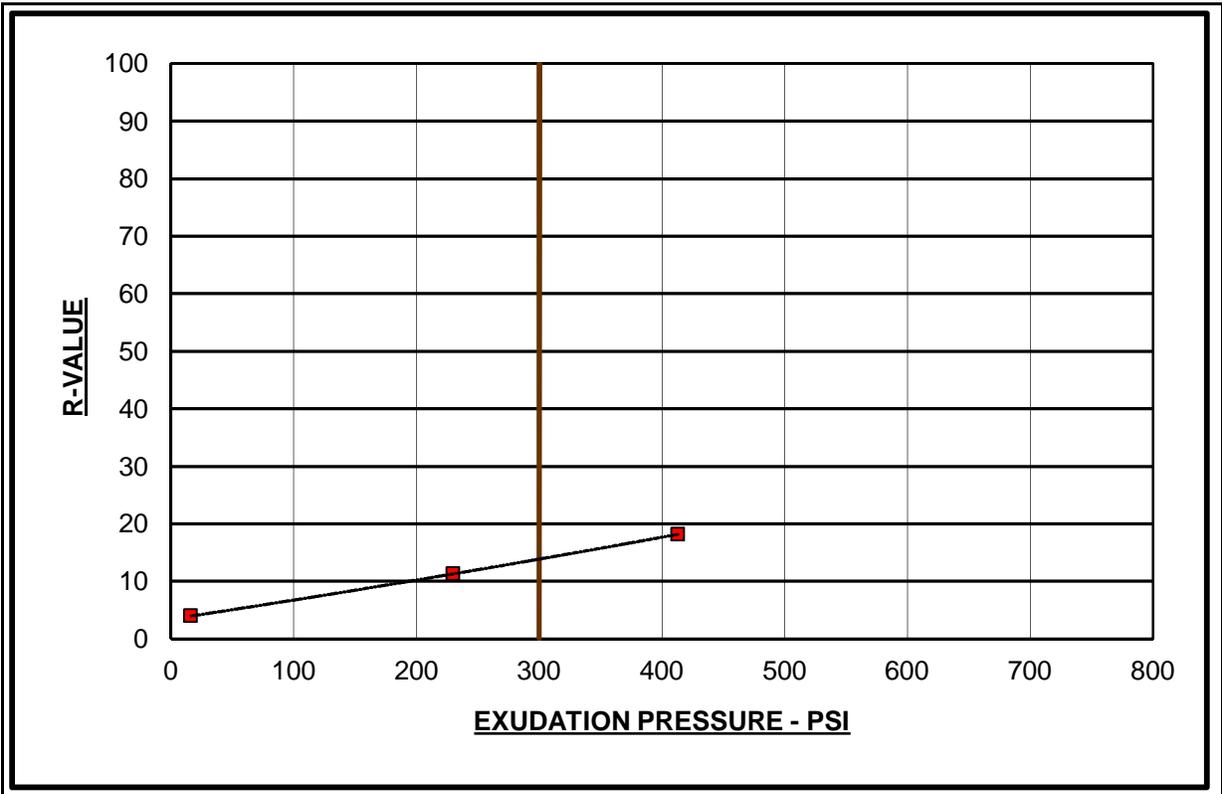
## RESISTANCE R-VALUE & EXPANSION PRESSURE OF COMPACTED SOIL AASHTO T190

**CLIENT:** Wilson & Company, Inc. **DATE OF TEST:** 01-Jul-14  
**PROJECT:** Centennial Boulevard Reconstruction  
**LOCATION:** B-1 at 0'-5'  
**TERRACON NO.** 23155014 **CLASSIFICATION:** A-2-4

### SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
COMPACTION PRESSURE (PSI)	10	60	120
DENSITY (PCF)	117.7	119.6	123.9
MOISTURE CONTENT (%)	14.8	9.2	7.8
EXPANSION PRESSURE (PSI)	-0.17	0.00	0.00
HORIZONTAL PRESSURE @ 160 PSI	148	133	125
SAMPLE HEIGHT (INCHES)	2.54	2.45	2.55
EXUDATION PRESSURE (PSI)	16.1	229.6	413.0
CORRECTED R-VALUE	4.0	11.3	18.2
UNCORRECTED R-VALUE	4.0	11.3	18.2

R-VALUE @ 300 PSI EXUDATION PRESSURE = 14





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Fort Collins, Colorado 80525  
(970) 484-0359 FAX (970) 484-0454

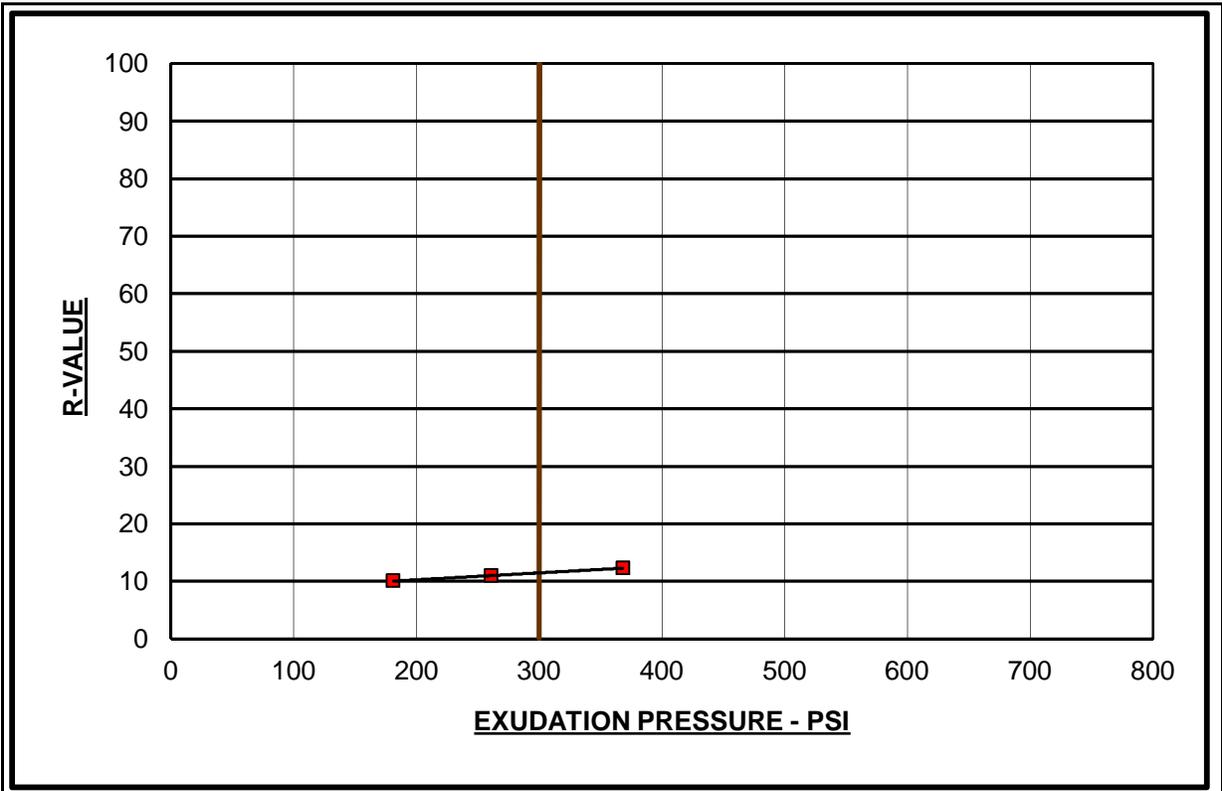
## RESISTANCE R-VALUE & EXPANSION PRESSURE OF COMPACTED SOIL AASHTO T190

**CLIENT:** Wilson & Company, Inc. **DATE OF TEST:** 01-Jul-15  
**PROJECT:** Centennial Boulevard Reconstruction  
**LOCATION:** B-9 at 0'-5'  
**TERRACON NO.** 23155014 **CLASSIFICATION:** A-2-6

### SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
COMPACTION PRESSURE (PSI)	30	60	90
DENSITY (PCF)	109.2	115.6	119.7
MOISTURE CONTENT (%)	18.9	16.3	14.8
EXPANSION PRESSURE (PSI)	-0.40	-0.16	0.11
HORIZONTAL PRESSURE @ 160 PSI	136	134	132
SAMPLE HEIGHT (INCHES)	2.76	2.65	2.63
EXUDATION PRESSURE (PSI)	181.1	260.7	368.2
CORRECTED R-VALUE	10.0	11.0	12.3
UNCORRECTED R-VALUE	9.1	10.4	11.7

R-VALUE @ 300 PSI EXUDATION PRESSURE = 11





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(970) 484-0359 FAX (970) 484-0454

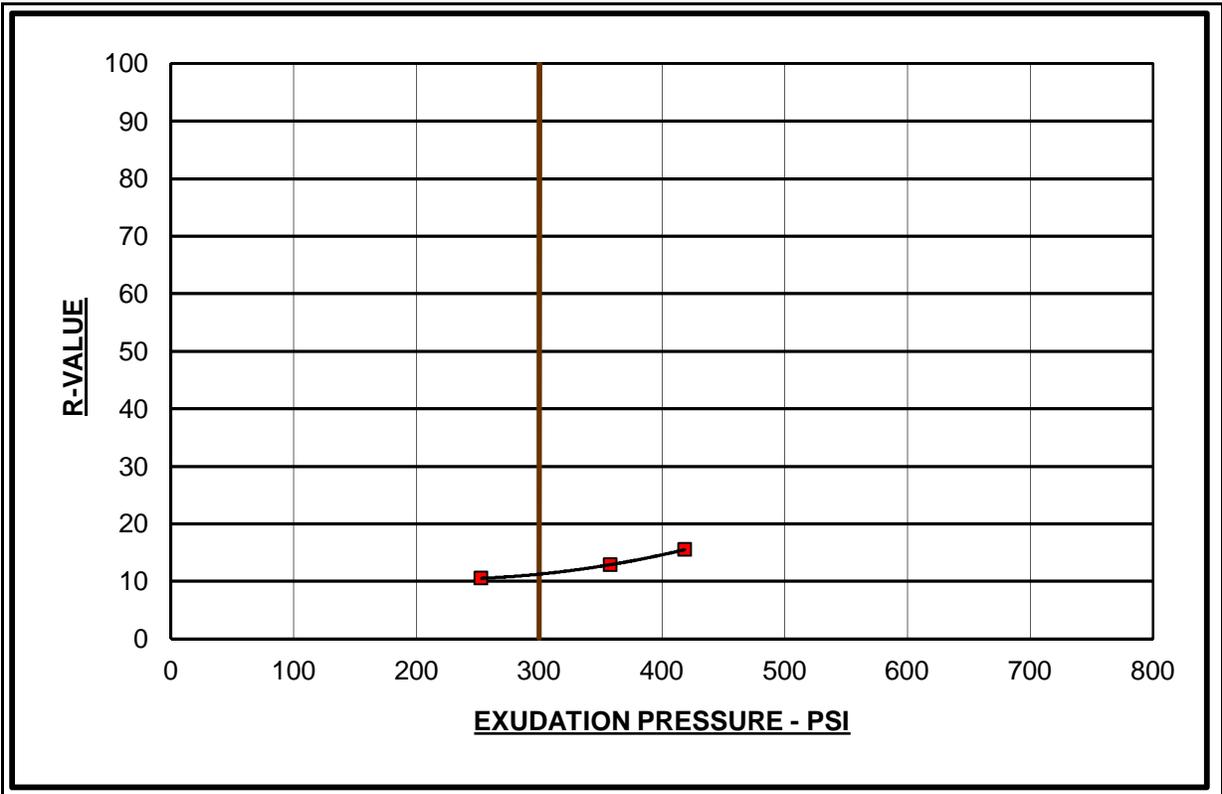
## RESISTANCE R-VALUE & EXPANSION PRESSURE OF COMPACTED SOIL AASHTO T190

**CLIENT:** Wilson & Company, Inc. **DATE OF TEST:** 01-Jul-15  
**PROJECT:** Centennial Boulevard Reconstruction  
**LOCATION:** B-49 @ 0'-5'  
**TERRACON NO.** 23155014 **CLASSIFICATION:** A-2-6

### SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
COMPACTION PRESSURE (PSI)	60	90	120
DENSITY (PCF)	117.2	119.1	123.2
MOISTURE CONTENT (%)	16.5	14.8	12.8
EXPANSION PRESSURE (PSI)	-0.16	0.12	0.31
HORIZONTAL PRESSURE @ 160 PSI	135	131	127
SAMPLE HEIGHT (INCHES)	2.61	2.64	2.68
EXUDATION PRESSURE (PSI)	252.7	357.8	418.7
CORRECTED R-VALUE	10.5	12.9	15.5
UNCORRECTED R-VALUE	10.1	12.2	14.5

R-VALUE @ 300 PSI EXUDATION PRESSURE = 12



**Report To:** Ryan Feist  
**Company:** Terracon, Inc. - Colo Springs  
4172 Center Park Drive  
Colo. Springs CO 80916

**Bill To:** Accounts Payable  
**Company:** Terracon, Inc. - Lenexa  
13910 W. 96th Terrace  
Lenexa KS 66215

<b>Task No.:</b> 150515008	<b>Date Received:</b> 5/15/15
<b>Client PO:</b>	<b>Date Reported:</b> 5/22/15
<b>Client Project:</b> Centennial Boulevard 23155014	<b>Matrix:</b> Soil - Geotech

**Customer Sample ID** 23155014 Boring B-1 0-5 Ft.  
**Lab Number:** 150515008-01

Test	Result	Method
Chloride - Water Soluble	0.0625 %	AASHTO T291-91/ ASTM D4327
pH	7.3 units	AASHTO T289-91
Resistivity	591 ohm.cm	AASHTO T288-91
Sulfate - Water Soluble	0.002 %	AASHTO T290-91/ ASTM D4327

**Customer Sample ID** 23155014 Boring B-41 0-5 Ft.  
**Lab Number:** 150515008-02

Test	Result	Method
Chloride - Water Soluble	0.0777 %	AASHTO T291-91/ ASTM D4327
pH	7.8 units	AASHTO T289-91
Resistivity	272 ohm.cm	AASHTO T288-91
Sulfate - Water Soluble	0.008 %	AASHTO T290-91/ ASTM D4327

**Customer Sample ID** 23155014 Boring B-49 0-5 Ft.  
**Lab Number:** 150515008-03

Test	Result	Method
Chloride - Water Soluble	0.0358 %	AASHTO T291-91/ ASTM D4327
pH	7.6 units	AASHTO T289-91
Resistivity	422 ohm.cm	AASHTO T288-91
Sulfate - Water Soluble	0.615 %	AASHTO T290-91/ ASTM D4327

**Abbreviations/ References:**

AASHTO - American Association of State Highway and Transportation Officials.  
ASTM - American Society for Testing and Materials.  
ASA - American Society of Agronomy.  
DIPRA - Ductile Iron Pipe Research Association Handbook of Ductile Iron Pipe.



DATA APPROVED FOR RELEASE BY

**Report To:** Ryan Feist  
**Company:** Terracon, Inc. - Colo Springs  
 4172 Center Park Drive  
 Colo. Springs CO 80916

**Bill To:** Accounts Payable  
**Company:** Terracon, Inc. - Lenexa  
 13910 W. 96th Terrace  
 Lenexa KS 66215

**Task No.:** 150522041  
**Client PO:**  
**Client Project:** Centennial Boulevard 23155014  
**Date Received:** 5/22/15  
**Date Reported:** 5/29/15  
**Matrix:** Soil - Geotech

**Customer Sample ID** 23155014 Boring B-53 0-5 Ft.  
**Lab Number:** 150522041-01

Test	Result	Method
Chloride - Water Soluble	0.0267 %	AASHTO T291-91/ ASTM D4327
pH	7.7 units	AASHTO T289-91
Resistivity	639 ohm.cm	AASHTO T288-91
Sulfate - Water Soluble	0.005 %	AASHTO T290-91/ ASTM D4327

**Customer Sample ID** 23155014 Boring B-63 0-5 Ft.  
**Lab Number:** 150522041-02

Test	Result	Method
Chloride - Water Soluble	0.0391 %	AASHTO T291-91/ ASTM D4327
pH	7.7 units	AASHTO T289-91
Resistivity	885 ohm.cm	AASHTO T288-91
Sulfate - Water Soluble	0.005 %	AASHTO T290-91/ ASTM D4327

**Abbreviations/ References:**

AASHTO - American Association of State Highway and Transportation Officials.  
 ASTM - American Society for Testing and Materials.  
 ASA - American Society of Agronomy.  
 DIPRA - Ductile Iron Pipe Research Association Handbook of Ductile Iron Pipe.



DATA APPROVED FOR RELEASE BY

**APPENDIX C**  
**SUPPORTING DOCUMENTS**

# GENERAL NOTES

## DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

<b>SAMPLING</b>			<b>WATER LEVEL</b>		Water Initially Encountered	<b>FIELD TESTS</b>	(HP) Hand Penetrometer	
	<b>Auger</b>	<b>Split Spoon</b>			Water Level After a Specified Period of Time		(T) Torvane	
					Water Level After a Specified Period of Time		(b/f) Standard Penetration Test (blows per foot)	
	<b>Shelby Tube</b>	<b>Macro Core</b>		Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.			(PID) Photo-Ionization Detector	
							(OVA) Organic Vapor Analyzer	
<b>Ring Sampler</b>	<b>Rock Core</b>							
								
<b>Grab Sample</b>	<b>No Recovery</b>							

## DESCRIPTIVE SOIL CLASSIFICATION

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

## LOCATION AND ELEVATION NOTES

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

STRENGTH TERMS	RELATIVE DENSITY OF COARSE-GRAINED SOILS <small>(More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.</small>			CONSISTENCY OF FINE-GRAINED SOILS <small>(50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance</small>			BEDROCK		
	Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.	Ring Sampler Blows/Ft.	Standard Penetration or N-Value Blows/Ft.
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3	< 30	< 20	Weathered
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4	30 - 49	20 - 29	Firm
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9	50 - 89	30 - 49	Medium Hard
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18	90 - 119	50 - 79	Hard
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42	> 119	>79	Very Hard
			Hard	> 8,000	> 30	> 42			

## RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

## GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

## RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

## PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

# UNIFIED SOIL CLASSIFICATION SYSTEM

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

<sup>A</sup> Based on the material passing the 3-inch (75-mm) sieve

<sup>B</sup> If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

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

<sup>D</sup> Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

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

<sup>F</sup> If soil contains  $\geq 15\%$  sand, add "with sand" to group name.

<sup>G</sup> If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

<sup>H</sup> If fines are organic, add "with organic fines" to group name.

<sup>I</sup> If soil contains  $\geq 15\%$  gravel, add "with gravel" to group name.

<sup>J</sup> If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

<sup>K</sup> If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

<sup>L</sup> If soil contains  $\geq 30\%$  plus No. 200 predominantly sand, add "sandy" to group name.

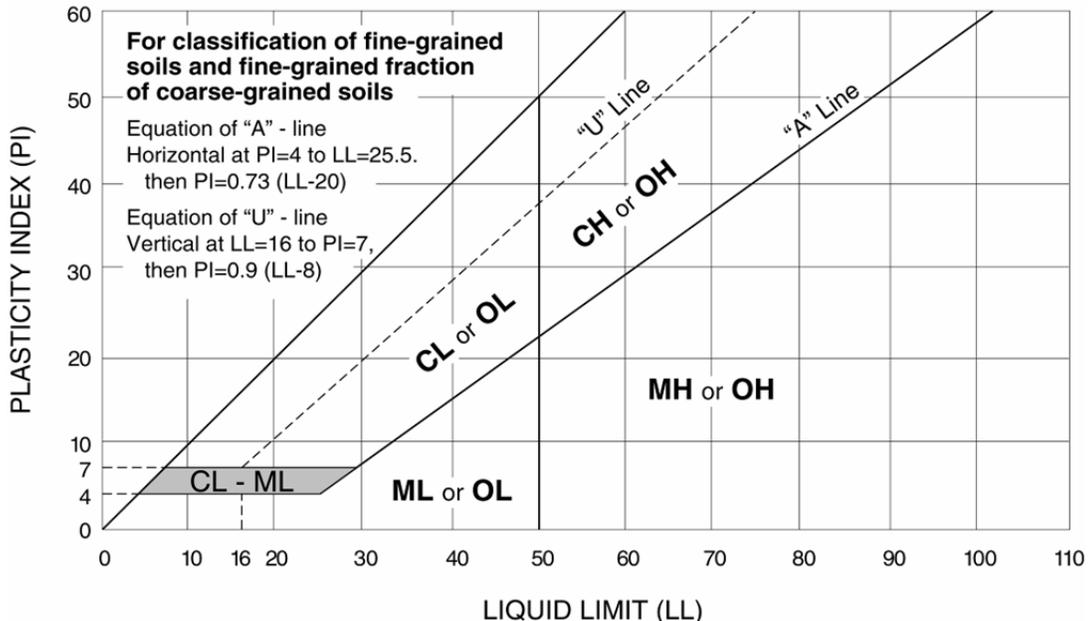
<sup>M</sup> If soil contains  $\geq 30\%$  plus No. 200, predominantly gravel, add "gravelly" to group name.

<sup>N</sup>  $PI \geq 4$  and plots on or above "A" line.

<sup>O</sup>  $PI < 4$  or plots below "A" line.

<sup>P</sup>  $PI$  plots on or above "A" line.

<sup>Q</sup>  $PI$  plots below "A" line.



## DESCRIPTION OF ROCK PROPERTIES

### WEATHERING

Term	Description
<b>Unweathered</b>	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
<b>Slightly weathered</b>	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
<b>Moderately weathered</b>	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
<b>Highly weathered</b>	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
<b>Completely weathered</b>	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
<b>Residual soil</b>	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

### STRENGTH OR HARDNESS

Description	Field Identification	Uniaxial Compressive Strength, PSI (MPa)
<b>Extremely weak</b>	Indented by thumbnail	40-150 (0.3-1)
<b>Very weak</b>	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	150-700 (1-5)
<b>Weak rock</b>	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	700-4,000 (5-30)
<b>Medium strong</b>	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	4,000-7,000 (30-50)
<b>Strong rock</b>	Specimen requires more than one blow of geological hammer to fracture it	7,000-15,000 (50-100)
<b>Very strong</b>	Specimen requires many blows of geological hammer to fracture it	15,000-36,000 (100-250)
<b>Extremely strong</b>	Specimen can only be chipped with geological hammer	>36,000 (>250)

### DISCONTINUITY DESCRIPTION

Fracture Spacing (Joints, Faults, Other Fractures)		Bedding Spacing (May Include Foliation or Banding)	
Description	Spacing	Description	Spacing
<b>Extremely close</b>	< ¾ in (<19 mm)	<b>Laminated</b>	< ½ in (<12 mm)
<b>Very close</b>	¾ in – 2-1/2 in (19 - 60 mm)	<b>Very thin</b>	½ in – 2 in (12 – 50 mm)
<b>Close</b>	2-1/2 in – 8 in (60 – 200 mm)	<b>Thin</b>	2 in – 1 ft (50 – 300 mm)
<b>Moderate</b>	8 in – 2 ft (200 – 600 mm)	<b>Medium</b>	1 ft – 3 ft (300 – 900 mm)
<b>Wide</b>	2 ft – 6 ft (600 mm – 2.0 m)	<b>Thick</b>	3 ft – 10 ft (900 mm – 3 m)
<b>Very Wide</b>	6 ft – 20 ft (2.0 – 6 m)	<b>Massive</b>	> 10 ft (3 m)

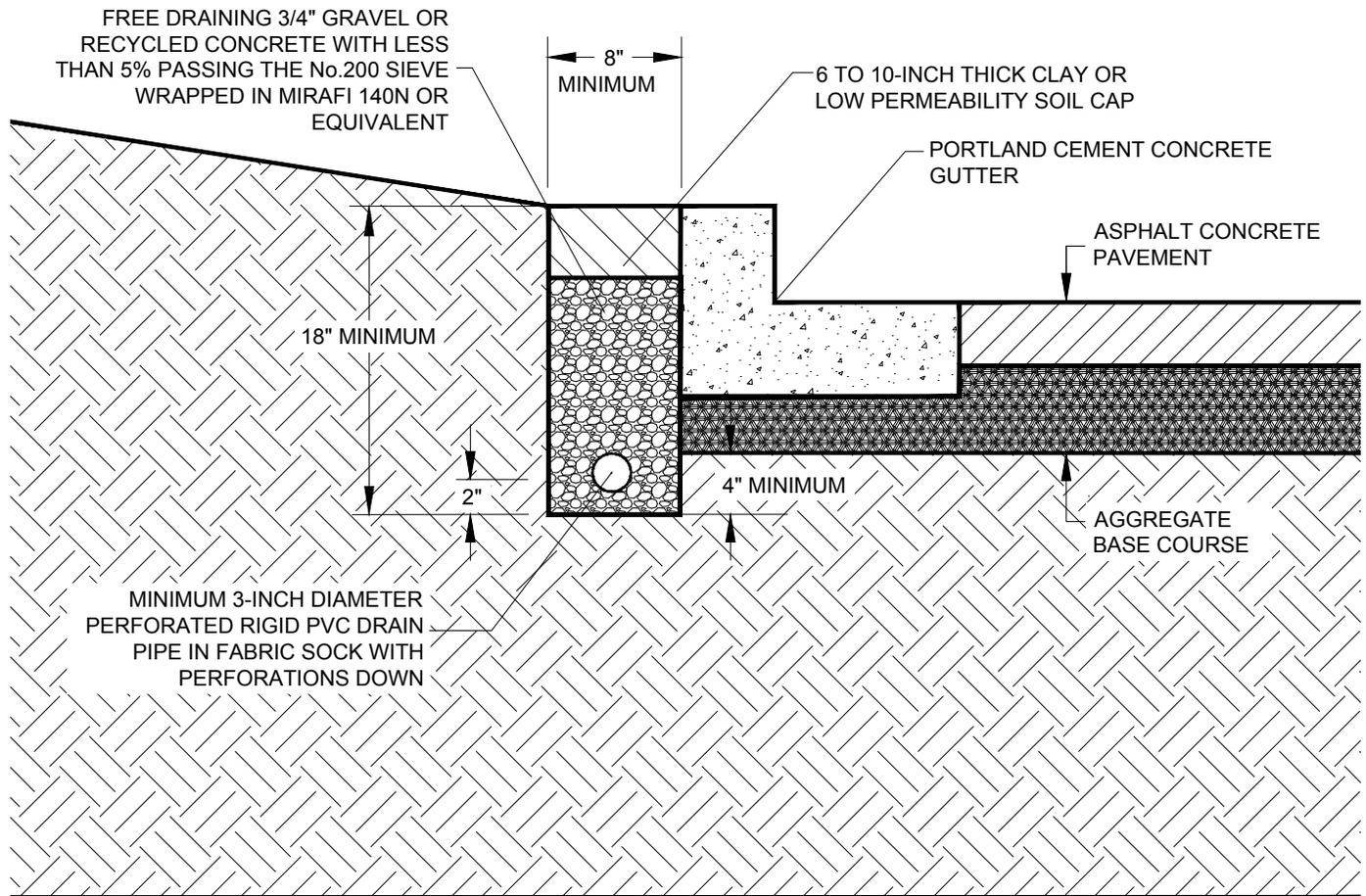
Discontinuity Orientation (Angle): Measure the angle of discontinuity relative to a plane perpendicular to the longitudinal axis of the core. (For most cases, the core axis is vertical; therefore, the plane perpendicular to the core axis is horizontal.) For example, a horizontal bedding plane would have a 0 degree angle.

### ROCK QUALITY DESIGNATION (RQD\*)

Description	RQD Value (%)
<b>Very Poor</b>	0 - 25
<b>Poor</b>	25 – 50
<b>Fair</b>	50 – 75
<b>Good</b>	75 – 90
<b>Excellent</b>	90 - 100

\*The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.

Reference: U.S. Department of Transportation, Federal Highway Administration, Publication No FHWA-NHI-10-034, December 2009  
Technical Manual for Design and Construction of Road Tunnels – Civil Elements



**NOTE:** DRAIN PIPE SHOULD BE SLOPED AT A MINIMUM OF 1/8-INCH PER FOOT TO STORM SEWER OR OTHER SUITABLE OUTLET

Project Mngr:	RWF
Drawn By:	AV
Checked By:	RWF
Approved By:	RWF

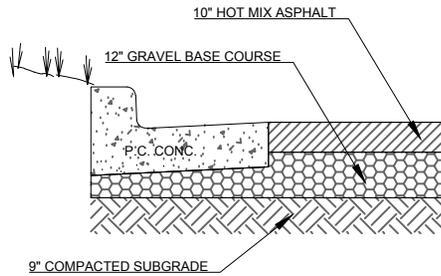
Project No.	23155014
Scale:	Not To Scale
File No.	Drawings\EdgeDrain
Date:	02/17/2016

**Terracon**  
 Consulting Engineers and Scientists  
 4172 Center Park Drive Colorado Springs, Colorado 80916  
 PH. (719) 597-2116 FAX. (719) 597-2117

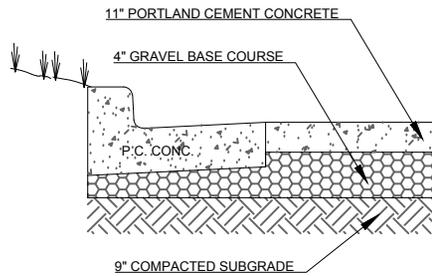
PAVEMENT EDGE DRAIN DETAIL  
 Wilson & Company, Inc.  
**CENTENNIAL BOULEVARD RECONSTRUCTION**  
 WEST FILLMORE STREET TO GARDEN OF THE GODS ROAD  
 COLORADO SPRINGS COLORADO

Exhibit  
**C-4**

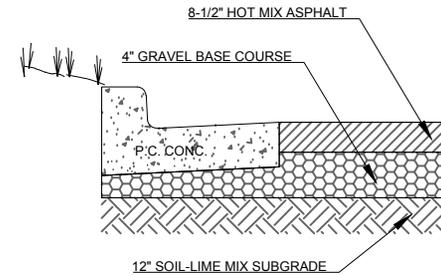
**PAVEMENT THICKNESS SECTIONS  
WEST FILLMORE AVENUE TO GARDEN OF THE GODS ROAD  
(APPROXIMATE STA 0+00 AND STA 78+80)**



①  
C-3 R-VALUE = 5  
FLEXIBLE PAVEMENT SECTION  
N.T.S.

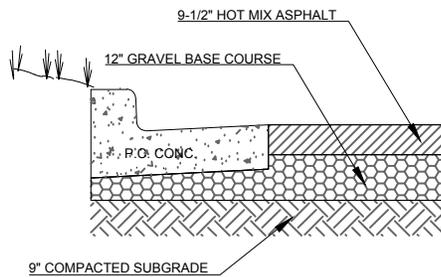


②  
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RIGID PAVEMENT SECTION  
N.T.S.

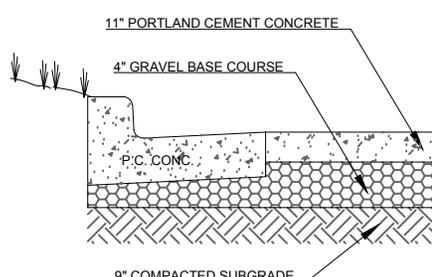


③  
C-3 R-VALUE = 5  
FLEXIBLE PAVEMENT SECTION (SOIL-LIME MIX)  
N.T.S.

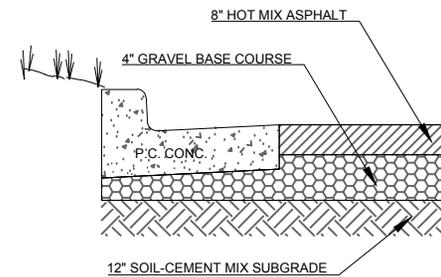
**R-VALUE = 5 OPTIONS**



⑤  
C-3 R-VALUE = 11  
FLEXIBLE PAVEMENT SECTION  
N.T.S.



⑥  
C-3 R-VALUE = 11  
RIGID PAVEMENT SECTION  
N.T.S.



⑦  
C-3 R-VALUE = 11  
FLEXIBLE PAVEMENT SECTION (SOIL-CEMENT MIX)  
N.T.S.

**R-VALUE = 11 OPTIONS**

Project Mng'r:	RWF	Project No.	23155014
Drawn By:	AV	Scale:	NOT TO SCALE
Checked By:	RWF	File No.	Pavement Edge
Approved By:	RWF	Date:	04/03/2016

**Terracon**  
Consulting Engineers and Scientists

4172 Center Park Drive Colorado Springs, Colorado 80916  
PH. (719) 597-2116 FAX. (719) 597-2117

PAVEMENT CROSS-SECTION DETAILS (APPROX. STA 0+00 TO STA 78+80)

Wilson & Company, Inc.  
**CENTENNIAL BOULEVARD RECONSTRUCTION**

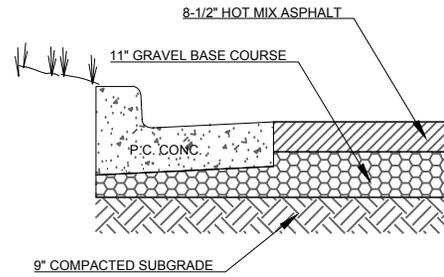
WEST FILLMORE STREET TO GARDEN OF THE GODS ROAD  
COLORADO SPRINGS

COLORADO

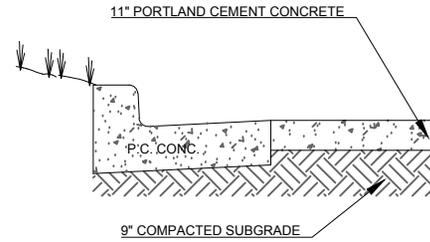
Ex. No.

**C-5**

**PAVEMENT THICKNESS SECTIONS  
WEST FILLMORE AVENUE TO GARDEN OF THE GODS ROAD  
(APPROXIMATE STA 0+00 AND STA 78+80 )**

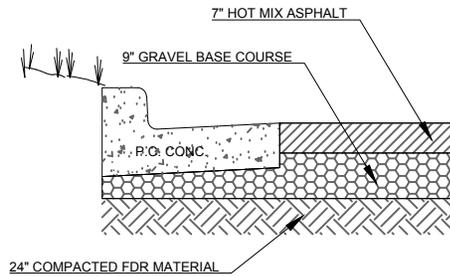


1  
C-4  
R-VALUE = 20  
FLEXIBLE PAVEMENT SECTION  
N.T.S.

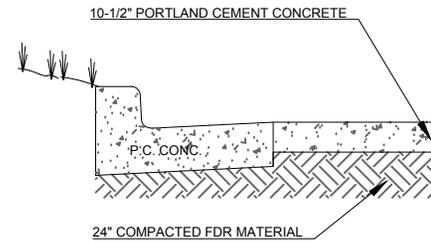


2  
C-4  
R-VALUE = 20  
RIGID PAVEMENT SECTION  
N.T.S.

R-VALUE = 20 OPTIONS



5  
C-3  
R-VALUE = 40  
FLEXIBLE PAVEMENT SECTION (FULL-DEPTH RECLAMATION)  
N.T.S.



7  
C-3  
R-VALUE = 40  
RIGID PAVEMENT SECTION (FULL-DEPTH RECLAMATION)  
N.T.S.

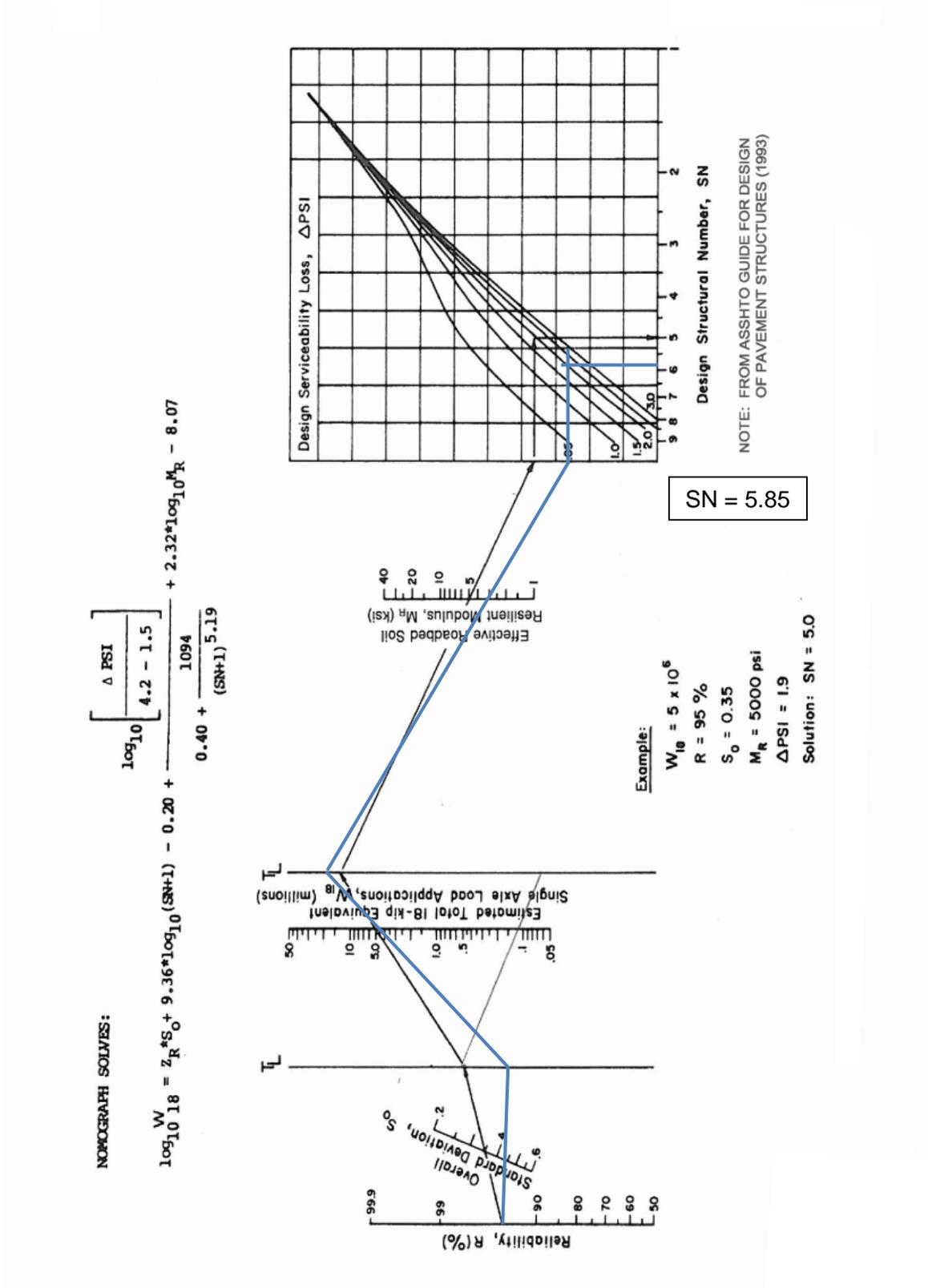
R-VALUE = 40 OPTIONS

Project Mngr:	RWF	Project No.:	23155014	<p><b>Terracon</b> Consulting Engineers and Scientists</p> <p>4172 Center Park Drive    Colorado Springs, Colorado 80916 PH. (719) 597-2116    FAX. (719) 597-2117</p>	PAVEMENT CROSS-SECTION DETAILS (APPROX. STA 0+00 TO STA 78+80)	Ex. No.	
Drawn By:	AV	Scale:	NOT TO SCALE		Wilson & Company, Inc.	<p><b>CENTENNIAL BOULEVARD RECONSTRUCTION</b> WEST FILLMORE STREET TO GARDEN OF THE GODS ROAD COLORADO SPRINGS    COLORADO</p>	C-6
Checked By:	RWF	File No.:	Pavement Edge		CENTENNIAL BOULEVARD RECONSTRUCTION		
Approved By:	RWF	Date:	04/03/2016		WEST FILLMORE STREET TO GARDEN OF THE GODS ROAD		
					COLORADO SPRINGS    COLORADO		

**APPENDIX D**  
**PAVEMENT THICKNESS DESIGN NOMOGRAPHS**

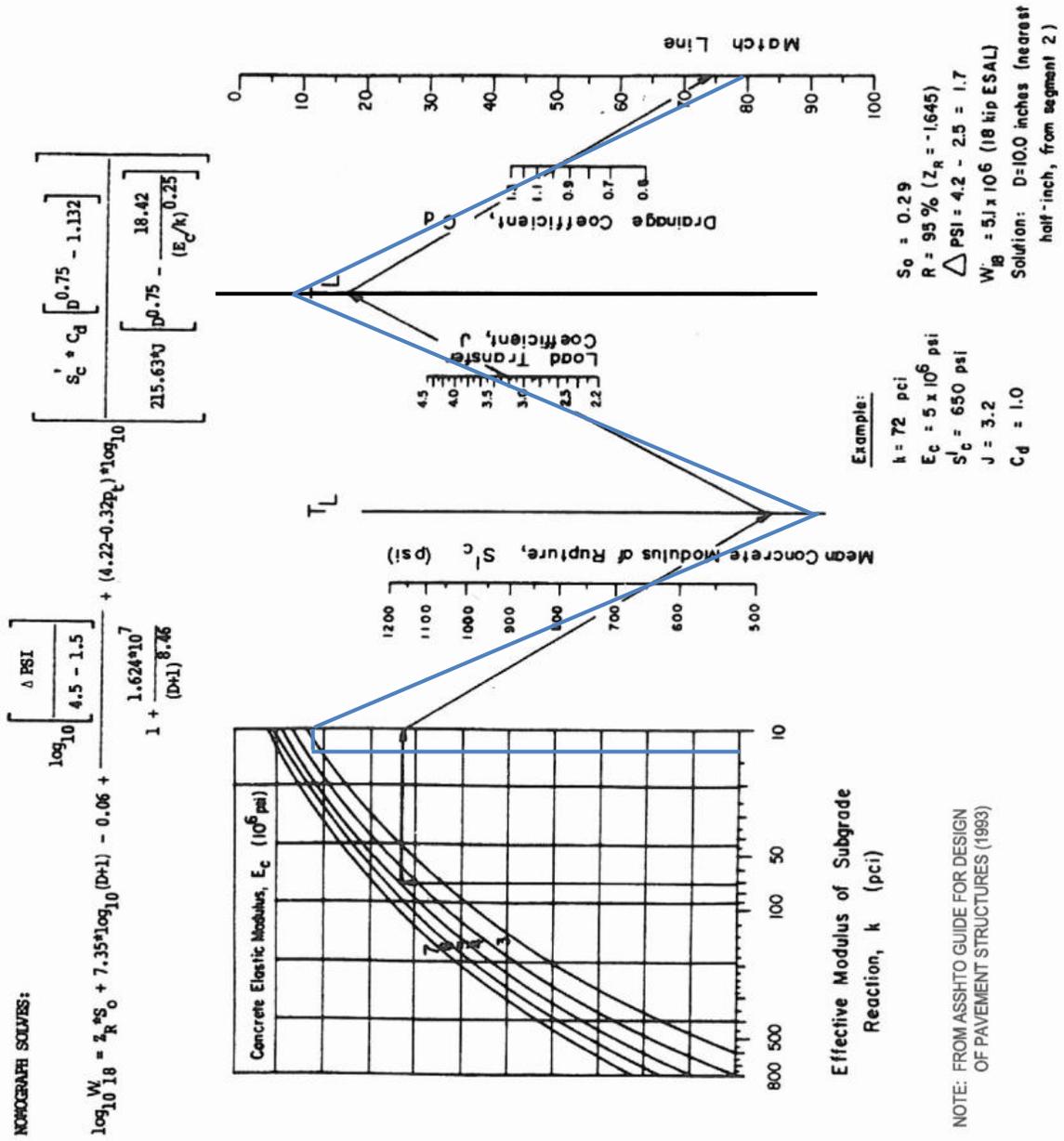
## Design chart for flexible pavements

R-VALUE = 5



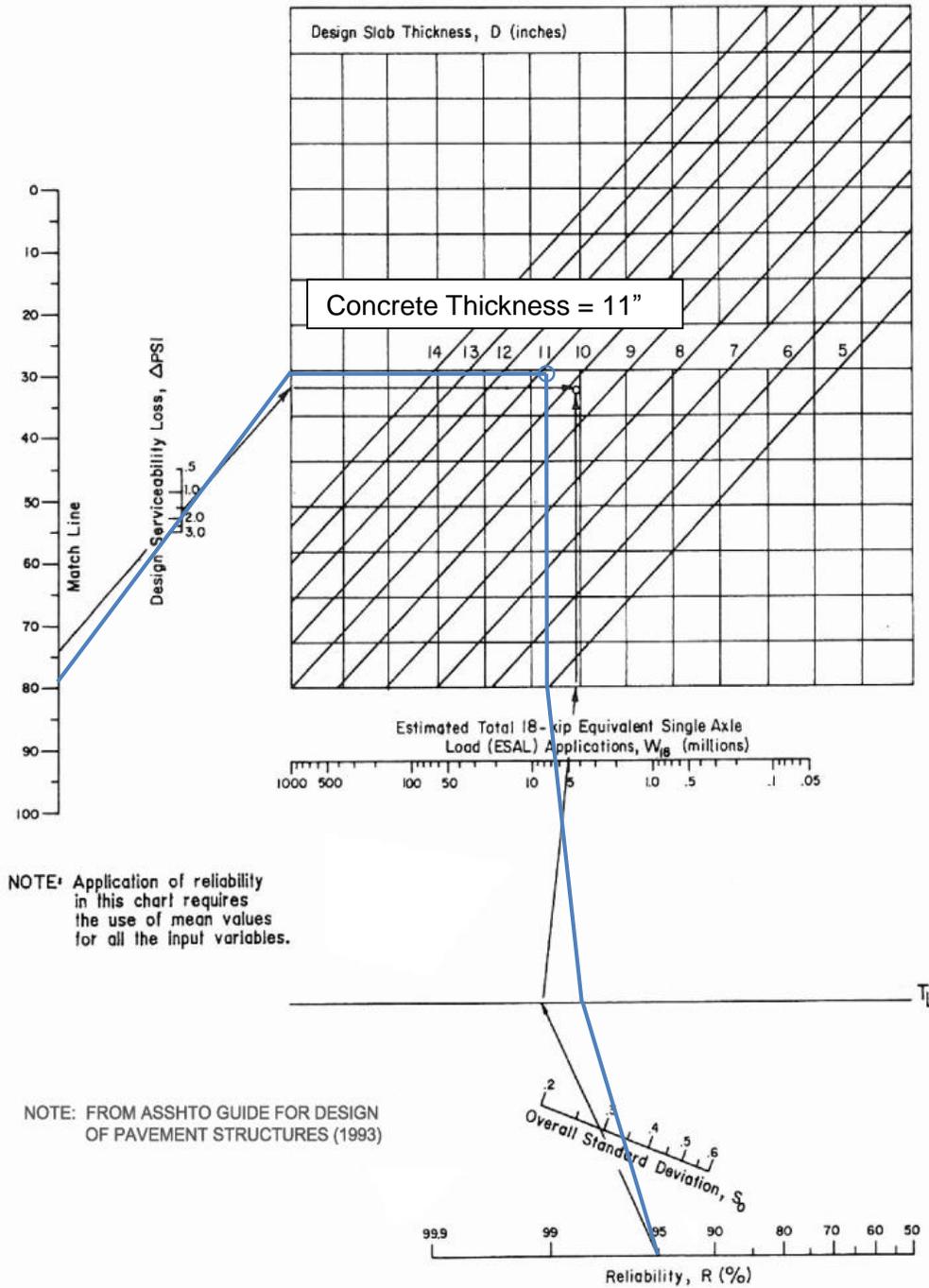
### Design chart for rigid pavements

R-VALUE = 5



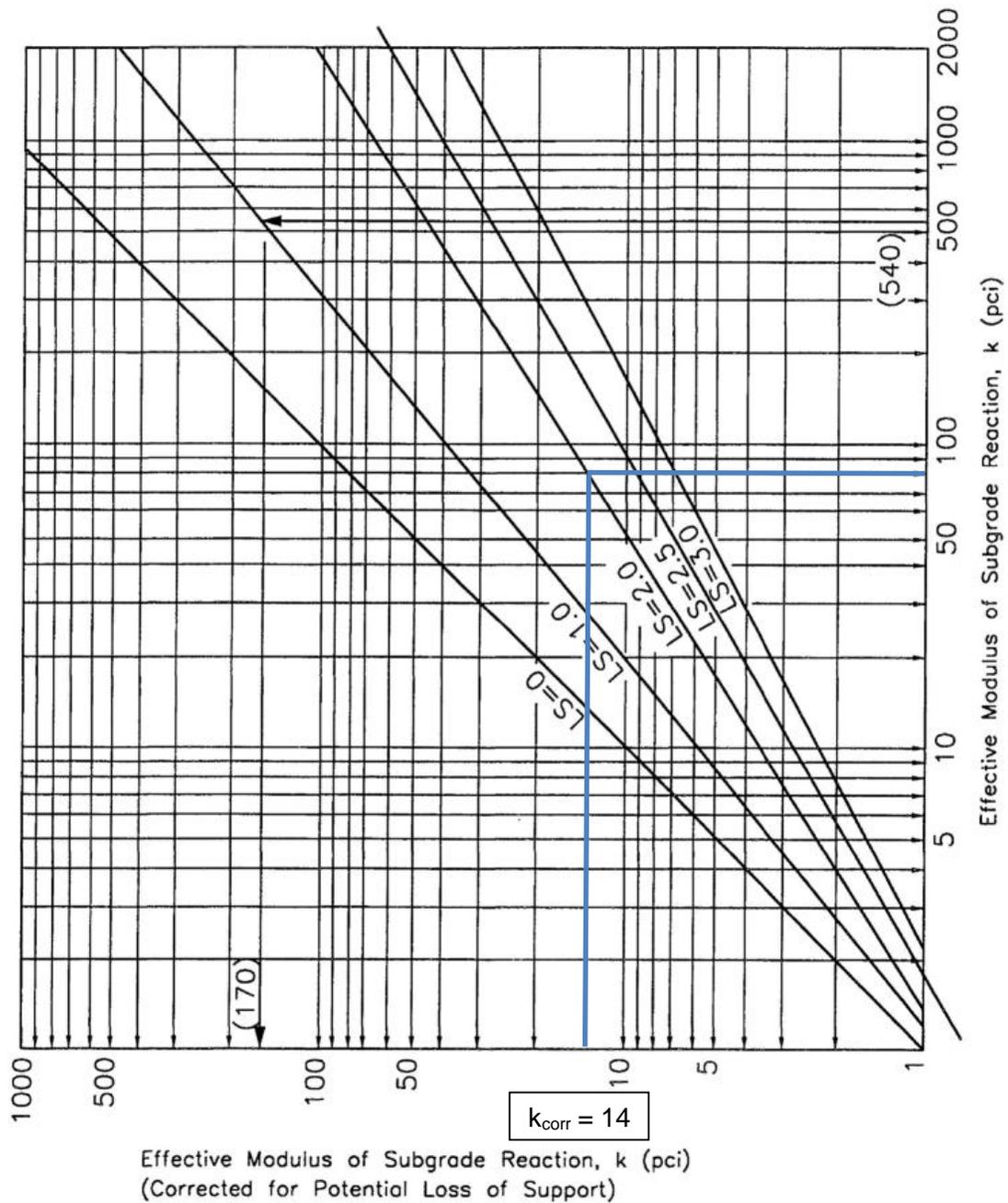
### Design chart for rigid pavements (Cont.)

R-VALUE = 5



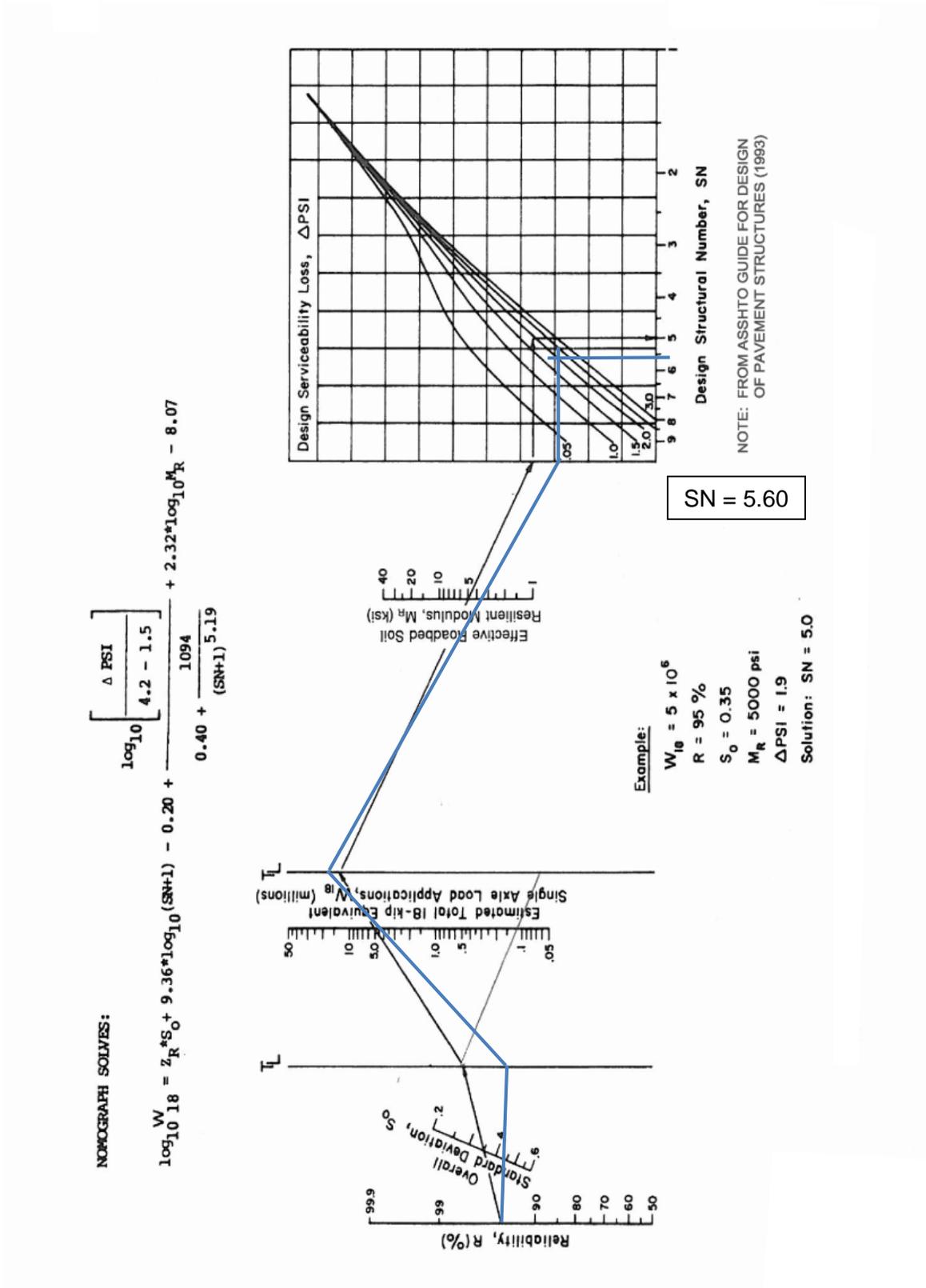
# CORRECTION OF EFFECTIVE MODULUS OF SUBGRADE REACTION FOR LOSS OF SUPPORT

R-VALUE = 5

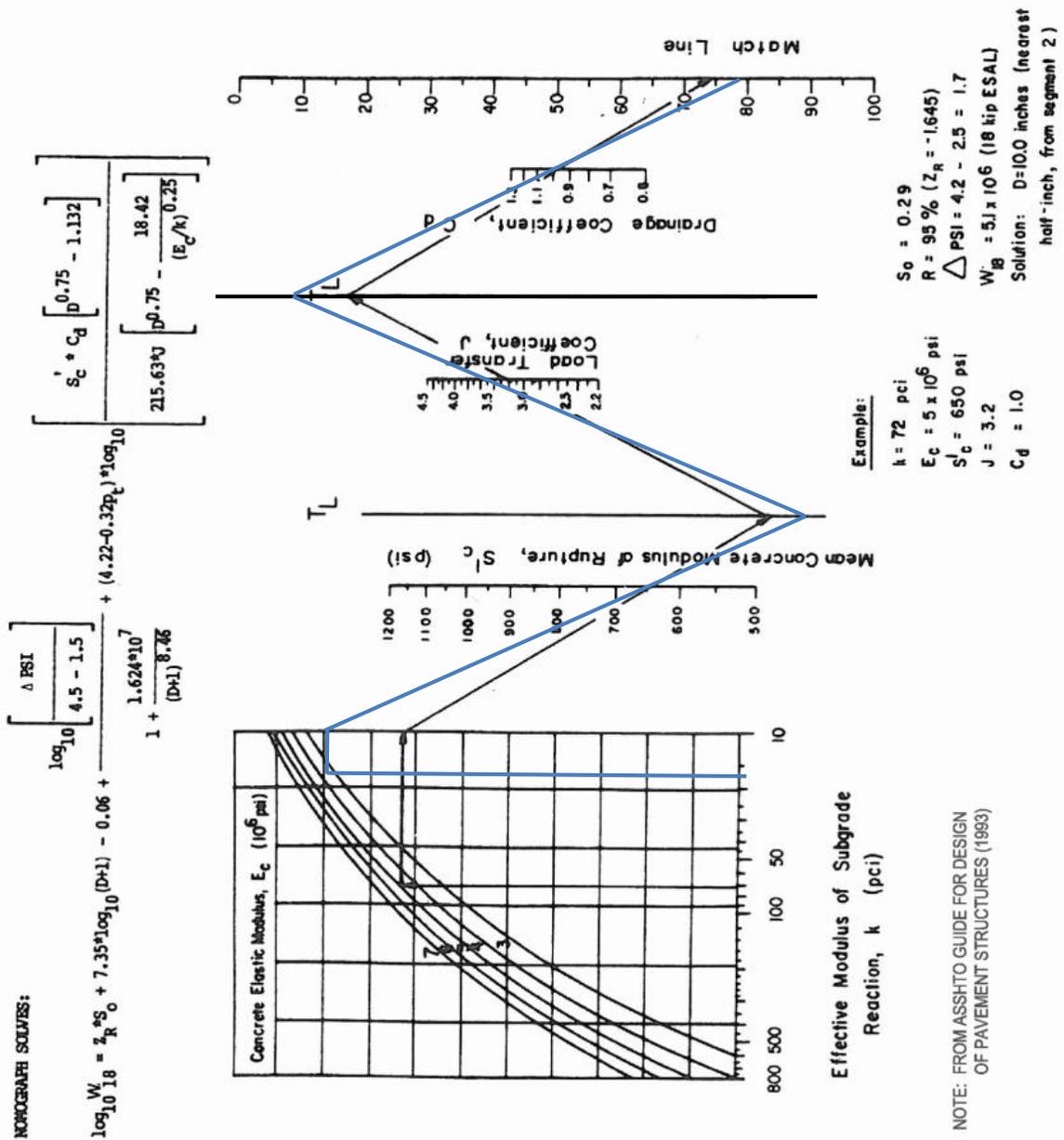


## Design chart for flexible pavements

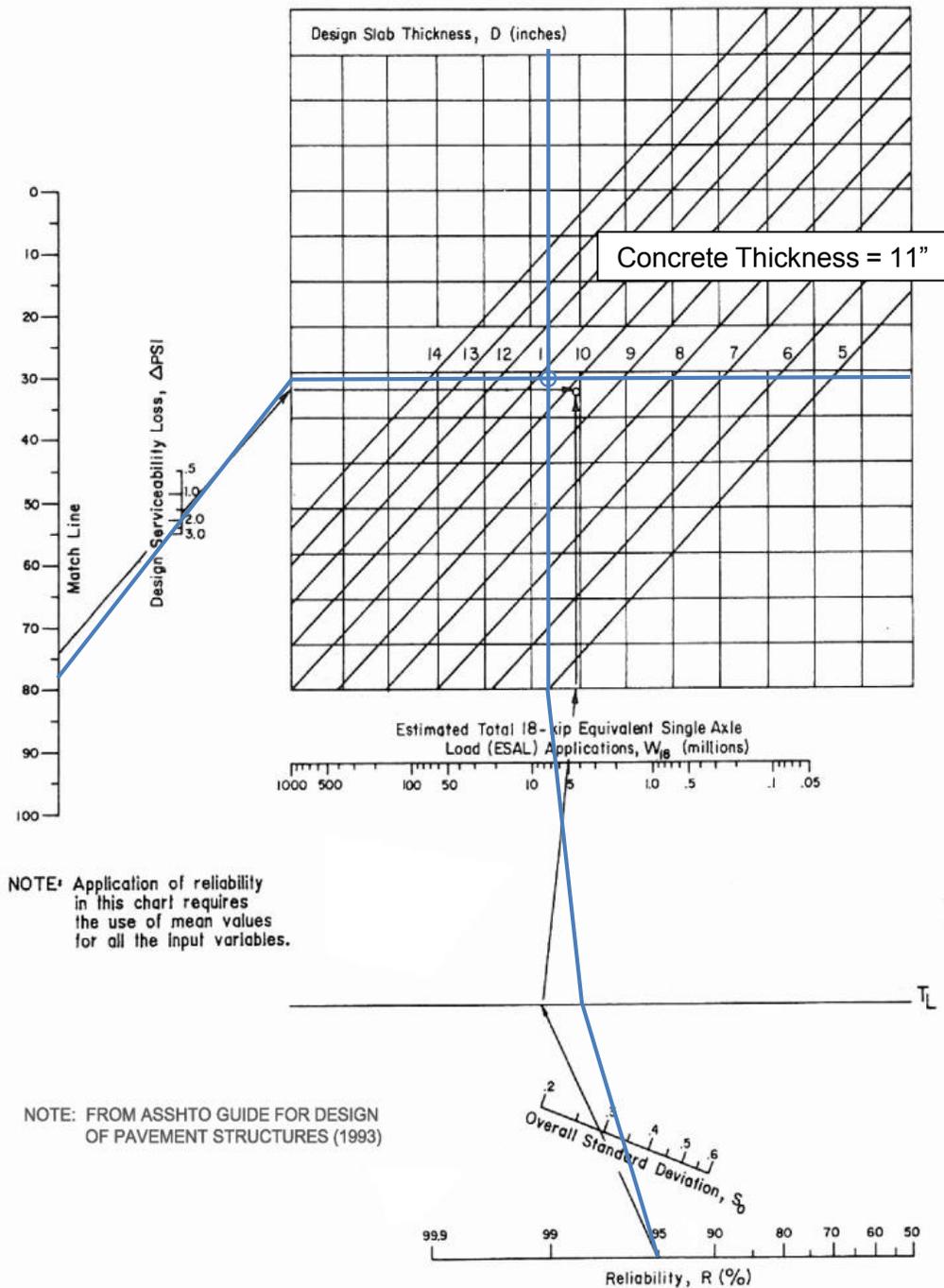
R-VALUE = 11



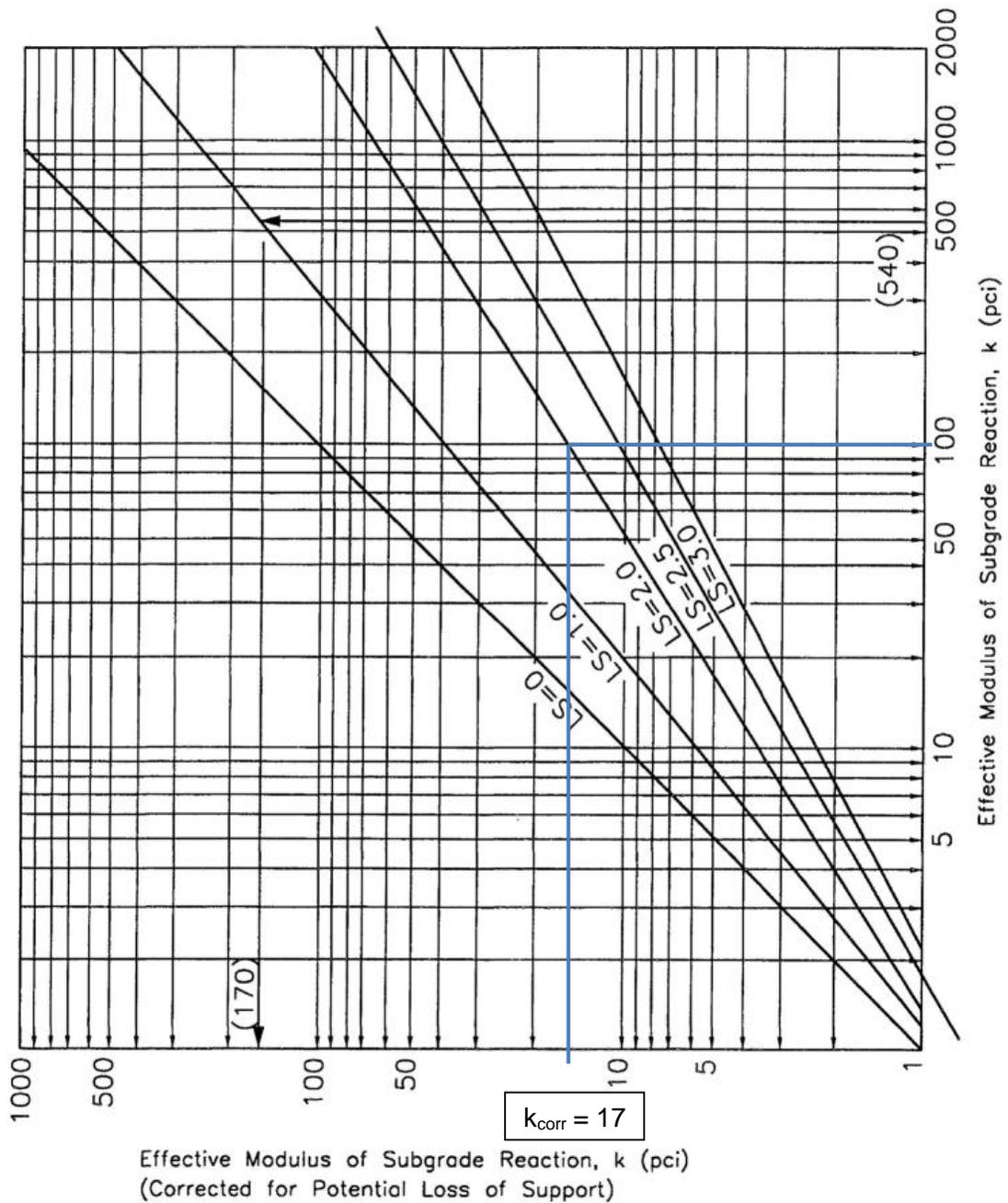
### Design chart for rigid pavements



### Design chart for rigid pavements (Cont.)

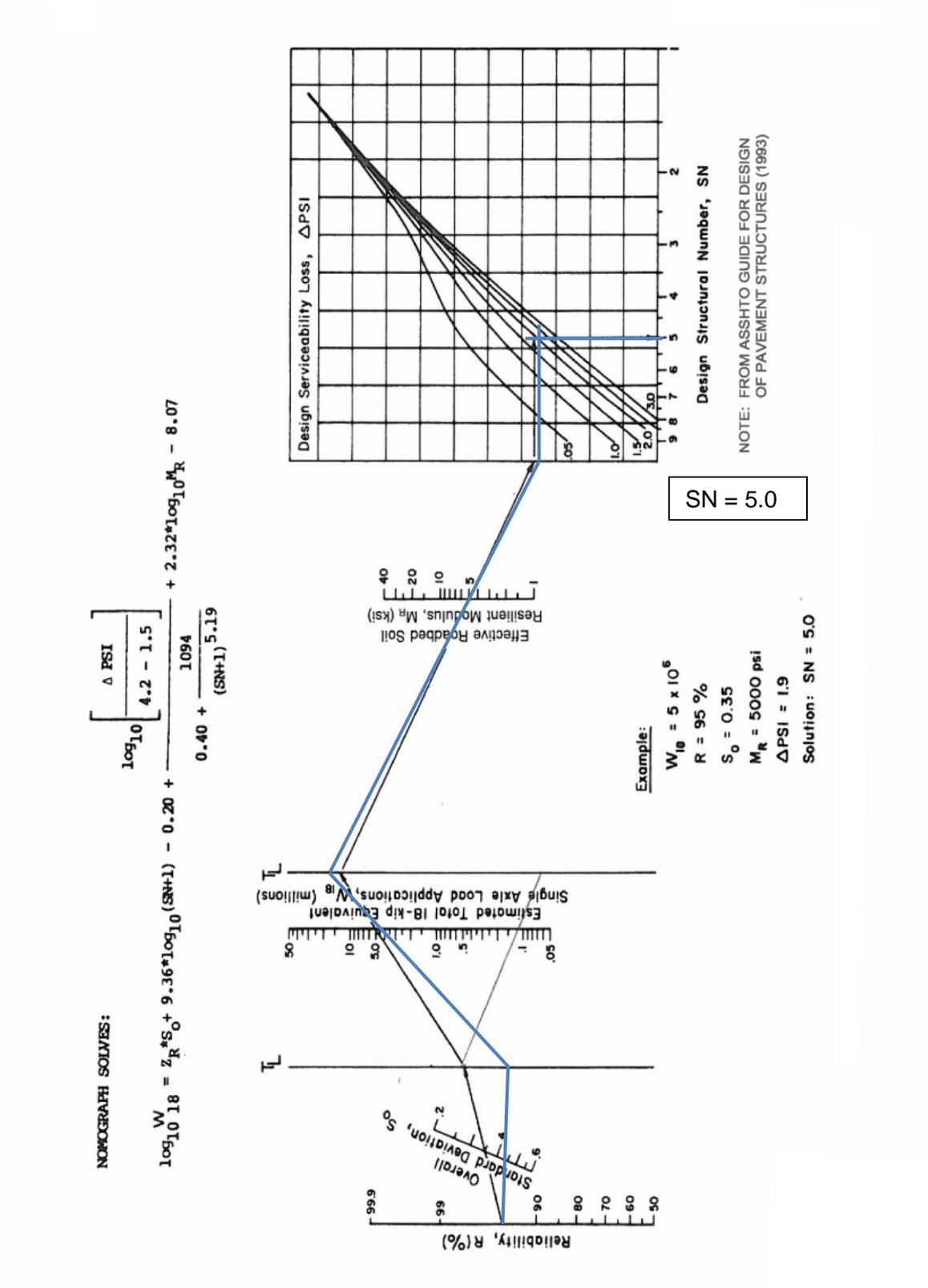


## CORRECTION OF EFFECTIVE MODULUS OF SUBGRADE REACTION FOR LOSS OF SUPPORT



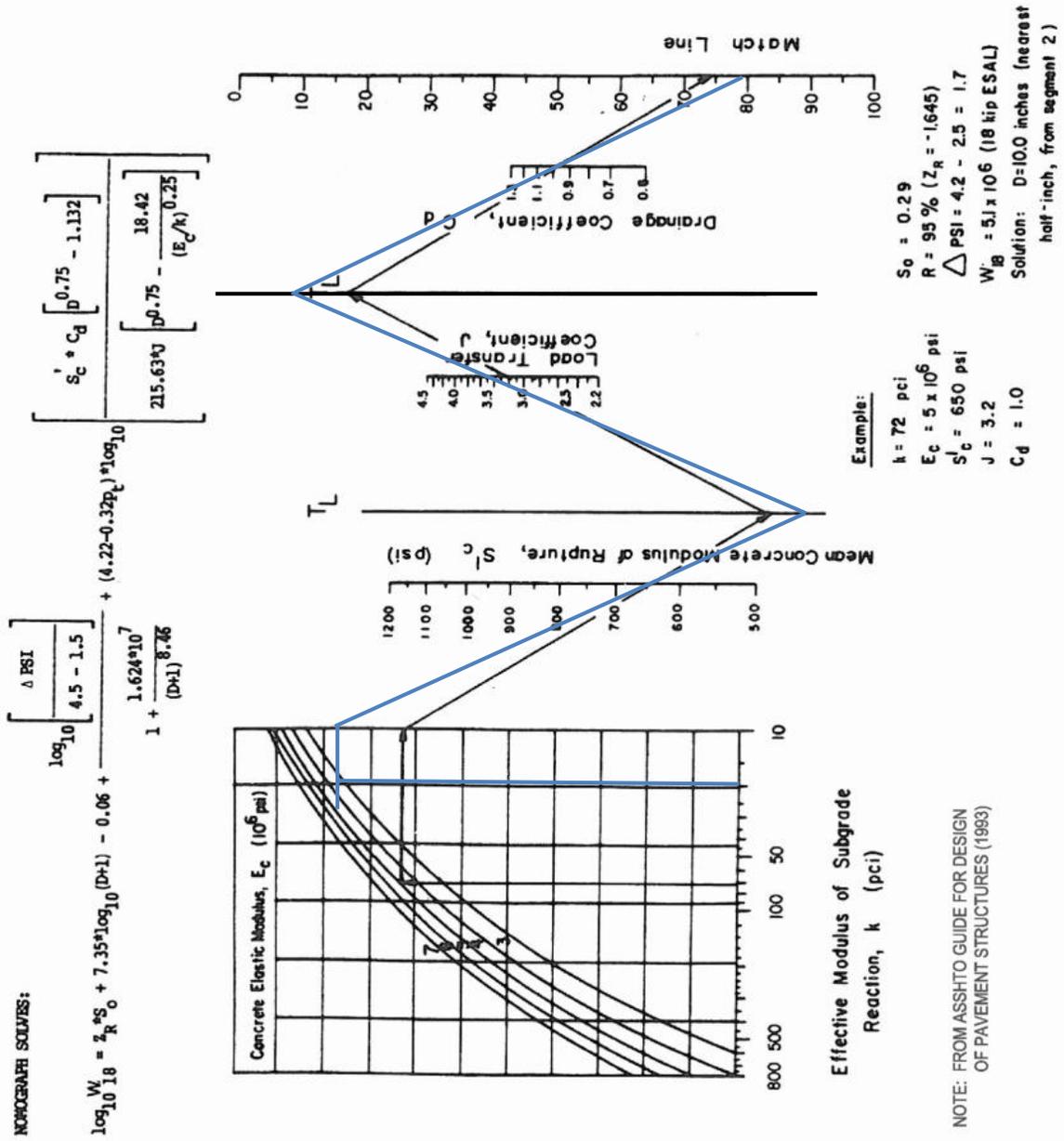
## Design chart for flexible pavements

R-VALUE = 20



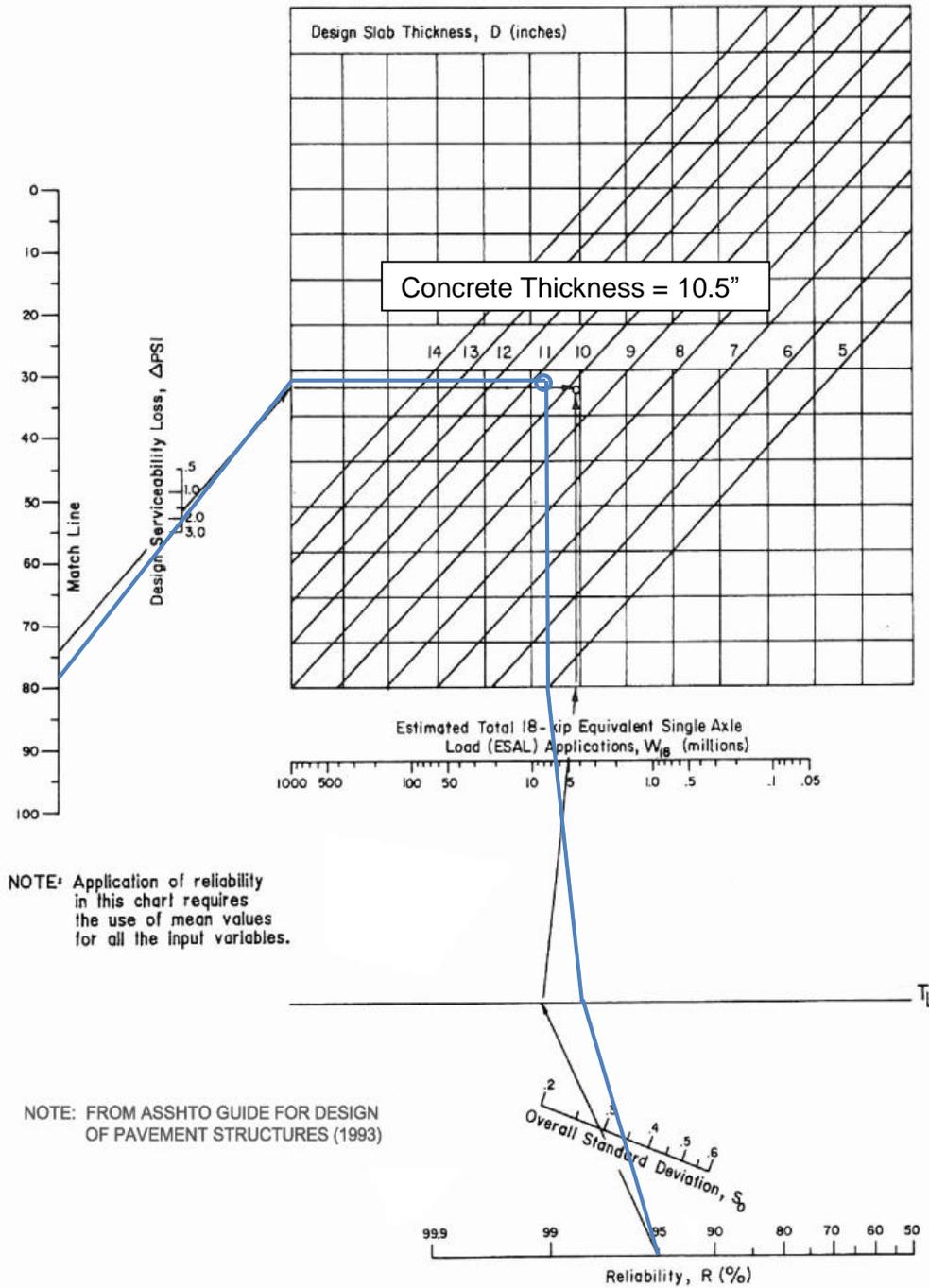
### Design chart for rigid pavements

R-VALUE = 20



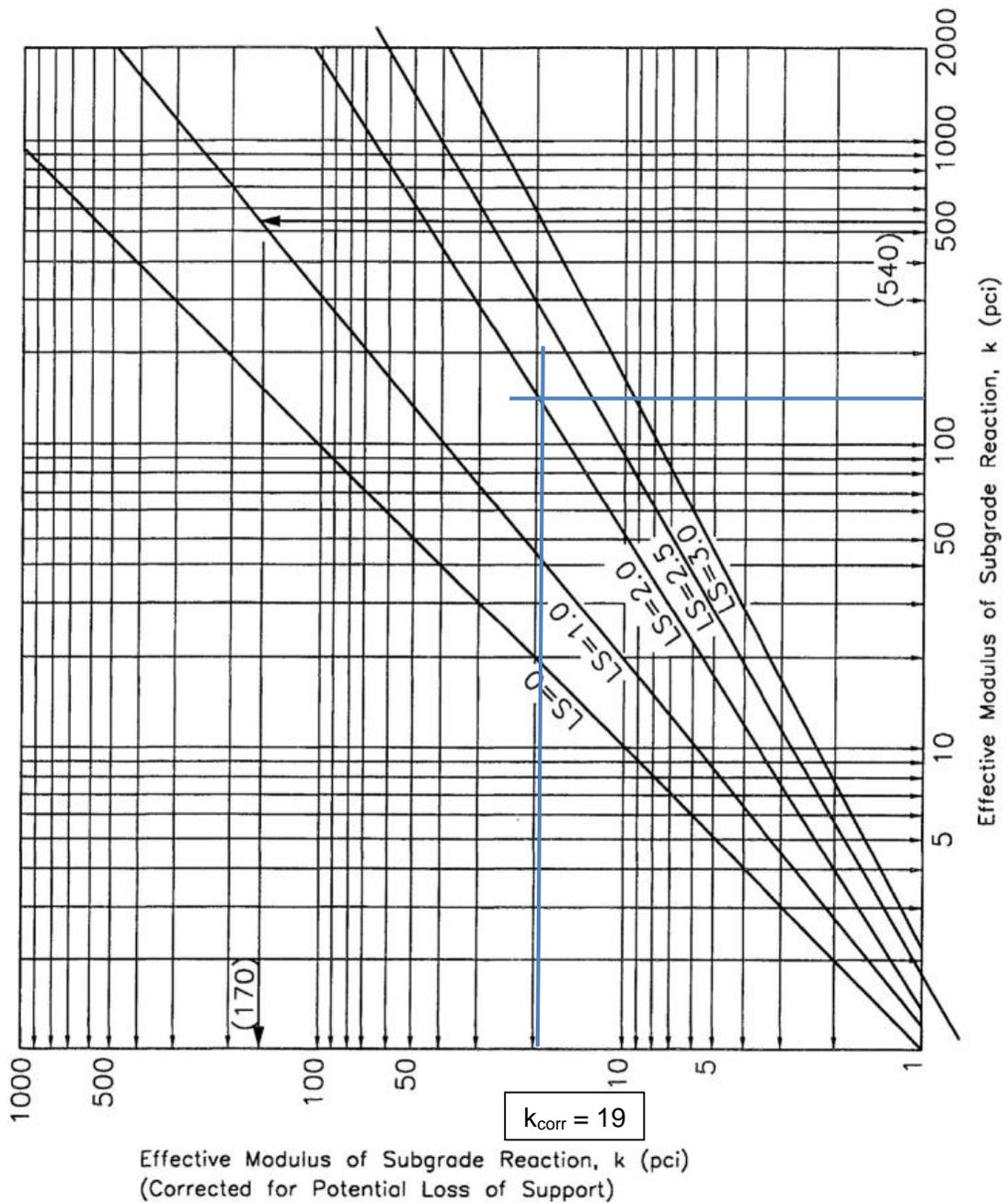
### Design chart for rigid pavements (Cont.)

R-VALUE = 20



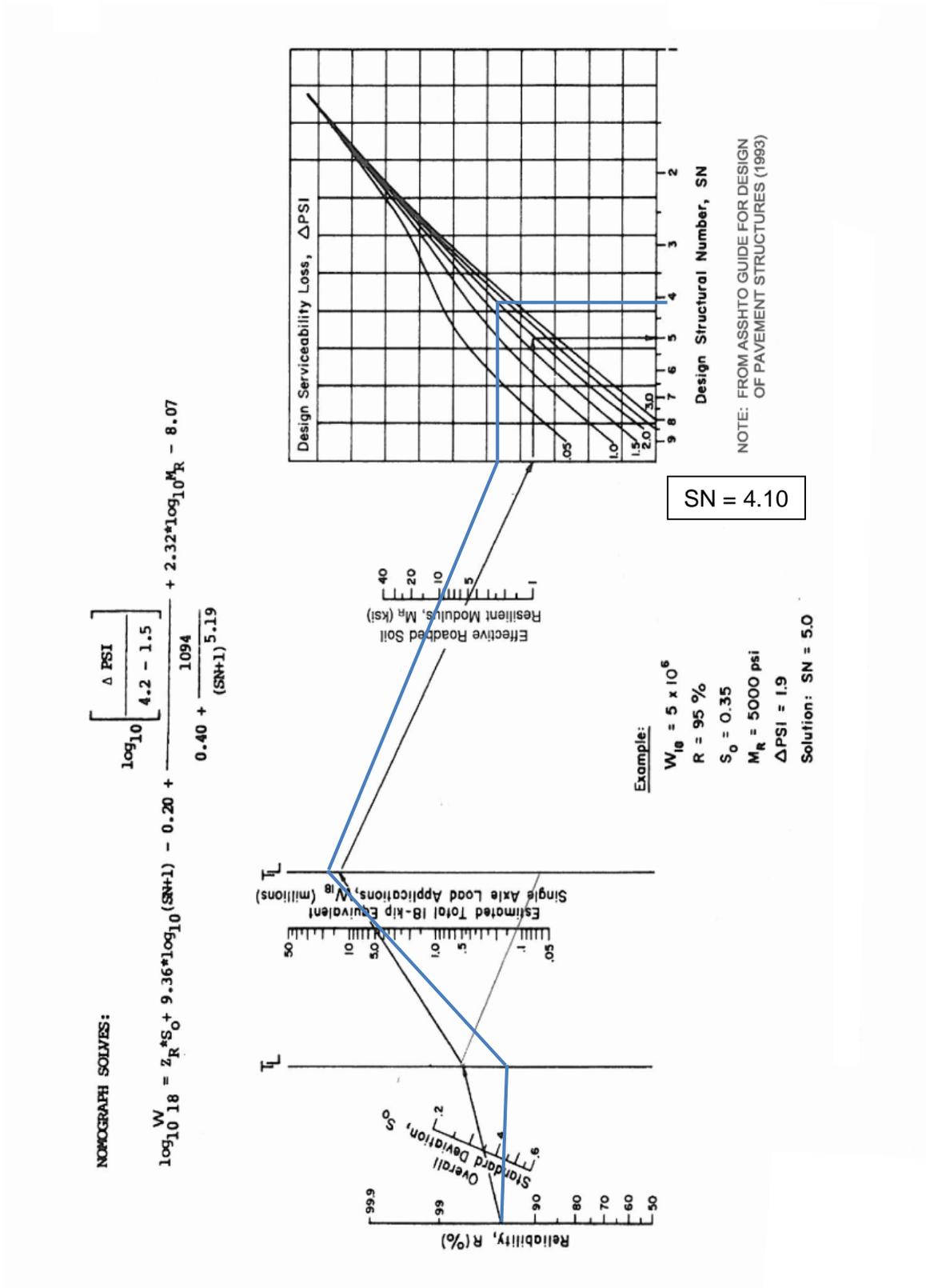
# CORRECTION OF EFFECTIVE MODULUS OF SUBGRADE REACTION FOR LOSS OF SUPPORT

R-VALUE = 20

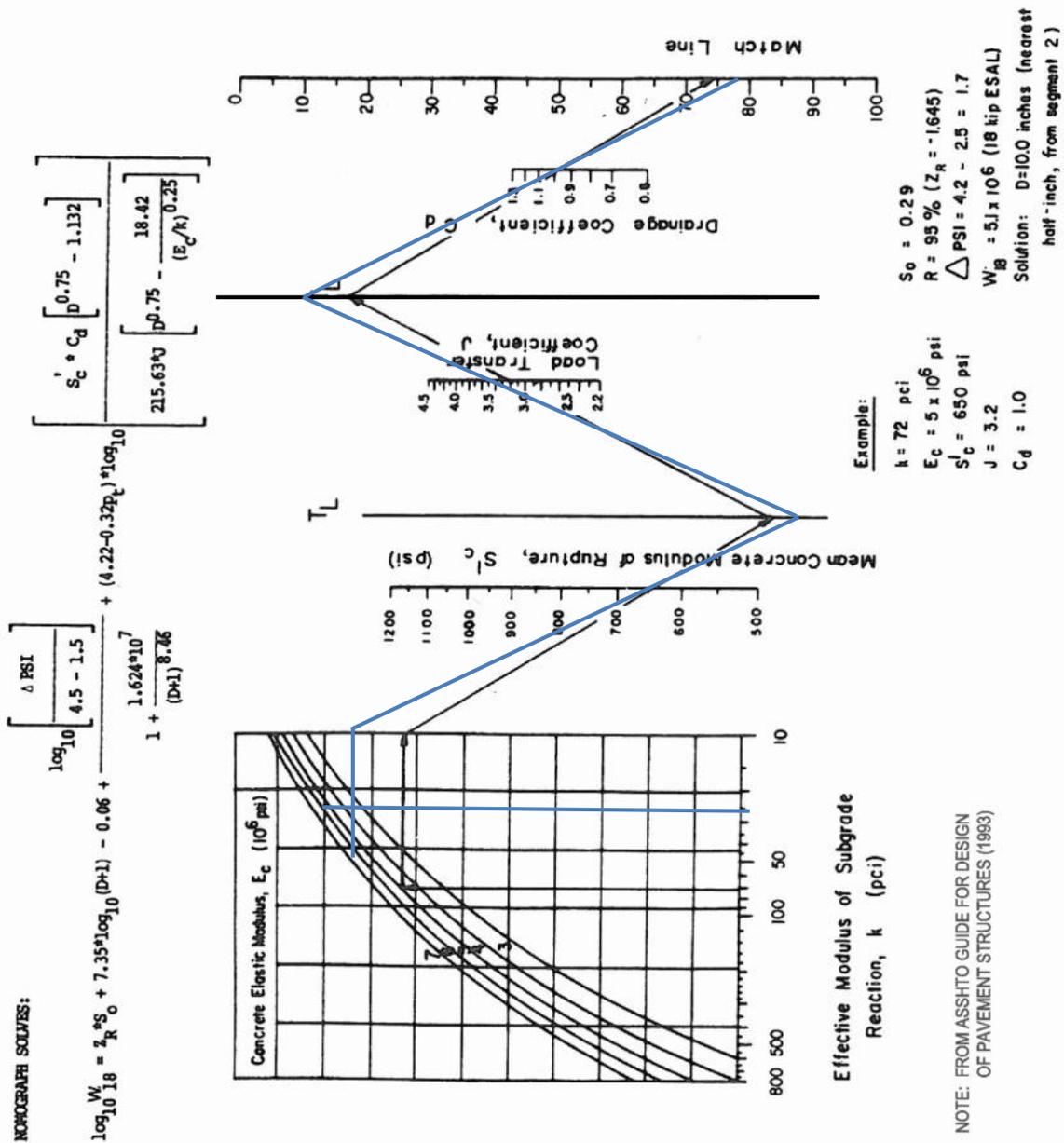


## Design chart for flexible pavements

R-value = 40

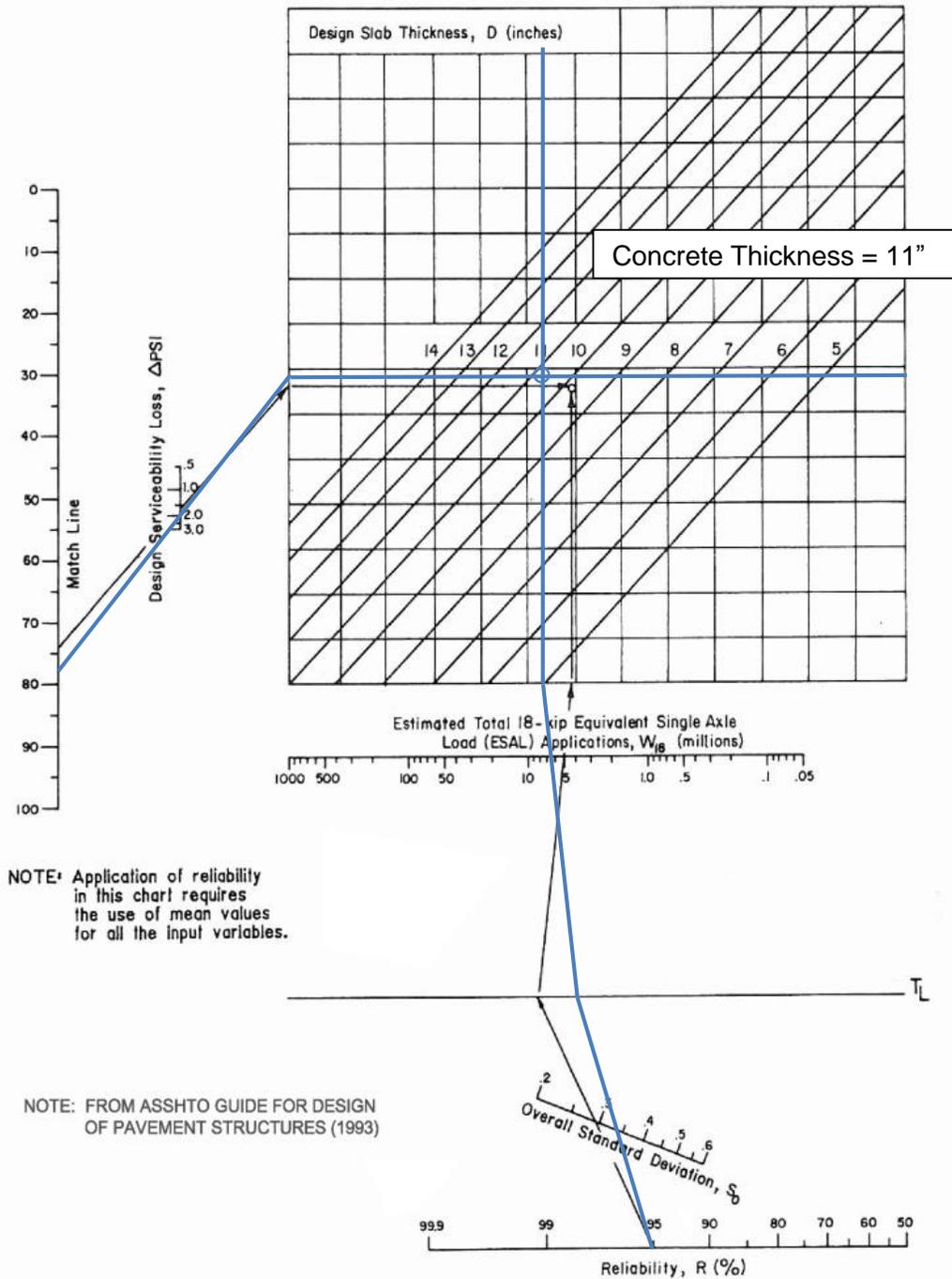


Design chart for rigid pavements  
 R-value = 40

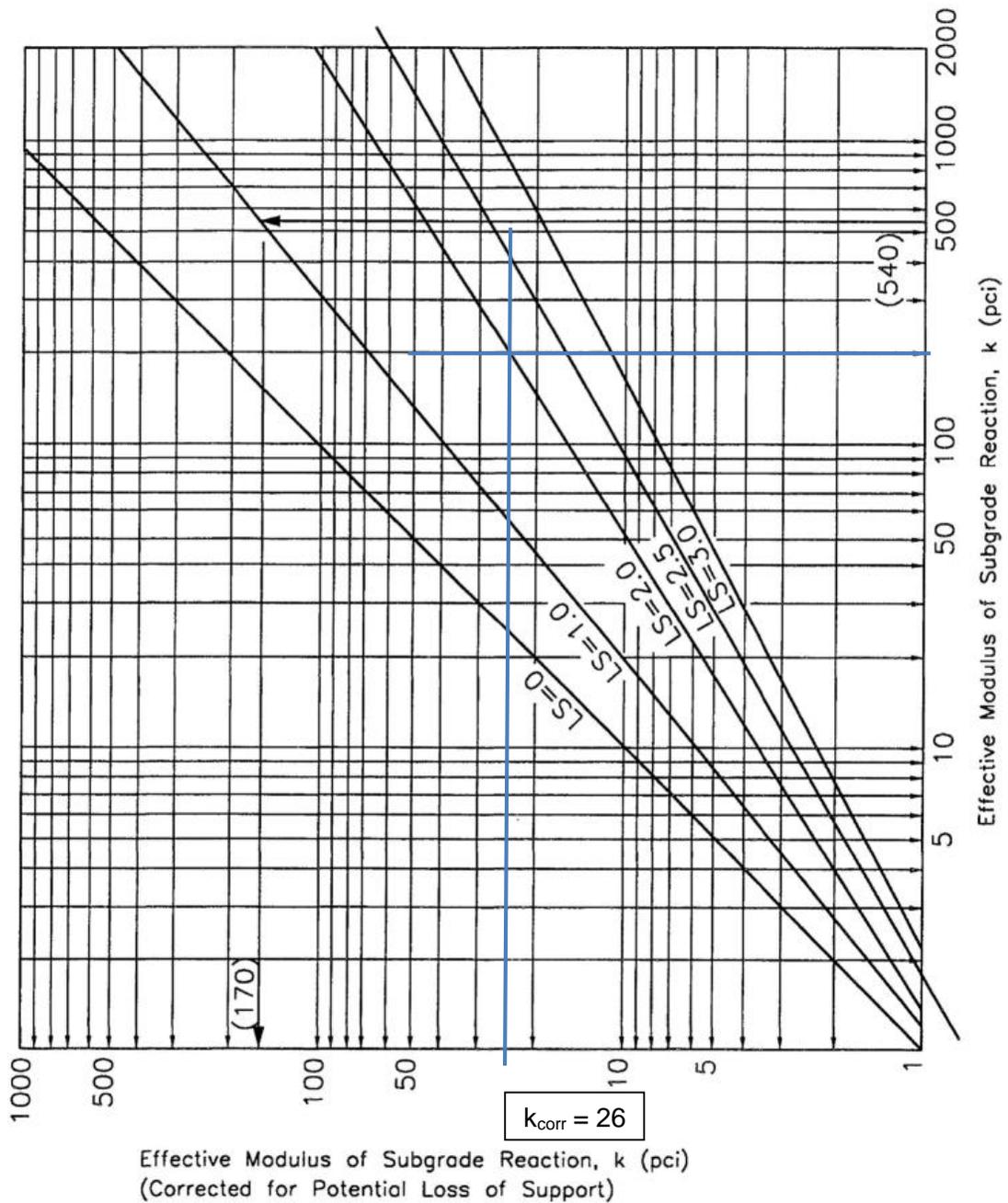


### Design chart for rigid pavements (Cont.)

R-value = 40



## CORRECTION OF EFFECTIVE MODULUS OF SUBGRADE REACTION FOR LOSS OF SUPPORT



**APPENDIX E**  
**PCI SURVEY SUMMARY**

## Asphalt Pavement Condition Summary - Northbound Lanes

### Sum of Low, Medium, and High Deduct Values

<u>Distress Type</u>	Approx. STA 16+30 to 69+70	Approx. STA 69+70 to Garden of the Gods Rd	W Fillmore St to Approx. STA 16+30
Alligator Cracking			
Block Cracking			
Depression	4.4		
Long & Tran Cracking	30.0	23.9	13.3
Patching	11.1	10.7	
Potholes	11.3		
Rutting			
Weathering/Raveling	14.3	14.4	14.6
<b>Total Deduction =</b>	71	49	28
<b>Weighted Deduction =</b>	39	31	22
<b>PCI =</b>	61	69	78
<b>Rating</b>	Fair	Fair	Satisfactory

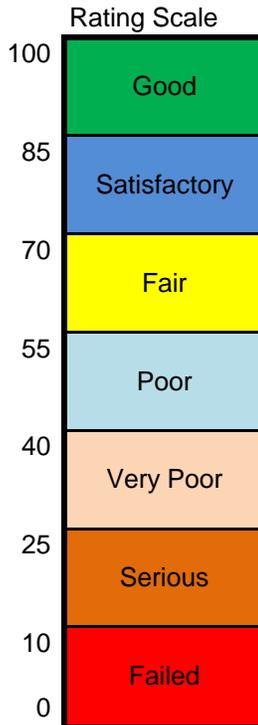
**Primary Cause(s) of Distress**

--	--	--

**Remedial Options**

Short  
Long

--	--	--



**Causes of Distress**

- A. Age
- B. Subgrade Issues
- C. Pavement Thickness
- D. Drainage
- E. Excessive Loads

**Remedial Option Alternatives**

- 1. Clean and Seal Cracks
- 2. Fog Seal
- 3. Shallow AC patch
- 4. Full depth AC patch
- 5. Mill and overlay
- 6. Pulverize and overlay
- 7. Overlay
- 8. Remove and replace AC

## Asphalt Pavement Condition Summary - Southbound Lanes

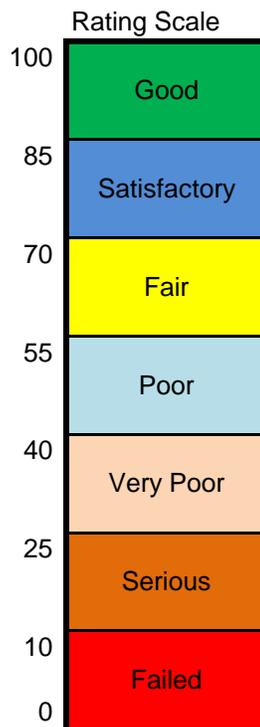
### Sum of Low, Medium, and High Deduct Values

<u>Distress Type</u>	Approx. STA 16+30 to 69+70	Approx. STA 69+70 to Garden of the Gods Rd	W Fillmore St to Approx. STA 16+30
Alligator Cracking			
Block Cracking		3.5	
Depression	4.4		
Long & Tran Cracking	25.9	25.8	23.7
Patching	34.0	9.9	5.0
Potholes	20.0		3.0
Rutting			
Weathering/Raveling	14.1	14.4	14.5
<b>Total Deduction =</b>	98	54	46
<b>Weighted Deduction =</b>	38	32	28
<b>PCI =</b>	62	68	72
<b>Rating</b>	Fair	Fair	Satisfactory

**Primary Cause(s) of Distress**

**Remedial Options**

Short  
Long



**Causes of Distress**

- A. Age
- B. Subgrade Issues
- C. Pavement Thickness
- D. Drainage
- E. Excessive Loads

**Remedial Option Alternatives**

- 1. Clean and Seal Cracks
- 2. Fog Seal
- 3. Shallow AC patch
- 4. Full depth AC patch
- 5. Mill and overlay
- 6. Pulverize and overlay
- 7. Overlay
- 8. Remove and replace AC

Project Mngr. RWF	Project No. 23155014	 Consulting Engineers and Scientists  <small>4172 Center Park Dr. Colorado Springs, CO 80916 (719) 597-2116 F(719) 597-2117</small>	PCI Survey Summary	EXHIBIT
Drawn By:	Scale As Shown		Centennial Boulevard Reconstruction	E-3
Checked By:	File No.		West Fillmore St to Garden of the Gods Rd	
Approved By:	Date: 5/6-7/15		Colorado Springs, Colorado	

**APPENDIX F**  
**FALLING WEIGHT DEFLECTOMETER RESULTS**



September 17, 2015  
Revised: October 8, 2015

Mr. Ryan Feist, P.E.  
Terracon Consultants, Inc.  
4172 Center Park Drive  
Colorado Springs, CO 80916

Subject: Nondestructive Deflection Testing Results and Pavement Structural Evaluation,  
Centennial Boulevard from Garden of the Gods Road to Fillmore Street, Colorado  
Springs, Colorado

Project No. 15-1-459

Dear Mr. Feist:

This letter presents the results of a nondestructive, falling weight deflectometer (FWD) deflection testing program and pavement structural evaluation program performed for approximately 1.5 centerline miles of Centennial Boulevard from Garden of the Gods Road to Fillmore Street in Colorado Springs, Colorado.

Existing Site/Pavement Conditions: The alignment of Centennial Boulevard within the limits of the testing consisted of two travel lanes in each direction. The existing pavement section types and thicknesses for the project segment were provided by Terracon Consulting, Inc. (Terracon) and were used in the data analysis. The pavement section type and thickness was based on cores taken throughout the pavement sections at various locations. The pavement sections varied considerably. In general, the cores encountered a flexible pavement section consisting of full-depth hot mix asphalt (HMA) or a composite section consisting of HMA over a base course made up of aggregate base (ABC). Thicknesses of full depth HMA encountered varied from approximately 4.0 to 9.0 inches. Thicknesses of composite sections ranged from 2.0 inches of HMA over 6.0 inches of ABC to 9.0 inches of HMA over 16.0 inches of ABC.

Field Testing: The FWD is an impulse-loading device that generates a force by dropping a pre-determined load on a set of springs. The force is then transmitted to the pavement surface through a 12-inch diameter rigid plate. The force applied to the pavement surface measures the elastic response of the pavement layers and underlying subgrade material, as measured through a set of 7 deflection sensors placed at various offsets from the load source. The deflection sensors used in this study were placed at offsets from the load source at distances of 0, 8, 12, 18, 24, 36 and 60 inches.

The FWD tests were taken at approximate 200-foot intervals within the travel lanes with a 100-foot staggered pattern between adjacent lanes.

Analysis and Results: The structural characteristics of the pavement section and underlying subgrade were determined from the AASHTOWare DARWin™ computer software program.

In analyzing flexible pavements, the FWD tests can be evaluated where the combined stiffness influence of the various pavement layer moduli represents the overall structural capacity of the pavement. The structural capacity obtained from this procedure is generally a function of the maximum deflection determined at the load center as well as the subgrade resilient modulus. The maximum measured deflection obtained at the load center is used to predict the effective pavement modulus of the pavement layers. The effective pavement modulus of the pavement layers and the known pavement thickness were correlated to an overall existing structural number of the pavement section at each test location. The existing structural numbers are a function of the pavement modulus, and the existing pavement thickness assumed at each test location.

In general, the deflection sensors located at a greater distance from the load source are used to determine the subgrade resilient modulus. When the deflection basin is measured using the FWD, the outer readings of the deflection basin under the imposed load represent the in-situ resilient modulus of the subgrade soil. The subgrade resilient modulus is the value that represents the pavement support condition.

The remaining service life of the roadway was determined by back-calculating the remaining ESALs with respect to the intended 20-year design life of the pavement. The existing structural numbers and resilient modulus values obtained from the FWD testing were used to back-calculate the remaining ESALs. A reliability of 85%, and design input values for initial (existing) and terminal serviceabilities of 3.8 psi and 2.5 psi, respectively were used in the ESAL back-calculation analysis.

The design subgrade resilient modulus, effective pavement modulus, correlating existing structural numbers, remaining ESALs of the roadway segments determined at each of the FWD test locations, and approximate existing asphalt pavement coefficients are provided in the attached Table.

Limitations: This study has been conducted in accordance with generally accepted pavement engineering practices in this area. The results and conclusions provided in this report are based upon the data obtained from the FWD tests taken at the approximate locations summarized in the attached Table, and the asphalt pavement section thicknesses provided by Terracon. Kumar & Associates, Inc. is not responsible for liability associated with interpretation of the data by others.

Sincerely,  
KUMAR & ASSOCIATES, INC.

Reviewed By:

James A. Noll, P.E.

By: \_\_\_\_\_  


Luke Wagner, Staff Engineer

LJW/as  
Attachments  
cc: File, book



TABLE 1

CENTENNIAL BOULEVARD  
FALLING WEIGHT DEFLECTOMETER RESULTS

Lane	Station	Design Resilient Modulus (psi)	Pavement Modulus (psi)	Existing SN	Approx. Remaining Life (ESAL)	Pavement Section Used (Inches HMA/Inches Base)	Existing Asphalt Pavement Coefficient
Northbound OL	0+00	6,127	104,222	4.55	2,817,449	7.5/14	0.42
Northbound OL	2+00	6,930	82,190	4.21	2,356,309	7.5/14	0.37
Northbound OL	4+00	6,069	110,386	5.40	8,386,530	9/16	0.42
Northbound OL	6+00	6,970	588,638	2.36	96,858	6.25	0.38
Northbound OL	8+00	7,033	959,107	3.55	936,568	8	0.44
Northbound OL	10+00	8,929	676,448	3.16	866,616	8	0.40
Northbound OL	12+00	8,978	469,189	2.27	139,800	6.5	0.35
Northbound OL	14+00	9,072	1,147,125	3.77	2,352,313	8	0.47
Northbound OL	16+00	8,338	985,437	3.58	1,455,414	8	0.45
Northbound OL	18+00	4,907	695,019	2.59	72,402	6.5	0.40
Northbound OL	20+00	8,869	337,562	2.51	239,767	8	0.31
Northbound OL	22+00	8,800	354,933	2.55	257,296	8	0.32
Northbound OL	24+00	8,849	336,310	1.96	58,686	6.25	0.31
Northbound OL	26+00	8,800	293,333	2.69	346,662	9	0.30
Northbound OL	28+00	5,307	446,824	3.10	233,575	9	0.34
Northbound OL	30+00	4,754	552,461	2.58	65,832	7	0.37
Northbound OL	32+00	4,714	542,675	2.57	63,167	7	0.37
Northbound OL	34+00	5,065	504,148	1.88	12,704	5.25	0.36
Northbound OL	36+00	6,189	794,319	1.67	6,189	4	0.42
Northbound OL	38+00	6,153	625,548	1.54	6,590	4	0.38
Northbound OL	40+00	4,387	517,198	2.17	20,549	6	0.36
Northbound OL	42+00	5,483	447,341	2.06	25,644	6	0.34
Northbound OL	44+00	5,825	357,062	1.92	19,792	6	0.32
Northbound OL	46+00	3,967	108,182	3.11	121,006	8.5/6	0.30
Northbound OL	48+00	2,502	107,497	3.10	40,813	8.5/6	0.29
Northbound OL	50+00	5,202	170,690	3.00	186,549	6/6	0.40
Northbound OL	52+00	3,955	82,003	2.44	31,404	3.5/9	0.44
Northbound OL	54+00	5,549	374,052	2.76	137,118	8.5	0.32
Northbound OL	56+00	5,215	73,137	2.16	29,893	3.5/8	0.39
Northbound OL	58+00	7,934	92,340	2.34	124,662	3.5/8	0.44
Northbound OL	60+00	6,254	90,084	2.62	135,539	5/8	0.36
Northbound OL	62+00	6,622	122,275	2.90	271,321	5/8	0.42
Northbound OL	64+00	5,266	114,090	3.06	213,773	6/8	0.38
Northbound OL	68+00	7,572	113,332	4.14	2,625,381	7/12	0.42
Northbound OL	70+00	5,632	75,547	2.95	204,627	5.5/10	0.35
<b>Average Lane Values</b>		<b>6,349</b>	<b>384,306</b>	<b>2.83</b>	<b>713,109</b>		<b>0.38</b>
<b>Standard Deviation</b>		<b>1,699</b>	<b>290,431</b>	<b>0.83</b>	<b>1,538,191</b>		<b>0.05</b>
Northbound IL	3+00	5,656	97,329	5.17	5,302,937	9/16	0.40
Northbound IL	5+00	6,890	527,529	2.27	75,648	6.25	0.36
Northbound IL	7+00	5,522	355,279	1.99	21,421	6.25	0.32
Northbound IL	9+00	6,873	520,697	2.90	295,780	8	0.36
Northbound IL	11+00	7,237	688,621	2.58	174,517	6.5	0.40
Northbound IL	13+00	7,660	673,152	3.16	607,260	8	0.39
Northbound IL	15+00	7,966	168,985	1.99	50,124	8	0.25
Northbound IL	17+00	6,931	497,133	2.32	86,785	6.5	0.36
Northbound IL	19+00	4,553	645,202	2.53	53,372	6.5	0.39
Northbound IL	21+00	5,790	372,084	2.59	106,284	8	0.32
Northbound IL	23+00	8,580	456,000	2.16	94,893	6.25	0.35

OL-Outside Lane

IL-Inside Lane

\* STA 0+00 is approximately 300 feet north of the intersection of Centennial Blvd and Fillmore St

TABLE 1

CENTENNIAL BOULEVARD  
FALLING WEIGHT DEFLECTOMETER RESULTS

Lane	Station	Design Resilient Modulus (psi)	Pavement Modulus (psi)	Existing SN	Approx. Remaining Life (ESAL)	Pavement Section Used (Inches HMA/Inches Base)	Existing Asphalt Pavement Coefficient
Northbound IL	25+00	5,219	660,440	3.53	454,569	9	0.39
Northbound IL	27+00	5,790	438,722	3.08	276,004	9	0.34
Northbound IL	29+00	4,135	365,406	2.90	90,994	9	0.32
Northbound IL	31+00	4,466	330,281	2.18	21,985	7	0.31
Northbound IL	33+00	4,091	522,654	1.90	8,217	5.25	0.36
Northbound IL	35+00	3,499	411,865	1.34	848	4	0.33
Northbound IL	37+00	3,211	341,173	1.26	506	4	0.31
Northbound IL	39+00	4,798	337,644	1.25	1,234	4	0.31
Northbound IL	41+00	4,919	447,801	2.07	20,492	6	0.34
Northbound IL	43+00	4,917	343,778	1.89	12,220	6	0.32
Northbound IL	45+00	3,193	225,518	1.64	2,030	6	0.27
Northbound IL	47+00	2,804	145,987	3.44	93,464	8.5/6	0.33
Northbound IL	49+00	3,713	191,360	3.11	103,785	6/6	0.42
Northbound IL	51+00	3,174	71,670	2.34	14,881	3.5/9	0.41
Northbound IL	53+00	4,164	416,390	2.86	85,695	8.5	0.34
Northbound IL	55+00	4,657	480,208	3.00	144,306	8.5	0.35
Northbound IL	57+00	5,579	75,139	2.18	36,840	3.5/8	0.40
Northbound IL	59+00	5,373	31,646	1.85	13,305	5/8	0.21
Northbound IL	61+00	6,887	81,277	2.53	139,410	5/8	0.35
Northbound IL	63+00	6,294	91,781	2.64	143,515	5/8	0.37
Northbound IL	65+00	5,833	68,806	2.58	105,811	6/8	0.30
Northbound IL	69+00	6,227	51,363	3.18	388,641	7/12	0.28
Northbound IL	71+00	5,388	68,330	2.85	152,842	5.5/10	0.34
<b>Average Lane Values</b>		<b>5,353</b>	<b>329,449</b>	<b>2.51</b>	<b>270,018</b>		<b>0.34</b>
<b>Standard Deviation</b>		<b>1,453</b>	<b>201,127</b>	<b>0.75</b>	<b>886,758</b>		<b>0.05</b>
Southbound OL	9+00	6,026	93,309	4.08	1,420,934	8/12	0.36
Southbound OL	11+00	10,967	82,637	3.33	1,854,688	7/10	0.33
Southbound OL	15+00	8,480	91,640	4.46	5,302,377	8/14	0.38
Southbound OL	17+00	7,475	57,521	3.13	544,836	7/11	0.29
Southbound OL	19+00	4,039	76,626	3.25	160,184	7/10	0.32
Southbound OL	21+00	6,381	66,372	3.37	563,260	6.5/12	0.33
Southbound OL	23+00	6,333	66,528	3.37	553,479	6.5/12	0.33
Southbound OL	25+00	7,720	74,273	3.69	1,436,996	6.5/13	0.37
Southbound OL	27+00	3,747	68,781	3.78	306,866	8.5/12	0.30
Southbound OL	29+00	3,484	103,299	2.96	68,404	6/8	0.36
Southbound OL	31+00	4,045	64,957	2.17	17,022	4/8	0.34
Southbound OL	33+00	3,650	71,553	2.24	16,064	4/8	0.36
Southbound OL	35+00	2,591	55,702	2.58	16,103	7/8	0.25
Southbound OL	37+00	4,675	106,675	2.13	21,423	4/6	0.38
Southbound OL	39+00	4,459	80,381	1.94	11,291	4/6	0.34
Southbound OL	41+00	3,550	77,079	1.92	6,274	4/6	0.33
Southbound OL	43+00	5,239	66,076	2.00	19,507	5/6	0.28
Southbound OL	45+00	6,011	348,018	2.22	48,568	7	0.32
Southbound OL	47+00	5,775	242,500	1.96	21,804	7	0.28
Southbound OL	49+00	5,065	387,274	2.30	39,912	7	0.33
Southbound OL	51+00	4,328	158,560	1.58	3,350	6.5	0.24
Southbound OL	53+00	3,722	439,828	2.22	15,973	6.5	0.34
Southbound OL	55+00	2,889	52,896	1.35	565	2/6	0.38

OL-Outside Lane                      IL-Inside Lane

\* STA 0+00 is approximately 300 feet north of the intersection of Centennial Blvd and Fillmore St

TABLE 1

CENTENNIAL BOULEVARD  
FALLING WEIGHT DEFLECTOMETER RESULTS

Lane	Station	Design Resilient Modulus (psi)	Pavement Modulus (psi)	Existing SN	Approx. Remaining Life (ESAL)	Pavement Section Used (Inches HMA/Inches Base)	Existing Asphalt Pavement Coefficient
Southbound OL	57+00	2,590	81,994	1.95	3,296	4/6	0.34
Southbound OL	59+00	4,036	97,921	2.07	12,949	4/6	0.37
Southbound OL	61+00	7,367	35,567	2.96	388,662	4/16	0.34
Southbound OL	63+00	8,947	399,543	1.66	23,703	5	0.33
Southbound OL	65+00	9,499	278,363	1.91	59,757	6.5	0.29
Southbound OL	67+00	8,275	66,260	2.73	326,194	5/10	0.35
Southbound OL	71+00	8,083	71,888	3.27	828,063	5.5/12	0.38
<b>Average Lane Values</b>		<b>5,648</b>	<b>132,134</b>	<b>2.62</b>	<b>469,750.13</b>		<b>0.33</b>
<b>Standard Deviation</b>		<b>2,205</b>	<b>114,778</b>	<b>0.79</b>	<b>1,016,825.85</b>		<b>0.04</b>
Southbound IL	2+00	8,288	297,878	2.25	110,437	7.5	0.30
Southbound IL	4+00	5,883	236,144	2.29	55,108	8.25	0.28
Southbound IL	6+00	6,998	79,962	3.68	1,127,297	7/12	0.35
Southbound IL	8+00	9,588	93,802	4.09	4,232,713	8/12	0.36
Southbound IL	10+00	12,521	76,523	3.25	2,210,983	7/10	0.32
Southbound IL	12+00	8,395	97,737	4.56	5,929,515	8/14	0.40
Southbound IL	14+00	10,219	89,928	4.44	7,954,741	8/14	0.38
Southbound IL	16+00	5,808	93,808	3.68	731,544	7/11	0.37
Southbound IL	18+00	5,808	105,600	3.62	668,436	7/10	0.37
Southbound IL	20+00	5,626	85,195	3.66	659,409	6.5/12	0.38
Southbound IL	22+00	9,333	79,738	3.58	1,890,481	6.5/12	0.37
Southbound IL	24+00	10,492	84,000	3.84	3,651,222	6.5/13	0.39
Southbound IL	26+00	4,679	67,516	3.76	498,873	8.5/12	0.30
Southbound IL	28+00	5,415	63,143	2.51	76,325	6/8	0.28
Southbound IL	30+00	3,669	53,325	2.03	9,290	4/8	0.31
Southbound IL	32+00	3,159	61,448	2.66	30,241	7/8	0.27
Southbound IL	34+00	2,621	37,719	1.51	818	4/6	0.23
Southbound IL	36+00	2,957	85,216	1.98	4,888	4/6	0.35
Southbound IL	38+00	3,379	96,342	2.06	8,342	4/6	0.37
Southbound IL	40+00	4,213	88,099	2.20	20,226	5/6	0.32
Southbound IL	42+00	3,234	121,439	2.45	20,147	5/6	0.37
Southbound IL	44+00	3,259	93,874	2.25	12,667	5/6	0.33
Southbound IL	46+00	3,567	198,000	1.84	4,989	7	0.26
Southbound IL	48+00	6,574	278,901	2.06	39,069	7	0.29
Southbound IL	50+00	6,240	267,203	1.88	20,613	6.5	0.29
Southbound IL	52+00	4,755	446,648	2.24	29,670	6.5	0.34
Southbound IL	54+00	2,405	44,017	1.27	270	2/6	0.34
Southbound IL	56+00	4,054	110,253	2.16	16,666	4/6	0.39
Southbound IL	58+00	4,311	65,404	1.81	7,058	4/6	0.30
Southbound IL	60+00	4,204	67,901	0.92	211	5	0.18
Southbound IL	62+00	4,817	322,151	1.54	3,735	5	0.31
Southbound IL	64+00	4,463	73,972	2.83	94,983	5/10	0.37
Southbound IL	68+00	6,657	66,855	3.20	469,448	5.5/12	0.36
Southbound IL	70+00	5,874	89,974	3.02	256,409	5/10	0.40
<b>Average Lane Values</b>		<b>5,690</b>	<b>124,109</b>	<b>2.68</b>	<b>907,260</b>		<b>0.33</b>
<b>Standard Deviation</b>		<b>2,484</b>	<b>93,500</b>	<b>0.93</b>	<b>1,826,428</b>		<b>0.05</b>

OL-Outside Lane

IL-Inside Lane

\* STA 0+00 is approximately 300 feet north of the intersection of Centennial Blvd and Fillmore St