



ARIZONA DEPARTMENT OF TRANSPORTATION

AVENUE B, COUNTY 18TH ST – SR 195

GEOTECHNICAL INVESTIGATION
YUMA COUNTY, ARIZONA

2026-07-14

PROJECT NO.: US-WSP-30902210.8950

TRACS NO.: 0000 YU YYU T0439 01C / Federal ID: YYU-0(221)T





AVENUE B, COUNTY 18TH ST - SR 195

YUMA COUNTY, ARIZONA

**ARIZONA DEPARTMENT OF TRANSPORTATION
PROJECT MANAGEMENT GROUP**

GEOTECHNICAL/PAVEMENT DESIGN

FINAL

**PROJECT NO.: US-WSP-30902210.8950
DATE: MAY 2026**

WSP.COM



July 14, 2026

Ms. Brenda Contreras
ARIZONA DEPARTMENT OF TRANSPORTATION
Project Management Group
205 South 17th Avenue, Mail Drop 614E
Phoenix, Arizona 85007

Subject: Arizona Department of Transportation / Project Management Group
Avenue B, County 18th St – SR 195
Yuma County, Arizona

WSP ref.: US-WSP-30902210.8950 / ADOT: T0439 01C / Fed ID: YYU-0(221)T

Dear Ms. Contreras:

WSP USA Inc. (WSP) has completed a Geotechnical/Pavement Design for the proposed improvements to Avenue B between County 18th Street to SR 195 located in Yuma County, Arizona. The project includes shoulder widening and edge line rumble strips for 5 miles along Avenue B. This work was performed in general accordance with the Contract No.: ADOT 2022-006.18, Modification 14, Task Order No. 10, dated January 30, 2024. The results of our investigation, along with the project vicinity map, boring location plan, laboratory test results, and recommendations are provided herein.

This report has been prepared for the development of the project described and is for the sole use of the Arizona Department of Transportation.

We are committed to providing quality engineering services combined with client satisfaction in order to achieve a continuing relationship with our clients. We appreciate the opportunity to provide these services for you. If you have any questions regarding any of the other engineering and testing services WSP provides, please do not hesitate to contact us.

Kind regards,

Cody Hatch, PE
Geotechnical Engineer

Mark Hartig, PE
Senior Geotechnical Engineer

WSP USA Inc.
1230 West Washington Street, Suite 405
Tempe, Arizona 85288

T: +1 480-966-8295
wsp.com





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1 INTRODUCTION

This report presents the results of our Geotechnical/Pavement Design performed in support of the proposed improvement project of Avenue B between County 18th Street to SR 195 located in Yuma County, Arizona. The project includes shoulder widening and ground-in edge line/centerline rumble strips for 5 miles along Avenue B. This work was performed in general accordance with the Contract No.: ADOT 2022-006.18, Modification 14, Task Order No. 10, dated January 30, 2024. The results of our investigation, along with vicinity map, the boring location plan, laboratory test results, and recommendations developed for the project are presented herein.

1.1 SCOPE OF SERVICES

Our Scope of Work (SOW) dated December 11, 2023, as described and detailed in the Contract No.: ADOT 2022-006.18, Task Order No. 10, includes a geotechnical investigation and pavement design and consists of the following topics:

- Review available information: review available as-built plans to develop an understanding of the existing pavement section thickness and age along the planned segment. Examine geologic maps to obtain an understanding of regional and site geology.
- Prepare for the field investigation: develop a site-specific Health and Safety Plan to guide the field efforts, mark the boring locations at the site, submit a ticket to AZ 811, request of an ADOT or Yuma County encroachment permit and traffic control in general conformance with the *Manual on Uniform Traffic Control Devices* (MUTCD).
- Field investigation: conduct a geotechnical investigation to evaluate subgrade conditions along Avenue B. Include subsurface exploration with borings to assess subsurface conditions and collect representative samples for laboratory testing to determine pertinent engineering qualities and properties of the subgrade and foundation soils.
- Soil laboratory testing: assign laboratory testing on subgrade soil samples. Perform tests for soil characterization (moisture content, United Soil Classification System (USCS) & AASHTO classification, and Atterberg limits) and material suitability for general earthwork, materials, and pavements, as needed.
- Analysis, pavement evaluation and recommendations report: perform engineering analysis of the field and laboratory test results with respect to the planned shoulder widening. Prepare a geotechnical/pavement design (shoulder) report presenting the investigation results and associated pavement engineering recommendations considering traffic data provided by ADOT (or Yuma County), pavement thickness design based on ADOT and/or Yuma County Design Criteria, Equivalent Single Axle Loads (ESALs) for the design life of the pavement, effective soil resilient modulus (M_R), pavement and/or aggregate surface structural design and material recommendations.

The scope of the exploration and engineering analysis for this evaluation, as well as the conclusions and recommendations in this report, are based on our understanding of the project as described herein. If pertinent details of the project have changed or otherwise differ from our descriptions, we should be notified and engaged to review the changes and modify our recommendations, as necessary.

2 PROJECT INFORMATION

2.1 PROJECT DETAILS

WSP understands this project is a Local Public Agency (Yuma County) project that includes shoulder widening and ground-in edge line rumble strips for 5 miles along Avenue B between County 18th Street (North) and County SR 195 (South). The project is located within Yuma County in the Arizona Department of Transportation (ADOT) Southwest District. ADOT will be administering this Federal Highway Administration (FHWA) funded project. In addition to the geotechnical investigation and pavement design, WSP's contract includes work from multiple disciplines including environmental studies with a Categorical Exclusion (CE) to define the limits of mitigation, survey, roadway design, and traffic engineering design.

Project improvements include:

- Widening shoulders to 5-feet width on both sides of Avenue B
- Installing ground-in edge line rumble strips in both directions
- Installing ground-in centerline rumble strips
- Installing pavement markings

This report only addresses the geotechnical/pavement design for the project.

2.2 SITE CONDITIONS

The South Avenue B from the SR 195, south end, to the West County 18th Street, north end, consists of a two (2) paved lanes, one in each direction, with limited paved (maximum width of 3-ft) or dirt shoulders. Near the intersection with County 18th Street, County 19th Street, and SR 195, the road was recently widened and repaved to allow right and left turns. A Bureau of Reclamation pressurized water pipeline is present on the east side of the road. Overhead powerlines are also present on the east side of the ROW, starting approximately 600-feet North of SR 195. Most of the adjacent properties are dedicated for agriculture except near the intersection of cross-streets where commercial properties are located. A few rural residential properties and ranches are found along the segment. There is a slight alignment change about halfway between County 23rd and County 21st Streets.

The existing pavement is severely damaged (longitudinal and transversal cracks, sealed or unsealed) and the indicated maximum speed is 50 mph.

3 FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD PREPARATION

A site Health and Safety Plan was developed for the field investigation. The Plan identified and discussed methods of minimizing hazards associated with working within the existing roadway and around the drill rigs. Prior to performing the field investigation, WSP staked the boring locations in the field and contacted Arizona 811 to locate and mark underground utilities near the boring locations.

An encroachment permit was obtained from Yuma County Department of Engineering (permit #EP25-0010, dated January 9, 2025) to perform the field exploration including the drilling operations and traffic control.

3.2 FIELD EXPLORATION

The subsurface exploration was performed on January 13 and 14, 2025. Eighteen (18) borings (identified B-B01 to B-B18) were drilled along Avenue B. All borings were drilled on the west side of the road due to the Bureau of Reclamation water pipeline present on the east side of the road. Considering the anticipated subgrade conditions within the Avenue B profile, the borings were performed at a reduced investigation spacing of about 1,500 feet. Each borehole was staked along the edge of existing pavement and dirt shoulder and drilled to a maximum sampling depth of 6.5 feet. However, the presence of underground utilities (including a water pipeline) was identified by AZ 811 and some borings had to be located more than 5 feet away from the edge of existing pavement and dirt shoulder.

The work was performed in accordance with Yuma County Encroachment Permit No. EP2025-0010. The borings were drilled to evaluate the subsurface conditions at the site and collect representative samples for laboratory testing. The boring locations are shown on Figures 2 and 3 in Appendix.

The borings were drilled with a truck-mounted CME-75 drill rig utilizing 6-5/8-inch outside diameter hollow stem augers. Soil sampling, using standard penetration testing (SPT) or undisturbed ring sampling methods, was generally performed at 2.5-foot intervals in general accordance with ASTM D1586. The SPT involves advancing a 2-inch outer diameter, 1.375-inch inner diameter, split-barrel sampler with a 140-pound weight (known as the hammer) falling 30 inches. The sampler (split spoon) is advanced up to 18 inches and the number of blows to advance the sampler each 6-inch interval is recorded. If the sampler is advanced less than 6 inches in 50 blows, the test is stopped and the distance the spoon was driven with 50 blows is recorded. The number of blows to advance the split spoon from 6 to 18 inches (the second and third intervals) is commonly referred to as the N-value. To increase the recovery sample volume, a 3-inch outer diameter (2.42-inch inner diameter) split-barrel was also used during sampling operations.

The subcontracted drill rig is owned and operated by *Resilient Drilling Services, LLC*. Upon completion of the drilling activities at each location, the borings were backfilled with a mixture of soil cuttings and cement. Any excess drill cuttings and spoils were disposed of within 100 feet of the boring location (as appropriate). The soils encountered were visually classified and recorded on the field logs. After completion of the laboratory tests on the samples retrieved, the field logs were reviewed and modified where necessary to produce the final boring logs presented in Appendix A. Our field and final classifications were based on the Unified Soil Classification System (USCS).

3.3 LABORATORY TESTING

For evaluating the pertinent engineering properties of the subsurface soils, laboratory tests were performed on selected representative samples obtained during our field exploration. The following tests were performed in general accordance with the applicable ASTM methods:

- Grain Size Analysis (ASTM C117 & C136)
- Atterberg Limits (ASTM D4318)
- *In-situ* Moisture and Density (ASTM D2216 & D2937)
- Standard Proctor Compaction Moisture-Density Relationship (ASTM D698A)
- Remolded expansion (ASTM D4546)
- R-Value (ASTM D2844)

The results of the laboratory testing performed are presented in Table B-1: Summary of Laboratory Test Results, attached in Appendix B, followed by the laboratory test worksheets.

4 SITE CONDITIONS

4.1 GEOLOGIC SETTING

The Yuma Geology and Geomorphology Regional setting includes the upstream part of the delta of the Colorado River, near the downstream end of the Colorado River basin. The site is located within the Basin and Range physiographic province. The Basin and Range province is typically characterized by a series of structurally uplifted mountain blocks composed of Tertiary to Precambrian bedrock separated by intervening down-dropped basins or valleys which commonly have been filled with thick sequences of Tertiary to Quaternary volcanic and sedimentary materials (Fenneman, 1931, 1946).

According to an AZGS publication (Pearthree, 2011), the site geology consists of river deposits composed of Chemehuevi Formation (symbol “Qch”) and Late Pleistocene Colorado River deposits including silt, clay, sand and some gravel, with the ground surface modified by agricultural activity or urban development.

Published geologic mapping indicates that the surficial geologic unit along Avenue B includes Quaternary surficial deposits (symbol “Q”), consisting of unconsolidated to strongly consolidated alluvial and eolian deposits, including coarse, poorly sorted alluvial fan and terrace deposits on middle and upper piedmonts and along large drainages; sand, silt and clay on alluvial plains and playas; and wind-blown sand deposits (Richard *et al.*, 2000).

4.2 GEOTECHNICAL PROFILE

Based on the results of the field exploration and laboratory testing, the generalized subsurface profile along Avenue B generally consists of slightly moist (1.7 to 7.3% moisture) loose to medium dense sand with silt (SP-SM) or silty sand (SM) over sand (SP), predominately fine to medium subangular sand (70 to 92% sand) with rare to trace fine angular to subangular gravel (1 to 16% gravel), no cementation, and no plasticity [7 to 15% passing the #200 sieve]. These deposits are consistent and were encountered along the entire segment of Avenue B.

Refer to the boring logs in Appendix A for additional details of the conditions encountered in the borings. Refer to Appendix B for the laboratory test results.

4.3 GROUNDWATER CONDITIONS

Groundwater was not encountered during the field investigation to the maximum depth explored of 6.5 feet. The depth to regional groundwater was measured at an Arizona Department of Water Resources (ADWR) well site as shown in Table 4.1 (ADWR, 2025).

Table 4.1 Index Well Water Levels

WELL LOCAL ID	WATER LEVEL ELEVATION (FT)	DEPTH TO WATER LEVEL (FT)
C-10-23 31BBB2	52.5 feet (above NGVD29)	120.45

Groundwater is not anticipated to impact construction of this project to the planned depths of construction. However, surface water may impact construction of this project depending on the time of year.

5 DISCUSSION AND RECOMMENDATIONS

5.1 PAVEMENT DESIGN PARAMETERS

5.1.1 DESIGN CRITERIA AND ASSUMPTIONS

The current Avenue B project is under the *Arizona Department of Transportation* (ADOT) and Yuma County territory and jurisdiction. The SOW specified that the pavement thickness design will be based on ADOT and/or Yuma County Design Criteria. The following requirements and Specifications have been utilized individually or combined:

- ADOT, *Standard Specifications for Road and Bridge Construction*, 2021.
- ADOT, *Pavement Design Manual*, September 2017.
- Yuma County, *Yuma County Public Works Standards*, Volume 2, Construction Details, 2023 Edition.

We did not consider the existing pavement conditions of Asphalt Concrete (AC) and Aggregate Base (AB) in our study considering that existing pavement survey was not part of the Scope of Work.

5.1.2 SUBGRADE EXPANSION POTENTIAL

Sieve and plasticity index (PI) results for subgrade soils (70 to 92% sand) encountered in the borings were Non-Plastic (NP) and have an average of 11% passing the No. 200 sieve size. The combination of these tests indicates these soils have “low” expansion potential.

Results of the six (6) swell tests yielded expansion potential to 0.0%, attached in Appendix B. The project subgrade soils encountered along this roadway have a “low” expansive potential and therefore mitigation will not be required or recommended.

5.1.3 R-VALUES ANALYSIS AND SUBGRADE MODULUS

Six (6) subgrade soil samples from borings along Avenue B were tested for R-value according with ASTM D2844 (Resistance R-Value and expansion pressure of compacted soils). The results of R-value test R-values are presented in the following Table.

Table 5.1 R-value laboratory testing results – Avenue B

LOCATION	SUBGRADE	SAMPLE DEPTH (FEET)	R-VALUE
B-B03	Silty sand (SM)	0.0-5.0	69
B-B05	Sand with silt (SP-SM)	0.0-5.0	74
B-B09	Silty sand (SM)	0.0-5.0	71
B-B13	Sand with silt (SP-SM)	0.0-5.0	74
B-B16	Silty sand (SM)	0.0-5.0	70
B-B17	Sand with silt (SP-SM)	0.0-5.0	71
Average			71.5

In accordance with the most recent Arizona Department of Transportation (ADOT) *Pavement Design Manual (PDM)* [September, 2017], generally the sieve and plasticity index (PI) values are utilized to determine correlated R-values for use in developing the mean R-value (R_{mean}) for determination of subgrade Resilient Modulus (M_R). However, the subgrade soils encountered within the Avenue B roadway segment predominantly consist of sand and were non-plastic (NP). Therefore, the correlated R-values were determined considering a PI of zero (0) combined with the fine contents (passing the No. 200 sieve size) of tested samples. Correlated R-values are shown in the following Table.

Table 5.2 R-value correlated results – Avenue B

LOCATION	SUBGRADE	SAMPLE DEPTH (FEET)	PLASTICITY INDEX	% < NO. 200	CORRELATED R-VALUE
B-B01	Sand with silt (SP-SM)	0.0-5.0	0	10	87
B-B02	Sand with silt (SP-SM)	0.0-5.0	0	10	87
B-B03	Silty sand (SM)	0.0-5.0	0	15	81
B-B04	Sand with silt (SP-SM)	0.0-5.0	0	11	86
B-B05	Sand with silt (SP-SM)	0.0-5.0	0	11	86
B-B06	Sand with silt (SP-SM)	0.0-5.0	0	9.2	88
B-B07	Sand with silt (SP-SM)	0.0-5.0	0	11	86
B-B08	Sand with silt (SP-SM)	0.0-5.0	0	10	87
B-B09	Silty sand (SM)	0.0-5.0	0	13	84
B-B10	Sand with silt (SP-SM)	0.0-5.0	0	11	86
B-B11	Silty sand (SM)	0.0-5.0	0	12	85
B-B13	Sand with silt (SP-SM)	0.0-5.0	0	11	86
B-B14	Silty sand (SM)	0.0-5.0	0	13	84
B-B15	Sand with silt (SP-SM)	0.0-5.0	0	9.1	88
B-B16	Silty sand (SM)	0.0-5.0	0	14	82
B-B17	Sand with silt (SP-SM)	0.0-5.0	0	10	87
B-B18	Sand with silt (SP-SM)	0.0-5.0	0	7	91
Average					85.9

The tested and correlated R-values were used to calculate the mean R-value (R_{mean}) using the procedure in the ADOT *Pavement Design Manual* section 2.1.5.2 (mean design R-value = 81.5). The seasonal variation factor (SVF) of 0.4 was chosen from ADOT *Pavement Design Manual*, Table 2-4 for the project area. The following formula from ADOT *Pavement Design Manual* section 2.1.5.2 was used to determine the Resilient Modulus (M_R) of the subgrade soils for the shoulder widening project:

$$M_R = (1815 + 225 \cdot R_{\text{mean}} + 2.4 \cdot R_{\text{mean}}^2) / (0.6 \cdot \text{SVF}^{0.6})$$

M_R was calculated to be 104,287 psi for Avenue B. However, the ADOT approach limits the value of M_R at 26,000 psi. Therefore, this latest value was used for the shoulder widening pavement design.

5.2 TRAFFIC DESIGN PARAMETERS AND ESALS

Pavement thickness design for the shoulder widening project was evaluated using the 1993 *American Association of State Highway Transportation Officials* (AASHTO) design approach within ADOT *Pavement Design Manual* (September, 2017).

5.2.1 DESIGN TRAFFIC LOAD

For the purposes of pavement design, no traffic counts were provided within the SOW. Therefore, the ADOT Annual Average Daily Traffic (AADT)¹ tool was used to estimate the design traffic load Average Daily Traffic (ADT). The AADT reported in 2023, for Avenue B, was estimated to be 10,847 (future [2050] 12,857) for the segment between SR 195 and County 19th Street and 9,691 (future [2050] 12,001) for the segment between County 19th and County 18th Streets. The larger value was used as the Start Year ADT.

No growth rate was given in the Scoping Report or within ADOT data, so a typical value of 2% was chosen. However, back calculating from ADOT 2023 AADT and future (2050) AADT, the growth rate would range between 0.65% and 0.83% [Future AADT = Present AADT * (1 + r)ⁿ where “r” is the growth rate and “n” the period]. Considering ADOT Functional Classification system, Avenue B is classified as “Rural Major Collector”. AADT Combination Unit Truck (heavy traffic) data was available for 2023 for Avenue B between County 19th Street and SR 195, showing approximately 3.5% of truck traffic rate. A typical 20-year design period was used.

The following flexible pavement design parameters were chosen and calculated based on ADOT *Pavement Design Manual* requirements as shown in Table 5.3.

Table 5.3 Flexible Pavement Traffic Parameters for Avenue B

TRAFFIC PARAMETER	VALUE
Functional Classification	Major Collector (Rural)
Start Year	2025
Average Daily Traffic (ADT) – Two Way, Start Year	10,847
Annual Growth Rate (r) [Cars, Buses, and Pick-ups]	2%
Analysis Period (Y)	20 years
% Trucks	3.5%
Directional Distribution Factor (D_D)	0.5
Lane Distribution Factor (D_L)	0.9
Design Lane ESALs over Analysis Period (W_{18})	1,245,093

¹ (<https://adot.maps.arcgis.com/apps/webappviewer/index.html?id=07cac1757f8a4ce1a73a6e5e79563fe4>)

5.3 PAVEMENT DESIGN

Structural Number (SN) calculations were performed using the Resilient Modulus (M_R) value and design lane ESALs for pavement thickness determinations per the 1993 AASHTO design approach included in *ADOT Pavement Design Manual*. Avenue B, between County 18th Street to SR 195, is classified as “Rural Major Collector” within the ADOT Functional Classification. Based on the *ADOT Pavement Design Manual* Table 2-10, a minimum SN of 2.25 and a minimum AC thickness of 3.0 inches is required for Rural Collector with ESAL > 750,000.

The existing pavement thickness of Avenue B is unknown and defining its thickness was not part of the SOW. Moreover, no as-built Drawings were provided by ADOT or Yuma County to review available information to develop an understanding of the existing pavement section thickness and age along the planned segment.

Provided in Table 5.4 is the recommended pavement section for Avenue B shoulder widening combined with the defined structural coefficient.

Table 5.4 Flexible Pavement Design Parameters and Section

MATERIAL	STRUCTURAL COEFFICIENT*	THICKNESS (IN)
Asphalt Concrete (AC)	$a_1 = 0.44$	3 (min.)
Aggregate Base (AB)	$a_2 = 0.14$	7
Structural Number	2.25 (required)	2.30

* ADOT *Pavement Design Manual* Table 2-6

5.3.1 DRAINAGE AND SHOULDER DESIGN

The proposed pavement should be constructed in a way that will prevent ponding of water on or directly adjoining paved surfaces. Ponding of water will decrease the expected life of the proposed pavements potentially causing subgrade expansion, cracking, and deterioration.

The ADOT *Roadway Design Guidelines* (2021 Edition), Section 300 “Cross-section Elements”, provides details on the required transition design between AB and AC from roadway to paved shoulder.

Both typical cross-sections (ADOT and Yuma County) provide slope details for transition between AB and AC from roadway toward paved shoulder and provide minimum transversal slopes to assure proper road drainage. Considering that the project includes widening of the shoulder, we recommend using the ADOT cross-section for the Avenue B shoulder design.

Our observations of the existing AC pavement longitudinal edge showed inconsistency and deteriorated pavement alignment. To properly match to proposed AC shoulder widening pavement with the existing pavement edge, it is recommended to properly cut the existing AC edge to adequately marry new and existing pavements.

The actual roadside conditions, within the ROW, may require regrading to comply with the above standards.

5.4 MATERIALS

5.4.1 EARTHWORK RECOMMENDATIONS

The locations along Avenue B to receive new pavement and gravel should be stripped of vegetation, structures (existing AC), and any other deleterious materials. The removal of such items should be performed in a manner

that will result in exposed surfaces free of mounds and depressions. If removal of these items results in the shallow excavation of site soils below new pavement or drainage areas, the soils should be replaced with approved fill using proper placement and compaction as indicated below.

The pavement subgrade soils shall be scarified and loosened to a minimum depth of 6 inches, moisture conditioned, and recompact. The moisture content and density of the prepared subgrade should be in accordance with the recommendations specified in the following Table 5.5.

Table 5.5 Material moisture-density relationship

MATERIAL TYPE	DENSITY SPECIFICATION - (ARIZ 225d/245b)	MOISTURE SPECIFICATION
Native Site Soils - Below Pavement	95% Minimum	± 2% of Optimum
Aggregate Base Course	100% Minimum	± 2% of Optimum
Landscape Areas (within the ROW)	90% Minimum	± 2% of Optimum

Based on the soil conditions encountered, it is anticipated that conventional excavation equipment would be suitable for shallow subgrade preparation excavations. For shallow utility excavations, if required, site soils shall be considered Type C soils corresponding to a maximum slope inclination of 1.5 Horizontal to 1.0 Vertical (1.5H:1.0V).

5.4.2 EARTHWORK FACTOR AND GROUND COMPACTION FACTOR

This section presents a discussion of the procedure for estimating earthwork factors for the planned project excavations. Development of earthwork factors was based on evaluation and analysis of data from *in-situ* density tests (undisturbed ring samples) and laboratory moisture-density relationships.

Earthwork factors were calculated using the following equation:

$$\% \text{ Shrink or Swell} = \left[1 - \frac{\gamma_{ex}}{\gamma_{emb}} \right] * 100$$

Where:

γ_{ex} = *in-situ* dry density of material to be excavated

γ_{emb} = dry density of material of compacted embankment

Based on the results of dry density testing on *in-situ* soil samples obtained from the geotechnical investigation, the results of standard Proctor testing, and the anticipated range of compaction densities, we estimated an approximate average shrinkage of 9% for the project. Table below present a summary of the results. Negative (-) earthwork factors would indicate swell while positive (+) earthwork factor would indicate shrink. All of the locations exhibited a shrink potential.

The mean earthwork factor was determined from the *in-situ* density tests and moisture-density relationship tests (Proctors) performed in order to select the design earthwork factor for the project shoulder widening. The Proctor tests were performed on soil cuttings collected from 0 to 5.0 feet within each of the shallow boring locations.

Table 5.6 Material moisture-density relationship

BORING NUMBER	BEGIN DEPTH (FT)	END DEPTH (FT)	USCS	IN-SITU DRY DENSITY (PCF)	MAXIMUM DRY DENSITY (PCF)	SHRINK AT MAX DD (%)
B-B03	0	5	SM	108.3	119.9	9.7
B-B05	0	5	SP-SM	104.3	113.4	8.0
B-B09	0	5	SM	104.6	116.2	10.0
B-B13	0	5	SP-SM	108.7	115.0	5.5
B-B16	0	5	SM	111.8	124.0	9.8
B-B17	0	5	SP-SM	106.7	116.2	8.2
AVERAGE						8.5

A ground compaction factor of 0.1 feet is estimated for compaction of the exposed ground surface throughout the project limits.

5.4.3 SUBGRADE PREPARATION AND ACCEPTANCE

The borings along Avenue B showed that the existing soils are generally loose to medium dense. Therefore, following cut/fill and rough grading operations for the shoulder widening subgrade preparation, we recommend that the final graded surface be recompacted. After re-compaction, the subgrade surface should be proof-rolled and any remaining loose or soft areas be scarified and recompacted. The subgrade re-compaction effort will require *in-situ* tests using a nuclear gauge (ASTM D6938 or AZ235) prior to spreading and compacting the Aggregate Base (AB) material. Prior to subgrade re-compaction, a visual inspection of the graded surface shall be completed by a Geotechnical Engineer to confirm that the subgrade soils are similar to those encountered in this study and described herein. Samples of the subgrade material shall be collected and laboratory compaction characteristic of soils using standard efforts (ARIZ 225d or ARIZ 245b) [a.k.a Proctor] tests should be performed on this material to evaluate the maximum dry density and the optimum moisture content. The results of those tests will then serve for density control *in-situ* testing.

If required, borrow shall be as specified in Section 203-9 of the Standard Specifications. Borrow placed within three (3) feet of finished subgrade shall meet the following requirements:

The Plasticity Index (PI) (AASHTO T90) and the percent passing the No. 200 Sieve (Minus 200) (Ariz. Test Method 201) when used in the equation below, shall give a value of X that does not exceed 74.0

$$X = (\text{Minus 200}) + [2.83 (\text{PI})]$$

For informational purposes only, laboratory compaction characteristic of soils using standard efforts (ASTM D698A) tests have been performed on bulk soil samples retrieved from some borings. The results of the testing can be found in Appendix B.

5.4.4 FILL MATERIALS AND PLACEMENT

Prior to the placement of aggregate base (AB) material, the subgrade of the excavation should be compacted to a uniform density of not less than 95 percent maximum dry density. With the approval of the compaction of the subgrade excavation by the Geotechnical Engineer, the placement of the aggregate base (AB) course shall begin.

Aggregate base (AB) course should be compacted in lifts not exceeding a compacted thickness of 8 inches, provided proper compaction can be achieved throughout the entire lift. Aggregate base (AB) course should be compacted to 100 percent of the maximum dry density as determined by ARIZ 225d or ARIZ 245b below asphalt concrete (AC).

5.5 RUMBLE STRIPS

Despite the fact that no pavement assessment was completed (not in the SOW), our observations during the boring operations noted a damaged existing pavement specifically exposing dried AC, longitudinal and transversal cracking (sealed or unsealed). It should be noted that the existing pavement thickness and the underlying pavement condition (aggregate base) were not determined through this Scope. Therefore, installation of rumble strips in pavements with unknown, or with a bad rating condition may exacerbate existing distresses.

The proposed longitudinal ground-in rumble strips should be installed within the new shoulder widening pavement, and it is our understanding that centerline ground-in rumble strips will be added to the existing pavement.

In rural areas, rumble strips should generally not be installed within 2000 feet (0.4 miles) of an inhabited residential structure. Rumble strips should not be installed in areas where asphalt concrete (AC) sections are less than 3 inches in thickness, per ADOT Standard.

The proposed longitudinal ground-in rumble strips should be designed per ADOT *Traffic Engineering Guidelines and Processes* (TGP), Section 480. Longitudinal rumble strips will normally be applied to new construction shoulders when the thickness of the asphaltic concrete (AC) will allow placement in accordance with the Traffic Engineering Group TGP 480 entitled “Longitudinal Rumble Strips”. Avenue B recommended minimum shoulder widening AC thickness is 3-inches and will allow installation of longitudinal ground-in rumble strips.

According to TGP, Section 480.2, the shoulder rumble strips, for undivided roadway with right shoulder less than 5'-6" (5.5-ft), the grooves width should be 8-inches and typically installed under the edge line in accordance with ADOT Drawing M-22. The centerline ground-in rumble strips will be 6-inches.

Rumble strip design should comply with ADOT M-22 Drawings. The grooves depth should be 3/8-inch $\pm$ 1/8-inch. However, considering that this specific project consists of widening the paved shoulder, there will be a longitudinal joint along the roadway resulting from matching the existing AC pavement with the new shoulder widening AC. Therefore, it is not recommended that the ground-in rumble strips be installed under the edge line considering that this edge line may be marked over or within 12 inches of the longitudinal AC joint.

6 BASIS FOR RECOMMENDATIONS

The recommendations provided in this report are based on our understanding of the project described herein and on our interpretation of the data collected during the subsurface exploration. We have made our recommendations based on experience with similar subsurface conditions under similar loading conditions. These recommendations apply to the specific project discussed in this report; therefore, any changes in project conditions or site grades should be provided to us so that we may review our conclusions and recommendations and make any necessary modifications.

Regardless of the thoroughness of the geotechnical exploration, there is always a possibility that conditions between the test borings will be different than those encountered, or that soil conditions may change subsequent to our investigation. Therefore, an experienced geotechnical engineer or qualified technical representative should monitor the earthwork and subgrade construction to confirm that the soil conditions encountered in the field conform to those described in this report.

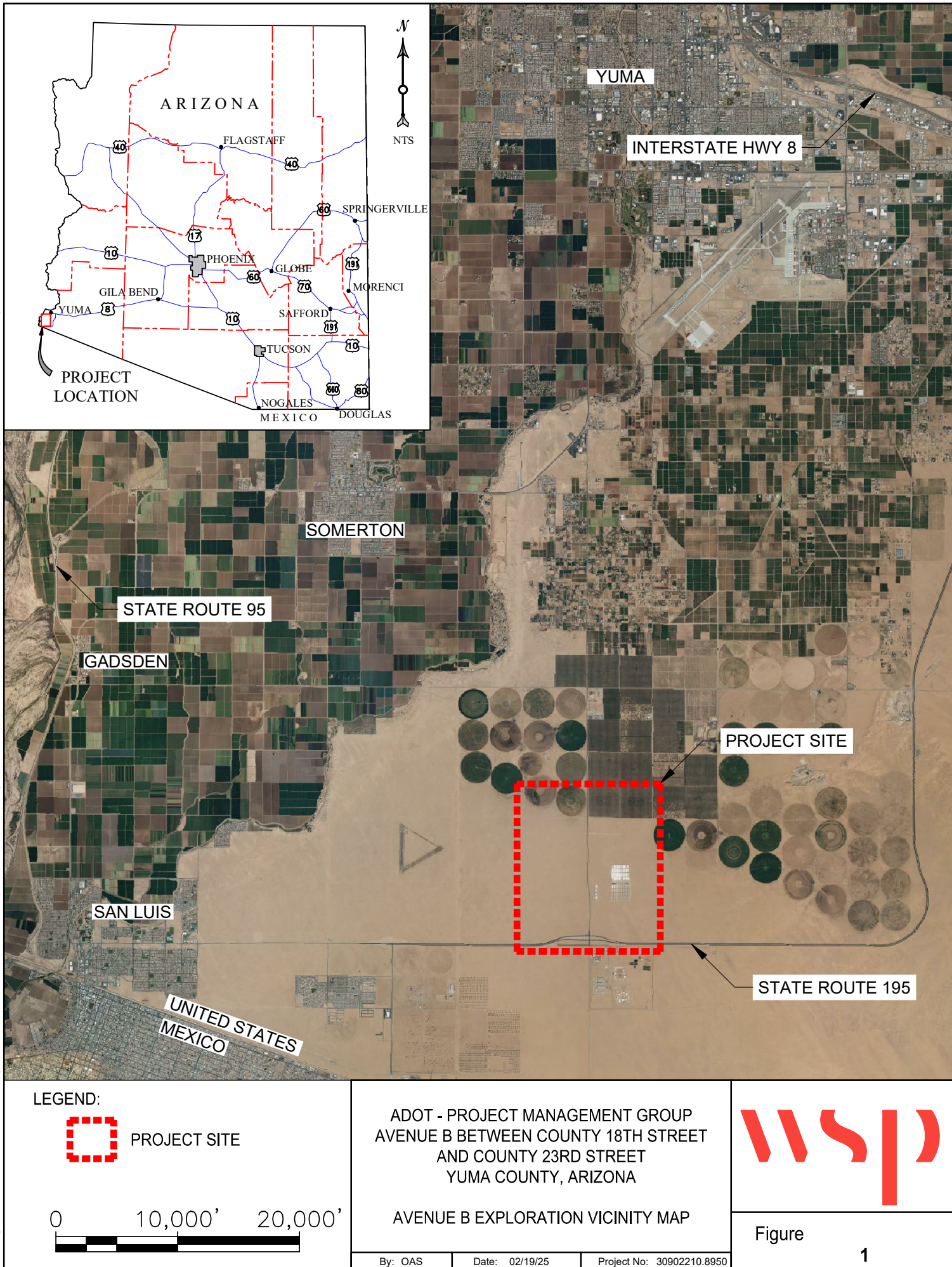
BIBLIOGRAPHY

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- Richard, S.M., Reynolds, S.J., Spencer, J.E., and Pearthree, P.A., comps., 2000, *Geologic Map of Arizona: Arizona Geological Survey Map M-35*, 1 sheet, scale 1:1,000,000
- Arizona Department of Transportation, *Standard Specifications for Road and Bridge Construction*, 2021
- Arizona Department of Transportation, *Pavement Design Manual*, September 2017
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- Arizona Department of Transportation, *Traffic Engineering Guidelines and Processes*, June 2015
- Federal Highway Administration, *Gravel Roads Maintenance and Design Manual*, November 2000.
- Pearthree, P.A., 2011, *Geologic map of the Yuma SE 7 ½' Quadrangle, Yuma County, Arizona: Arizona Geological Survey Digital Geologic Map DGM-87*, version 1.0, scale 1:24,000.

FIGURES



Drawing Path: G:\Infrastructure\Trans\Projects\2024\ADOT\PDOT\Yuma County\T0437_T0439\04 EngTech\Geotechnical\04_CAD_GIS\FIG\ Drawing Name: Vicinity Map.dwg Plot Date: 02/19/25 - 3:32pm



Drawing Path: G:\Infrastructure\Trans\Projects\2024\ADOT\PDOT\Yuma County T0437_T0439\04 EngTech\Geotechnical\04_CAD_GIS\FIG1, Drawing Name: Boring Figures.dwg Plot Date: 02/19/25 - 11:20am



LEGEND:



BORING LOCATION



ADOT - PROJECT MANAGEMENT GROUP
AVENUE B BETWEEN COUNTY 18TH STREET
AND COUNTY 23RD STREET
YUMA COUNTY, ARIZONA

AVENUE B EXPLORATION LOCATION MAP



Figure

2

By: OAS

Date: 02/19/25

Project No: 30902210.8950

Drawing Path: G:\Infrastructure\Trans\Projects\2024\ADOT PDOC Yuma County T0437_T0439\04 EngTech\Geotechnical\04_CAD_GIS\FIG\, Drawing Name: Boring Figures.dwg Plot Date: 02/19/25 - 11:21am



LEGEND:



BORING LOCATION



ADOT - PROJECT MANAGEMENT GROUP
AVENUE B BETWEEN COUNTY 18TH STREET
AND COUNTY 23RD STREET
YUMA COUNTY, ARIZONA

AVENUE B EXPLORATION LOCATION MAP



Figure

APPENDIX

A BORING LOGS



Page of 1

PROJECT:	Avenue B - County 11th Street to County 23rd Street			PROJECT LOCATION:	Yuma, Arizona		
LOGGED BY:	J. Ramirez			PROJECT FEATURE:	Avenue B southbound shoulder		
DRILLER:	Ramon			WSP PROJECT #:	US-WSP-30902210.8950		
DRILLER FIRM:	Resilient Drilling			STATION/OFFSET:			
RIG I.D.:	117			REFERENCE:			
RIG TYPE:	CME 75			COORDINATES:	32.522805°N 114.648184°W		
BORING TYPE:	Hollow Steam Auger	BORING DIA.:	6 5/8"	COORDINATE SYS:	Latitude, Longitude		
ORIENTATION:	Vertical			SURFACE ELEV. (FT):	---		
HAMMER TYPE:	Automatic 140-lb			VERTICAL DATUM:	---		
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:				COMPLETION DATE:	1/14/2025	COMPLETION TIME:	09:46
START DATE:	1/14/2025	START TIME:	09:25				

[illegible]

GROUNDWATER

	DEPTH(ft)		DATE
▽	N/A		
▼			
▼			
▼			

METHOD

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery



Page of 1

PROJECT:	Avenue B - County 11th Street to County 23rd Street			PROJECT LOCATION:	Yuma, Arizona		
LOGGED BY:	J. Ramirez			PROJECT FEATURE:	Avenue B southbound shoulder		
DRILLER:	Ramon			WSP PROJECT #:	US-WSP-30902210.8950		
DRILLER FIRM:	Resilient Drilling			STATION/OFFSET:			
RIG I.D.:	117			REFERENCE:			
RIG TYPE:	CME 75			COORDINATES:	32.506395°N 114.648366°W		
BORING TYPE:	Hollow Steam Auger	BORING DIA.:	6 5/8"	COORDINATE SYS:	Latitude, Longitude		
ORIENTATION:	Vertical			SURFACE ELEV. (FT):	---		
HAMMER TYPE:	Automatic 140-lb			VERTICAL DATUM:	---		
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:				COMPLETION DATE:	1/14/2025	COMPLETION TIME:	10:08
START DATE:	1/14/2025	START TIME:	09:53				

[illegible]

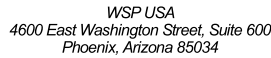
GROUNDWATER

	DEPTH(ft)		DATE
▽	N/A		
▼			
▼			
▼			

METHOD

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery





WSP USA
4600 East Washington Street, Suite 600
Phoenix, Arizona 85034

BORING LOG I.D.: B-B05

Page of 1

PROJECT:		Avenue B - County 11th Street to County 23rd Street				PROJECT LOCATION:		Yuma, Arizona			
LOGGED BY:		J. Ramirez				PROJECT FEATURE:		Avenue B southbound shoulder			
DRILLER:		Ramon				WSP PROJECT #:		US-WSP-30902210.8950			
DRILLER FIRM:		Resilient Drilling				STATION/OFFSET:					
RIG I.D.:		117				REFERENCE:					
RIG TYPE:		CME 75				COORDINATES:		32.514558°N 114.648852°W			
BORING TYPE:		Hollow Steam Auger		BORING DIA.:		6 5/8"		COORDINATE SYS:		Latitude, Longitude	
ORIENTATION:		Vertical				SURFACE ELEV. (FT):		---			
HAMMER TYPE:		Automatic 140-lb				VERTICAL DATUM:		---			
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:						COMPLETION DATE:		1/13/2025		COMPLETION TIME: 15:16	
START DATE:		1/13/2025		START TIME:		15:03					
Elevation in Feet	Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
	0				A				SP-SM	Slightly moist Medium dense	SAND WITH SILT , predominantly fine sand, no cementation, nonplastic, brown
					U	8-10		2.0			
	5				S	3-3-2				Loose	
											Auger stopped at 5.0 feet Sampler stopped at 6.5 feet Backfilled with soil cement mixture Boring located 2.0 feet from edge of asphalt
	10										
	15										
	20										

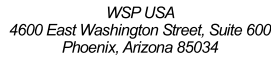
GROUNDWATER

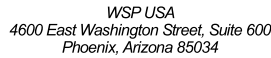
DEPTH(ft)		DATE
N/A		

METHOD

SAMPLE TYPE

- A - Drill cuttings
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - Thin Walled Shelby tube sample
- NR - No Recovery





Page of 1

[illegible]

GROUNDWATER

	DEPTH(ft)		DATE
▽	N/A		
▼			
▼			
▼			

METHOD

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery



Page of 1

COMPLETION TIME:	13:03
------------------	-------

START TIME:	12:47
-------------	-------

[illegible]

GROUNDWATER

	DEPTH(ft)		DATE
▽	N/A		
▼			
▼			
▼			

METHOD

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery



Page of 1

[illegible]

GROUNDWATER

	DEPTH(ft)		DATE
▽	N/A		
▼			
▼			
▼			

METHOD

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery



Page of 1

[illegible]

GROUNDWATER

	DEPTH(ft)		DATE
▽	N/A		
▼			
▽			
▼			

METHOD

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery



WSP USA
4600 East Washington Street, Suite 600
Phoenix, Arizona 85034

BORING LOG I.D.: B-B14

Page of 1

PROJECT:		Avenue B - County 11th Street to County 23rd Street				PROJECT LOCATION:		Yuma, Arizona					
LOGGED BY:		J. Ramirez				PROJECT FEATURE:		Avenue B southbound shoulder					
DRILLER:		Ramon				WSP PROJECT #:		US-WSP-30902210.8950					
DRILLER FIRM:		Resilient Drilling				STATION/OFFSET:							
RIG I.D.:		117				REFERENCE:							
RIG TYPE:		CME 75				COORDINATES:		32.549550°N 114.649371°W					
BORING TYPE:		Hollow Steam Auger		BORING DIA.:		6 5/8"		COORDINATE SYS:		Latitude, Longitude			
ORIENTATION:		Vertical				SURFACE ELEV. (FT):		---					
HAMMER TYPE:		Automatic 140-lb				VERTICAL DATUM:		---					
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:						COMPLETION DATE:		1/13/2025		COMPLETION TIME:		11:22	
START DATE:		1/13/2025		START TIME:		11:06							
Elevation in Feet	Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION		
	0				A				SM	Slightly moist Loose	SILTY SAND , occasional fine subangular gravel, predominantly fine sand, no cementation, nonplastic, brown		
					U	4-6							
	5				S	5-7-8				Medium dense	note: fine to medium subangular sand at 5.0 feet		
											Auger stopped at 5.0 feet Sampler stopped at 6.5 feet Backfilled with soil cement mixture Boring located 2.5 feet from edge of asphalt		
	10												
	15												
	20												

GROUNDWATER

DEPTH(ft)		DATE
N/A		

METHOD

SAMPLE TYPE

- A - Drill cuttings
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - Thin Walled Shelby tube sample
- NR - No Recovery



Page of 1

PROJECT:	Avenue B - County 11th Street to County 23rd Street			PROJECT LOCATION:	Yuma, Arizona		
LOGGED BY:	J. Ramirez			PROJECT FEATURE:	Avenue B southbound shoulder		
DRILLER:	Ramon			WSP PROJECT #:	US-WSP-30902210.8950		
DRILLER FIRM:	Resilient Drilling			STATION/OFFSET:			
RIG I.D.:	117			REFERENCE:			
RIG TYPE:	CME 75			COORDINATES:	32.55449°N 114.64947°W		
BORING TYPE:	Hollow Steam Auger	BORING DIA.:	6 5/8"	COORDINATE SYS:	Latitude, Longitude		
ORIENTATION:	Vertical			SURFACE ELEV. (FT):	---		
HAMMER TYPE:	Automatic 140-lb			VERTICAL DATUM:	---		
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START DATE:	1/14/2025	START TIME:	08:22				

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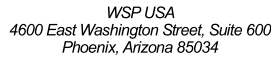
GROUNDWATER

	DEPTH(ft)	DATE
▽	N/A	
▼		
▼		
▼		

METHOD

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery





WSP USA
4600 East Washington Street, Suite 600
Phoenix, Arizona 85034

BORING LOG I.D.: B-B17

Page of 1

PROJECT:		Avenue B - County 11th Street to County 23rd Street				PROJECT LOCATION:		Yuma, Arizona			
LOGGED BY:		J. Ramirez				PROJECT FEATURE:		Avenue B southbound shoulder			
DRILLER:		Ramon				WSP PROJECT #:		US-WSP-30902210.8950			
DRILLER FIRM:		Resilient Drilling				STATION/OFFSET:					
RIG I.D.:		117				REFERENCE:					
RIG TYPE:		CME 75				COORDINATES:		32.561392°N 114.649482°W			
BORING TYPE:		Hollow Steam Auger		BORING DIA.:		6 5/8"		COORDINATE SYS:		Latitude, Longitude	
ORIENTATION:		Vertical				SURFACE ELEV. (FT):		---			
HAMMER TYPE:		Automatic 140-lb				VERTICAL DATUM:		---			
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:						COMPLETION DATE:		1/13/2025		COMPLETION TIME: 10:08	
START DATE:		1/13/2025		START TIME:		09:53					
Elevation in Feet	Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
	0				A				SM	Slightly moist Dense	SAND WITH SILT , predominantly fine sand, no cementation, nonplastic, brown
					U	7-40		2.0		Loose	
	5				S	3-3-7					
											Auger stopped at 5.0 feet Sampler stopped at 6.5 feet Backfilled with soil cement mixture Boring located 4.5 feet from edge of asphalt
	10										
	15										
	20										

GROUNDWATER

DEPTH(ft)		DATE
N/A		

METHOD

SAMPLE TYPE

- A - Drill cuttings
- S - 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- T - Thin Walled Shelby tube sample
- NR - No Recovery



Page of 1

PROJECT:	Avenue B - County 11th Street to County 23rd Street			PROJECT LOCATION:	Yuma, Arizona		
LOGGED BY:	J. Ramirez			PROJECT FEATURE:	Avenue B southbound shoulder		
DRILLER:	Ramon			WSP PROJECT #:	US-WSP-30902210.8950		
DRILLER FIRM:	Resilient Drilling			STATION/OFFSET:			
RIG I.D.:	117			REFERENCE:			
RIG TYPE:	CME 75			COORDINATES:	32.56552°N 114.64962°W		
BORING TYPE:	Hollow Steam Auger	BORING DIA.:	6 5/8"	COORDINATE SYS:	Latitude, Longitude		
ORIENTATION:	Vertical			SURFACE ELEV. (FT):	---		
HAMMER TYPE:	Automatic 140-lb			VERTICAL DATUM:	---		
HAMMER CALIBRATION-ENERGY TRANSFER RATIO:				COMPLETION DATE:	1/14/2025	COMPLETION TIME:	08:04
START DATE:	1/14/2025	START TIME:	07:46				

[illegible]

GROUNDWATER

	DEPTH(ft)		DATE
▽	N/A		
▼			
▼			
▼			

METHOD

SAMPLE TYPE

A - Drill cuttings
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - Thin Walled Shelby tube sample
NR - No Recovery

APPENDIX

B LABORATORY TESTING RESULTS

Summary of Laboratory Test Results

Boring Number	Depth (ft)		USCS/Group Symbol (ASTM D2487)	Percent Fines (minus 200) (ASTM D422)	Liquid Limit (ASTM D4318)	Plasticity Index (ASTM D4318)	Moisture Content (%) (ASTM D2216)	In-Place Dry Density (pcf) ¹ (ASTM D2937)	Optimum Moisture Content (%) (by ASTM D698A)	Maximum Dry Density (pcf) ¹ (ASTM D698A)	One Dimensional Swell (%) ² (ASTM D4546)	R-Value (ASTM D2844)
	Begin	End										
B-B01	0.0	5.0	SP-SM	10	NV	NP						
B-B02	0.0	5.0	SP-SM	10	NV	NP						
B-B03	0.0	5.0	SM	15	NV	NP			12.0	119.9	0.0	69
B-B03	2.0	3.0					1.8	108.3				
B-B04	0.0	5.0	SP-SM	11	NV	NP						
B-B05	0.0	5.0	SP-SM	11	NV	NP			12.0	113.4	0.0	74
B-B05	2.0	3.0					2.0	104.3				
B-B06	0.0	5.0	SP-SM	9.2	NV	NP						
B-B07	0.0	5.0	SP-SM	11	NV	NP						
B-B08	0.0	5.0	SP-SM	10	NV	NP						
B-B09	0.0	5.0	SM	13	NV	NP			12.0	116.2	0.0	71
B-B09	2.0	3.0					2.8	104.6				
B-B10	0.0	5.0	SP-SM	11	NV	NP						
B-B11	0.0	5.0	SM	12	NV	NP						
B-B13	0.0	5.0	SP-SM	11	NV	NP			12.4	115.0	0.0	74
B-B13	2.0	3.0					1.7	108.7				
B-B14	0.0	5.0	SM	13	NV	NP						
B-B15	0.0	5.0	SP-SM	9.1	NV	NP						
B-B16	0.0	5.0	SM	14	NV	NP			14.6	124.0	0.0	70
B-B16	2.0	3.0					7.3	111.8				
B-B17	0.0	5.0	SP-SM	10	NV	NP			11.0	116.2	0.0	71
B-B17	2.0	3.0					2.2	106.7				
B-B18	0.0	5.0	SP-SM	7	NV	NP						
Average Standard Deviation Maximum Minimum Count				11	NV	NP	3.0	107.4	12.3	117.5	0.0	71.5
				2	---	---	2.2	2.8	1.2	3.9	0.0	2.1
				15	NV	NP	7.3	111.8	14.6	124.0	0.0	74.0
				7	NV	NP	1.7	104.3	11.0	113.4	0.0	69.0
				17	17	17	6	6	6	6	6	6

1 - pcf = pounds / cubic feet



PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St

LOCATION: Yuma AZ Avenue B

MATERIAL: See boring logs

JOB NO: US-WSP-30902210.8950

WORK ORDER NO: 1

DATE ASSIGNED:

**MECHANICAL SIEVE ANALYSIS (ASTM C136/C117) PLASTICITY INDEX (ASTM D4318)
GROUP SYMBOL, USCS (ASTM D2487)**

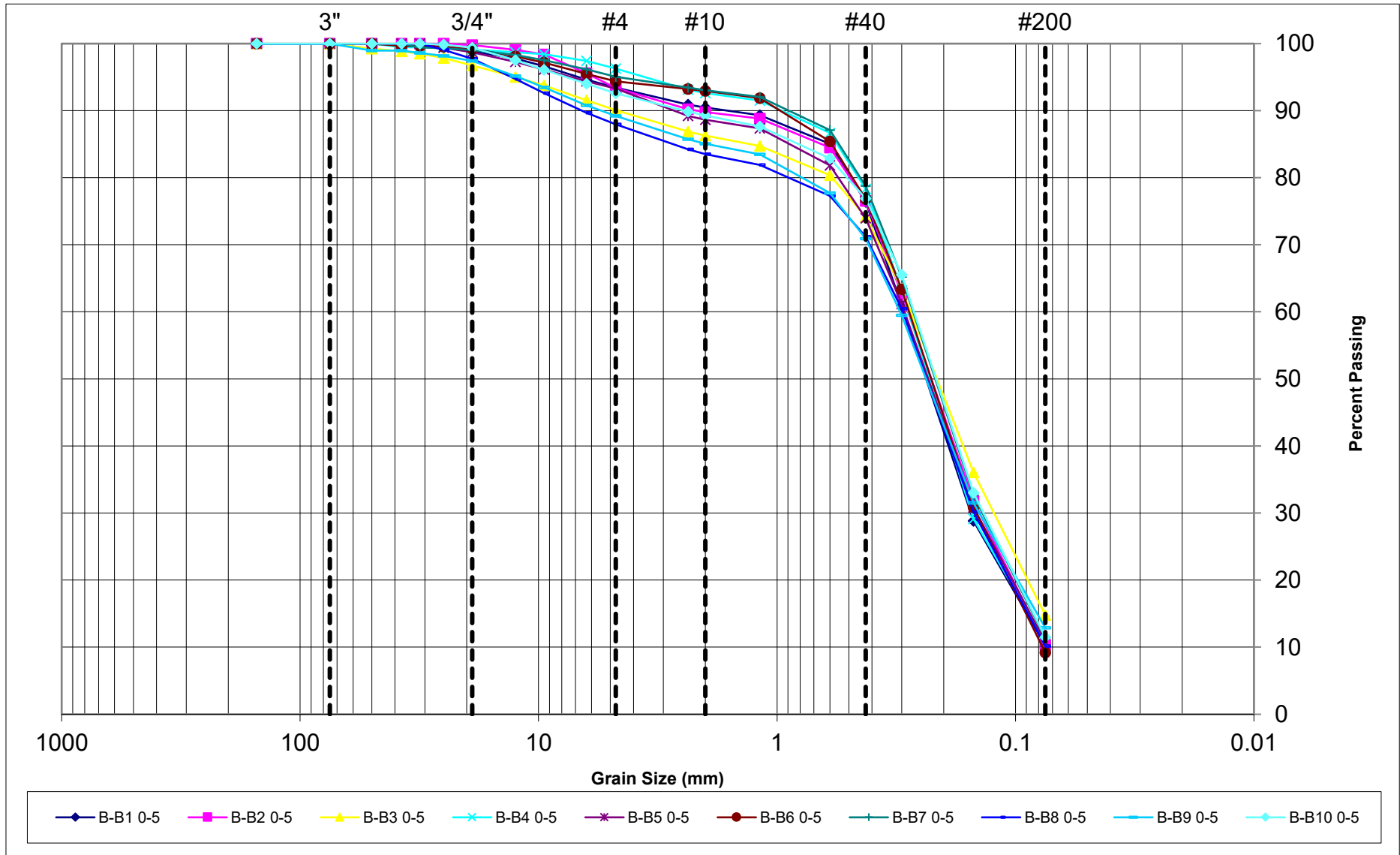
PERCENT PASSING BY WEIGHT

				Silt or Clay	SAND								GRAVEL								COBBLES		
					Fine			Medium			Coarse		Fine				Coarse						
Location & Depth	USCS	LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	3"	6"	Lab #
B-B1 0-5	SP-SM	NV	NP	10	29	61	76	85	89	90	91	93	95	97	98	99	99	100	100	100	100	100	25-0147.01
B-B2 0-5	SP-SM	NV	NP	10	32	63	77	84	89	90	90	93	96	98	99	100	100	100	100	100	100	100	25-0147.04
B-B3 0-5	SM	NV	NP	15	36	63	74	80	85	86	87	90	92	94	95	97	98	98	99	99	100	100	25-0147.07
B-B4 0-5	SP-SM	NV	NP	11	29	63	78	87	91	93	93	96	97	98	99	99	99	99	99	100	100	100	25-0147.10
B-B5 0-5	SP-SM	NV	NP	11	31	61	74	82	87	89	89	93	94	96	97	99	99	100	100	100	100	100	25-0147.13
B-B6 0-5	SP-SM	NV	NP	9.2	31	63	77	85	92	93	93	94	95	97	98	99	100	100	100	100	100	100	25-0147.16
B-B7 0-5	SP-SM	NV	NP	11	33	65	79	87	92	93	93	95	96	98	98	99	99	99	100	100	100	100	25-0147.19
B-B8 0-5	SP-SM	NV	NP	10	30	60	71	77	82	84	84	88	90	93	95	98	99	100	100	100	100	100	25-0147.22
B-B9 0-5	SM	NV	NP	13	32	59	71	78	83	85	86	89	91	93	95	97	98	99	99	99	100	100	25-0147.25
B-B10 0-5	SP-SM	NV	NP	11	33	66	77	83	88	89	90	93	94	96	98	99	100	100	100	100	100	100	25-0147.28

PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs

JOB NO: US-WSP-30902210.8950
WORK ORDER NO: 1
DATE ASSIGNED:

MECHANICAL SIEVE ANALYSIS GRAPHS





PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St

LOCATION: Yuma AZ Avenue B

MATERIAL: See boring logs

JOB NO: US-WSP-30902210.8950

WORK ORDER NO: 1

DATE ASSIGNED:

**MECHANICAL SIEVE ANALYSIS (ASTM C136/C117) PLASTICITY INDEX (ASTM D4318)
GROUP SYMBOL, USCS (ASTM D2487)**

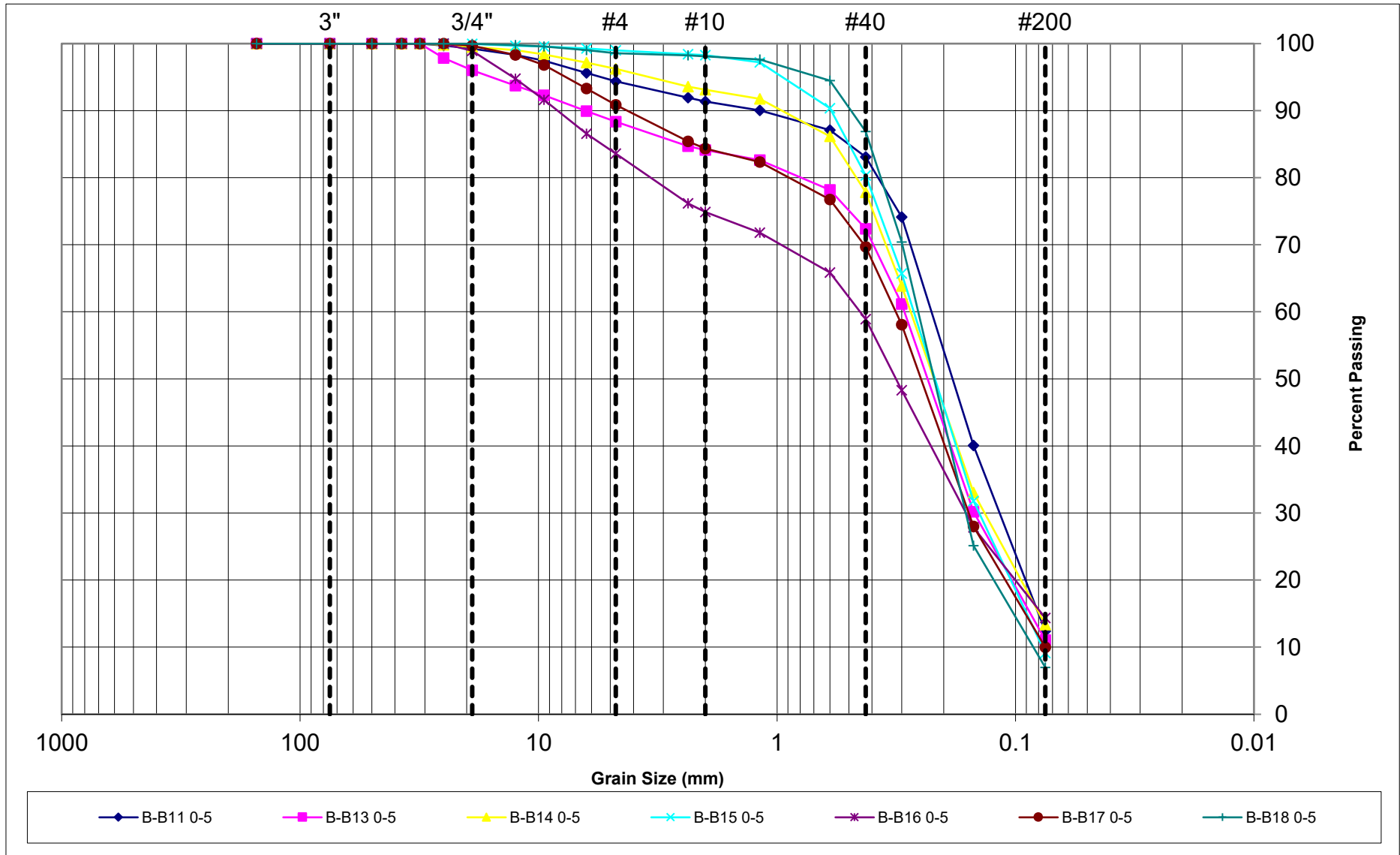
PERCENT PASSING BY WEIGHT

				Silt or Clay	SAND								GRAVEL								COBBLES		
					Fine			Medium			Coarse		Fine				Coarse						
Location & Depth	USCS	LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	3"	6"	Lab #
B-B11 0-5	SM	NV	NP	12	40	74	83	87	90	91	92	94	96	97	98	99	100	100	100	100	100	100	25-0147.31
B-B13 0-5	SP-SM	NV	NP	11	30	61	72	78	83	84	85	88	90	92	94	96	98	100	100	100	100	100	25-0147.38
B-B14 0-5	SM	NV	NP	13	33	64	78	86	92	93	94	96	97	98	99	99	100	100	100	100	100	100	25-0147.41
B-B15 0-5	SP-SM	NV	NP	9.1	32	66	80	90	97	98	98	99	99	100	100	100	100	100	100	100	100	100	25-0147.44
B-B16 0-5	SM	NV	NP	14	28	48	59	66	72	75	76	84	87	92	95	99	100	100	100	100	100	100	25-0147.47
B-B17 0-5	SP-SM	NV	NP	10	28	58	70	77	82	84	85	91	93	97	98	100	100	100	100	100	100	100	25-0147.50
B-B18 0-5	SP-SM	NV	NP	7	25	70	87	94	98	98	98	99	99	100	100	100	100	100	100	100	100	100	25-0147.53

PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs

JOB NO: US-WSP-30902210.8950
WORK ORDER NO: 1
DATE ASSIGNED:

MECHANICAL SIEVE ANALYSIS GRAPHS





PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St

LOCATION: Yuma AZ Avenue B

MATERIAL: See boring logs

JOB NO: US-WSP-30902210.89

WORK ORDER NO: 1

DATE ASSIGNED:

DENSITY OF SOIL IN PLACE BY THE DRIVE-CYLINDER METHOD (ASTM D2937)

LAB #	BORING	MOISTURE			NUMBER OF RINGS	WET WEIGHT & RINGS (g)	WEIGHT OF RINGS (g)	DRY DENSITY (pcf)
		WET WT. (g)	DRY WT. (g)	MOISTURE CONTENT				
25-0147.08	B-B3 2-3	799.1	784.8	1.8%	6	1,056.6	257.7	108.3
25-0147.14	B-B5 2-3	642.4	629.8	2.0%	5	857.6	214.9	104.3
25-0147.26	B-B9 2-3	648.8	631.4	2.8%	5	868.9	219.9	104.6
25-0147.39	B-B13 2-3	667.3	656.0	1.7%	5	877.8	210.3	108.7
25-0147.48	B-B16 2-3	869.1	809.8	7.3%	6	1,129.7	260.1	111.8
25-0147.51	B-B17 2-3	789.7	772.7	2.2%	6	1,062.9	273.0	106.7



PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St

LOCATION: Yuma AZ Avenue B

MATERIAL: See boring logs

SAMPLE SOURCE: B-B3 0-5

JOB NO: US-WSP-30902210.8951

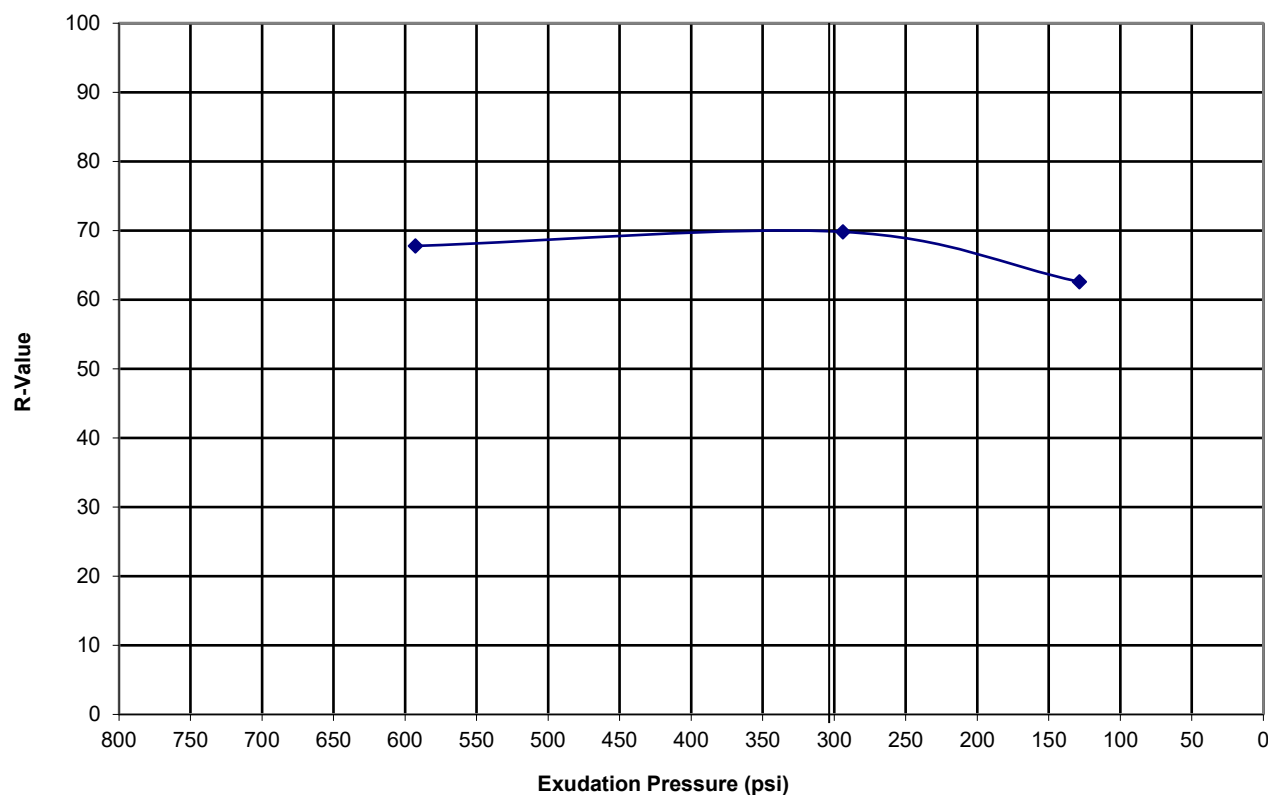
WORK ORDER NO: 1

LAB NO: 25-0147.07

DATE SAMPLED:

RESISTANCE R-VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS (ASTM D2844)

SPECIMEN ID	A	B	C
Moisture Content	11.8%	12.2%	13.1%
Compaction Pressure (psi)	50	50	50
Specimen Height (inches)	2.57	2.63	2.63
Dry Density (pcf)	120.5	119.9	117.9
Horiz. Pres. @ 1000lbs (psi)	20.0	20.0	26.0
Horiz. Pres. @ 2000lbs (psi)	38.0	39.0	48.0
Displacement	4.10	3.83	3.98
Expansion Pressure (psi)	0.1	0.0	-0.1
Exudation Pressure (psi)	593	294	129
R Value	68	70	63



R Value at 300 PSI = 69



PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St

LOCATION: Yuma AZ Avenue B

MATERIAL: See boring logs

SAMPLE SOURCE: B-B5 0-5

JOB NO: US-WSP-30902210.8951

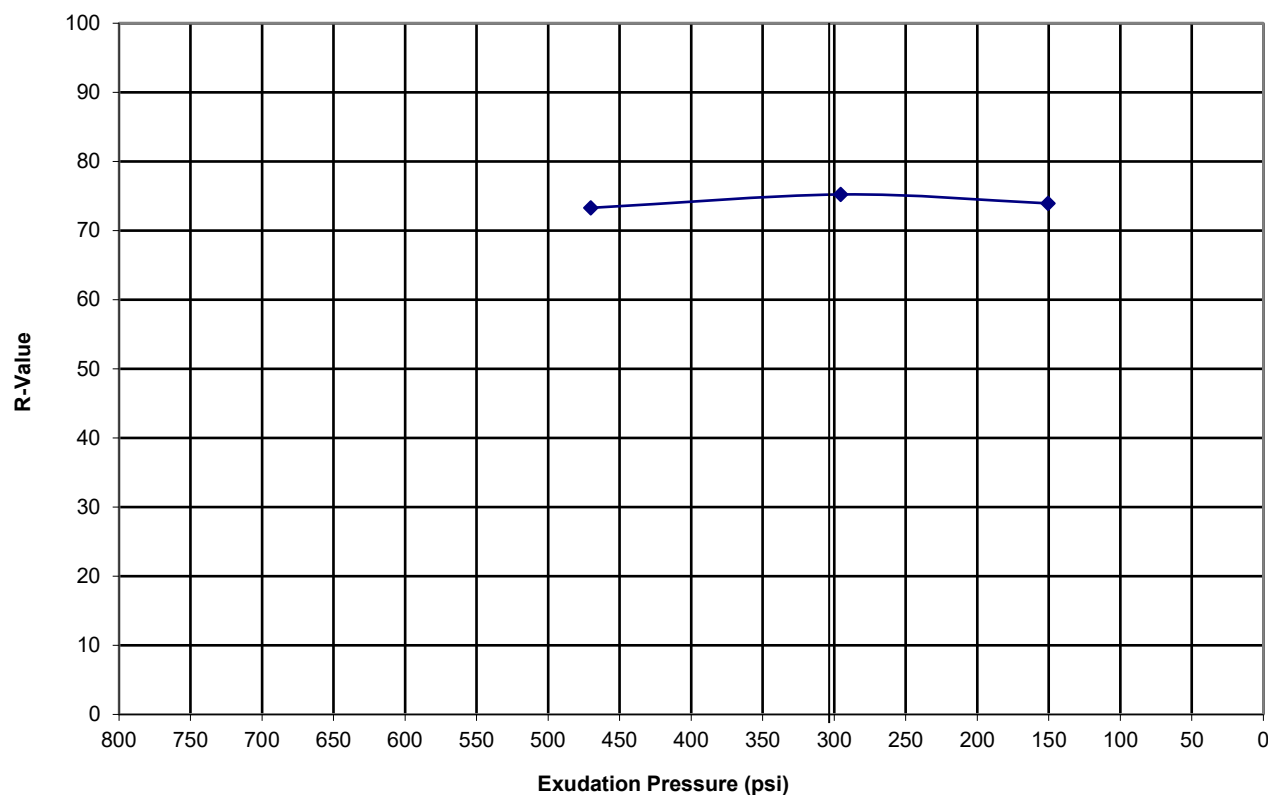
WORK ORDER NO: 1

LAB NO: 25-0147.13

DATE SAMPLED:

RESISTANCE R-VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS (ASTM D2844)

SPECIMEN ID	A	B	C
Moisture Content	11.5%	12.4%	13.2%
Compaction Pressure (psi)	50	50	50
Specimen Height (inches)	2.59	2.54	2.59
Dry Density (pcf)	120.8	119.2	114.2
Horiz. Pres. @ 1000lbs (psi)	19.0	16.0	18.0
Horiz. Pres. @ 2000lbs (psi)	35.0	30.0	34.0
Displacement	3.57	3.57	3.58
Expansion Pressure (psi)	-0.2	-0.1	-0.2
Exudation Pressure (psi)	470	295	151
R Value	73	75	74



R Value at 300 PSI = 74



PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St

LOCATION: Yuma AZ Avenue B

MATERIAL: See boring logs

SAMPLE SOURCE: B-B9 0-5

JOB NO: US-WSP-30902210.8951

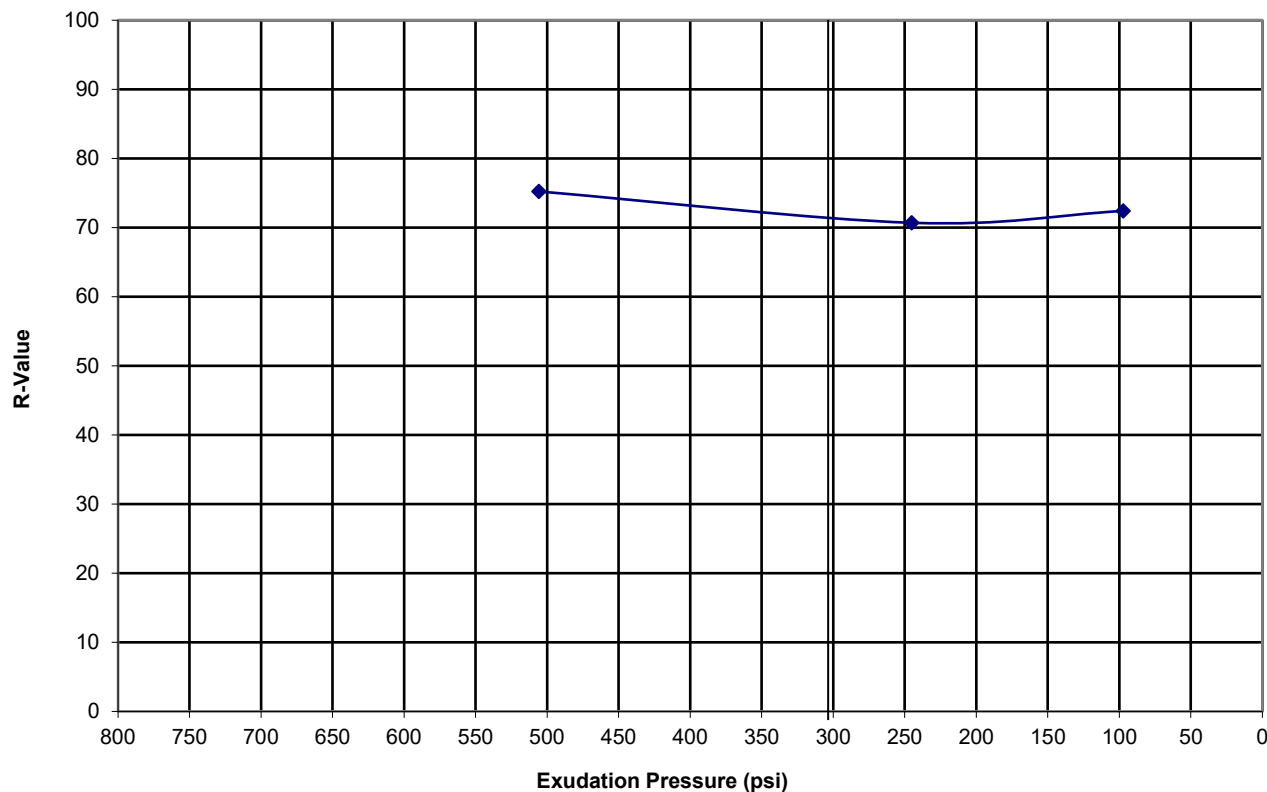
WORK ORDER NO: 1

LAB NO: 25-0147.25

DATE SAMPLED:

RESISTANCE R-VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS (ASTM D2844)

SPECIMEN ID	A	B	C
Moisture Content	12.6%	12.2%	11.3%
Compaction Pressure (psi)	50	50	75
Specimen Height (inches)	2.62	2.59	2.61
Dry Density (pcf)	119.5	117.4	119.2
Horiz. Pres. @ 1000lbs (psi)	20.0	21.0	17.0
Horiz. Pres. @ 2000lbs (psi)	36.0	37.0	32.0
Displacement	3.71	3.78	3.69
Expansion Pressure (psi)	-0.1	-0.1	-0.1
Exudation Pressure (psi)	97	245	506
R Value	72	71	75



R Value at 300 PSI = 71



PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St

LOCATION: Yuma AZ Avenue B

MATERIAL: See boring logs

SAMPLE SOURCE: B-B13 0-5

JOB NO: US-WSP-30902210.8951

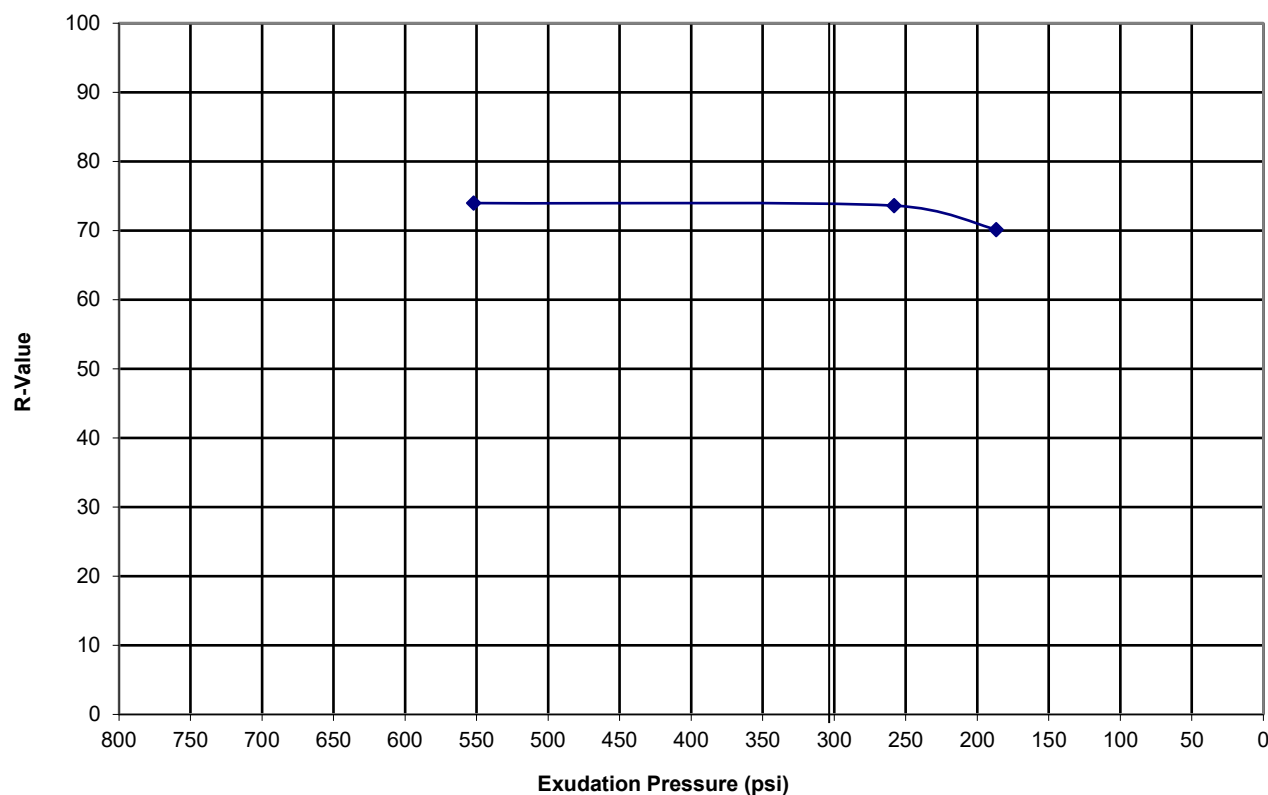
WORK ORDER NO: 1

LAB NO: 25-0147.38

DATE SAMPLED:

RESISTANCE R-VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS (ASTM D2844)

SPECIMEN ID	A	B	C
Moisture Content	11.7%	12.5%	12.9%
Compaction Pressure (psi)	50	50	50
Specimen Height (inches)	2.61	2.59	2.58
Dry Density (pcf)	117.9	117.4	116.9
Horiz. Pres. @ 1000lbs (psi)	20.0	20.0	20.0
Horiz. Pres. @ 2000lbs (psi)	35.0	35.0	38.0
Displacement	3.52	3.51	3.71
Expansion Pressure (psi)	-0.1	0.1	-0.1
Exudation Pressure (psi)	552	258	187
R Value	74	74	70



R Value at 300 PSI = 74



PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St

LOCATION: Yuma AZ Avenue B

MATERIAL: See boring logs

SAMPLE SOURCE: B-B16 0-5

JOB NO: US-WSP-30902210.8951

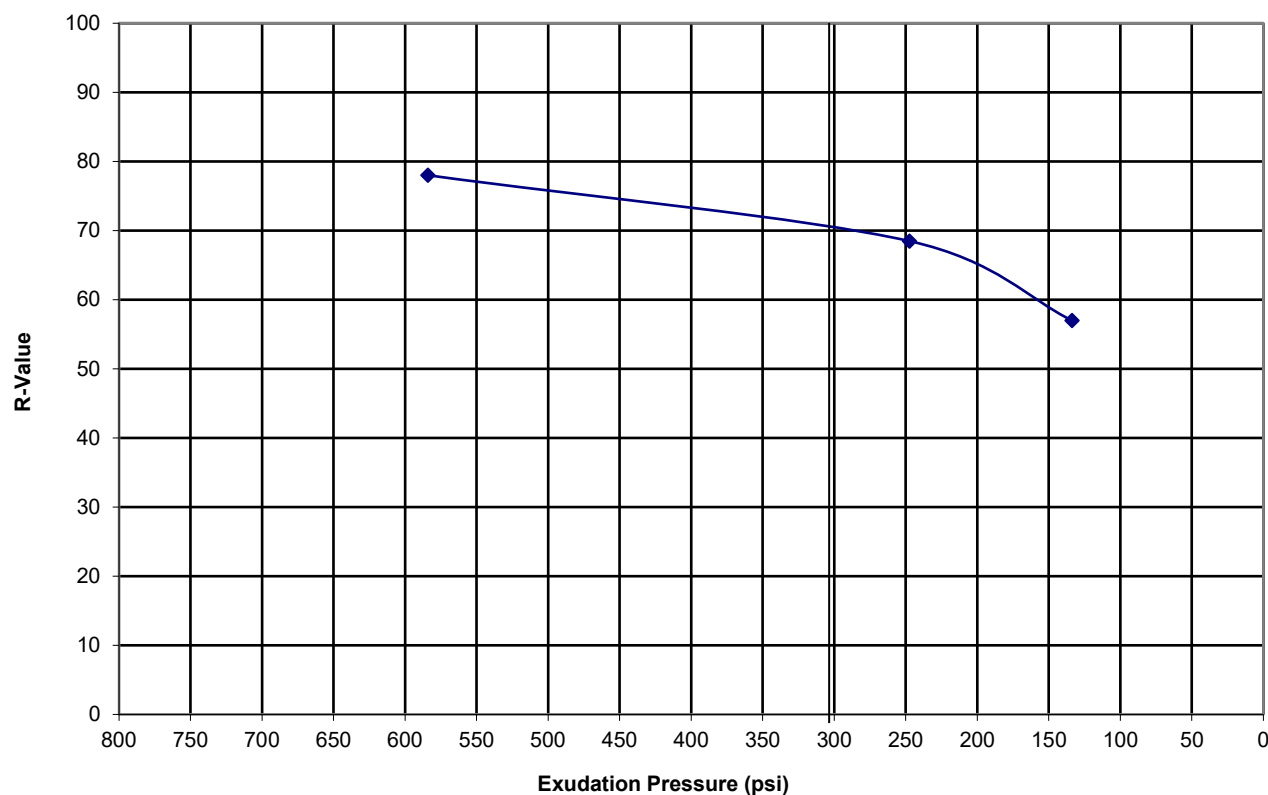
WORK ORDER NO: 1

LAB NO: 25-0147.47

DATE SAMPLED:

RESISTANCE R-VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS (ASTM D2844)

SPECIMEN ID	A	B	C
Moisture Content	11.8%	10.9%	10.1%
Compaction Pressure (psi)	50	550	50
Specimen Height (inches)	2.61	2.55	2.59
Dry Density (pcf)	121.9	123.4	121.7
Horiz. Pres. @ 1000lbs (psi)	26.0	20.0	14.0
Horiz. Pres. @ 2000lbs (psi)	51.0	37.0	27.0
Displacement	4.51	3.83	3.81
Expansion Pressure (psi)	-0.2	-0.1	0.2
Exudation Pressure (psi)	134	247	584
R Value	57	68	78



R Value at 300 PSI = 70



PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St

LOCATION: Yuma AZ Avenue B

MATERIAL: See boring logs

SAMPLE SOURCE: B-B17 0-5

JOB NO: US-WSP-30902210.8951

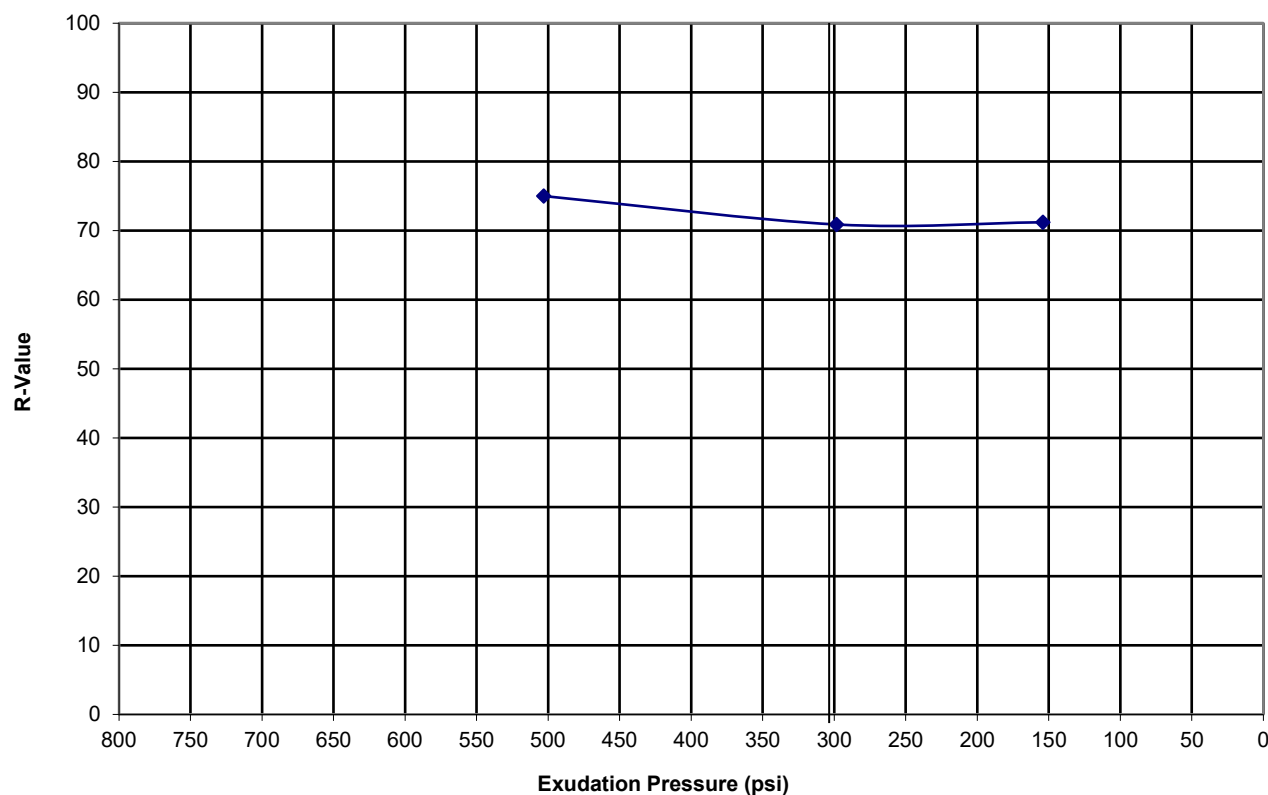
WORK ORDER NO: 1

LAB NO: 25-0147.50

DATE SAMPLED:

RESISTANCE R-VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS (ASTM D2844)

SPECIMEN ID	A	B	C
Moisture Content	11.9%	11.4%	11.0%
Compaction Pressure (psi)	50	50	50
Specimen Height (inches)	2.67	2.60	2.64
Dry Density (pcf)	119.5	120.6	120.0
Horiz. Pres. @ 1000lbs (psi)	21.0	21.0	17.0
Horiz. Pres. @ 2000lbs (psi)	39.0	38.0	33.0
Displacement	3.74	3.65	3.71
Expansion Pressure (psi)	-0.1	-0.1	0.0
Exudation Pressure (psi)	154	298	503
R Value	71	71	75



R Value at 300 PSI = 71

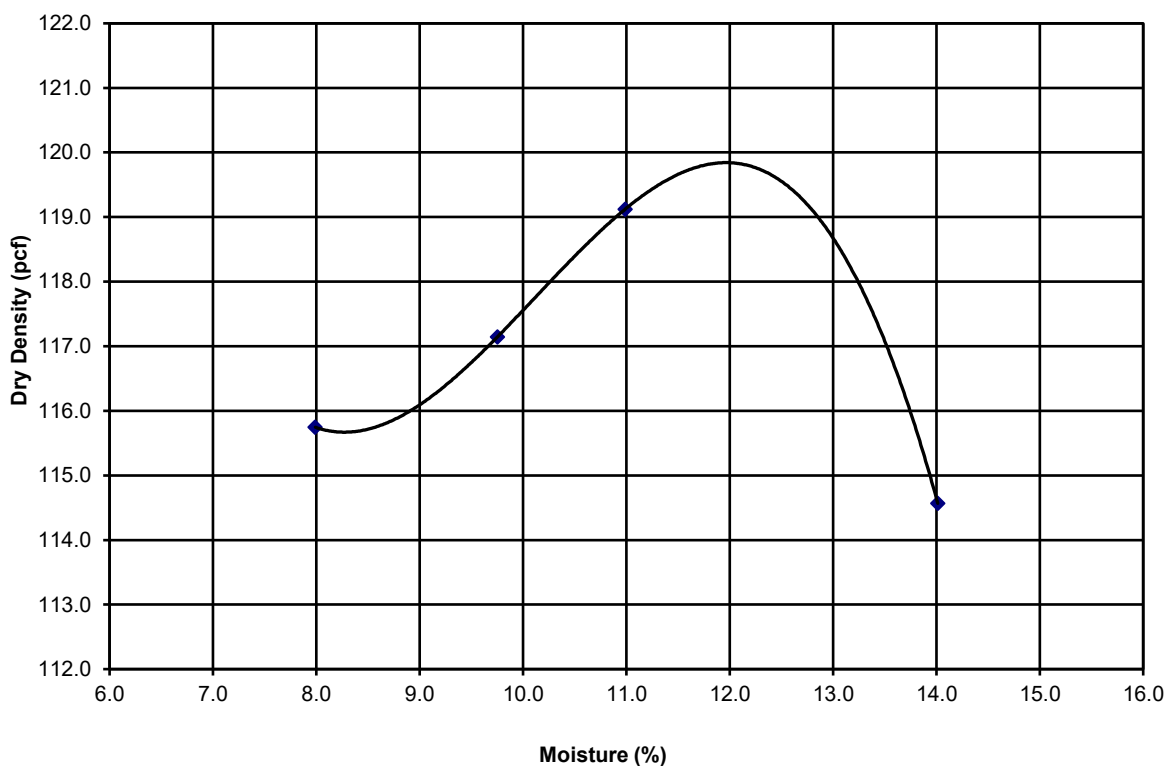


PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs
SAMPLE SOURCE: B-B3 0-5

JOB NO: US-WSP-30902210
WORK ORDER NO: 1
LAB NO: 25-0147.07
DATE SAMPLED:

**LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING
STANDARD EFFORTS (12,400ft-lb-ft/cu.ft) (ASTMD698A)**

MAXIMUM DRY DENSITY (pcf):	119.9
OPTIMUM MOISTURE (%):	12.0



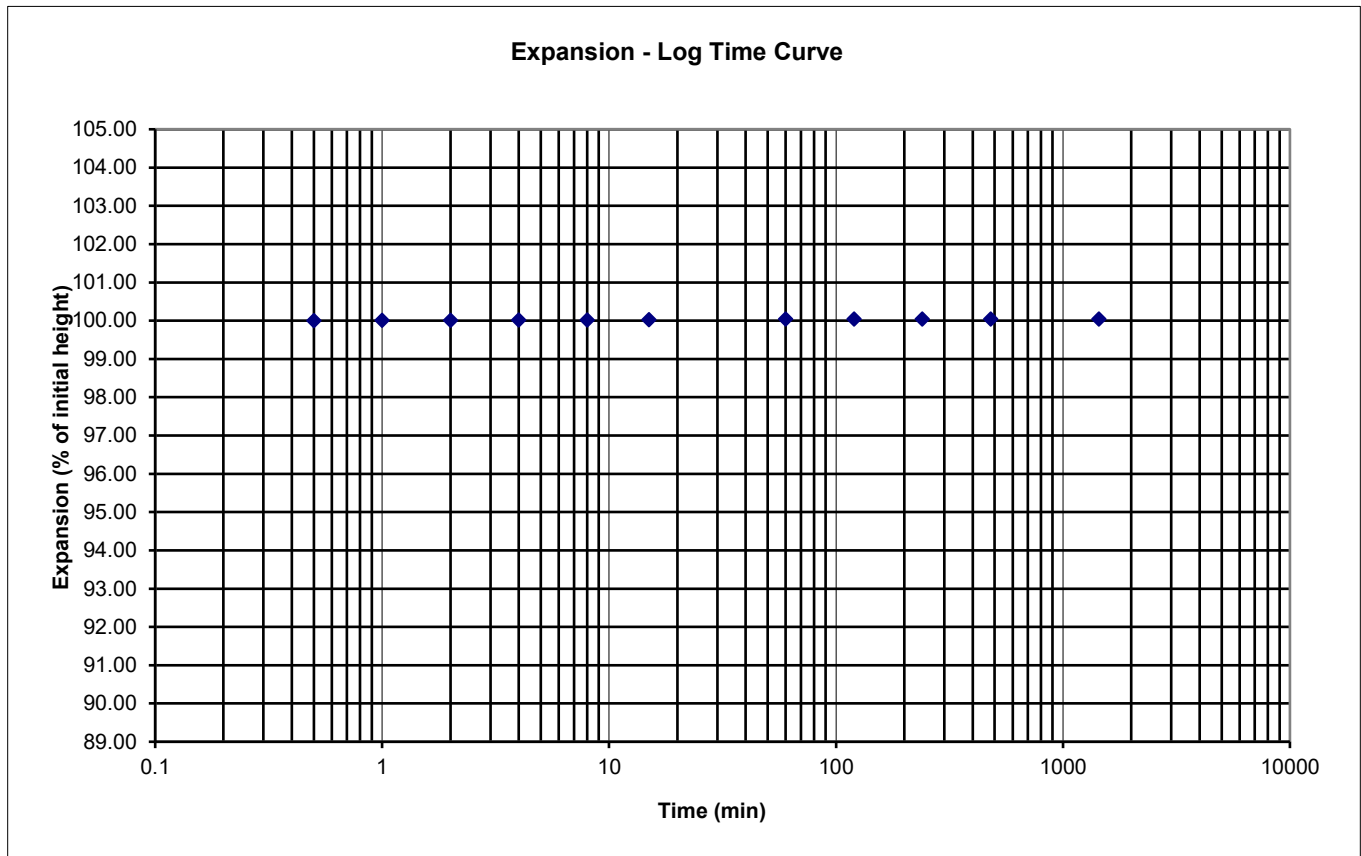


PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs
SAMPLE SOURCE: B-B3 0-5
SAMPLE PREP: Remolded to 95% max dry density and 3% below optimum moisture
Max dry density D698A 119.9 pcf @ 12.0 opt. moisture

JOB NO: US-WSP-30902210.895
WORK ORDER NO: 1
LAB NO: 25-0147.07
DATE SAMPLED:
LOAD: 100 psf

ONE DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS (ASTM D-4546)

INITIAL DRY DENSITY (PCF) 114.2
FINAL DRY DENSITY (PCF) 114.2
INITIAL MOISTURE CONTENT 8.8%
FINAL MOISTURE CONTENT 15.7%
MOIST. PICK-UP (% DRY WT.) 7.0%
MOIST. PICK-UP (% IN. VOL.) 12.8%
SWELL (% INITIAL HT.) 0.0%
TYPE OF WATER USED TAP WATER



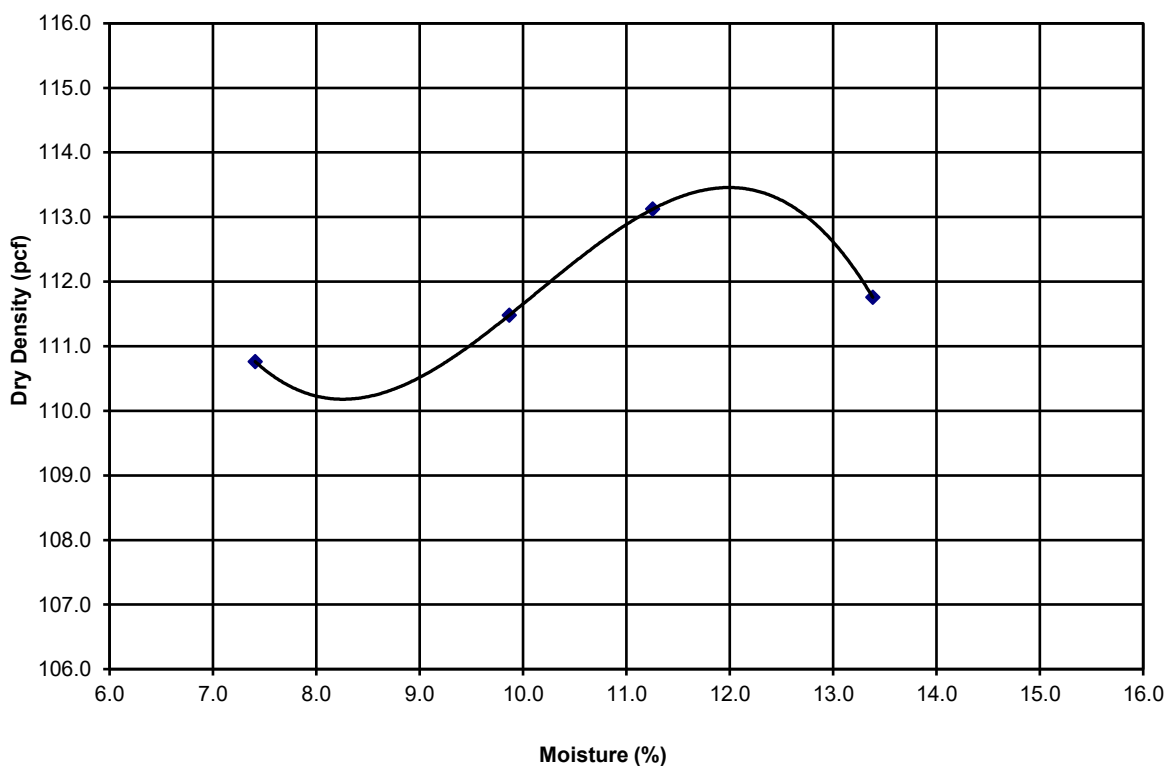


PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs
SAMPLE SOURCE: B-B5 0-5

JOB NO: US-WSP-30902210
WORK ORDER NO: 1
LAB NO: 25-0147.13
DATE SAMPLED:

**LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING
STANDARD EFFORTS (12,400ft-lb-ft/cu.ft) (ASTMD698A)**

MAXIMUM DRY DENSITY (pcf):	113.4
OPTIMUM MOISTURE (%):	12.0





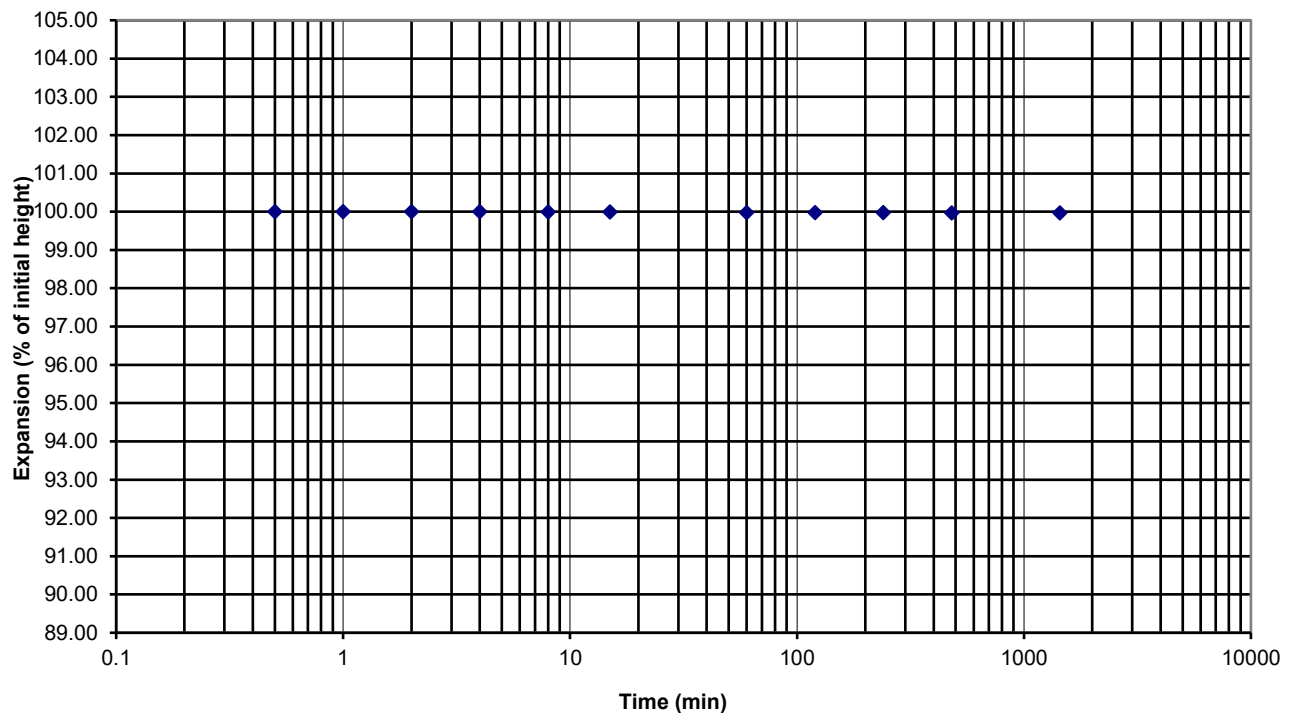
PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs
SAMPLE SOURCE: B-B5 0-5
SAMPLE PREP: Remolded to 95% max dry density and 3% below optimum moisture
Max dry density D698A 113.4 pcf @ 12.0 opt. moisture

JOB NO: US-WSP-30902210.895
WORK ORDER NO: 1
LAB NO: 25-0147.13
DATE SAMPLED:
LOAD: 100 psf

ONE DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS (ASTM D-4546)

INITIAL DRY DENSITY (PCF) 107.8
FINAL DRY DENSITY (PCF) 107.8
INITIAL MOISTURE CONTENT 9.0%
FINAL MOISTURE CONTENT 16.4%
MOIST. PICK-UP (% DRY WT.) 7.4%
MOIST. PICK-UP (% IN. VOL.) 12.8%
SWELL (% INITIAL HT.) 0.0%
TYPE OF WATER USED TAP WATER

Expansion - Log Time Curve



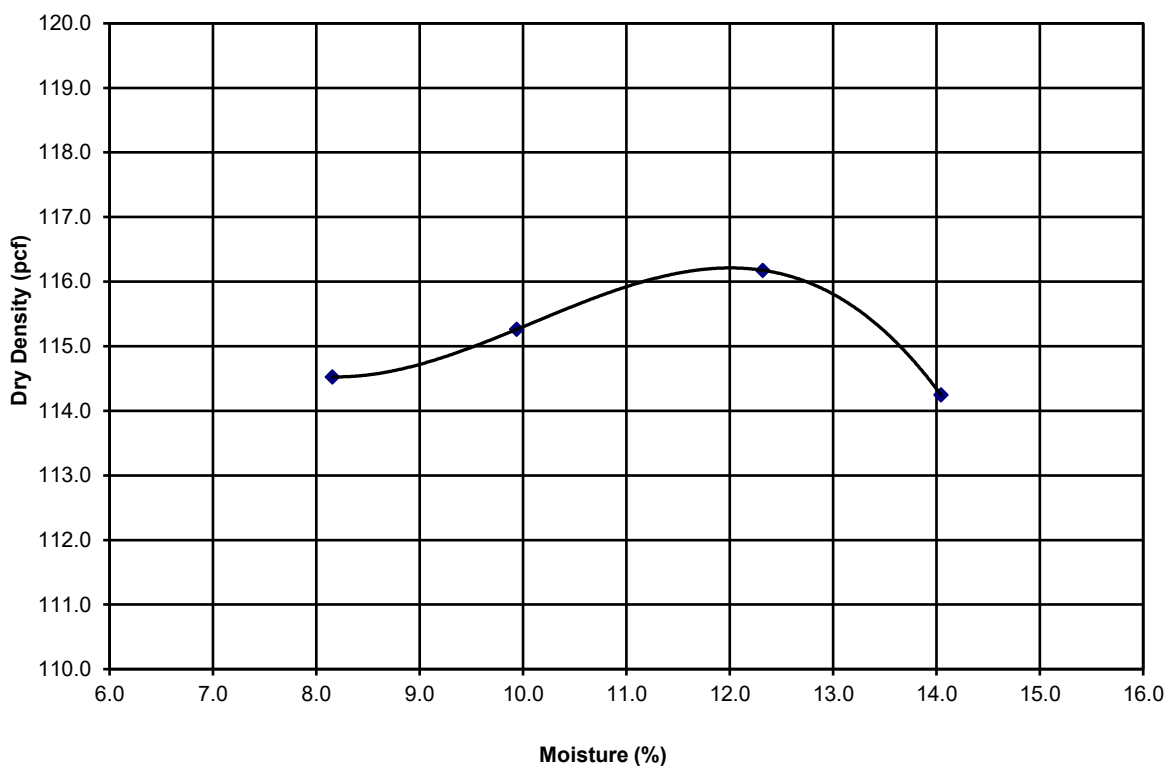


PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs
SAMPLE SOURCE: B-B9 0-5

JOB NO: US-WSP-30902210
WORK ORDER NO: 1
LAB NO: 25-0147.25
DATE SAMPLED:

**LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING
STANDARD EFFORTS (12,400ft-lb-ft/cu.ft) (ASTMD698A)**

MAXIMUM DRY DENSITY (pcf):	116.2
OPTIMUM MOISTURE (%):	12.0



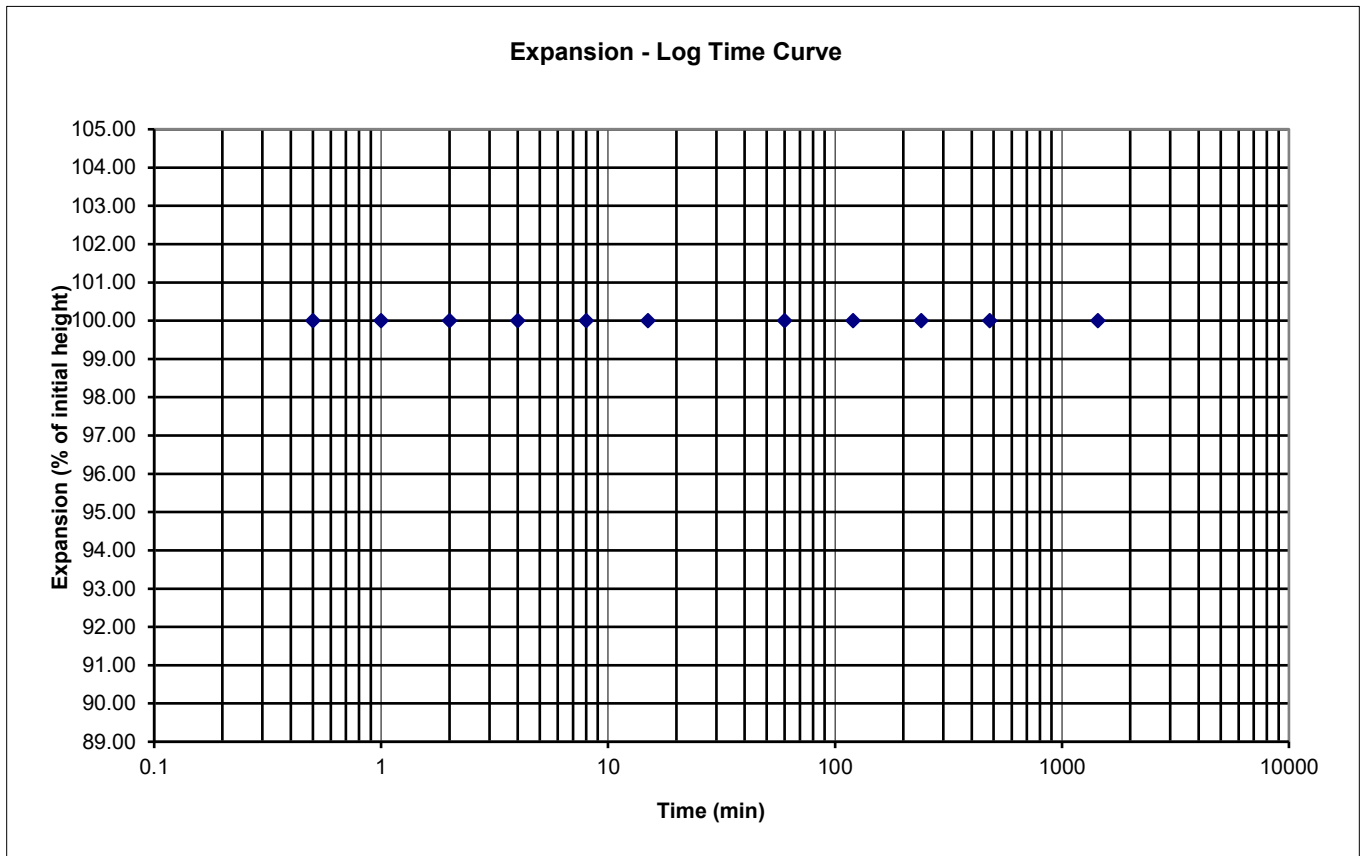


PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs
SAMPLE SOURCE: B-B9 0-5
SAMPLE PREP: Remolded to 95% max dry density and 3% below optimum moisture
Max dry density D698A 116.2 pcf @ 12.0 opt. moisture

JOB NO: US-WSP-30902210.895
WORK ORDER NO: 1
LAB NO: 25-0147.25
DATE SAMPLED:
LOAD: 100 psf

ONE DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS (ASTM D-4546)

INITIAL DRY DENSITY (PCF) 110.4
FINAL DRY DENSITY (PCF) 110.4
INITIAL MOISTURE CONTENT 9.1%
FINAL MOISTURE CONTENT 14.0%
MOIST. PICK-UP (% DRY WT.) 5.0%
MOIST. PICK-UP (% IN. VOL.) 8.8%
SWELL (% INITIAL HT.) 0.0%
TYPE OF WATER USED TAP WATER



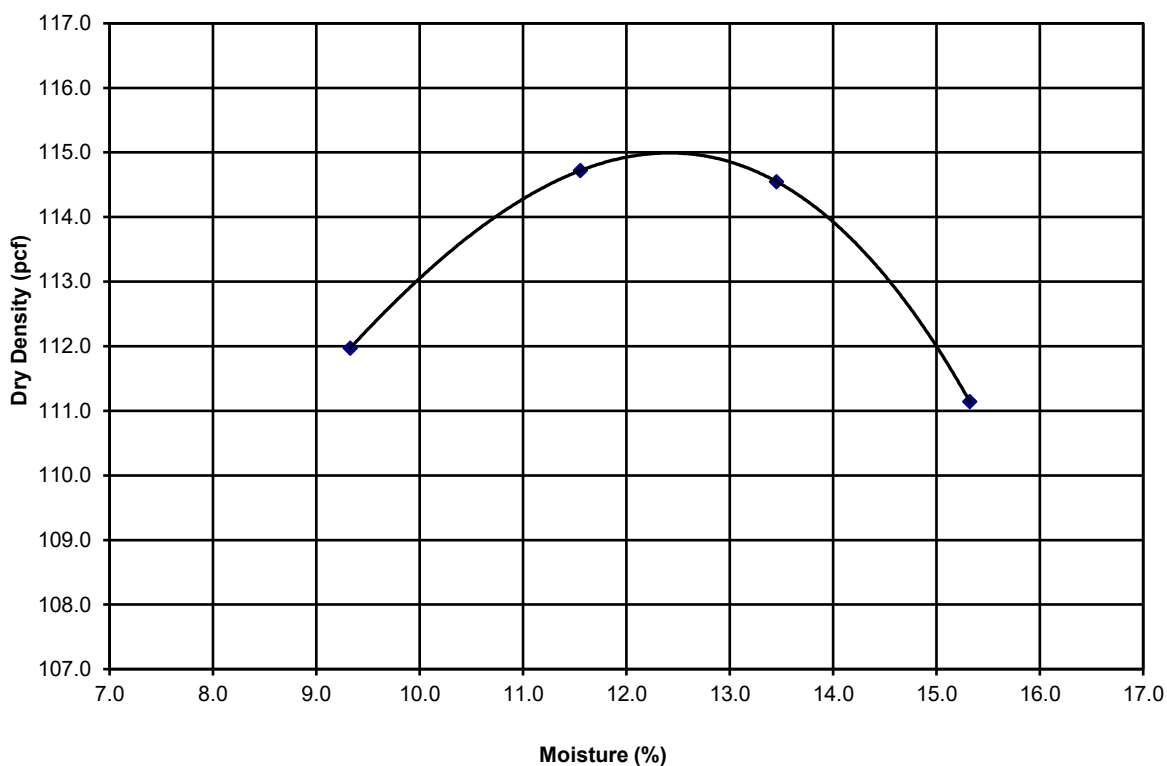


PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs
SAMPLE SOURCE: B-B13 0-5

JOB NO: US-WSP-30902210
WORK ORDER NO: 1
LAB NO: 25-0147.38
DATE SAMPLED:

**LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING
STANDARD EFFORTS (12,400ft-lb-ft/cu.ft) (ASTMD698A)**

MAXIMUM DRY DENSITY (pcf):	115.0
OPTIMUM MOISTURE (%):	12.4



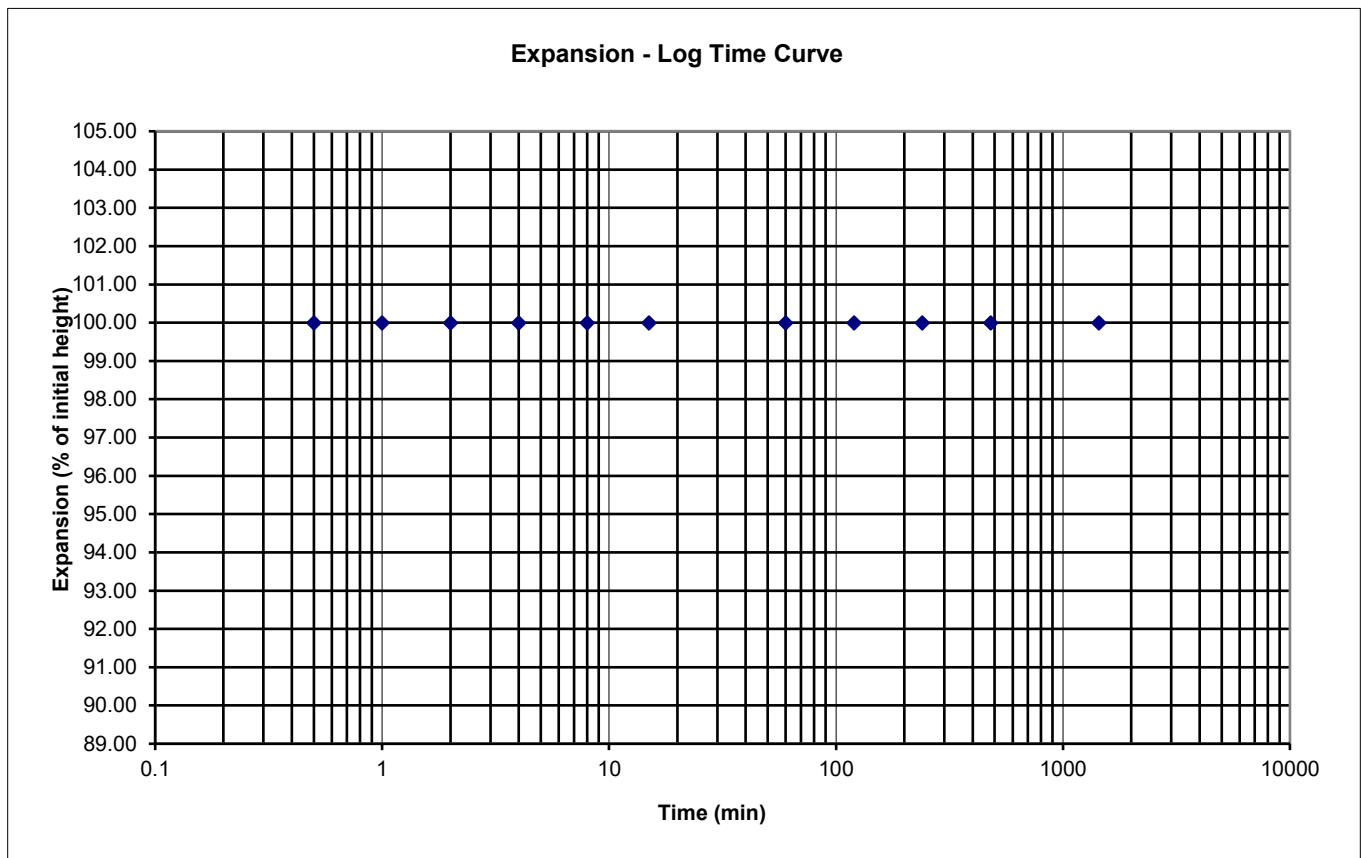


PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs
SAMPLE SOURCE: B-B13 0-5
SAMPLE PREP: Remolded to 95% max dry density and 3% below optimum moisture
Max dry density D698A 115.0 pcf @ 12.4 opt. moisture

JOB NO: US-WSP-30902210.895
WORK ORDER NO: 1
LAB NO: 25-0147.38
DATE SAMPLED:
LOAD: 100 psf

ONE DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS (ASTM D-4546)

INITIAL DRY DENSITY (PCF) 109.2
FINAL DRY DENSITY (PCF) 109.3
INITIAL MOISTURE CONTENT 9.7%
FINAL MOISTURE CONTENT 16.0%
MOIST. PICK-UP (% DRY WT.) 6.3%
MOIST. PICK-UP (% IN. VOL.) 11.1%
SWELL (% INITIAL HT.) 0.0%
TYPE OF WATER USED TAP WATER



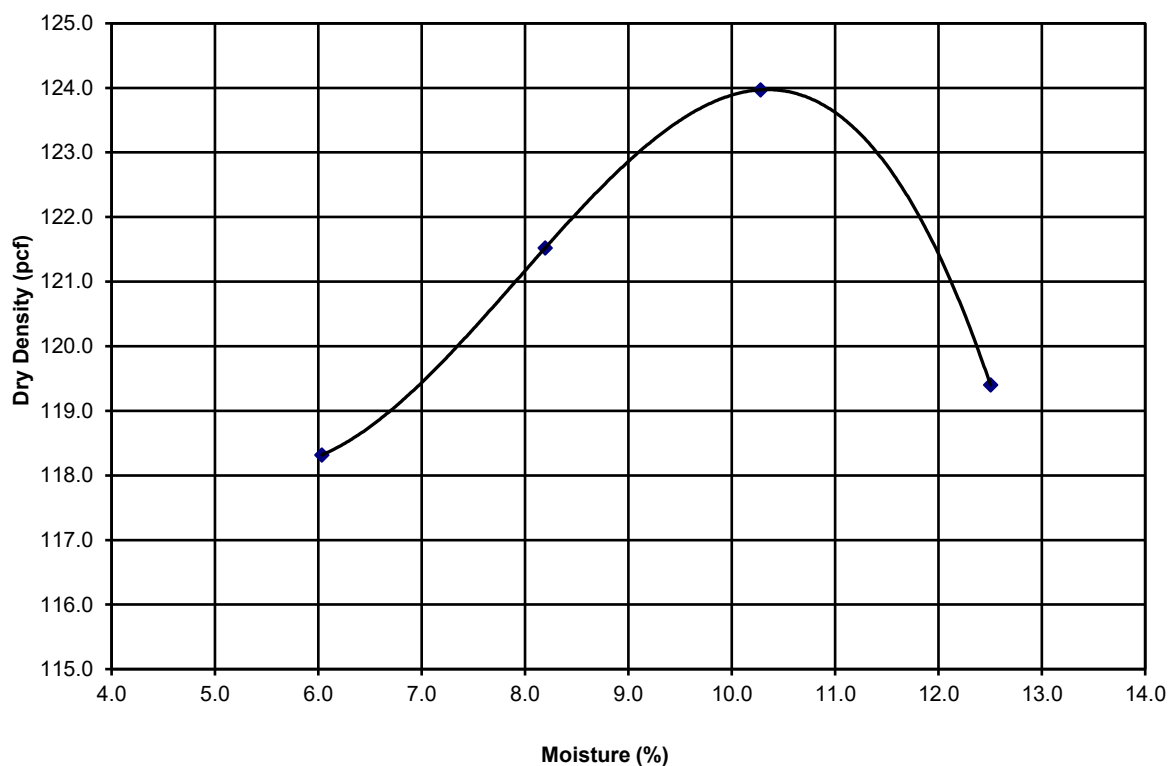


PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs
SAMPLE SOURCE: B-B16 0-5

JOB NO: US-WSP-30902210
WORK ORDER NO: 1
LAB NO: 25-0147.47
DATE SAMPLED:

**LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING
STANDARD EFFORTS (12,400ft-lb-ft/cu.ft) (ASTMD698A)**

MAXIMUM DRY DENSITY (pcf):	124.0
OPTIMUM MOISTURE (%):	14.6





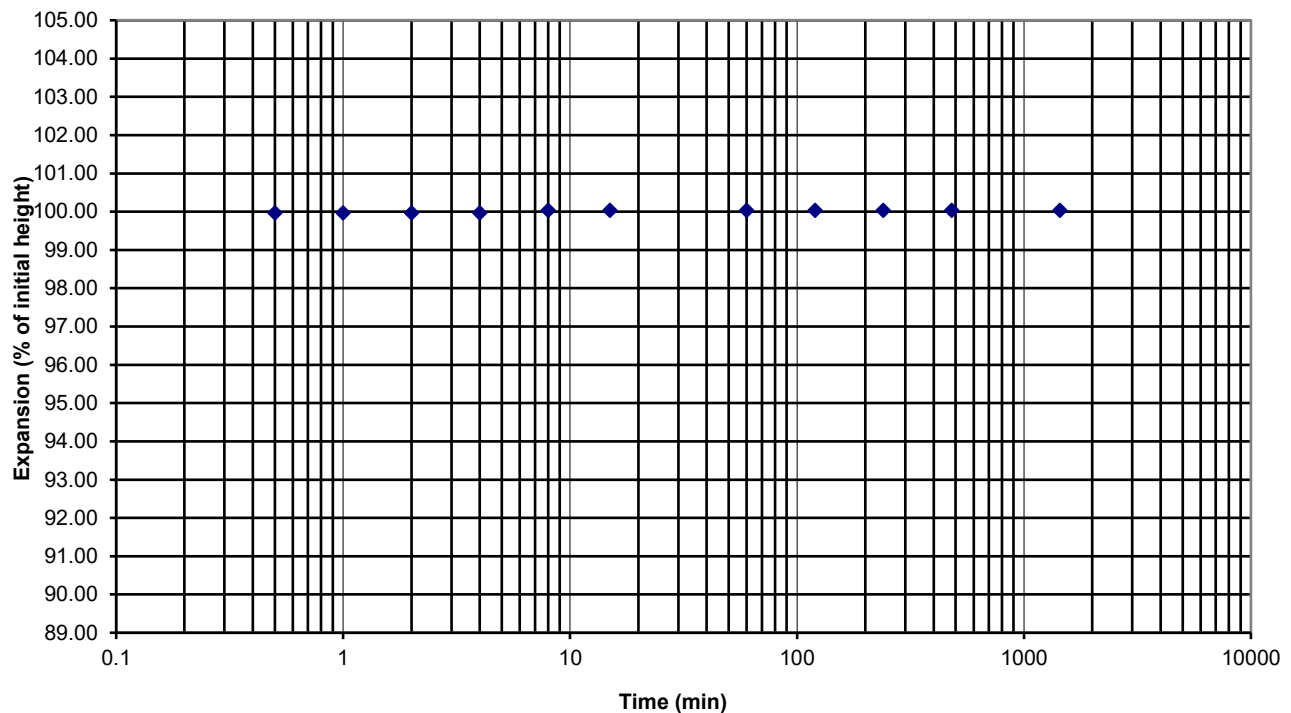
PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs
SAMPLE SOURCE: B-B16 0-5
SAMPLE PREP: Remolded to 95% max dry density and 3% below optimum moisture
Max dry density D698A 124.0 pcf @ 10.4 opt. moisture

JOB NO: US-WSP-30902210.895
WORK ORDER NO: 1
LAB NO: 25-0147.47
DATE SAMPLED:
LOAD: 100 psf

ONE DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS (ASTM D-4546)

INITIAL DRY DENSITY (PCF)	117.5
FINAL DRY DENSITY (PCF)	117.6
INITIAL MOISTURE CONTENT	7.7%
FINAL MOISTURE CONTENT	12.4%
MOIST. PICK-UP (% DRY WT.)	4.7%
MOIST. PICK-UP (% IN. VOL.)	8.9%
SWELL (% INITIAL HT.)	0.0%
TYPE OF WATER USED	TAP WATER

Expansion - Log Time Curve



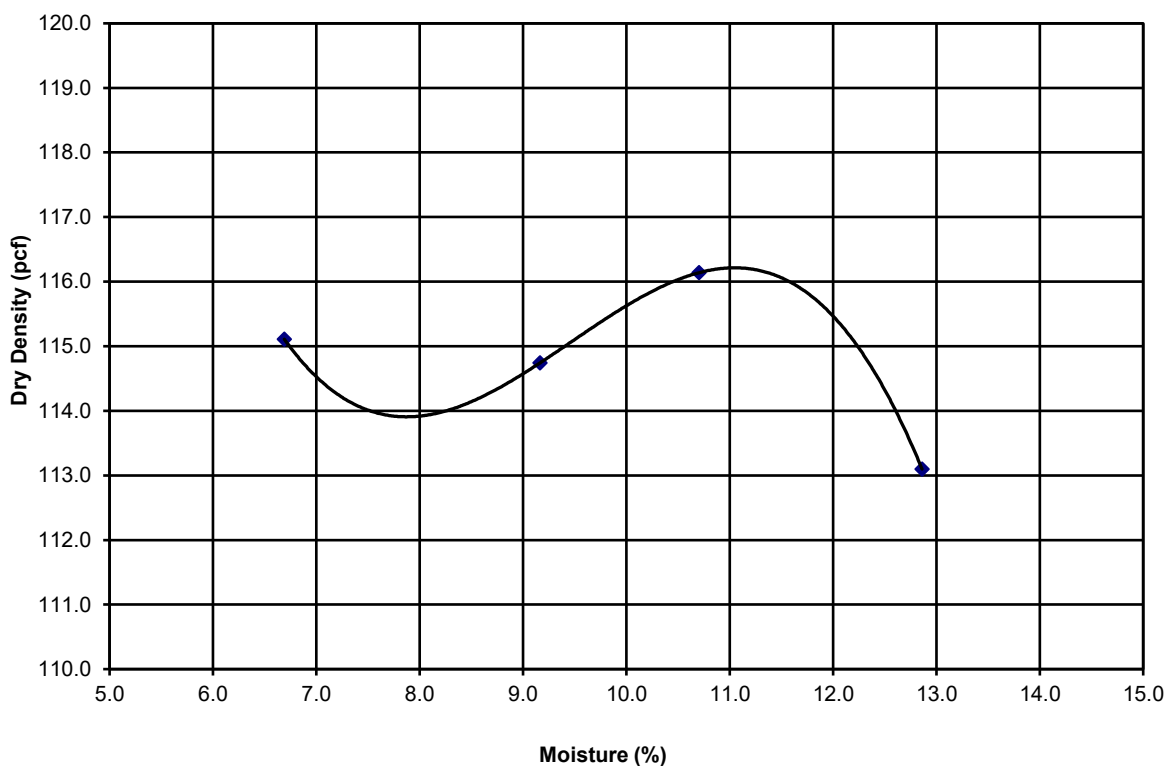


PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs
SAMPLE SOURCE: B-B17 0-5

JOB NO: US-WSP-30902210
WORK ORDER NO: 1
LAB NO: 25-0147.50
DATE SAMPLED:

**LABORATORY COMPACTION CHARACTERISTICS OF SOILS USING
STANDARD EFFORTS (12,400ft-lb-ft/cu.ft) (ASTMD698A)**

MAXIMUM DRY DENSITY (pcf):	116.2
OPTIMUM MOISTURE (%):	11.0





PROJECT: ADOT shoulder widening, Yuma County, Avenue B - County 18th St to 23rd St
LOCATION: Yuma AZ Avenue B
MATERIAL: See boring logs
SAMPLE SOURCE: B-B17 0-5
SAMPLE PREP: Remolded to 95% max dry density and 3% below optimum moisture
Max dry density D698A 116.2 pcf @ 11.0 opt. moisture

JOB NO: US-WSP-30902210.895
WORK ORDER NO: 1
LAB NO: 25-0147.50
DATE SAMPLED:
LOAD: 100 psf

ONE DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS (ASTM D-4546)

INITIAL DRY DENSITY (PCF) 110.2
FINAL DRY DENSITY (PCF) 110.1
INITIAL MOISTURE CONTENT 8.3%
FINAL MOISTURE CONTENT 14.6%
MOIST. PICK-UP (% DRY WT.) 6.3%
MOIST. PICK-UP (% IN. VOL.) 11.2%
SWELL (% INITIAL HT.) 0.0%
TYPE OF WATER USED TAP WATER

