CMT TECHNICAL SERVICES

ENGINEERING • ENVIRONMENTAL (ESA I & II)
MATERIALS TESTING •SPECIAL INSPECTIONS •
ORGANIC CHEMISTRY

GEOTECHNICAL ENGINEERING PAVEMENT STUDY

Proposed 1200 West Improvement From 2980 South to 2200 South

Nibley, Utah

CMT Project No. 18890

FOR:
CRS Engineers
2 North Main, Suite 8
Providence, Utah 84332

September 20, 2022

CMT TECHNICAL SERVICES

September 20, 2022

Mr. Max Pierce
CRS Engineers
2 North Main, Suite 8
Providence, Utah 84332

Subject: Proposed 1200 West Improvement Study
From 2980 South to 2200 South
Nibley, Utah
CMT Job No. 18890

Mr. Pierce:

Submitted herewith is the report for our geotechnical engineering study for the proposed 1200 West roadway improvements from about 2980 South to 2200 South in Nibley, Utah. This report contains the results of our findings and an interpretation of the results with respect to the available project characteristics. It also contains recommendations to aid in the design of the new pavement improvement section.

CMT Technical Services (CMT) personnel performed Dynamic Cone Penetrometer testing (DCP), at 20 locations, and drilled and soil sampled within 10 bore holes locations completed along the length of planned roadway improvement section.

Soil samples were obtained during the field operations and subsequently transported to our laboratory for further testing. A detailed discussion of existing conditions encountered during the field investigation is provided in this report.

We appreciate the opportunity to work with you on this project. CMT offers a full range of Geotechnical Engineering, Geological, Material Testing, Special Inspection services, and Phase I and II Environmental Site Assessments. With offices throughout Utah, Idaho, Arizona, Colorado and Texas, our staff is capable of efficiently serving your project needs. If we can be of further assistance or if you have any questions regarding this project, please do not hesitate to contact us at (801) 590-0394. To schedule materials testing please call (801) 908-5859.

Sincerely,
CMT Technical Services

LICENSED PROFESSIONAL ENGINEER
276476
BRYAN N. ROBERTS
9/20/2022
STATE OF UTAH

Bryan N. Roberts, P.E.
Senior Geotechnical Engineer

Reviewed by:

Andrew M. Harris, P.E.
Geotechnical Division Manager

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1.0 INTRODUCTION

1.1 General

CMT Technical Services (CMT) was retained to conduct a geotechnical engineering pavement study for the roadway improvements along 1200 West from about 2980 South to 2200 South in Nibley, Utah, as shown in Vicinity Map Figure below.

Vicinity Map

The purpose of this study was to provide an assessment of the existing pavement cross section and subgrade soil conditions and to provide pavement reconstruction/new construction recommendations for the approximately 4,900-foot section of roadway. The objectives and scope of our study were planned in discussions between Mr. Max Pierce of CRS Engineers, and Mr. Andrew Harris of CMT.

In accomplishing these objectives, our scope of work has included performing field explorations, which included drilling, logging and sampling 10 bore holes to depths of about 2.0 to 11.5 feet, soil sampling within the bore holes, and performing in-situ Dynamic Cone Penetrometer testing (DCP) below the current asphalt surface and along the new roadway alignment. Soil samples were returned to our laboratory for testing and further classification followed by an office program, which consisted of correlating available data, performing engineering analyses, and preparing this summary report.

1.3 Authorization

This scope of work was authorized by returning a signed copy of the subcontractor agreement based on the scope of work outlined in our Statement of Work proposal dated March 28, 2022 and executed on July 18, 2022.

2.0 DESCRIPTION OF PROPOSED CONSTRUCTION

We understand that improvements are planned for 1200 West from about 2980 South to 2200 South. The project will require reconstruction of existing roadways as well as some new road construction. The total length of road to be constructed/reconstructed is about 4,900 lineal feet. The roadway is anticipated to be constructed using asphalt pavement supported over base course and subbase. Construction activities along the proposed alignment are anticipated to include some demolition of existing structures and pavements as well as new utility installation and relocation of existing utilities.

Initial design is based on an average daily traffic (ADT) of 10,000 vehicles based on Nibley Transportation Maser Plan Document (dated December 2018) which designates 1200 West as a minor arterial and service class C. We further project that the traffic type will be a combination of residential and light commercial based on anticipated truck traffic.

3.0 FIELD EXPLORATION AND SITE CONDITIONS

3.1 Field Exploration

In order to define and evaluate the subsurface soil and groundwater conditions, 10 bore holes were completed along the roadway alignment extending to depths of about 2.0 to 11.5 feet below the existing ground surface (the 2-foot depth achieved at bore hole B-4 was dictated by auger refusal on an obstruction/very dense material). Further, in-situ DCP testing was completed at the bore hole locations, as well as additional locations along the existing and proposed new roadway alignment. Locations of the test holes and DCP tests are presented on **Figure 1, Site Map**. The majority of the testing for the existing roadway section was completed along the southbound lane where a buffer lane was available.

Samples of the subsurface soils encountered in the bore holes were collected at varying depths through the hollow stem drill augers. Relatively undisturbed samples of the subsurface soils were obtained by driving a split-spoon sampler with 2.5-inch outside diameter rings/liners into the undisturbed soils below the drill augers. Disturbed samples were collected utilizing a standard split spoon sampler. This standard split spoon sampler was driven 18 inches into the soils below the drill augers using a 140-pound hammer free-falling a distance of 30 inches. The number of hammer blows needed for each 6-inch interval was recorded. The sum of the hammer blows for the final 12 inches of penetration is known as a standard penetration test and this 'blow count' was recorded on the bore hole logs. The blow count provides a reasonable approximation of the relative density of granular soils, but only a limited indication of the relative consistency of fine-grained soils because the consistency of these soils is significantly influenced by the moisture content.

A bulk sample was taken near bore hole B-1 of the native clay soils at a depth of about 12 inches below the ground surface (See Figure 1 Site Map for approximate location). A laboratory Proctor, gradation, Atterberg Limits, and CBR tests was completed on this bulk sample.

The subsurface soils encountered in the bore holes were logged and described in general accordance with ASTM[1] D-2488. Soil samples were collected as described above and were classified in the field based upon visual and textural examination. These field classifications were supplemented by subsequent examination and testing of select samples in our laboratory. Logs of the bore holes, including a description of the soil strata encountered, is presented on each individual Bore Hole Log, Figures 2 through 11, included in the Appendix. Sampling information and other pertinent data and observations are also included on the logs. In addition, a Key to Symbols defining the terms and symbols used on the logs is provided as Figure 12 in the Appendix.

3.2 Dynamic Cone Penetrometer (DCP) Testing

As discussed previously, following the removal of the upper asphalt soil layer along portions of the current asphalt road as well as along the proposed, unpaved alignment, Dynamic Cone Penetrometer testing (DCP) was performed on the existing, exposed, subgrade in order to ascertain in-situ California Bearing Ratio (CBR) values. The aggregate base below the existing pavement appeared to be relatively thin (about 6 inches) and which was somewhat disturbed through the asphalt coring activities. Granular borrow was located directly below the road base. The following table provides estimated field CBR correlations within the upper about 7 to 29 inches penetrated. The field values were then factored/corrected with respect to moisture content and AASHTO recommendations.

[1]American Society for Testing and Materials

DCP RESULTS

Test Location	Estimated Soil	Penetration Depth (inches)	Field Correlated CBR	Factored/Corrected Field CBR
B-1	Sandy Clay	27	16	9
B-2	Granular borrow/ Sandy Clay	28	40/ 8	27/ 4
B-3	Sandy Clay	26	10	6
B-4	10" Granular base/ Granular borrow	22	10/ 50	7/ 34
B-5	Clay with gravel	26	20	13
B-6	Clay with gravel	7	(≈20)-CPT refusal on a rock at 7inches	13
B-7	Silty Sand with gravel	25	25	17
B-8	Silty Gravel	18	70	47
B-9	Sandy Silt with gravel	26	10 for 10"/ 40	7/ 27
B-10	Clayey Gravel with sand	15	80	54
DCP-11	Landscaped Roundabout (Clay)	25	8	4
DCP-12	Landscaped Roundabout (sand with fines)	24	20	11
C-1	Granular borrow	29	30	20
C-2	Granular borrow	24	20	13
C-3	Granular borrow/ subgrade	26	50/ 18	34/ 10
C-4	Granular borrow	7	70	47
C-5	Granular borrow	7	80+	54
C-6	Granular borrow	7	50	34
C-7	Granular borrow	27	40	27

*Soil sample at depth was high in moisture therefore no correction.

3.3 Surface and Subsurface Conditions

The existing paved roadway section is about 20 to 50 feet wide and paved with asphalt with some variable cracking both longitudinal and transversely across the roadway section. Significant rutting and visible subgrade failure indicators were not significant. The visible asphalt distress may be more related to mix design, placement, oxidation/degradation, and maintenance.

At the core/DCP test locations and at bore holes B-2 and B-4, the measured asphalt thickness varied between about 2.6 inches and 5 inches thick. Measured asphalt thicknesses are tabulated below:

Measured Asphalt Thickness Along Existing Roadway (cores and bore holes complete between about 5 and 8 feet from road edge)	
Test Location	Observed Asphalt Thickness (inches)
Core 1	3
Core 2	4
Core 3	2.6
Core 4	3
Core 5	2.6
Core 6	3
Core 7	3
Bore hole B-2	5
Bore hole B-4	3

Directly below the asphalt, at the test locations, a granular fill was present and was difficult to fully delineate the thickness of roadbase in the test holes, but estimated to consist of about 6 inches of an aggregate base overlying about 12 inches (occasionally estimated up to 24 inches thick) of a 3-inch minus granular borrow.

At the bore holes, completed outside the existing pavement, the natural, surficial soils varied along the alignment. However, in general, at bore holes B-1, B-3 through B-6, and B-9, fine grained clays and silts were encountered at the surface often grading to more sandy soils and some gravel soils below roughly 3 to 5 feet from the surface and extending to the depths penetrated of about 5.5 to 11.5 feet. At the remaining bore holes, near surface soils consisted of sands and gravels with moderate fines content roughly 4 to 6 feet thick overlying fine grained soils (clays/silts) extending to the full depth penetrated, about 11.5 feet.

The natural clay and silt soils encountered were brown to dark brown in color, moist to wet, and generally medium stiff grading soft with depth. The natural sand and gravel soils encountered were brown to gray in color, slightly moist to wet, and loose to occasionally medium dense.

For a more descriptive interpretation of subsurface conditions, please refer to the bore hole logs, ***Figures 2 through 11***, which graphically represent the subsurface conditions encountered. The lines designating the interface between soil types on the logs generally represent approximate boundaries - in situ, the transition between soil types may be gradual.

3.4 Groundwater

Groundwater was visibly observed within the bore holes at the time of the exploration between depths of about 5 and 9 feet below the ground surface. Additionally, we observed very moist fine-grained soils as shallow as about 3 to 4 feet.

Groundwater levels can fluctuate seasonally. Numerous factors such as heavy precipitation, irrigation of neighboring land, and other unforeseen factors, may also influence ground water elevations at the site. The detailed evaluation of these and other factors, which may be responsible for ground water fluctuations, is beyond the scope of this study.

Please note: CMT cannot reasonably predict groundwater level changes and its effects on construction from surrounding field irrigation, which we understand consists generally of flood irrigation locally. Further, we recommend that seasonal irrigation be factored into construction schedule and that the city or contractor work with local property owners to reduced flood irrigation during construction.

3.5 Site Subsurface Variations

Due to the heterogeneous characteristics of natural soils, care should be taken in interpolating or extrapolating subsurface conditions beyond the exploratory locations. Seasonal fluctuations in groundwater conditions may also occur.

4.0 LABORATORY TESTING

4.1 General

Soil samples were obtained from the bore hole locations and subjected to various laboratory tests to assess pertinent engineering properties, as follows:

1. Moisture Content, ASTM D-2216, Percent moisture representative of field conditions
2. Gradation Analysis, ASTM D-1140/C-117, Grain Size Analysis
3. Atterberg Limits, ASTM D-4318, Plasticity and workability
4. Laboratory Compaction Test, ASTM D 1557, Modified Proctor density
5. California Bearing Ratio, ASTM D-2937, Subgrade support properties

4.2 Lab Summary

Laboratory test results are presented in the following Lab Summary tables:

Lab Summary Table

Test Hole #	Depth (feet)	Soil Class	Sample Type	Moisture Content (%)	Dry Denstiy (pcf)	Gradation			Atterberg Limits		
						Grav	Sand	Fines	LL	PL	PI
B-1	2.5	CL	SPT	15.5				56	23	15	8
	5	SM	SPT	19.5				48			
	7.5	GP-GM	SPT	7.7		54	34	12			
B-2	0.5	SM	SPT	2.9		9	72	19			
	3	ML-CL	Rings	18.8	105			66	23	16	7
	5	GM-SM	SPT	5.7		41	42	18			
B-3	2.5	CL	Rings	25.0	95			91	27	17	11
	5	CL	SPT	22.8				56			
	7.5	CL	SPT	28.0					33	20	13
B-7	2.5	SM	SPT	8.2		36	41	23			
	5	CL	SPT	24.8				68			
	7.5	CL	Rings	29.3				99	45	18	27
B-8	2.5	GM	SPT	7.3		48	34	18			
	5	SM	SPT	18.8				48			
	7.5	CL	SPT	31.0				92	42	19	23
B-9	2.5	ML	SPT	16.2		20	35	45	19	17	2
B-10	2.5	GC-SC	SPT	4.1		51	32	17			
	5	GC-SC	SPT	8.8		44	34	21			
	10	CH	SPT	40.0				99	54	17	34

4.3 Granular Base Full Gradation Summary

Samples of the underlying aggregate base materials was obtained below the core locations along the edge of the existing roadway. These samples were tested for gradation with the results tabulated below.

Core No.	Depth (inches)	Percent Passing Sieve											Soil Classification*
		1.5”	1"	3/4"	1/2"	3/8"	No. 4	No. 10	No. 16	No. 40	No. 100	No. 200	
C-1	3	---	100	93	74	65	51	42	38	30	18	11.3	SM-SP
C-2	6	---	100	90	70	52	28	22	21	18	14	11.0	GM-GP
C-3	6	---	---	100	94	83	59	44	38	30	18	12.4	SM
C-4	6	---	---	100	91	75	48	30	24	17	11	8.2	GM-GP
C-5	6	---	100	99	89	79	58	42	36	28	21	16.1	SM
C-6	6	93	83	77	64	51	28	15	12	9	7	5.4	GP-GM
C-7	10	100	94	86	68	55	40	32	3 0	25	19	14.5	GM

5.0 TRAFFIC ANALYSIS

It is our understanding that the proposed roadway reconstruction will be surfaced with asphalt concrete pavement. Estimated total traffic counts were taken from the Nibley Transportation Master Plan where 3200 South and 1200 West Streets are labeled as a Minor Arterial (3 lane street with trail facility and 2 lane street with trail facility respectively). The build out forecast provided in the Master plan for a Minor Arterial was given between about 5,000 to 15,000 vehicles per day. For design we utilized and average of 10,000 vehicles per day. We project that the traffic type will be somewhere between residential and light commercial based on anticipated truck traffic. These vehicles were then categorized as follow: 5.0 percent trucks (2.0 percent heavy-tractor trailer vehicles and 3.0 percent single unit trucks, Category 3 (Class 5-7) vehicles); 1.0 percent busses; 6.0 percent Class 3 vehicles; and 88.0 percent light Class 1 and 2 passenger vehicles based on UDOT Vehicle classifications.

Additional criteria utilized in the analysis consisted of the follow:

- A CBR of 4 percent based on field and laboratory testing.
- 20-year life cycle
- 2.0 percent growth
- Design ESAL's over life cycle of 2,717,498 (372.3 ESAL's per day)
- UDOT Function Class: 06 Rural-Minor Arterial System
- Initial PSI: 4.2
- Final PSI: 2.0
- Reliability: 90 percent
- Drainage Coefficient: 1.0

6.0 PAVEMENTS

The natural fine-grained clay soil will exhibit poor pavement support characteristics when wet. Based on DCP testing for native subgrade along the roadway alignment, a subgrade CBR of 4 percent is recommended for the roadway reconstruction. Our calculated minimum structural number required for a 20-year life cycle is on the order of 4.1. The following pavement sections meet this minimum requirement.

MATERIAL	PAVEMENT SECTION THICKNESS (inches)					
	372.3 ESALS/Day					
Asphalt	5	5	5.5	6	---	
PCC	---	---	---	---	7.5	7
Road-Base	18	8	8	8	12	6**
Subbase	---	15	12	10	---	---
Total Thickness	23	28	25.5	24	19.5	13

**placed over a “high MARV” stabilization separation geotextile fabric installed directly above stable subgrade (see APWA 31-05-19 Table 1).

Untreated base course (UTBC) should conform to city specifications, or to 1-inch-minus UDOT specifications for A–1-a/NP and have a minimum 50% fracture face aggregate on two faces and a CBR value of 70%. Subbase shall consist of a granular soil with a minimum CBR of 40%. Roadbase and subbase material shall be compacted as recommended above in **Section 6.3** Fill Placement and Compaction of this report. Asphalt material generally should conform to APWA requirements, having a ½-inch maximum aggregate size, a 75-gyration Superpave mix containing no more than 15% of recycled asphalt (RAP) and a PG58-28 binder. The asphalt pavement should be compacted to a minimum 93% of the maximum density for the asphalt material.

It is important to the long-term performance of pavements that water not be allowed to collect or pond across the surface. Therefore, proper grading and drainage must be considered in final design. Further, to promote adequate design life, regular/typical standard maintenance must be completed.

7.0 SITE PREPARATION AND GRADING

7.1 Site Preparation

Initial site preparation will consist of; some demolition of conflicting structures along the proposed alignment, the removal of all surface vegetation, topsoil and other deleterious materials, milling/removal of existing asphalt, removing non-engineered fills, potential realignment/termination of existing utilities and performing grading activities associated with the preferred pavement replacement section.

Subgrade preparation, shall consist of scarifying and moisture preparing the upper 9 inches of exposed subgrade, and recompacting to a minimum of 90 percent of the maximum dry density as outlined by ASTM D-1557. Subsequent to initial removals/rework and prior to the placement of structural site grading fills, curb and gutter and pavements, the exposed subgrade must be proof rolled by passing moderate-weight rubber tire-mounted construction equipment over the surface at least twice to determine any soft areas prior to placing new materials. If soft areas are encountered, these areas must be stabilized as recommended in section **7.6 Stabilization** below. Exposed subgrades must be observed/reviewed by authorized oversite personnel prior to placing site grading fills, and pavements. Further, we recommend that all fills, geotextiles and geogrid submittals be reviewed by CMT and any contractor substitutions for these materials, prior to utilization.

Milled asphalt and existing granular fill soils may be re-utilized as subbase provided it meets the requirements for such as outlined later in this report.

7.2 Temporary Excavations

Temporary construction excavations in cohesive soil, not exceeding 4 feet in depth and above or below the groundwater table, may be constructed with near-vertical sideslopes. Temporary excavations up to 8 feet deep in fine-grained cohesive soils, above or below the water table, may be constructed with sideslopes no steeper than three-quarter horizontal to one vertical (0.75H:1V). Excavations deeper than 10- feet are not anticipated at the site.

For granular (cohesionless) soils, construction excavations above the water table, not exceeding 4 feet, should be no steeper than one-half horizontal to one vertical (0.5H:1V). For excavations up to 10- feet, in granular soils and above the water table, the slopes should be no steeper than one horizontal to one vertical (1H:1V) without bracing. Excavations encountering very clean and/or saturated cohesionless soils will be very difficult and will require very flat sideslopes and/or shoring, bracing and dewatering as these soils will tend to flow into the excavation.

To reduce disturbance of the natural soils during excavation, it is recommended that smooth edge buckets/blades be utilized.

All excavations must be inspected periodically by qualified personnel. If any signs of instability or excessive sloughing are noted, immediate remedial action must be initiated. All excavations should be made following OSHA safety guidelines.

7.3 Roadway Construction Fills

The natural fine-grained clay soil, encountered at each exploration bore hole, classify as A-4 through A-7 soils with the majority meeting groups A-6 and A-7. According to the UDOT Standard Specifications for “Borrow” the soils utilized for roadway embankment fill shall classify within the limits of A-1-a through A-4. Similar recommendations are provided in APWA Standards Under Section 31 05 13 Common Fill. Therefore, the majority of existing natural fine-grained soils are not recommended for re-utilization as suitable borrow.

Borrow, Granular Borrow, and Granular Backfill Borrow as specified in Part 2.2 of Section 02056 of the UDOT Standard Specifications as well as APWA Part 2 Products of Section 31 05 13 Common Fill are recommended for roadway borrow. Existing suitable granular fill soils and/or milled asphalt which may be produced/available from partial demolition of existing roadways, meeting the specified requirement may be reutilized for borrow/subbase.

Untreated base course (UTBC) shall meet the requirements outlined in Section 2721 of the UDOT Standard Specifications or APWA Section 32 11 23.

7.4 Fill Placement and Compaction

The various types of compaction equipment available have their limitations as to the maximum lift thickness that can be compacted. For example, hand operated equipment is limited to lifts of about 4 inches and most "trench compactors" have a maximum, consistent compaction depth of about 6 inches. Large rollers, depending on soil and moisture conditions, can achieve compaction at 8 to 12 inches loose.

Structural fills greater than about 10-feet thick are not anticipated at the site. We recommend for best compaction results that the moisture content for structural fill/backfill be within 2% of optimum.

Field density tests should be performed on each lift as necessary to verify that proper compaction is being achieved as outlined by project specifications. In general, materials placed and compacted within the roadway area must be compacted to a minimum of 96% of the Modified Proctor (ASTM D-1557).

7.5 Utility Trenches

For the bedding zone around the utility, we recommend utilizing sand bedding fill material that meets current APWA[2] requirements.

All utility trench backfill material below structurally loaded facilities (flatwork, roads, etc.) shall be placed at the same density requirements as per current city standard. If the surface of the backfill becomes disturbed during the course of construction, the backfill shall be proofrolled and/or properly compacted prior to the construction of any exterior flatwork over a backfilled trench. Proofrolling shall be performed by passing moderately loaded rubber tire-mounted construction equipment uniformly over the surface at least twice. If excessively loose or soft areas are encountered during proofrolling, they shall be removed to a maximum depth of 2- feet below design finish grade and replaced with Stabilization fill.

We recommend that utility trench backfill consist of A-1 soils (AASHTO Designation – basically granular soils with limited fines) which are Proctorable and readily testable with a nuclear densometer.

[2] American Public Works Association

7.6 Stabilization

The fine-grained soils encountered will likely be susceptible to rutting and pumping. The likelihood of disturbance or rutting and/or pumping of the existing natural soils is a function of the soil moisture content, the load applied to the surface, as well as the frequency of the load. Consequently, rutting and pumping can be minimized by avoiding concentrated traffic, minimizing the load applied to the surface by using lighter equipment and/or partial loads, by working in drier times of the year, or by providing a working surface for the equipment. Rubber-tired equipment particularly, because of high pressures, promotes instability in moist/wet, soft soils; therefore, track-mounted equipment should be used in areas of soft subgrade.

To stabilize soft subgrade conditions (if encountered), a mixture of coarse, clean, **angular** gravels and cobbles may be utilized. This coarse material may be placed and worked into the soft soils until firm and non-yielding and/or incorporate additional stabilization methods utilizing geotextile separation fabric and geogrid with suitable sand and gravel soils with low fines. This would likely consist of removing 24 inches of poor soils, installing a permeable geotextile fabric such as Mirafi 150N and installing one or more layers of geogrid with an initial geogrid layer directly over the separation fabric. A manufactured combination of fabric with geogrid such as Combigrid® may also be considered. For economic as well as practical purposes, further details related utilization geotextile and fabric should be implemented on a case-by-case stabilization need following observation and review of exposed site conditions. Further a test area should be implemented to achieve a proper stabilization strategy.

Following the installation of the fabric and geogrid the aggregate fill may be installed in proper lifts beginning at a stable edge and working/pushing the fill material across the grid/fabric/subgrade such that all construction traffic will be effectively above the aggregate base fill. To help limit compaction effort and equipment passes we recommend the aggregate fill be prior moisture conditioned to near optimum moisture content before installation and compacted such that the entire sequence is adequately compacted to the requirements for such as outlined herein. Again, for best and effective results, we recommend that the stabilization aggregate fill contain at least 50 percent fractured/angular gravels.

8.0 QUALITY CONTROL

Our recommendations in this report are based on the assumption that adequate quality control testing and observations will be conducted by CMT during construction to verify compliance. This may include but not necessarily be limited to the following:

8.1 Field Observations

Observations should be completed during all phases of construction such as site preparation, structural fill placement and pavement section placement. Exposed subgrades must be observed/reviewed by authorized oversite personnel prior to placing site grading fills, and pavements. Further, we recommend that all fills, geotextiles and geogrid submittals be reviewed by CMT and any contractor substitutions for these materials, prior to utilization.

8.2 Quality Control

All fill/backfill and pavements should be density tested.

8.3 Long Term Performance

The analysis was competed with the assumption of a 20-year life cycle. However, the projected life could be significantly shortened without proper maintenance and repairs over the life of the pavement.

9.0 LIMITATIONS

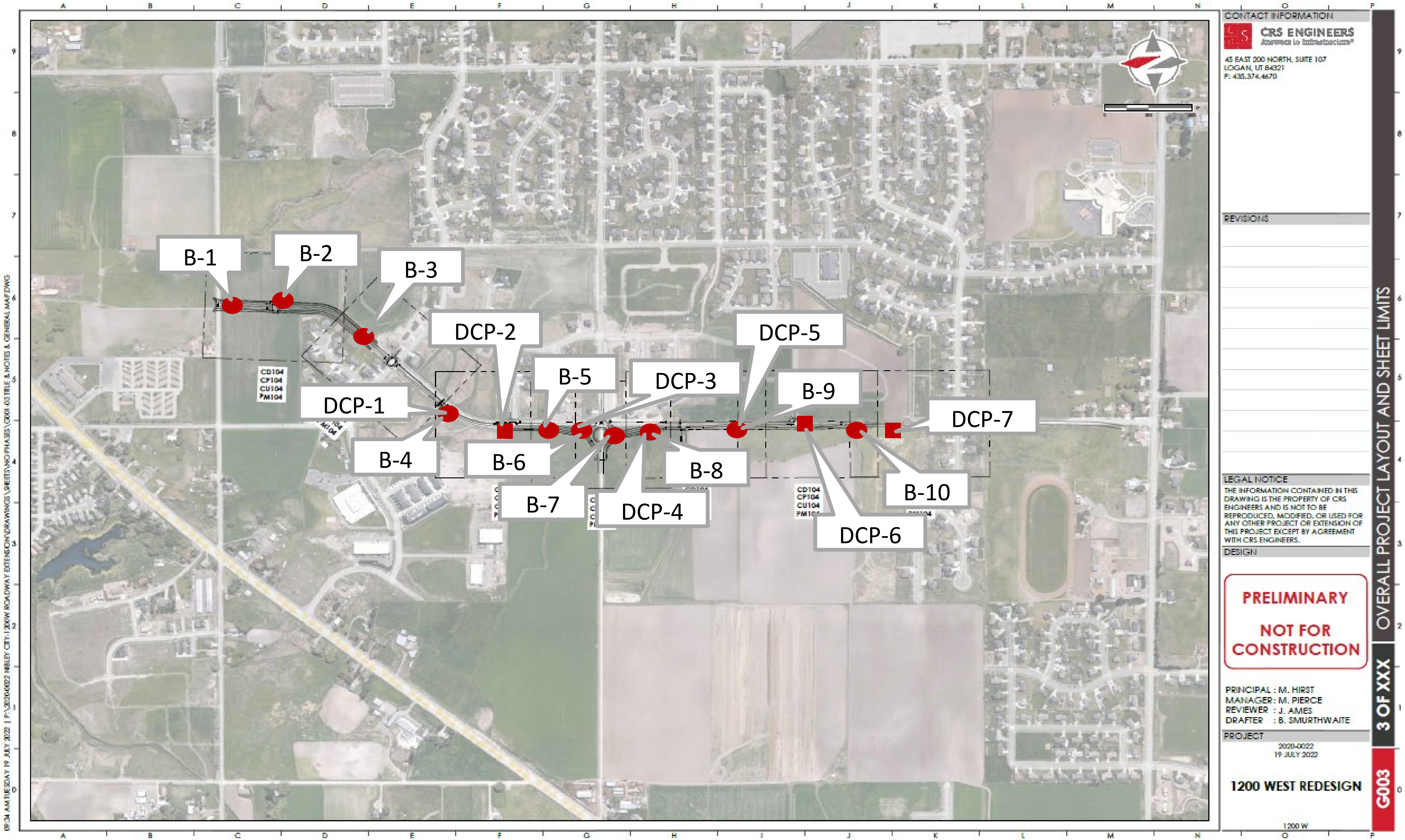
The recommendations provided herein were developed by evaluating the information obtained from the test holes and site exploration. The test hole data reflects the subsurface conditions only at the specific locations at the particular time designated. Soil and ground water conditions may differ from conditions encountered at the actual exploration locations. The nature and extent of any variation in the explorations may not become evident until during the course of construction. If variations do appear, it may become necessary to re-evaluate the recommendations of this report after we have observed the variation.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

We appreciate the opportunity to be of service to you on this project. If we can be of further assistance or if you have any questions regarding this project, please do not hesitate to contact us at (801) 590-0394. To schedule materials testing, please call (801) 381-5141.

APPENDIX

SUPPORTING DOCUMENTATION



CMT TECHNICAL SERVICES	**1200 West Improvements** 1200 W from 2980 S to 2200 S, Nibley, Utah	**SITE PLAN**	Date: 1-Aug-2022 CMT No.: 18890	Figure: 1

1200 West Improvements Pavement Study — Bore Hole Log — B-1

1200 West from 2980 South to 2200 South, Nibley, Utah

Total Depth: 11.5'
Water Depth: 5'

Date: 7/28/22
Job #: 18890

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; disturbed field												
	Light Brown Fine Sandy CLAY (CL) dry to slightly moist, medium stiff		1	4 4 2	6	15.5				56	23	15	8
4	Tan Silty SAND (SM) wet very loose		2	2 1 3	4	19.5				48			
8	GRAVEL (GP-GM) with sand and fines wet, medium dense		3	8 15 14	29	7.7		54	34	12			
			4	6 9 7	16								
12	END AT 11.5'												

Depth scale: 0, 4, 8, 12, 16, 20, 24, 28

Remarks: Groundwater encountered during drilling at depth of 5 feet.

Coordinates: 41.692682°, -111.858987°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Trevor Durrant

CMT TECHNICAL SERVICES

Figure: 2

1200 West Improvements Pavement Study Bore Hole Log B-2

1200 West from 2980 South to 2200 South, Nibley, Utah

Total Depth: 11.5'
Water Depth: 9'

Date: 7/28/22
Job #: 18890

Depth (ft)	Soil Description	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	5" Asphalt											
	Silty SAND (SM) with gravel; slightly moist, dense	5	3, 22, 15	37	2.9		9	72	19.4			
	Brown Fine Sandy Silt/Clay (ML-CL); slightly moist, loose											
4		6	7, 7, 7	14	18.8	105			66	23	16	7
	Brown Silty Sand and Gravel (SM-GM); moist, medium dense	7	6, 10, 15	25	5.7		41	42	17.7			
8	very dense	8	50/4"									
	wet											
	grades with more gravel; medium dense	9	6, 6, 7	13								
12	END AT 11.5'											
16												
20												
24												
28												

Remarks: Groundwater encountered during drilling at depth of 9 feet.

Coordinates: 41.691699°, -111.858926°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Trevor Durrant

CMT TECHNICAL SERVICES

Figure: 3

1200 West Improvements Pavement Study

Bore Hole Log B-3

1200 West from 2980 South to 2200 South, Nibley, Utah

Total Depth: 11.5'
Water Depth: 9'

Date: 7/28/22
Job #: 18890

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; light brown silty sand with gravel and organics												
	Brown Silty CLAY (CL) with some fine sand; slightly moist, medium stiff												
			10	5 7 8	15	25	95			91	28	17	11
4													
	Brown Sandy CLAY (CL) with oxidation		11	3 5 10	15	27.8				56			
	Brown Silty CLAY (CL) with oxidation; moist to very moist, very soft												
8			12	0 0 1	1	28					33	20	13
	wet												
	grades gray with roots		13	0 1 1	2								
	END AT 11.5'												
12													
16													
20													
24													
28													

Remarks: Groundwater encountered during drilling at depth of 9 feet.

Coordinates: 41.689989°, -111.859737°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Trevor Durrant

CMT TECHNICAL SERVICES

Figure: 4

1200 West Improvements Pavement Study Bore Hole Log

B-4

1200 West from 2980 South to 2200 South, Nibley, Utah

Total Depth: 2'
Water Depth: (see Remarks)

Date: 8/15/22
Job #: 18890

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Blows (N)	Blows (N) Total	Moisture (%)	Dry Density(pcf)	Gradation Gravel %	Gradation Sand %	Gradation Fines %	Atterberg LL	Atterberg PL	Atterberg PI
0		3" Asphalt												
		6" Roadbase; brown silty sandy gravel												
		3" Subbase; clayey gravel with sand moist, dense												
		REFUSAL AT 2.0'												
4														
8														
12														
16														
20														
24														
28														

Remarks: Groundwater not encountered during drilling.

Coordinates: 41.688534°, -111.861668°
Surface Elev. (approx): Not Given

Equipment: Hand Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Hand Auger
Logged By: Annie Smoot

CMT TECHNICAL SERVICES

Figure: 5

1200 West Improvements Pavement Study

Bore Hole Log — B-5

1200 West from 2980 South to 2200 South, Nibley, Utah

Total Depth: 5.5'
Water Depth: (see Remarks)

Date: 8/15/22
Job #: 18890

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Blows (N) Total	Moisture (%)	Dry Density (pcf)	Gradation Gravel %	Gradation Sand %	Gradation Fines %	Atterberg LL	Atterberg PL	Atterberg PI
0	6" Topsoil												
	Dark Brown CLAY (CL) with gravel; very moist, stiff												
	Gray Silty Clayey SAND (SM-SC); very moist, soft/loose	◣	28										
4													
	END AT 5.5'												
8													
12													
16													
20													
24													
28													

Remarks: Groundwater not encountered during drilling.

Coordinates: 41.6857065°, -111.8621318°
Surface Elev. (approx): Not Given

Equipment: Hand Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Hand Auger
Logged By: Nate Pack

CMT TECHNICAL SERVICES

Figure: 6

1200 West Improvements Pavement Study Bore Hole Log B-6

1200 West from 2980 South to 2200 South, Nibley, Utah

Total Depth: 5.5'
Water Depth: (see Remarks)

Date: 8/15/22
Job #: 18890

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gradation Gravel %	Sand %	Fines %	Atterberg LL	PL	PI
0	6" Topsoil												
	Dark Brown CLAY (CL) with gravel — very moist, stiff												
			29										
	Gray Silty Clayey SAND (SM-SC) — very moist, loose												
4			30										
	END AT 5.5'												

Depth scale: 0, 4, 8, 12, 16, 20, 24, 28

Remarks: Groundwater not encountered during drilling.

Coordinates: 41.6857065°, -111.8621318°
Surface Elev. (approx): Not Given

Equipment: Hand Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Hand Auger
Logged By: Nate Pack

CMT TECHNICAL SERVICES

Figure: 7

1200 West Improvements Pavement Study — Bore Hole Log — B-7

1200 West from 2980 South to 2200 South, Nibley, Utah

Total Depth: 11.5'
Water Depth: 5'

Date: 8/28/22
Job #: 18890

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Blows (N)	Blows (N) Total	Moisture (%)	Dry Density(pcf)	Gradation Gravel %	Gradation Sand %	Gradation Fines %	Atterberg LL	Atterberg PL	Atterberg PI
0		Topsoil; dark brown gravelly silty sand with organics												
		Brown Silty SAND (SM) with gravel, moist, medium dense												
				14	6 5 6	11	8.2		36	41	22.5			
4														
		Brown Fine Sandy CLAY (CL), wet, loose		15	4 2 3	5	24.8				67.7			
8		Brown Silty CLAY (CL) with oxidation and calcification, wet, medium stiff		16	2 4 5	9	29.3				99	45	18	27
		soft		17	1 1 2	3								
12		END AT 11.5'												
16														
20														
24														
28														

Remarks: Groundwater encountered during drilling at depth of 5 feet.

Coordinates: 41.68524°, -111.862307°
Surface Elev. (approx): Not Given

CMT TECHNICAL SERVICES

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Trevor Durrant

Figure: 8

1200 West Improvements Pavement Study Bore Hole Log B-8

1200 West from 2980 South to 2200 South, Nibley, Utah

Total Depth: 11.5'
Water Depth: 5'

Date: 8/28/22
Job #: 18890

Depth (ft)	Soil Description	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; dark brown gravelly silty sand with organics											
	Brown Silty GRAVEL (GM) with sand and organics slightly moist, medium dense	18	5 5 10	15	7.3		48	34	18.1			
4												
	Brown Silty SAND (SM) with gravel wet	19	6 5 7	12	18.8				48.4			
8	Brown Silty CLAY (CL) with oxidation wet, soft	20	1 1 2	3	31				91	42	19	23
		21	0 1 2	3								
12	END AT 11.5'											
16												
20												
24												
28												

Remarks: Groundwater encountered during drilling at depth of 5 feet.

Coordinates: 41.684886°, -111.862162°
Surface Elev. (approx): Not Given

CMT TECHNICAL SERVICES

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Trevor Durrant

Figure: 9

1200 West Improvements Pavement Study — Bore Hole Log — B-9

1200 West from 2980 South to 2200 South, Nibley, Utah

Total Depth: 6.5'
Water Depth: 4'
Date: 8/28/22
Job #: 18890

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Total	Moisture (%)	Dry Density (pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Tan Sandy SILT (ML) with gravel; moist, soft												
			22	2, 2, 2	4			20	35	44.6	69	17	2
4 (water level)	wet												
	medium dense		23	4, 6, 10	16								
6.5	END AT 6.5'												

Remarks: Groundwater encountered during drilling at depth of 4 feet.

Coordinates: 41.682906°, -111.862137°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Trevor Durrant

CMT TECHNICAL SERVICES

Figure: 10

1200 West Improvements Pavement Study Bore Hole Log B-10

1200 West from 2980 South to 2200 South, Nibley, Utah

Total Depth: 11.5'
Water Depth: 7.5'

Date: 8/28/22
Job #: 18890

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Blows Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; tan gravelly sand with organics, dry												
	Brown Clayey GRAVEL (GC) with sand, slightly moist, medium dense												
			24	5 17 12	29	4.1		51	32	17			
4													
	grades with silt/clay		25	7 8 7	15	8.8		44	34	21			
8	wet		26	12 10 11	21								
	Brown Silty Fat CLAY (CH) with oxidation, wet, very soft		27	1 0 1	1	40				99.2	54	17	37
12	END AT 11.5'												
16													
20													
24													
28													

Remarks: Groundwater encountered during drilling at depth of 7.5 feet.

Coordinates: 41.680732°, -111.862109°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Trevor Durrant

Page: 1 of 1

Figure: 11

1200 West Improvements Pavement Study

Key to Symbols

1200 West from 2980 South to 2200 South, Nibley, Utah

Date: 7/28/22
Job #: 18890

① Depth (ft)	② GRAPHIC LOG	③ Soil Description	④ Sample Type	⑤ Sample #	⑥ Blows(N)	⑦ Total	⑧ Moisture (%)	⑨ Dry Density(pcf)	⑩ Gradation Gravel %	Sand %	Fines %	Atterberg LL	PL	PI

COLUMN DESCRIPTIONS

Depth (ft.): Depth (feet) below the ground surface (including groundwater depth - see below right).

Graphic Log: Graphic depicting type of soil encountered (see ② below).

Soil Description: Description of soils, including Unified Soil Classification Symbol (see below).

Sample Type: Type of soil sample collected; sampler symbols are explained below-right.

Sample #: Consecutive numbering of soil samples collected during field exploration.

Blows: Number of blows to advance sampler in 6" increments, using a 140-lb hammer with 30" drop.

Total Blows: Number of blows to advance sampler the 2nd and 3rd 6" increments.

Moisture (%): Water content of soil sample measured in laboratory (percentage of dry weight).

Dry Density (pcf): The dry density of a soil measured in laboratory (pounds per cubic foot).

Gradation: Percentages of Gravel, Sand and Fines (Silt/Clay), from lab test results of soil passing No. 4 and No. 200 sieves.

Atterberg: Individual descriptions of Atterberg Tests are as follows:

LL = Liquid Limit (%): Water content at which a soil changes from plastic to liquid behavior.

PL = Plastic Limit (%): Water content at which a soil changes from liquid to plastic behavior.

PI = Plasticity Index (%): Range of water content at which a soil exhibits plastic properties (= Liquid Limit - Plastic Limit).

STRATIFICATION	
Description	**Thickness**
Seam	Up to ½ inch
Lense	Up to 12 inches
Layer	Greater than 12 in.
Occasional	1 or less per foot
Frequent	More than 1 per foot

MODIFIERS
Trace
<5%
Some
5-12%
With
> 12%

MOISTURE CONTENT
Dry: Absence of moisture, dusty, dry to the touch.
Moist: Damp / moist to the touch, but no visible water.
Saturated: Visible water, usually soil below groundwater.

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			USCS SYMBOLS	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS More than 50% of material is larger than No. 200 sieve size.	GRAVELS The coarse fraction retained on No. 4 sieve.	CLEAN GRAVELS (< 5% fines)	GW	Well-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
			GP	Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
		GRAVELS WITH FINES (≥ 12% fines)	GM	Silty Gravels, Gravel-Sand-Silt Mixtures
			GC	Clayey Gravels, Gravel-Sand-Clay Mixtures
	SANDS The coarse fraction passing through No. 4 sieve.	CLEAN SANDS (< 5% fines)	SW	Well-Graded Sands, Gravelly Sands, Little or No Fines
			SP	Poorly-Graded Sands, Gravelly Sands, Little or No Fines
		SANDS WITH FINES (≥ 12% fines)	SM	Silty Sands, Sand-Silt Mixtures
			SC	Clayey Sands, Sand-Clay Mixtures
FINE-GRAINED SOILS More than 50% of material is smaller than No. 200 sieve size.	SILTS AND CLAYS Liquid Limit less than 50%		ML	Inorganic Silts and Very Fine Sands, Silty or Clayey Fine Sands or Clayey Silts with Slight
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean
			OL	Organic Silts and Organic Silty Clays o f Low Plasticity
	SILTS AND CLAYS Liquid Limit greater than 50%		MH	Inorganic Silts, Micacious or Diatomacious Fine Sand or Silty Soils with Plasticity (Elastic Silts)
			CH	Inorganic Clays of High Plasticity, Fat Clays
			OH	Organic Silts and Organic Clays of Medium to High Plasticity
HIGHLY ORGANIC SOILS			PT	Peat, Humus, Swamp Soils with High Organic Contents

Note: Dual Symbols are used to indicate borderline soil classifications (i.e. GP-GM, SC-SM, etc.).

SAMPLER SYMBOLS

- Block Sample
- Bulk/Bag Sample
- Modified California Sampler 3.5" OD, 2.42" ID
- D&M Sampler
- Rock Core
- Standard Penetration Split Spoon Sampler
- Thin Wall (Shelby Tube)

WATER SYMBOL

- Encountered Water Level
- Measured Water Level

(see Remarks on Logs)

1. The results of laboratory tests on the samples collected are shown on the logs at the respective sample depths.
2. The subsurface conditions represented on the logs are for the locations specified. Caution should be exercised if interpolating between or extrapolating beyond the exploration locations.
3. The information presented on each log is subject to the limitations, conclusions, and recommendations presented in this report.

CMT TECHNICAL SERVICES

Figure: 12

CMT TECHNICAL SERVICES

DCP TEST DATA

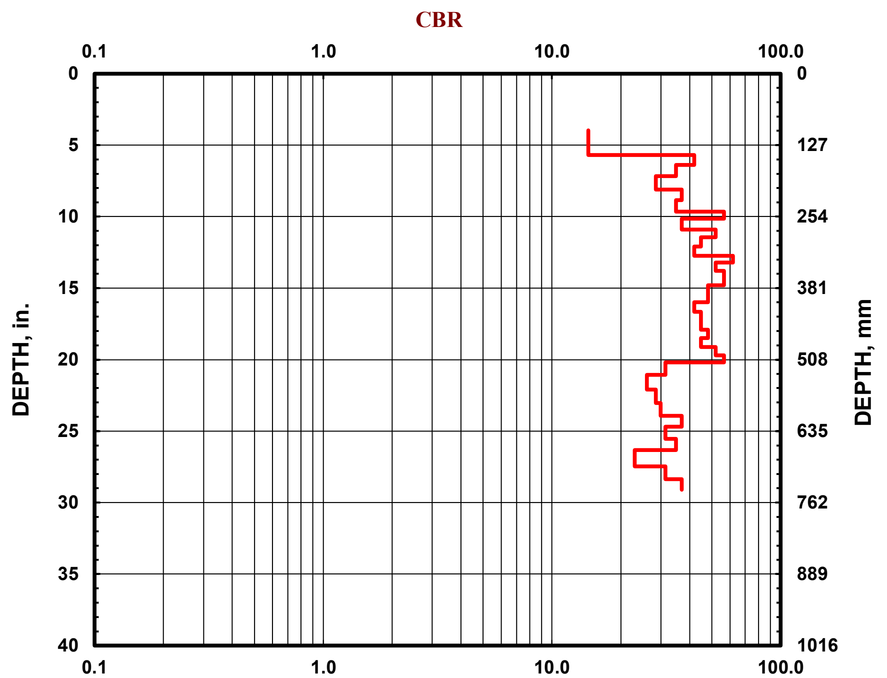
Figure 13

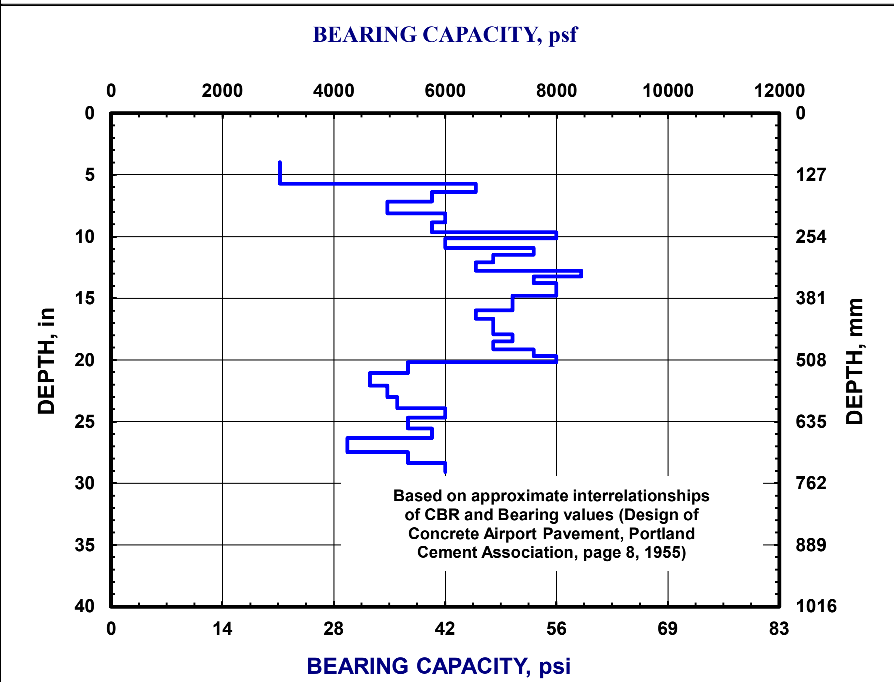
Project: *1200 West ReconstructNibley*
Location: C-1
Date: 15-Aug-22
Soil Type(s):

Hammer
- ○ 10.1 lbs.
- ● 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ● All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	101	1
3	145	1
3	162	1
3	182	1
3	206	1
3	225	1
3	245	1
3	258	1
3	277	1
3	291	1
3	307	1
3	324	1
3	336	1
3	350	1
3	363	1
3	376	1
3	391	1
3	406	1
3	423	1
3	439	1
3	455	1
3	470	1
3	486	1
3	500	1
3	513	1
3	535	1
3	561	1
3	585	1
3	608	1
3	627	1
3	649	1
3	669	1
3	698	1
3	720	1
3	739	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1





DCP TEST DATA

Figure 14

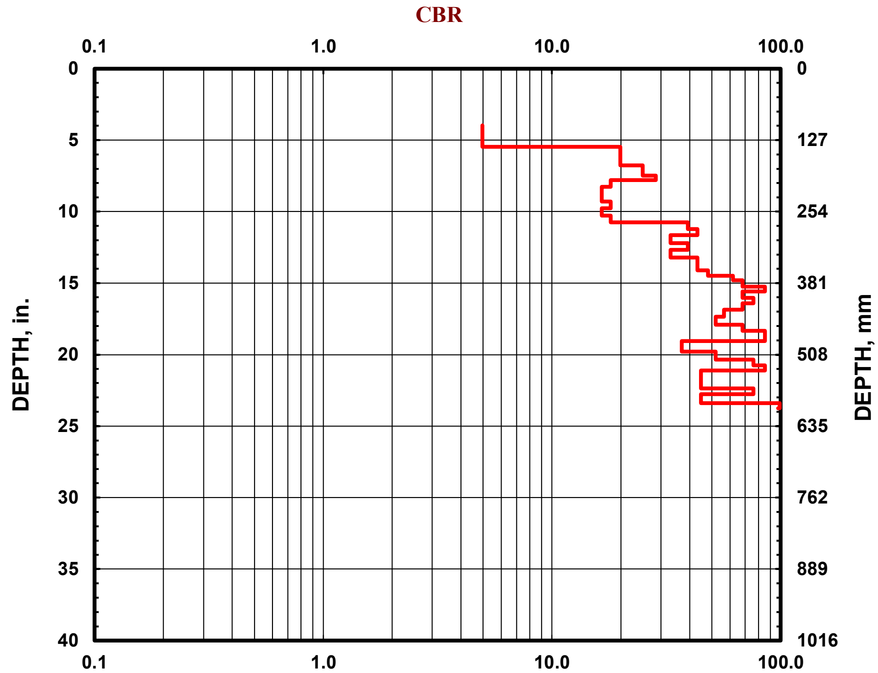
CMT TECHNICAL SERVICES

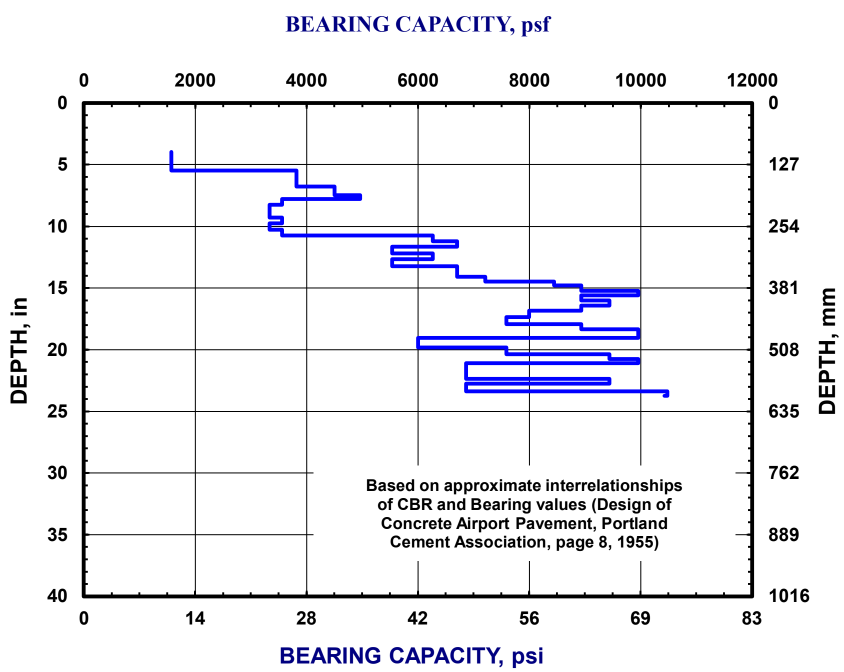
Project: *1200 West ReconstructNibley* **Date:** 15-Aug-22
Location: C-2 **Soil Type(s):** Type in the soil type

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	101	1
1	139	1
1	150	1
1	161	1
1	172	1
1	181	1
1	190	1
1	198	1
1	210	1
1	223	1
1	236	1
1	248	1
1	261	1
1	273	1
2	285	1
2	296	1
2	310	1
2	322	1
2	336	1
2	347	1
2	358	1
2	368	1
2	376	1
3	387	1
3	396	1
3	407	1
3	417	1
3	428	1
3	441	1
3	455	1
3	466	1
3	475	1
3	484	1
3	503	1
3	517	1
3	527	1
3	536	1
3	552	1
3	568	1
3	578	1
3	594	1
6	603	1
3	611	1





DCP TEST DATA

Figure 15

Project: *1200 West ReconstructNibley*
Location: C-3

Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
- ◯ 10.1 lbs.
- ◉ 17.6 lbs.
- ◯ Both hammers used

Soil Type
- ◯ CH
- ◯ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	76	1
3	93	1
3	103	1
3	114	1
3	122	1
3	135	1
3	144	1
3	154	1
3	166	1
3	179	1
3	190	1
3	201	1
3	210	1
3	223	1
3	237	1
3	249	1
5	258	1
5	263	1
5	270	1
5	278	1
5	284	1
5	303	1
5	310	1
5	320	1
5	332	1
5	343	1
5	357	1
5	372	1
5	383	1
5	403	1
5	436	1
5	467	1
3	498	1
3	533	1
3	570	1
3	601	1
3	622	1
3	642	1
3	656	1
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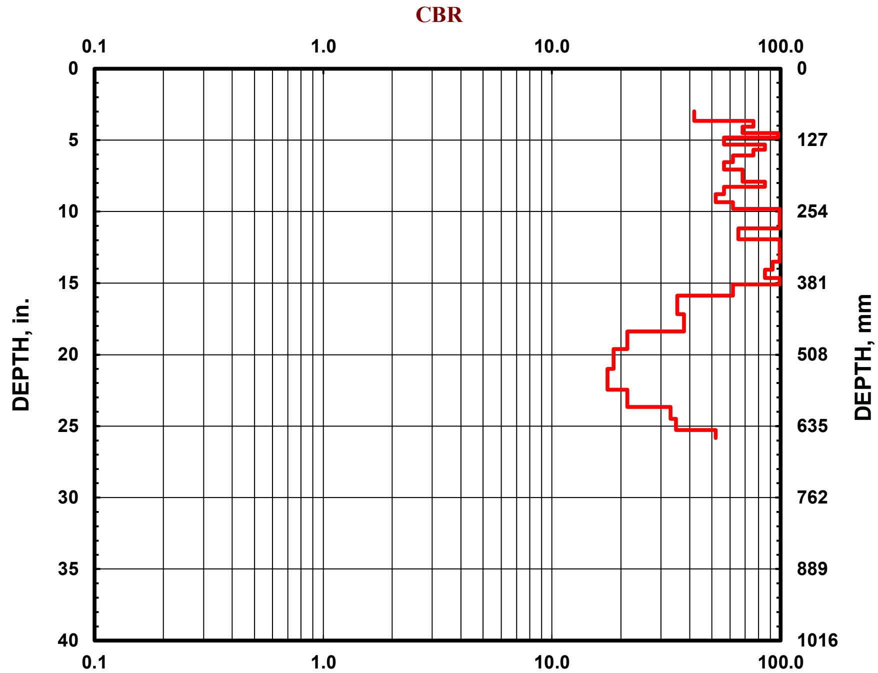
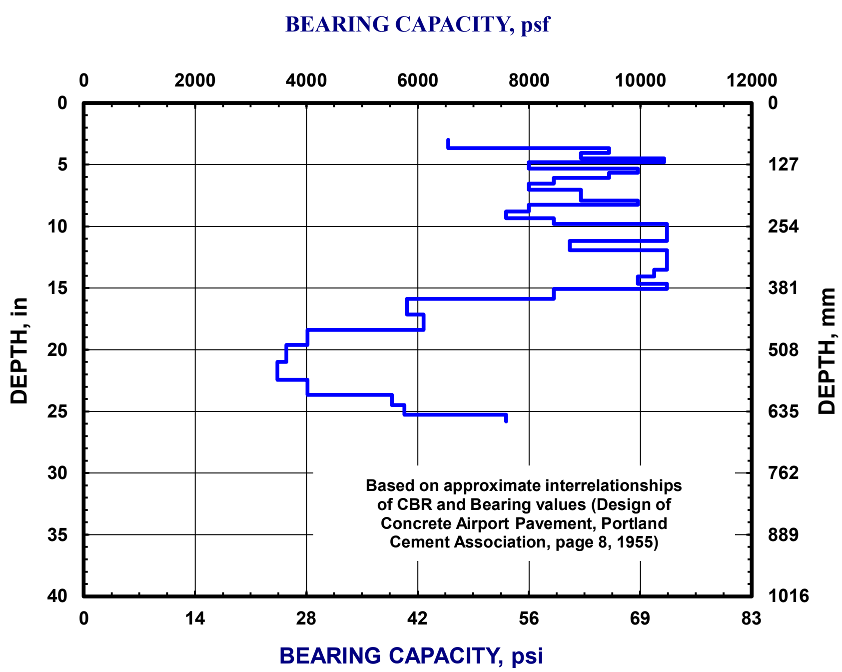
0	0	1
0	0	1
0	0	1





DCP TEST DATA

Figure 16

CMT TECHNICAL SERVICES

Project: *1200 West ReconstructNibley*
Location: C-4
Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
- ◯ 10.1 lbs.
- ◉ 17.6 lbs.
- ◯ Both hammers used

Soil Type
- ◯ CH
- ◯ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	76	1
3	98	1
3	109	1
3	119	1
3	128	1
3	135	1
3	143	1
5	152	1
5	161	1
5	173	1
5	181	1
5	187	1
0	0	1
0	0	1
	0	1
0	0	1
0	0	1
0	0	1
0	0	1
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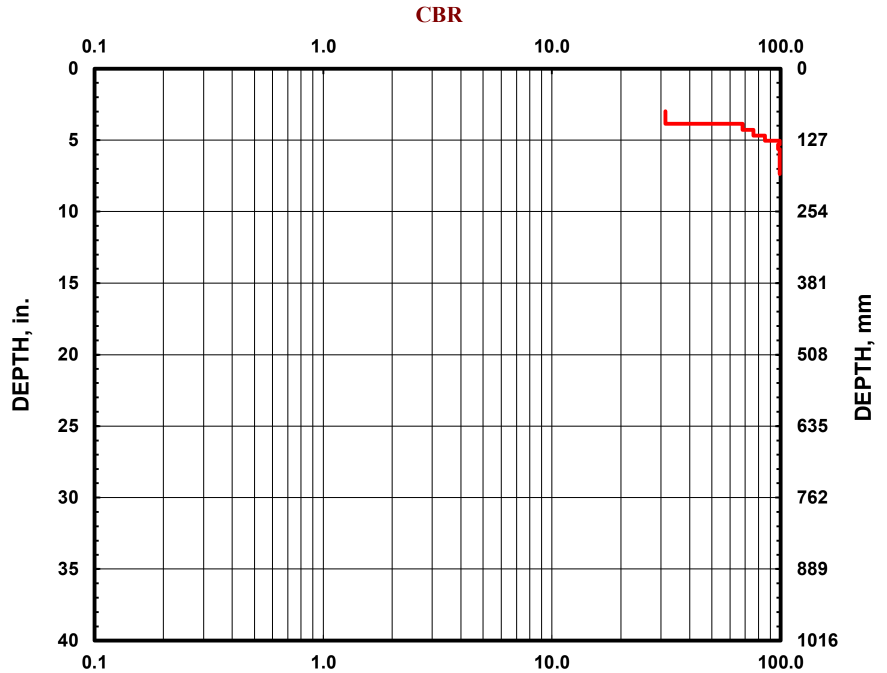
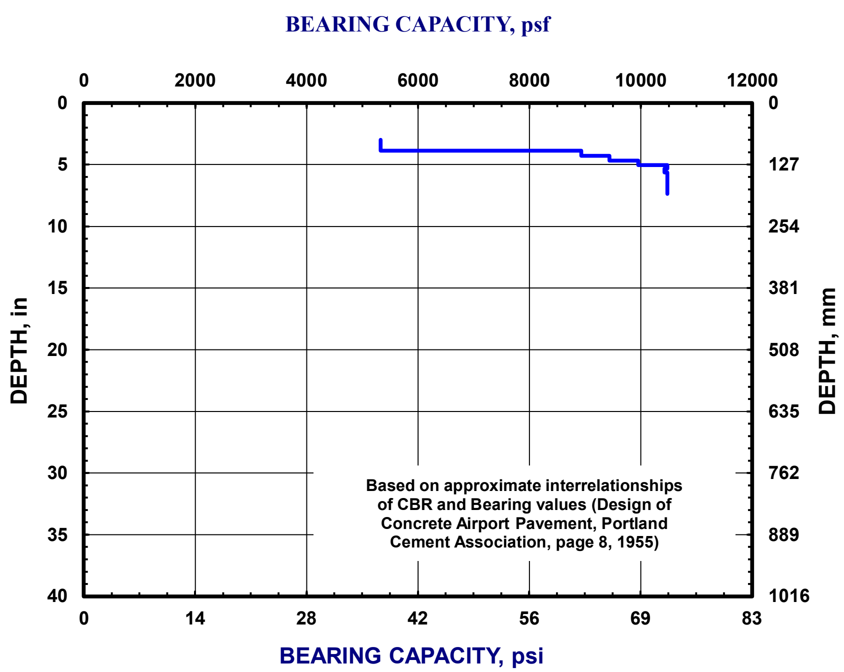
0	0	1





CMT TECHNICAL SERVICES

DCP TEST DATA

Figure 17

Project: *1200 West ReconstructNibley*
Location: C-5

Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ● 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ● All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	76	1
3	99	1
5	107	1
5	123	1
5	138	1
5	147	1
5	157	1
5	167	1
5	178	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
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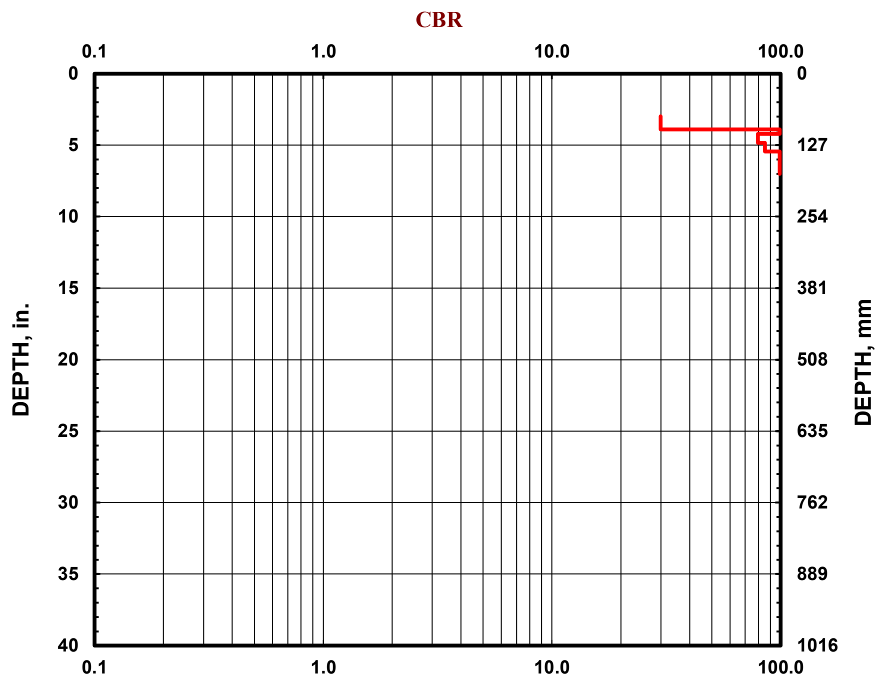
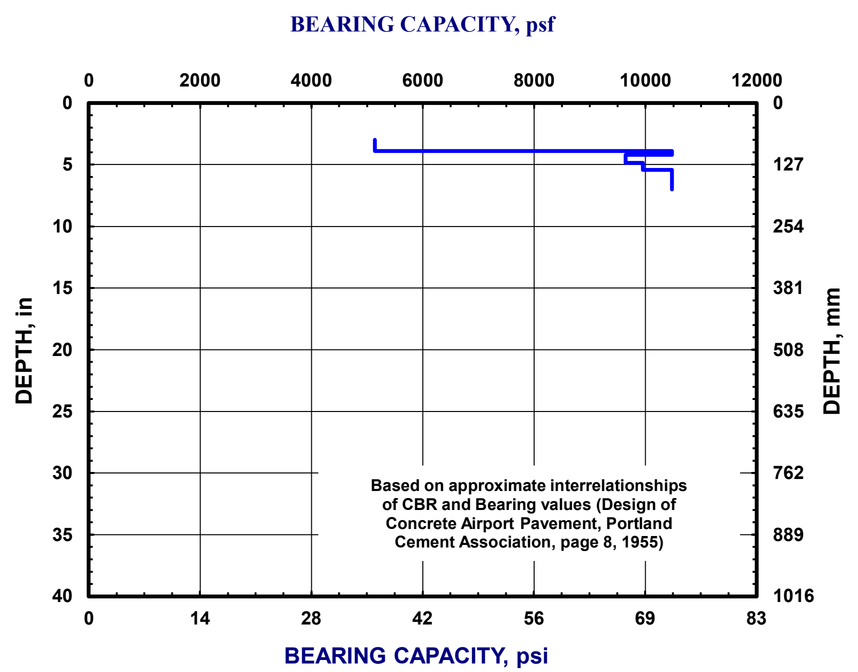
0	0	1





CMT TECHNICAL SERVICES

DCP TEST DATA

Figure 18

Project: *1200 West ReconstructNibley*
Location: C-6

Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	101	1
3	126	1
3	136	1
3	150	1
3	162	1
3	171	1
3	178	1
3	183	1
5	186	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
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0	0	1
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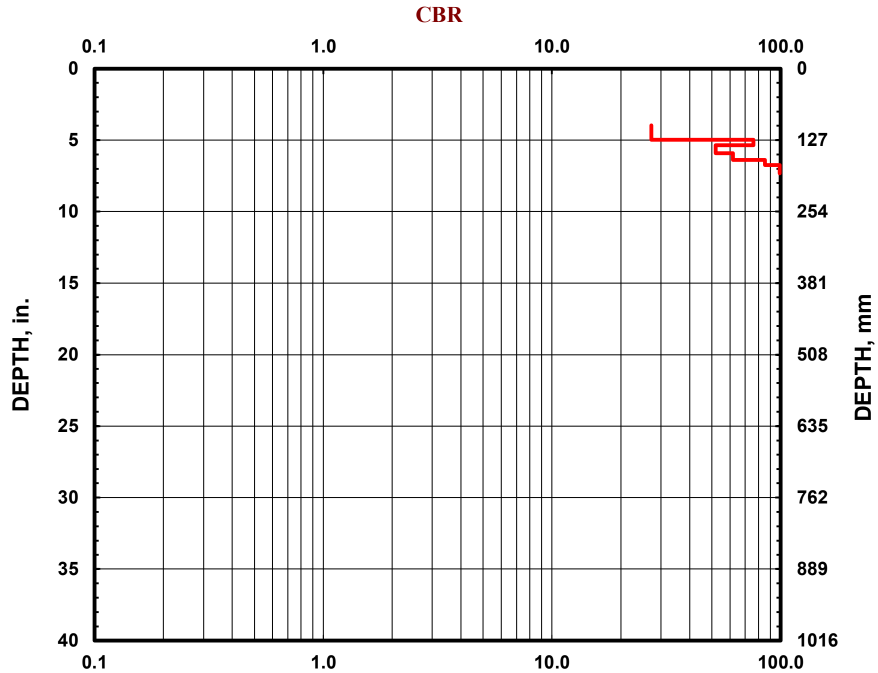
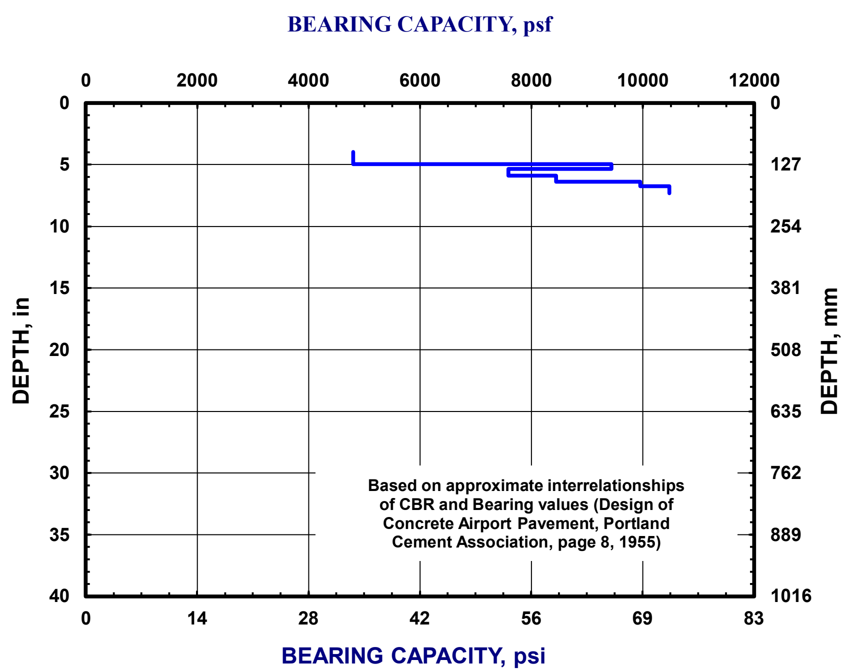




CMT TECHNICAL SERVICES

DCP TEST DATA

Figure 19

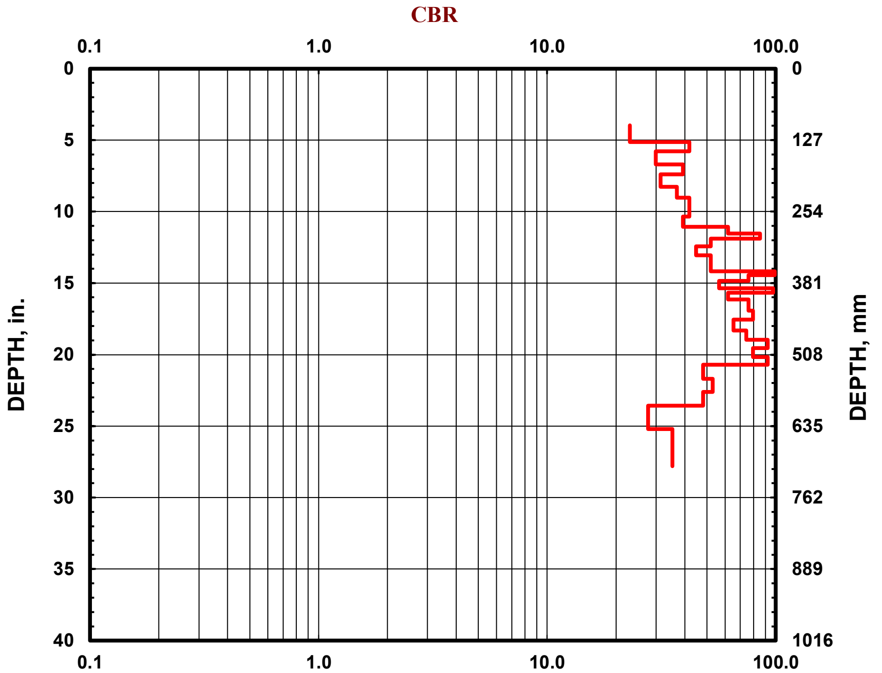
Project: *1200 West ReconstructNibley* Date: 15-Aug-22

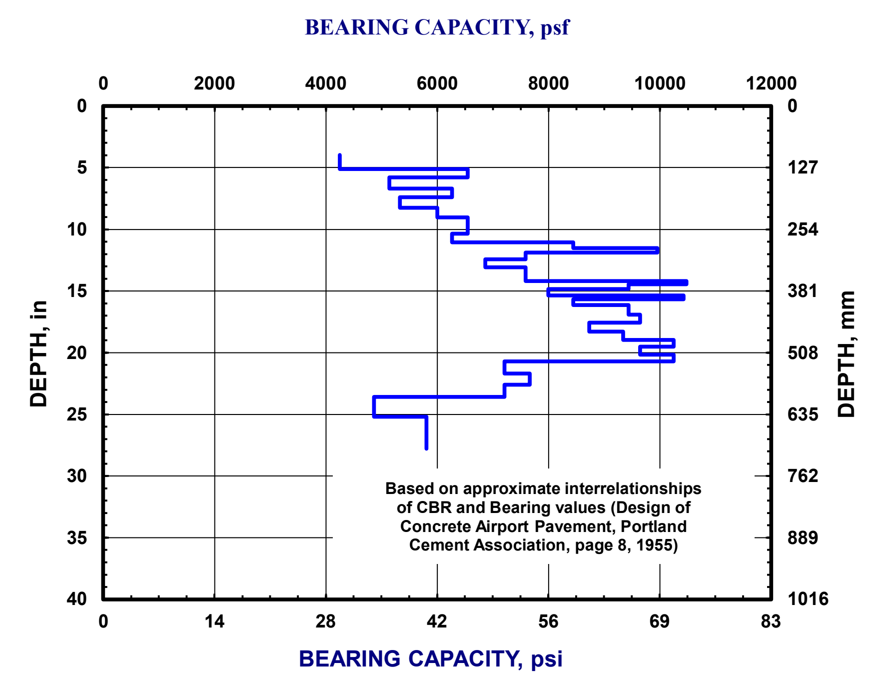
Location: C-7 Soil Type(s): Type in the soil type

Hammer
- ◯ 10.1 lbs.
- ◉ 17.6 lbs.
- ◯ Both hammers used

Soil Type
- ◯ CH
- ◯ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	101	1
3	130	1
3	147	1
3	170	1
3	188	1
3	210	1
3	229	1
3	246	1
3	263	1
3	281	1
3	293	1
3	302	1
3	316	1
3	332	1
3	346	1
3	360	1
3	367	1
3	377	1
3	390	1
3	398	1
3	410	1
3	420	1
3	430	1
5	446	1
5	465	1
5	482	1
5	496	1
5	512	1
5	526	1
5	551	1
5	574	1
5	599	1
5	640	1
5	673	1
5	706	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1





DCP TEST DATA

Figure 20

Project: *1200 West ReconstructNibley*
Date: 15-Aug-22
Location: B-1
Soil Type(s):

Hammer
- ◯ 10.1 lbs.
- ◉ 17.6 lbs.
- ◯ Both hammers used

Soil Type
- ◯ CH
- ◯ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
3	54	1
3	96	1
3	138	1
3	182	1
3	218	1
3	253	1
3	291	1
3	329	1
3	358	1
3	383	1
3	406	1
3	426	1
3	448	1
3	468	1
3	489	1
3	515	1
3	552	1
3	646	1
3	678	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
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0	0	1
0	0	1
0	0	1
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0	0	1
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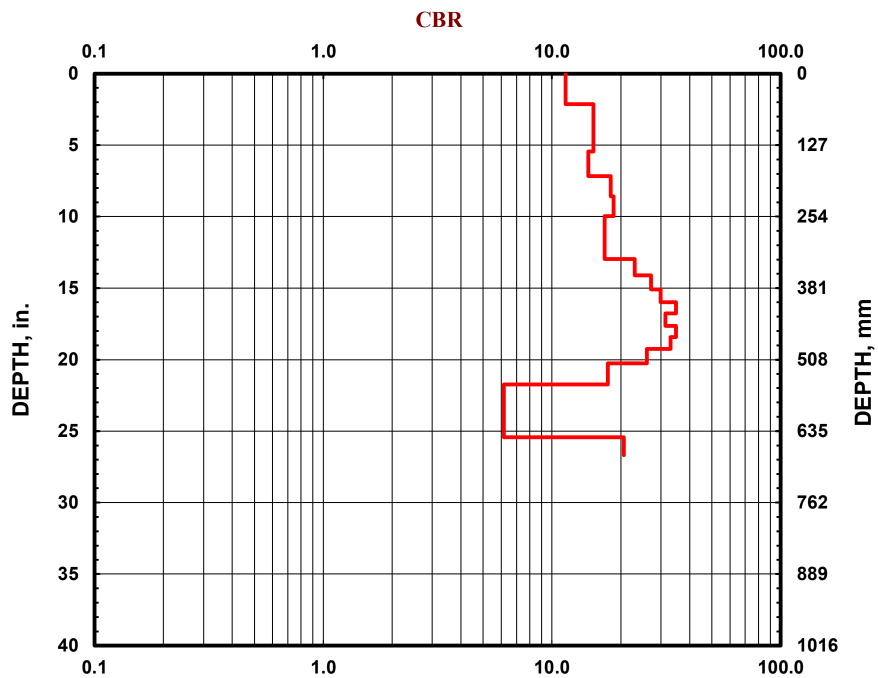
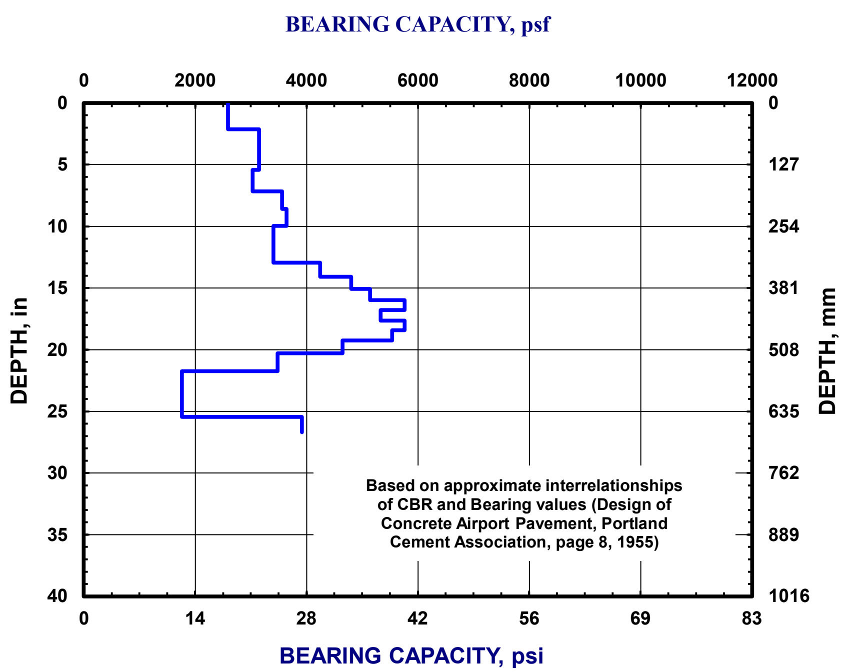
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1





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DCP TEST DATA

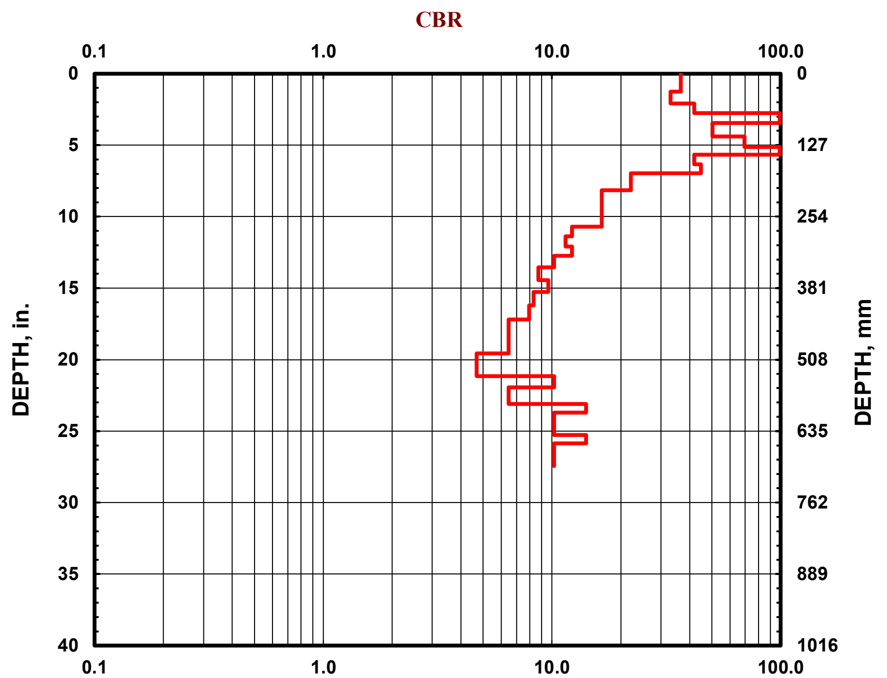
Figure 21

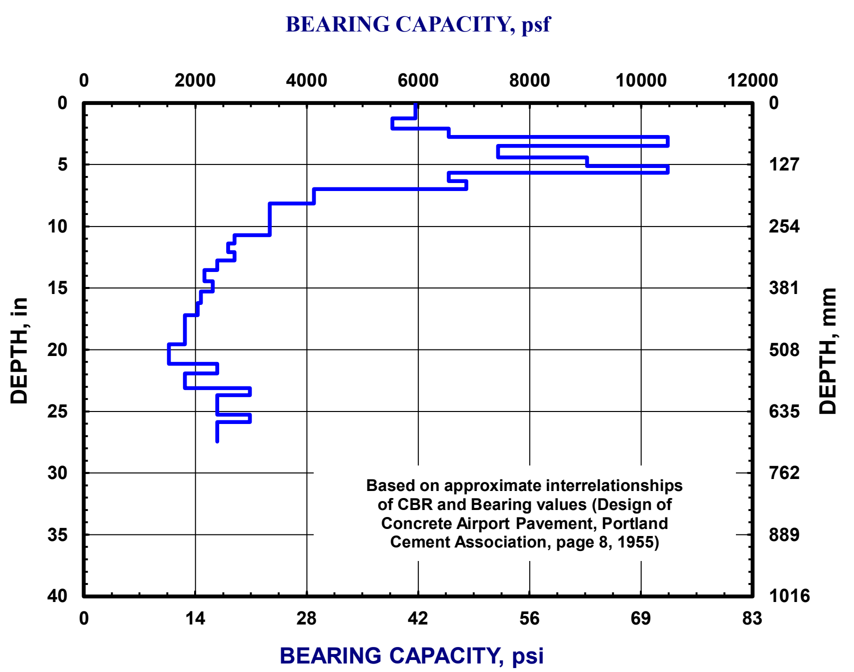
Project: *1200 West ReconstructNibley* **Date:** 15-Aug-22
Location: B-2 **Soil Type(s):** Type in the soil type

Hammer
○ 10.1 lbs.
◉ 17.6 lbs.
○ Both hammers used

Soil Type
○ CH
○ CL
◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
5	32	1
3	53	1
3	70	1
3	77	1
3	82	1
5	88	1
5	112	1
5	130	1
5	137	1
5	144	1
3	161	1
3	177	1
3	207	1
3	246	1
2	272	1
1	289	1
1	307	1
1	324	1
1	344	1
1	367	1
1	388	1
1	412	1
1	437	1
1	467	1
1	497	1
1	537	1
1	557	1
1	587	1
1	602	1
1	622	1
1	642	1
1	657	1
1	677	1
1	697	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1





CMT TECHNICAL SERVICES

DCP TEST DATA

Figure 22

Project: *1200 West ReconstructNibley*
Location: B-3

Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ● 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ● All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
3	20	1
3	37	1
3	55	1
3	70	1
3	85	1
3	101	1
3	117	1
3	136	1
3	160	1
3	190	1
3	227	1
3	275	1
3	335	1
2	370	1
1	385	1
2	408	1
1	419	1
1	434	1
1	444	1
1	458	1
1	470	1
1	480	1
1	496	1
1	515	1
1	541	1
1	569	1
1	594	1
1	622	1
1	650	1
1	664	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
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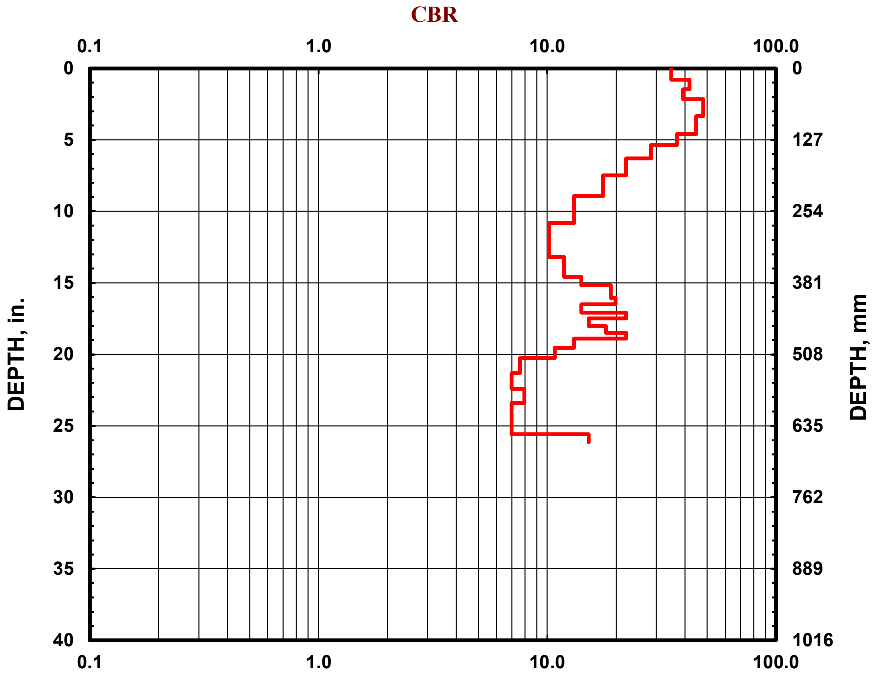
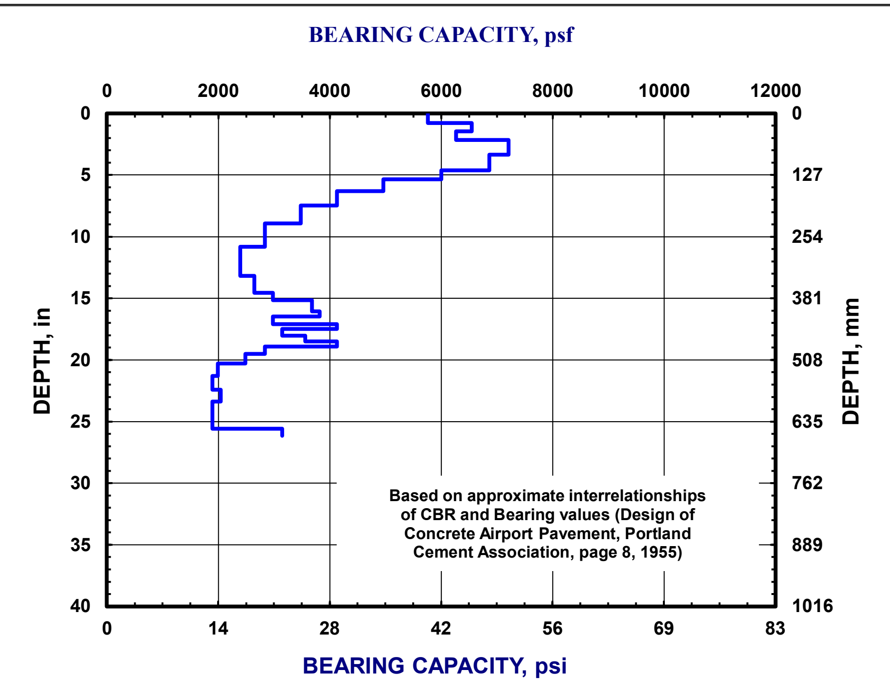
0	0	1





DCP TEST DATA

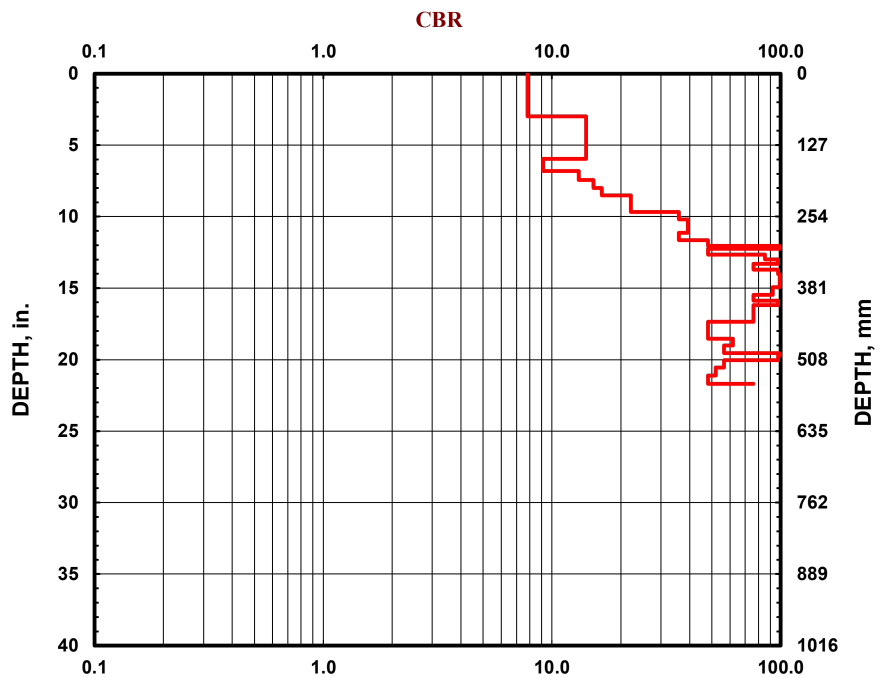
Figure 23

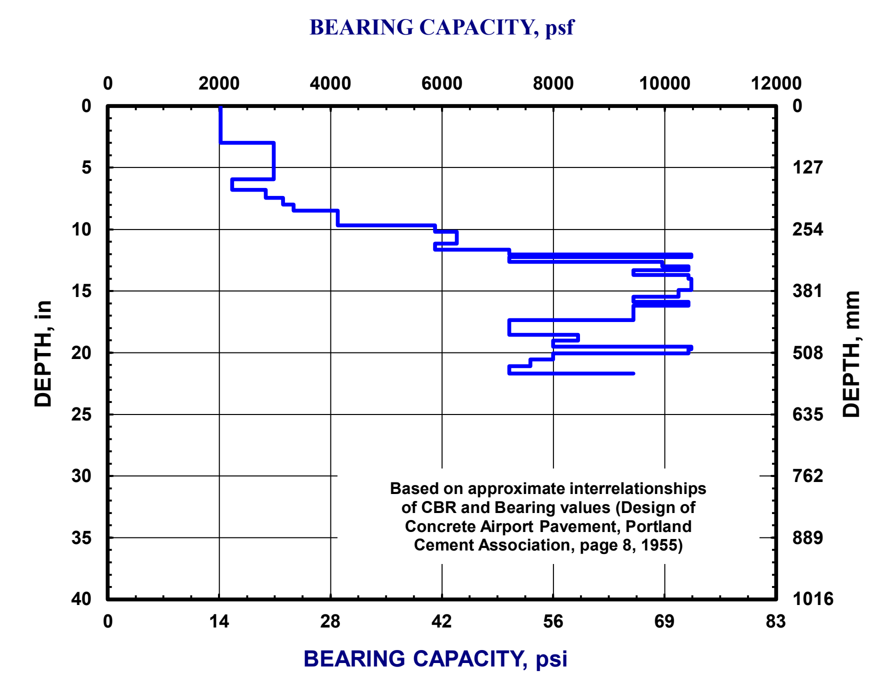
Project: *1200 West ReconstructNibley*
Location: B-4
Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
3	76	1
1	91	1
1	106	1
1	121	1
1	136	1
1	151	1
1	173	1
1	189	1
1	203	1
1	216	1
1	226	1
1	236	1
1	246	1
2	259	1
2	271	1
2	283	1
2	296	1
2	306	1
2	311	1
2	321	1
3	330	1
3	338	1
3	348	1
3	356	1
5	366	1
5	379	1
5	393	1
3	403	1
3	411	1
3	421	1
3	431	1
3	441	1
3	456	1
3	471	1
3	483	1
3	496	1
3	501	1
3	509	1
3	522	1
3	536	1
3	551	1
3	561	1





CMT TECHNICAL SERVICES

DCP TEST DATA

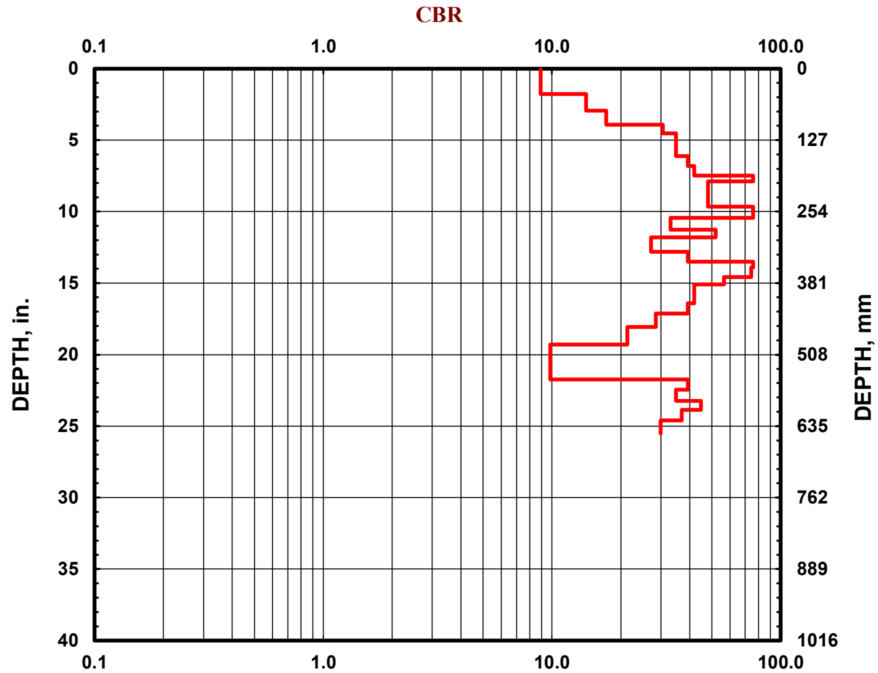
Figure 24

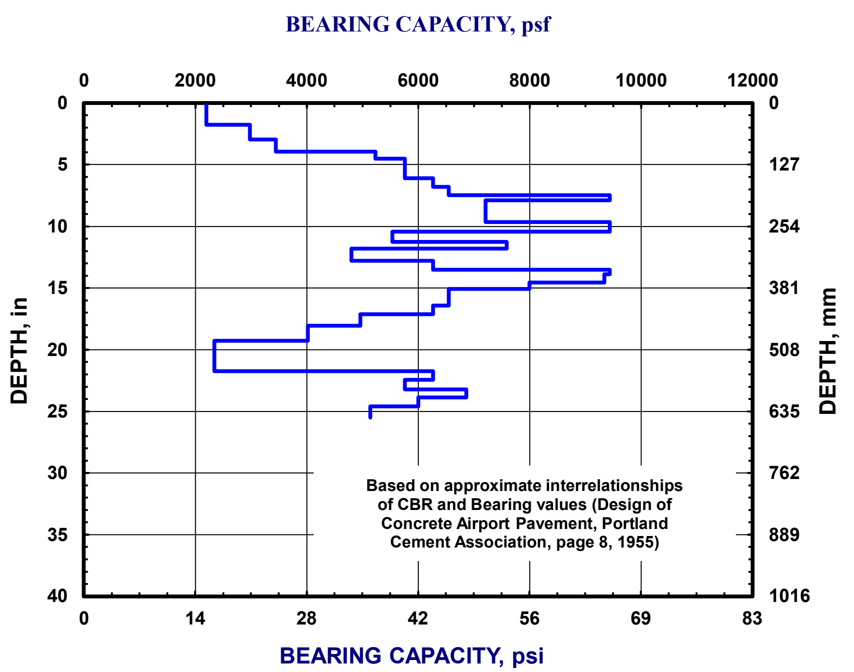
Project: *1200 West ReconstructNibley*
Location: B-5
Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ● 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ● All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
2	45	1
2	75	1
2	100	1
2	115	1
3	135	1
3	155	1
3	173	1
3	190	1
3	200	1
3	215	1
3	230	1
3	245	1
3	255	1
3	265	1
3	286	1
3	300	1
3	325	1
3	343	1
3	353	1
5	370	1
3	383	1
3	400	1
3	417	1
3	435	1
3	459	1
3	490	1
3	552	1
3	570	1
3	590	1
3	606	1
3	625	1
3	648	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1





DCP TEST DATA

CMT TECHNICAL SERVICES

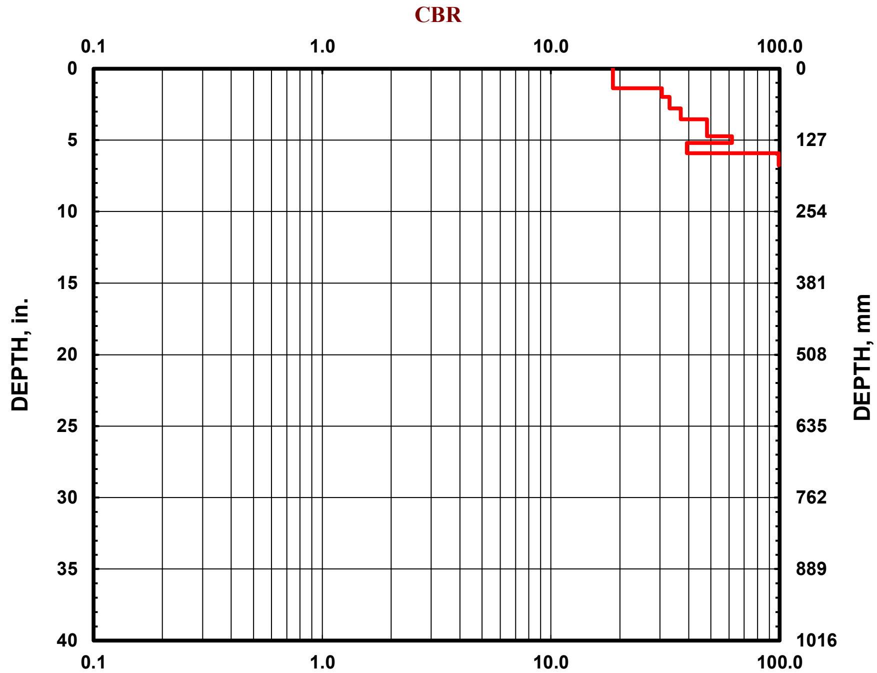
Figure 25

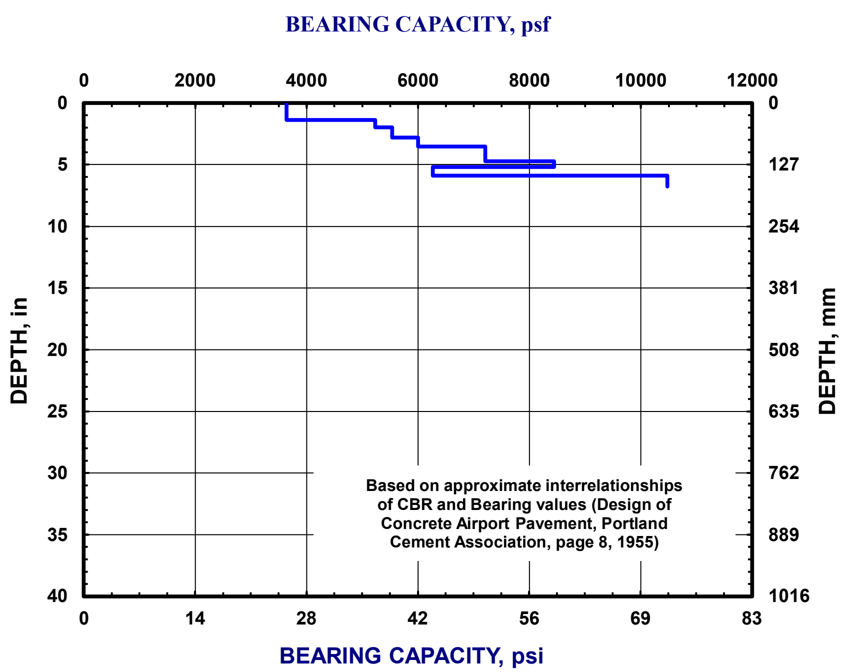
Project: *1200 West ReconstructNibley*
Location: B-6
Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
○ 10.1 lbs.
◉ 17.6 lbs.
○ Both hammers used

Soil Type
○ CH
○ CL
◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
3	35	1
2	50	1
3	71	1
3	90	1
3	105	1
3	120	1
3	132	1
3	150	1
5	155	1
5	160	1
10	162	1
10	169	1
10	172	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1





DCP TEST DATA

Figure 26

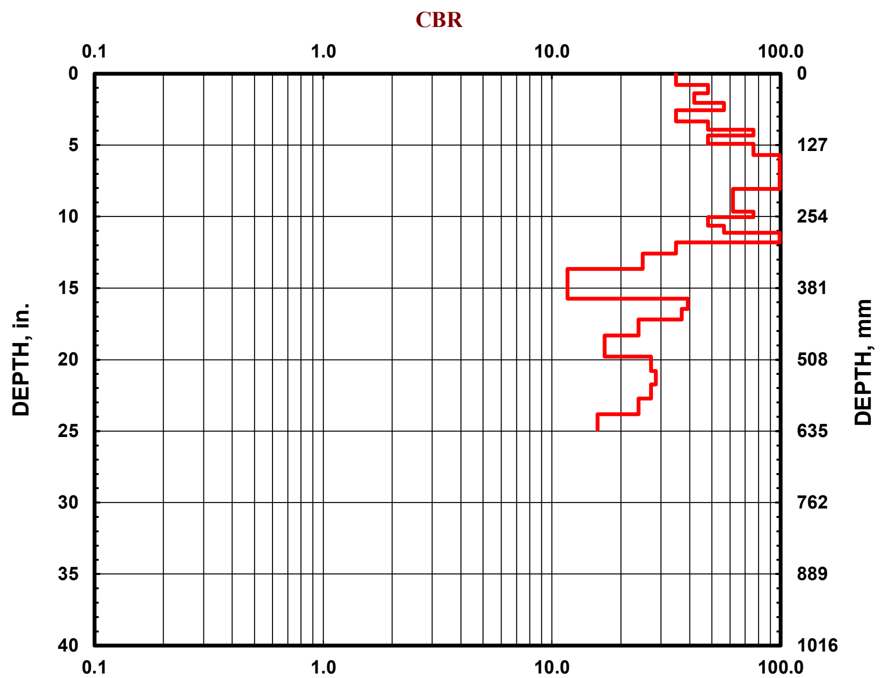
CMT TECHNICAL SERVICES

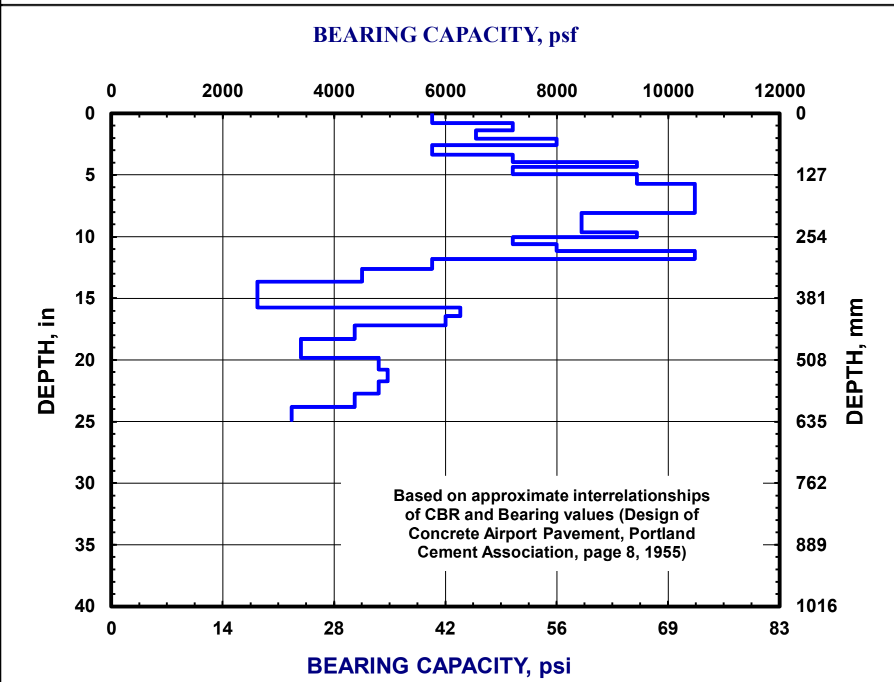
Project: *1200 West ReconstructNibley*
Location: B-7
Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ● 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ● All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
3	20	1
3	35	1
3	52	1
3	65	1
3	85	1
3	100	1
3	110	1
3	125	1
3	135	1
3	145	1
3	150	1
3	153	1
6	158	1
10	167	1
10	175	1
10	183	1
10	194	1
10	205	1
10	245	1
3	255	1
3	270	1
3	283	1
3	288	1
5	300	1
3	320	1
3	347	1
3	400	1
3	418	1
3	437	1
3	465	1
3	503	1
3	528	1
3	552	1
3	577	1
3	605	1
2	632	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1





CMT TECHNICAL SERVICES

DCP TEST DATA

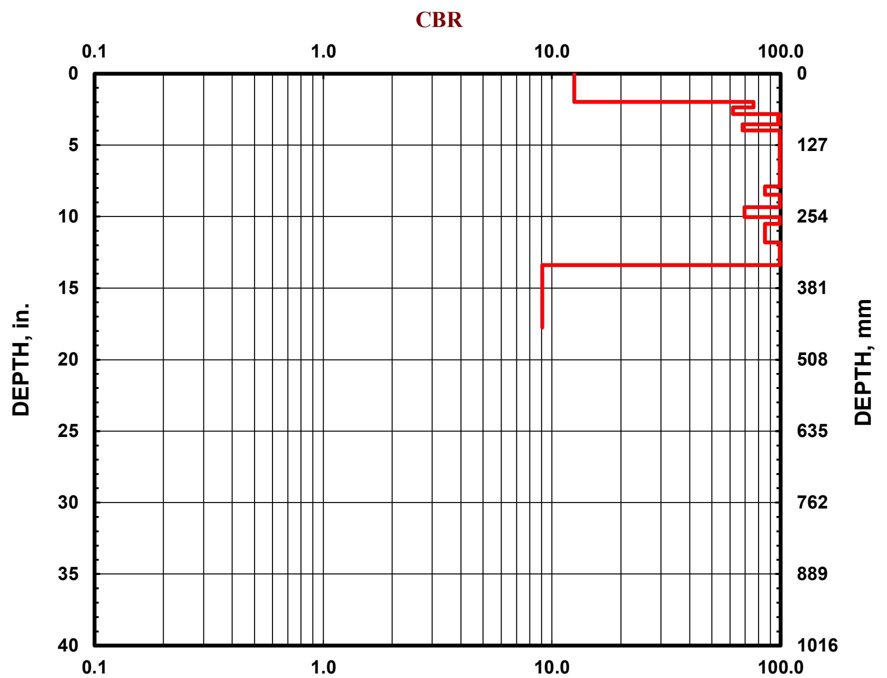
Figure 27

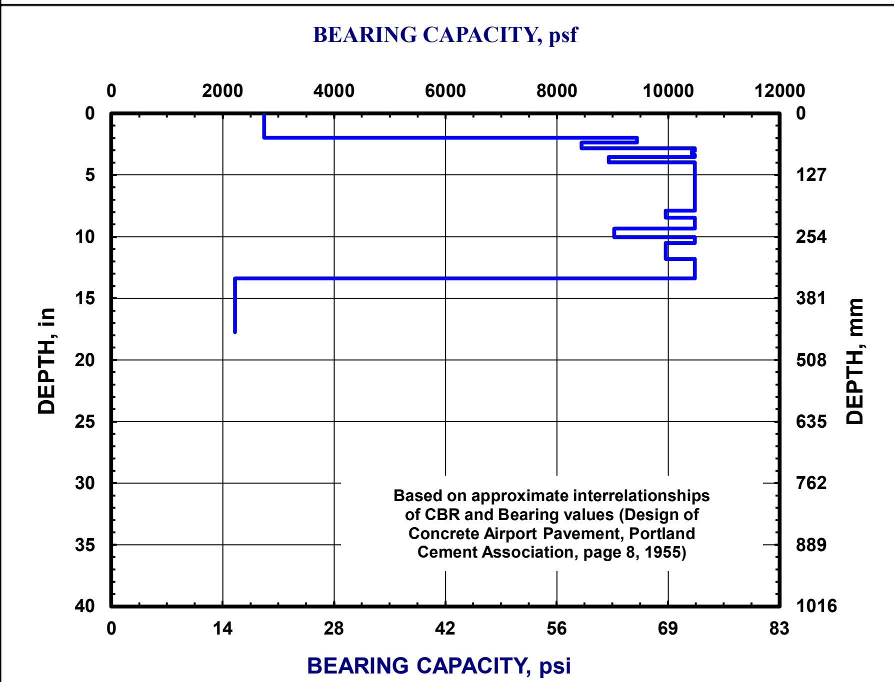
Project: 1200 West ReconstructNibley
Location: B-8
Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
○ 10.1 lbs.
◉ 17.6 lbs.
○ Both hammers used

Soil Type
○ CH
○ CL
◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
3	50	1
3	60	1
3	72	1
3	77	1
3	85	1
3	90	1
3	101	1
3	105	1
5	116	1
5	128	1
10	140	1
5	150	1
5	157	1
5	170	1
5	175	1
5	187	1
5	200	1
5	215	1
5	227	1
5	237	1
5	255	1
5	267	1
3	276	1
3	285	1
5	300	1
5	307	1
5	315	1
5	325	1
5	327	1
5	335	1
5	340	1
5	451	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1





DCP TEST DATA

Figure 28

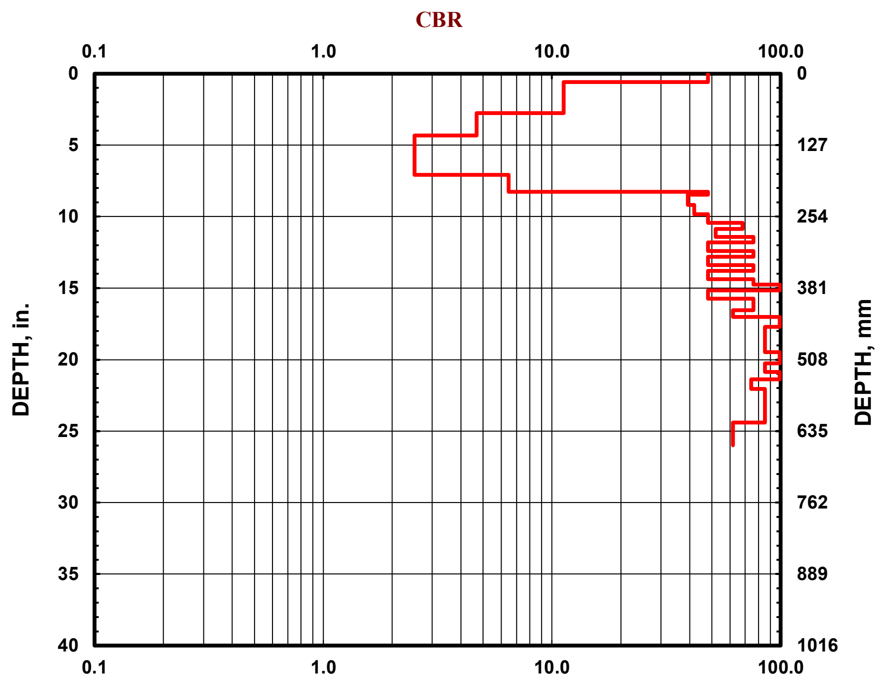
Project: *1200 West ReconstructNibley*
Location: B-9

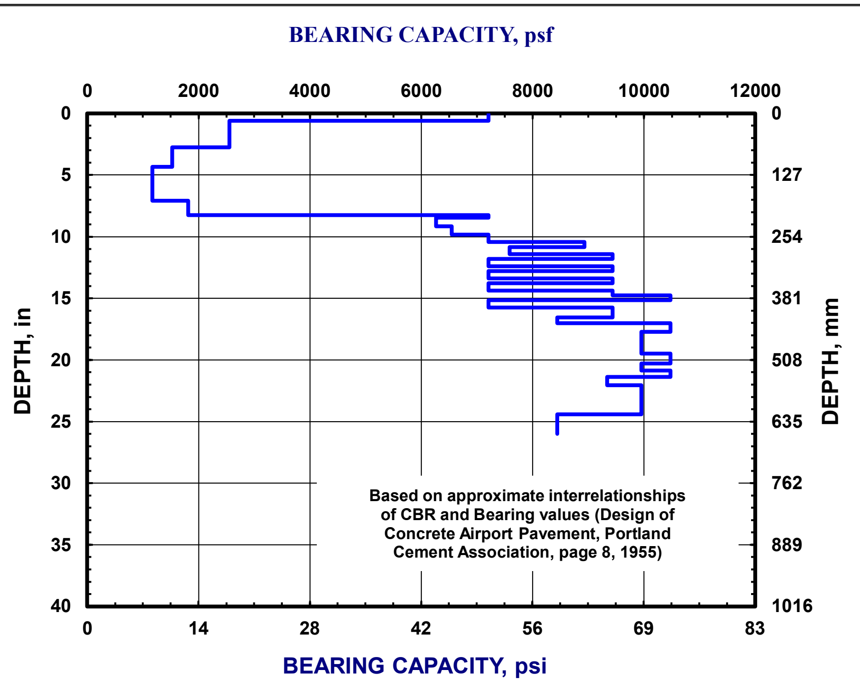
Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ● 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ● All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
3	15	1
3	70	1
1	110	1
1	180	1
1	210	1
1	215	1
3	233	1
3	250	1
3	265	1
3	276	1
3	290	1
3	300	1
3	315	1
3	325	1
3	340	1
3	350	1
3	365	1
3	375	1
6	385	1
3	400	1
3	410	1
3	420	1
3	432	1
3	435	1
3	440	1
5	450	1
5	465	1
5	480	1
5	495	1
5	505	1
5	515	1
5	530	1
5	543	1
5	560	1
5	575	1
5	590	1
5	605	1
5	620	1
5	640	1
5	660	1
0	0	1
0	0	1





CMT TECHNICAL SERVICES

DCP TEST DATA

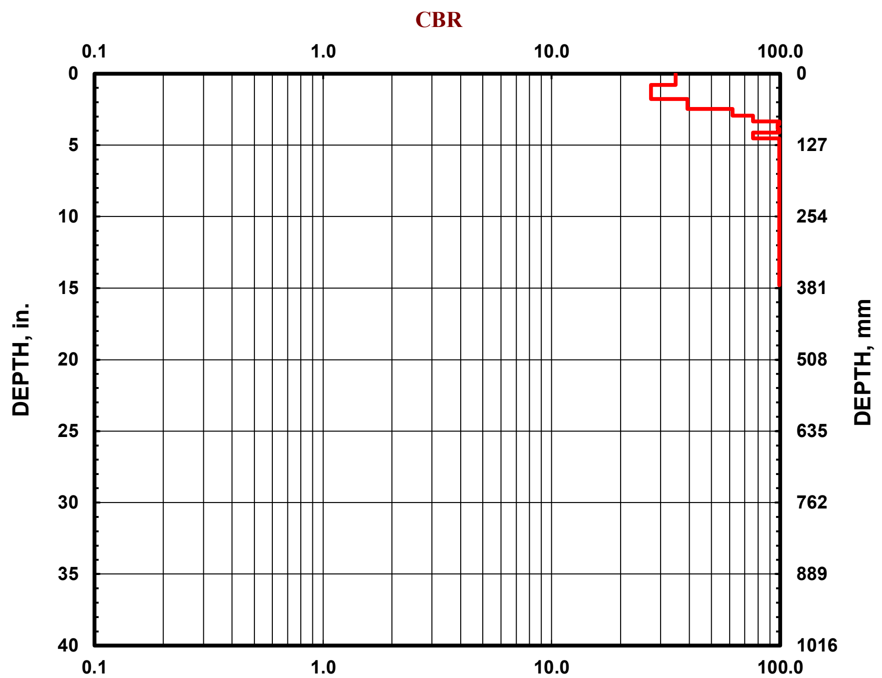
Figure 29

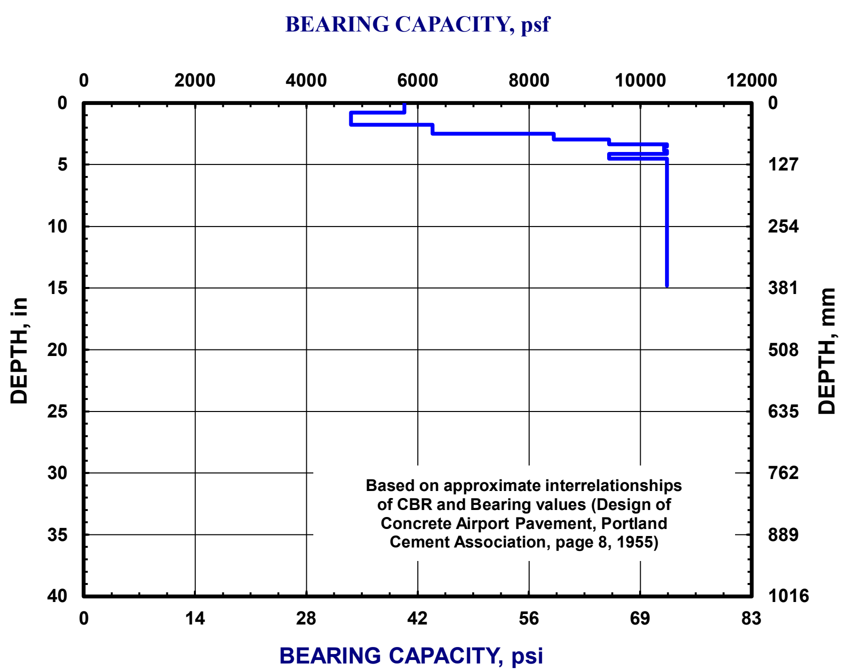
Project: *1200 West ReconstructNibley*
Location: B-10
Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ● 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ● All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
3	20	1
3	45	1
3	63	1
3	75	1
3	85	1
3	90	1
3	98	1
3	105	1
3	115	1
3	122	1
5	132	1
5	142	1
5	150	1
5	161	1
5	173	1
5	182	1
5	193	1
5	200	1
5	210	1
5	220	1
5	230	1
5	243	1
5	250	1
10	266	1
10	272	1
10	283	1
10	293	1
10	303	1
10	312	1
10	321	1
10	329	1
10	343	1
10	352	1
10	366	1
10	367	1
10	371	1
10	375	1
10	376	1
0	0	1
0	0	1
0	0	1
0	0	1





CMT TECHNICAL SERVICES

DCP TEST DATA

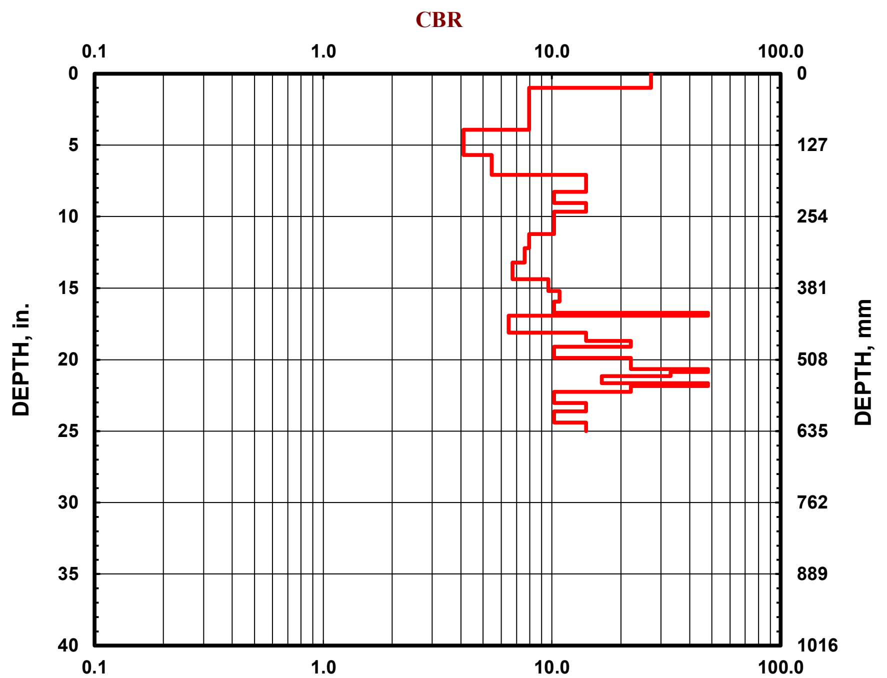
Figure 30

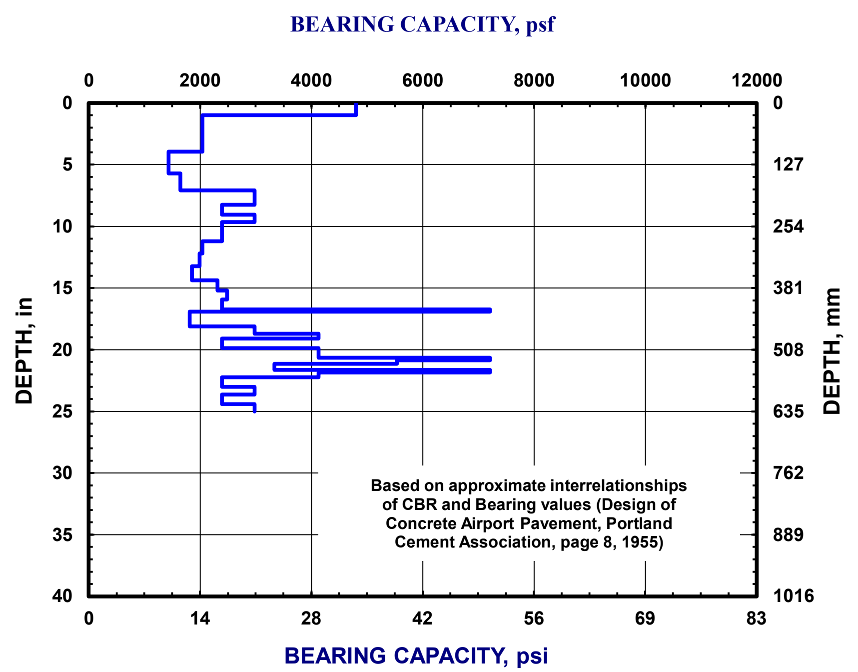
Project: *1200 West ReconstructNibley*
Location: DCP-11
Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
- ◯ 10.1 lbs.
- ◉ 17.6 lbs.
- ◯ Both hammers used

Soil Type
- ◯ CH
- ◯ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
3	25	1
3	100	1
1	145	1
1	180	1
1	195	1
1	210	1
1	230	1
1	245	1
1	265	1
1	285	1
1	310	1
1	336	1
1	365	1
1	386	1
1	405	1
1	425	1
1	430	1
1	460	1
1	475	1
1	485	1
1	505	1
1	515	1
1	525	1
1	530	1
1	537	1
1	550	1
1	555	1
1	565	1
1	585	1
1	600	1
1	620	1
1	635	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1





CMT TECHNICAL SERVICES

DCP TEST DATA

Figure 31

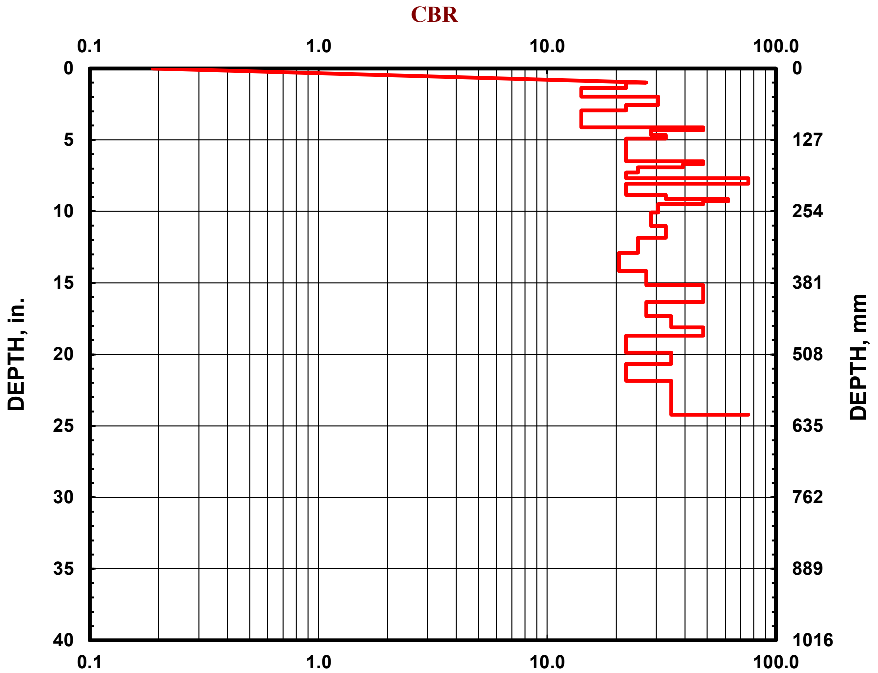
Project: *1200 West ReconstructNibley*
Location: DCP-12

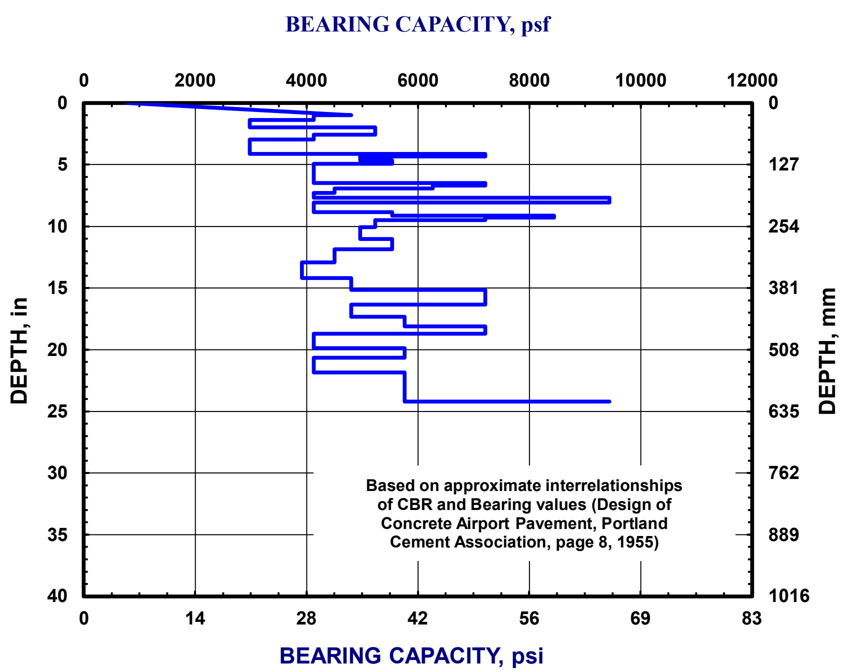
Date: 15-Aug-22
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ● 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ● All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
3	25	1
1	35	1
1	50	1
2	65	1
1	75	1
1	90	1
1	105	1
1	110	1
1	118	1
1	125	1
1	135	1
1	145	1
1	155	1
1	165	1
1	170	1
1	176	1
1	185	1
1	195	1
3	205	1
1	215	1
1	225	1
1	232	1
1	236	1
1	241	1
2	256	1
3	280	1
3	301	1
3	328	1
3	360	1
3	385	1
3	400	1
3	415	1
3	440	1
3	460	1
3	475	1
3	505	1
3	525	1
3	555	1
3	575	1
3	595	1
3	615	1
3	625	1





Form R-274R		
a. Traffic Analysis Period	20	yr
b. Terminal Serviceability Index	2	
c. CBR of subgrade	3	
d. Modulus of Subgrade Rxn	4200	psi
Design ESAL's	**417,191**	(from ESAL sheet)

$$\log_{10}W_{18} = Z_R S_O + 9.36\log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2-1.5}\right]}{0.04 + \frac{1094}{(SN+1)^{5.19}}} + 2.32\log_{10}M_R - 8.07$$

Urban	Classificiation (Urban, Rural)	
20	Design Life, Years	
417,191	W = Number of Design Lane ESAL's	
0.45	So= Overall Standard Deviation	
2.20	δPSI = Design Serviceability Loss (set by UDOT)	
-1.28	Zr = Z-Table Factor at Reliability R(%)	
3.60	**SN = Structural Number**	
2.00	PSI = Terminal Serviceability	
1.00	Cd = Drainage Coefficient (see Table3C-3)	
0.90	Reliability (.95 for interstate, .9 otherwise)	
-0.58	6.00	
-0.11	0.34	
5.65		
5.65	AASHTO Equation (right side)	
5.62	Log W	
OK	AASHTO Equation equal to or greater than Log W	

The required AASHTO inputs are:

1. The estimated future traffic, W_{18}, for the performance period.
2. The reliability, R, which assumes that average values are used for all inputs.
3. The overall standard deviation, .
4. The effective roadbed soil resilient modulus, .
5. The design serviceability loss, PSI = 2.2