

December 4, 2023

Mr David Chugg
16487 Farr West Drive
Ogden, Utah 84404

Re: Arrow Leaf Pavement Design
About 4700 North 2900 East
Eden, Utah
CMT Project Number 21356

INTRODUCTION

We understand that a private roadway has been cut to subgrade and is ready to be paved. The roadway is roughly a quarter mile long and will be paved with asphalt concrete. Anticipated traffic will consist of light automobiles and trucks with occasional medium weight trucks and fire trucks. It is our understanding that a pavement section design/review is required by the county. The roadway is located at about 4700 North 2900 East in Eden, Utah, as shown on the **Vicinity Map** below. To generally define the existing subgrade, CMT has performed the requested Dynamic Cone Penetrometer (DCP) testing at 8 locations along the referenced length of road (see attached "**Site Plan**" for test locations). In addition, samples at each location were collected by hand augur or shovel.



Vicinity Map

FIELD WORK

A total of 8 DCP tests were conducted along the planned roadway. Hand auguring was attempted at each test location and extended to depths of about 2 to 24 inches below the existing grade. DCP testing was completed either at surface grade or within the augured hole at each location. Soil samples were obtained and transported back to our laboratory for further evaluation.

The subsurface soils encountered were classified in the field based upon visual and textural examination, logged and described in general accordance with ASTM¹ D-2488.

3.0 LABORATORY TESTING

Selected samples of the subsurface soils were 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. Atterberg Limits, ASTM D-4318, Plasticity and workability
3. Gradation Analysis, ASTM D-1140/C-117, Grain Size Analysis

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

LAB SUMMARY TABLE 1

TEST LOCATION	DEPTH (inches)	SOIL CLASS	SAMPLE TYPE	MOISTURE CONTENT(%)	GRADATION			ATTERBERG LIMITS		
					GRAV.	SAND	FINES	LL	PL	PI
DCP-2	12	CL	Bag	19	3	12	85			
DCP-5	0	SC	Bag	12	26	32	42	28	18	10
DCP-8	2	SC	Bag	7	31	44	25			

SUBSURFACE SOIL DESCRIPTION

The following table describes the soils encountered at each test location.

¹American Society for Testing and Materials

TEST LOCATION	MAXIMUM AUGERED DEPTH (inches)	SOIL DESCRIPTION
DCP-1	6	Brown Gravelly CLAY with sand and small cobbles
DCP-2	12	Sandy CLAY with trace gravel/cobble
DCP-3	2	Brown CLAY with some Gravel
DCP-4	2	Brown Gravelly CLAY
DCP-5	4	Surface coated in 1" minus gravel. Brown Clayey SAND with gravel
DCP-6	24	Surface coated in 1" minus gravel. Brown Clayey SAND with gravel
DCP-7	2	Surface coated in 1" minus gravel. Brown CLAY with trace sand and gravel
DCP-8	6	Surface coated in 1" minus gravel. FILL-Brown Clayey Sand with Gravel

DYNAMIC CONE PENETROMETER (DCP) TESTING

DCP testing was completed at 8 locations along the roadway alignment. The following table provides estimated CBR correlations.

Field DCP Testing

Test Location	Estimated Soil	Penetration Depth (inches)*	Est. Field Correlated CBR	** AASHTO Corrected CBR
1	Gravelly CLAY	0 to 15	20	11
2	Sandy CLAY	18 to 21	20	11
3	CLAY with some Gravel	1 to 23	8	5
4	Gravelly CLAY	1 to 35	10	6
5	Clayey SAND with Gravel	4 to 18	15	10
6	Clayey SAND with Gravel	24 to 33	15	10
7	CLAY with Trace Sand, Gravel, Cobbles	2 to 30	8	5
8	Fill, Clayey Sand with Gravel	6 to 14	25	17

** AASHTO correction factor for high moisture seasonal periods.

PAVEMENT SECTION REVIEW/RECOMMENDATIONS

We understand that the planned roadway will service up to six single family residential properties. Further we anticipate daily 18-kip ESAL's up to about 4. Based on the in-situ,

corrected CBR values obtained through field DCP testing, we have utilized a design CBR of 5 percent. The following minimum pavement sections are recommended:

MATERIAL	PAVEMENT SECTION THICKNESS (inches)	
Asphalt	3	3
Aggregate Base	10	4
Aggregate-subbase	0	8
Total Thickness	13	15

Imported 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 CBR value of 70%. Subbase shall consist of a low plastic, granular fill soil with a minimum CBR value of 40%. Asphalt material generally should conform to APWA requirements, having a ½-inch maximum aggregate size, mix containing no more than 15% of recycled asphalt (RAP) and a PG64-34 binder.

The life of the pavement will be prolonged with proper, timely maintenance such as rubberized sealing of cracks, and slurry seal coating of the surface. Inversely, without proper maintenance the longevity of the pavement will be reduced.

Subgrade preparation shall consist of the removal of all deleterious material and topsoil, if/where remains. The exposed subgrade must then be proofrolled by passing moderate-weight rubber tire-mounted construction equipment over the surface at least twice. If excessively soft or loose soils are encountered, they must be removed (up to a maximum depth of 2 feet) and replaced with additional aggregate subbase.

We recommend that the aggregate base/subbase be compacted to a minimum 96 percent of the Modified Proctor Density (ASTM D1557) and not be installed over frozen subgrade.

CLOSURE

The conclusions and recommendations presented in this letter are based on the information provided, the soil conditions observed, and our experience with similar conditions. It is possible that soil conditions other than those observed during our visit or the study may exist, which could potentially be problematic. We cannot assume responsibility for conditions of which we are not aware or have not observed. No other warranty or representation, either expressed or implied, is intended in our proposals, contracts or reports.

If you have any questions or would like to discuss these items further, please feel free to contact us at (801) 590-0394.

Sincerely,
CMT Technical Services



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



Reviewed by:



Jeffrey J. Egbert, P.E., LEED A.P., M. ASCE
Senior Geotechnical Engineer

Attachments: Figure 1 Site Map
 DCP Test Data



DCP TEST DATA

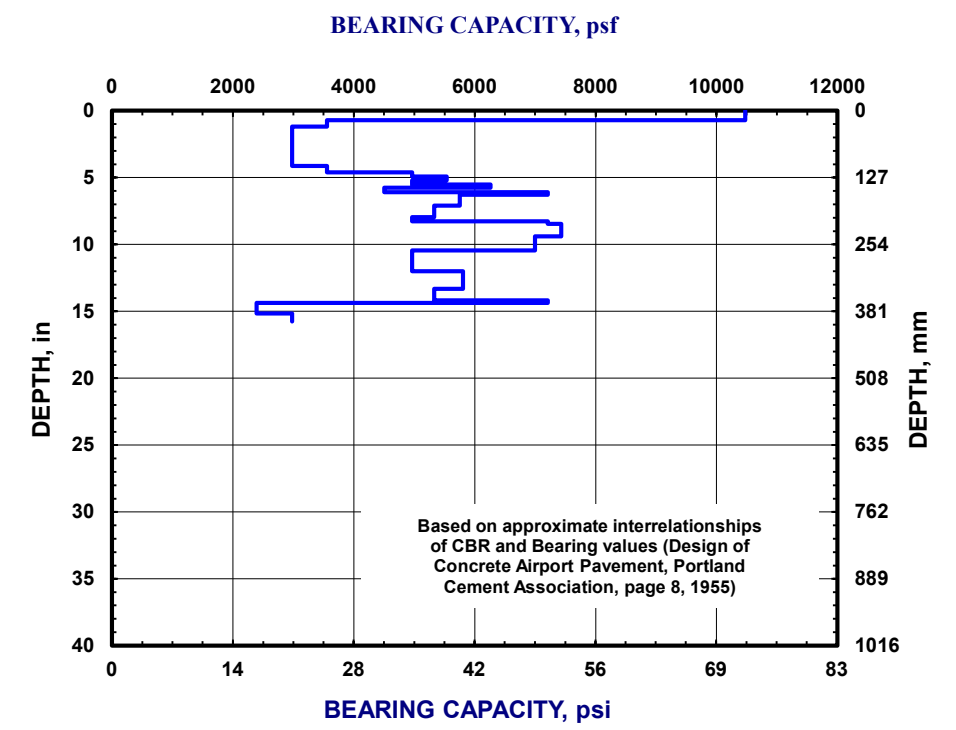
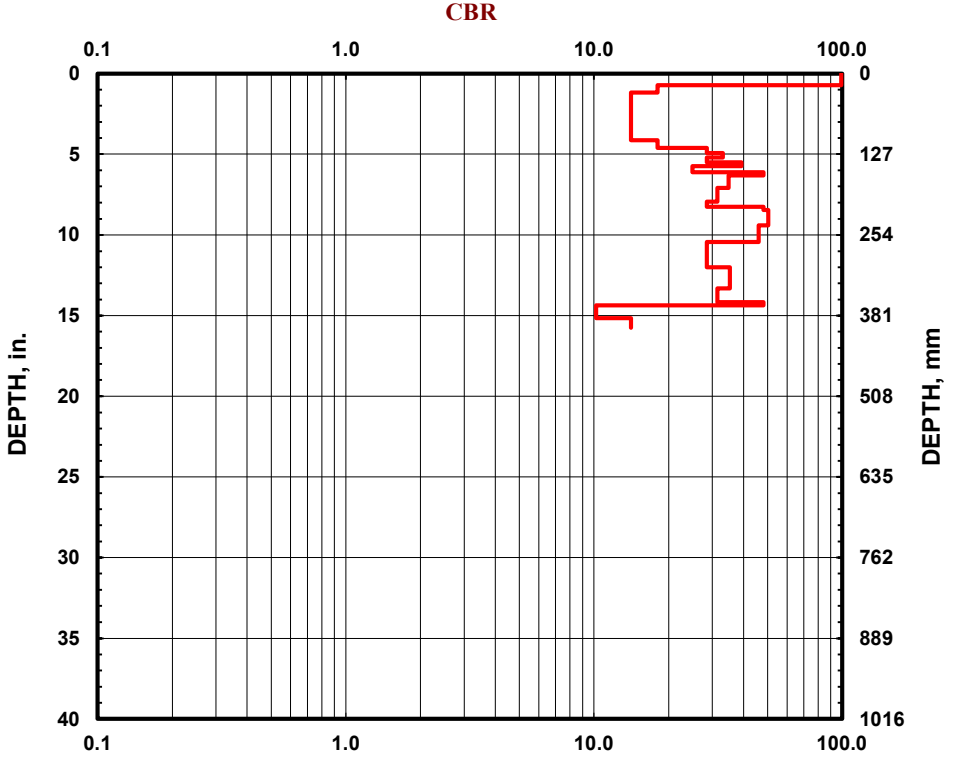
Project: Arrow Leaf Pavement
 Location: DCP-1 (start surface)

Date: 21-Nov-23
 Soil Type(s): Gravelly CLAY with sand and some Cobble

- 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
0	18	1
1	30	1
1	45	1
1	60	1
1	75	1
1	90	1
1	105	1
1	117	1
1	125	1
1	132	1
1	140	1
1	146	1
1	155	1
1	160	1
3	180	1
3	202	1
1	210	1
1	215	1
5	239	1
5	265	1
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DCP TEST DATA

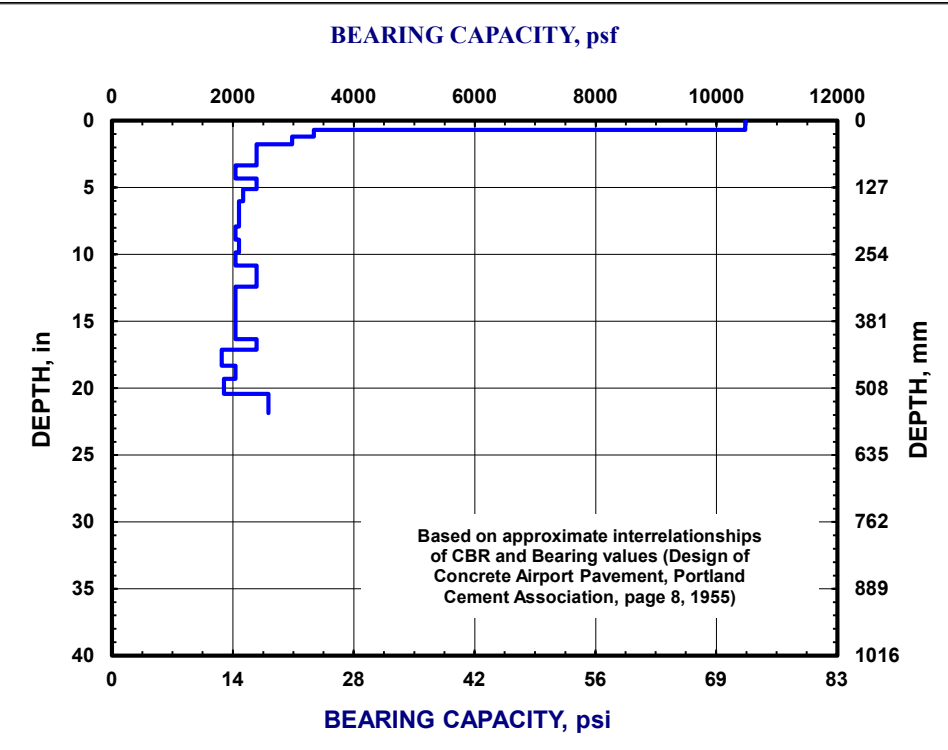
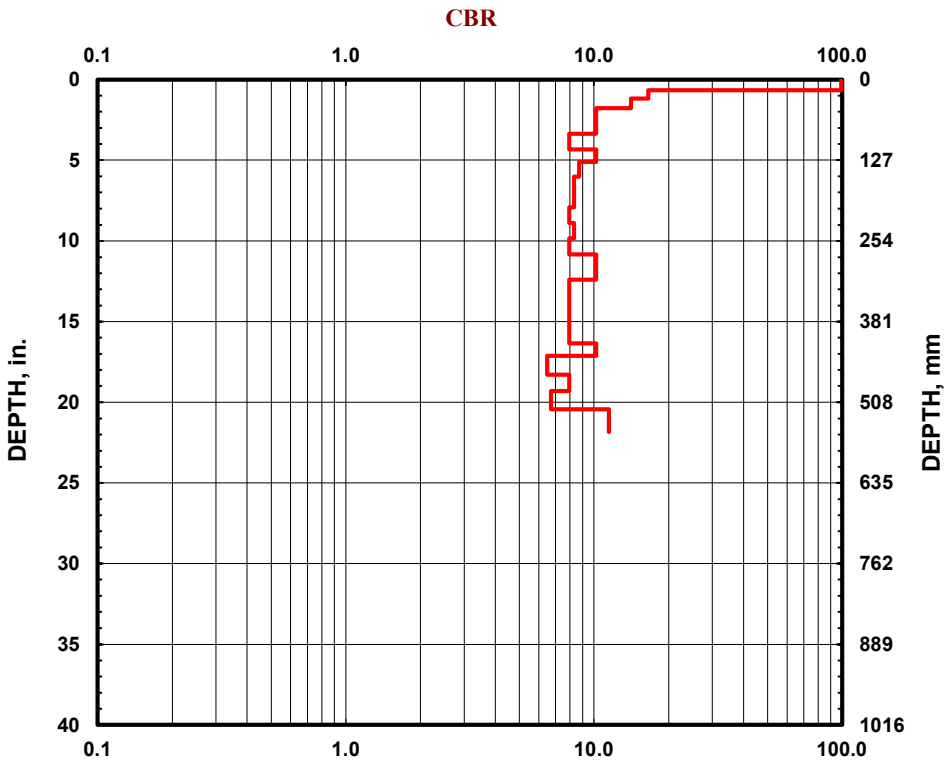
Project: Arrow Leaf Pavement
 Location: DCP-3 (@ surface)

Date: 21-Nov-23
 Soil Type(s): CLAY with some Gravel

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
0	17	1
1	30	1
1	45	1
1	65	1
1	85	1
1	110	1
1	130	1
1	153	1
1	177	1
1	201	1
1	226	1
1	250	1
1	275	1
1	295	1
1	315	1
1	340	1
1	365	1
1	390	1
1	415	1
1	435	1
1	465	1
1	490	1
1	519	1
1	537	1
1	555	1
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DCP TEST DATA

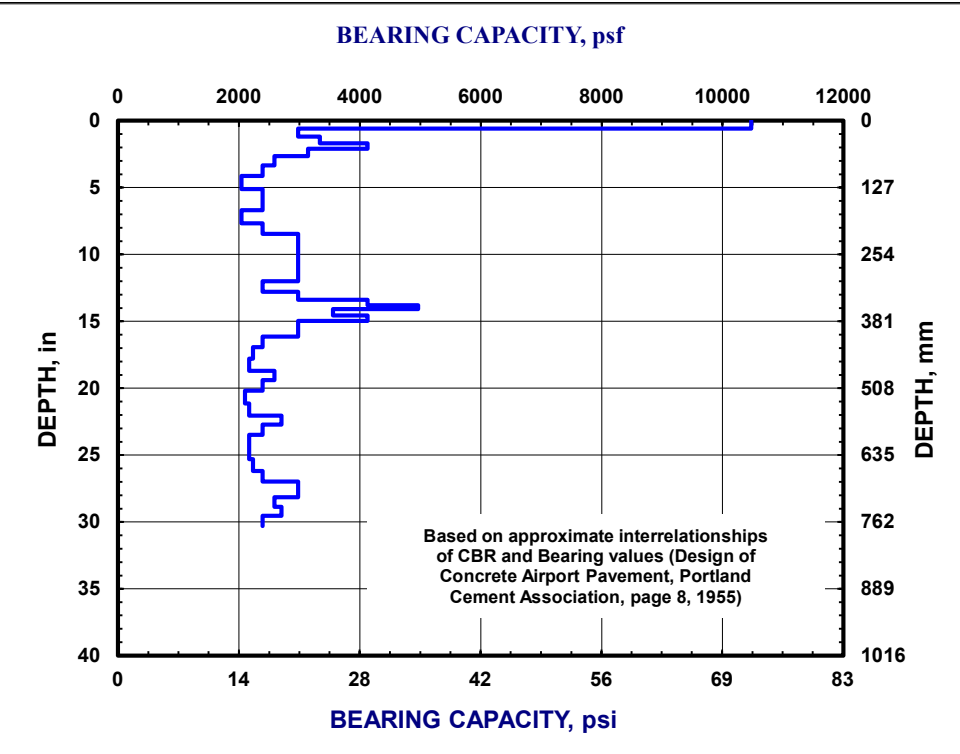
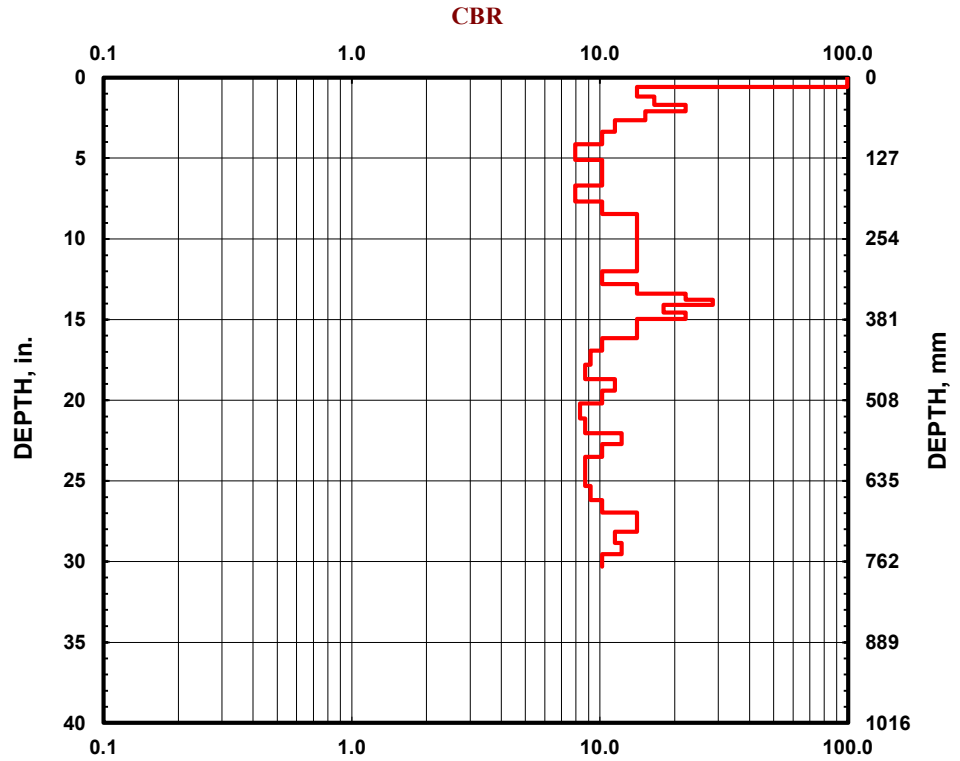
Project: Arrow Leaf Pavement
Location: DCP-4 (@ 1")

Date: 21-Nov-23
Soil Type(s): Gravelly CLAY

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	2
0	15	1
1	30	1
1	43	1
1	53	1
1	67	1
1	85	1
1	105	1
1	130	1
1	150	1
1	170	1
1	195	1
1	215	1
3	260	1
2	290	1
1	305	1
1	325	1
1	340	1
1	350	1
1	358	1
1	370	1
1	380	1
1	395	1
1	410	1
1	430	1
1	452	1
1	475	1
1	493	1
1	513	1
1	537	1
1	560	1
1	577	1
1	597	1
1	620	1
1	643	1
1	665	1
1	685	1
1	700	1
1	715	1
1	733	1
1	750	1
1	770	1
1	790	1



DCP TEST DATA

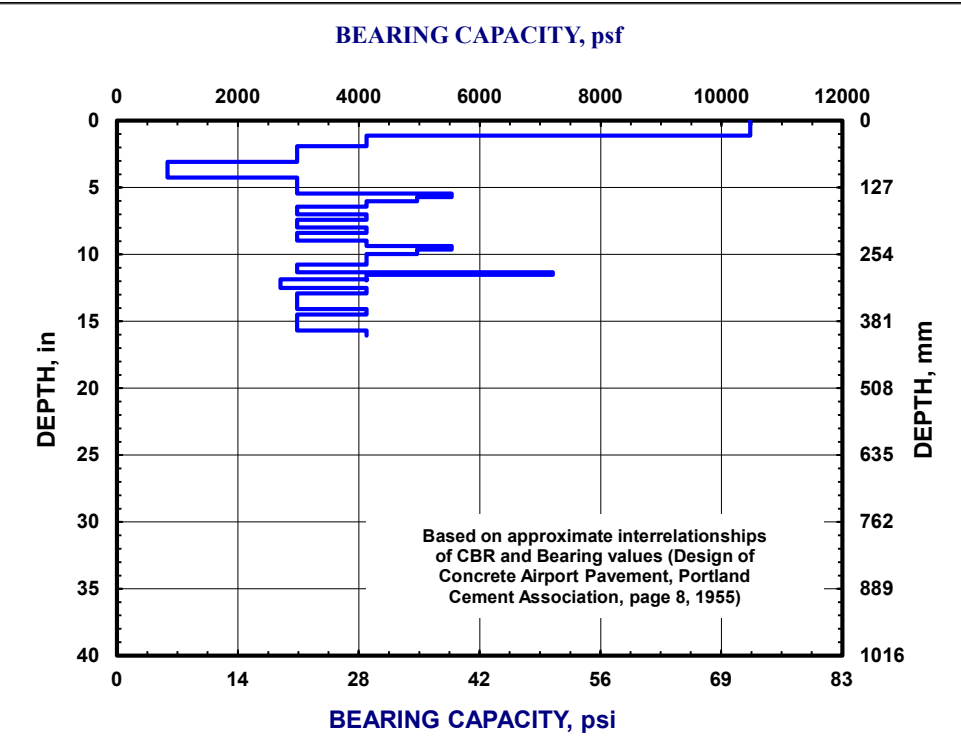
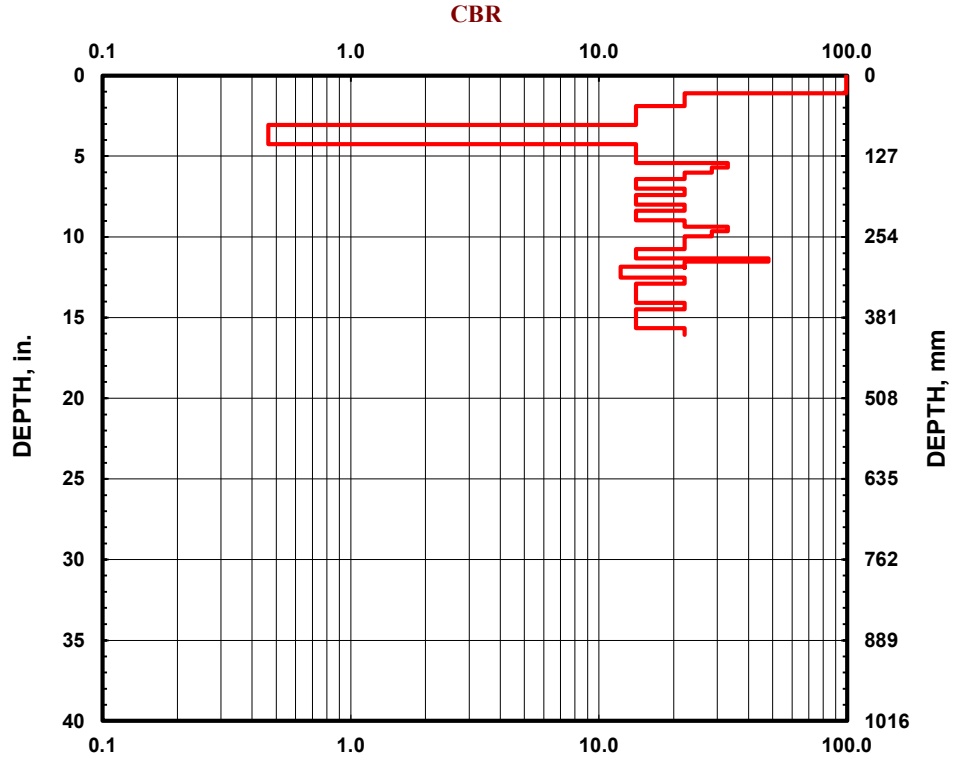
Project: Arrow Leaf Pavement
Location: DCP-5 (@ 4")

Date: 21-Nov-23
Soil Type(s): Clayey SAND with Gravel

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
0	28	1
1	38	1
1	48	1
1	63	1
1	78	1
1	-207	1
1	108	1
1	123	1
1	138	1
1	145	1
1	153	1
1	163	1
1	178	1
1	188	1
1	203	1
1	213	1
1	228	1
1	238	1
1	245	1
1	253	1
1	263	1
1	273	1
1	288	1
1	293	1
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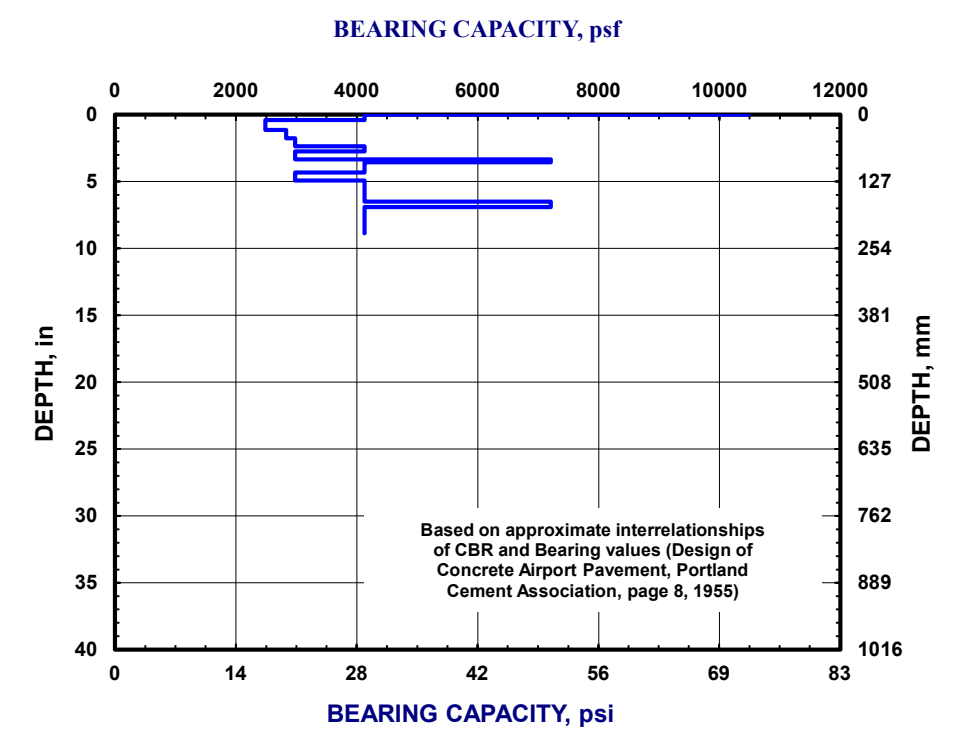
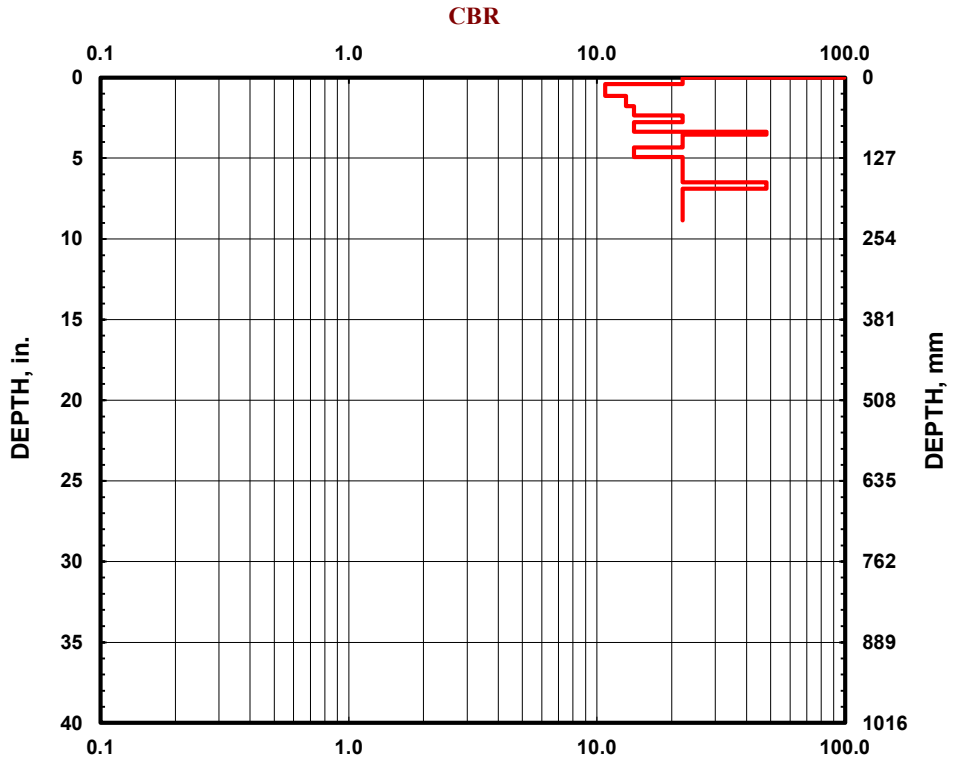
Project: Arrow Leaf Pavement
Location: DCP-6 (@ 24")

Date: 21-Nov-23
Soil Type(s): Clayey SAND with Gravel

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
0	0	1
1	10	1
1	29	1
1	45	1
1	60	1
1	70	1
1	85	1
1	90	1
1	100	1
1	110	1
1	125	1
1	135	1
1	145	1
1	155	1
1	165	1
1	170	1
1	175	1
1	185	1
1	195	1
1	205	1
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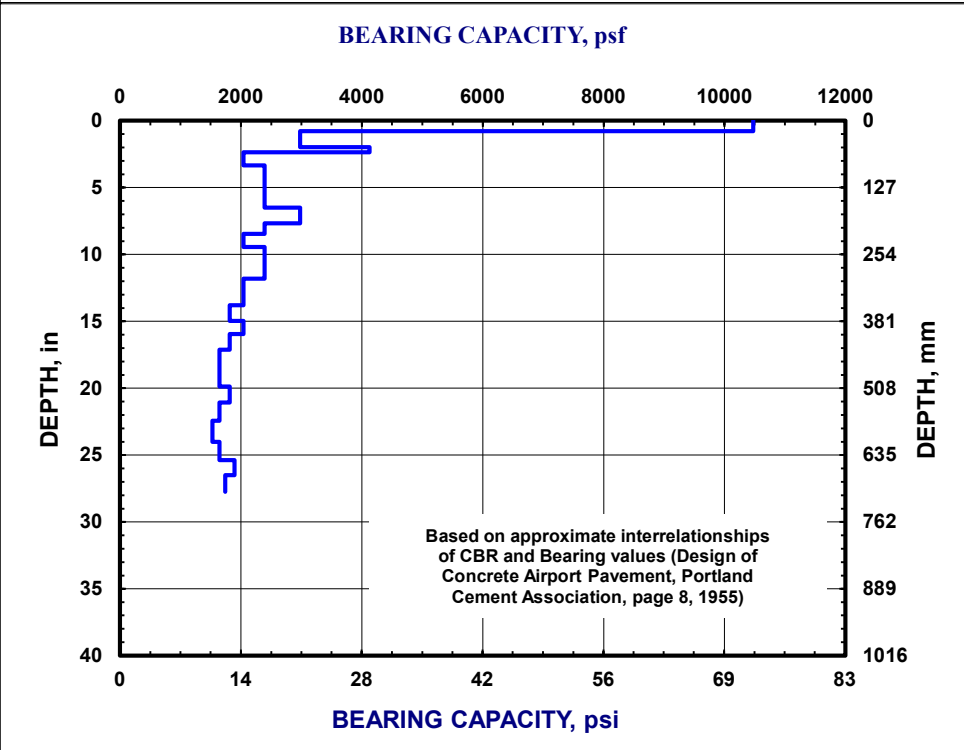
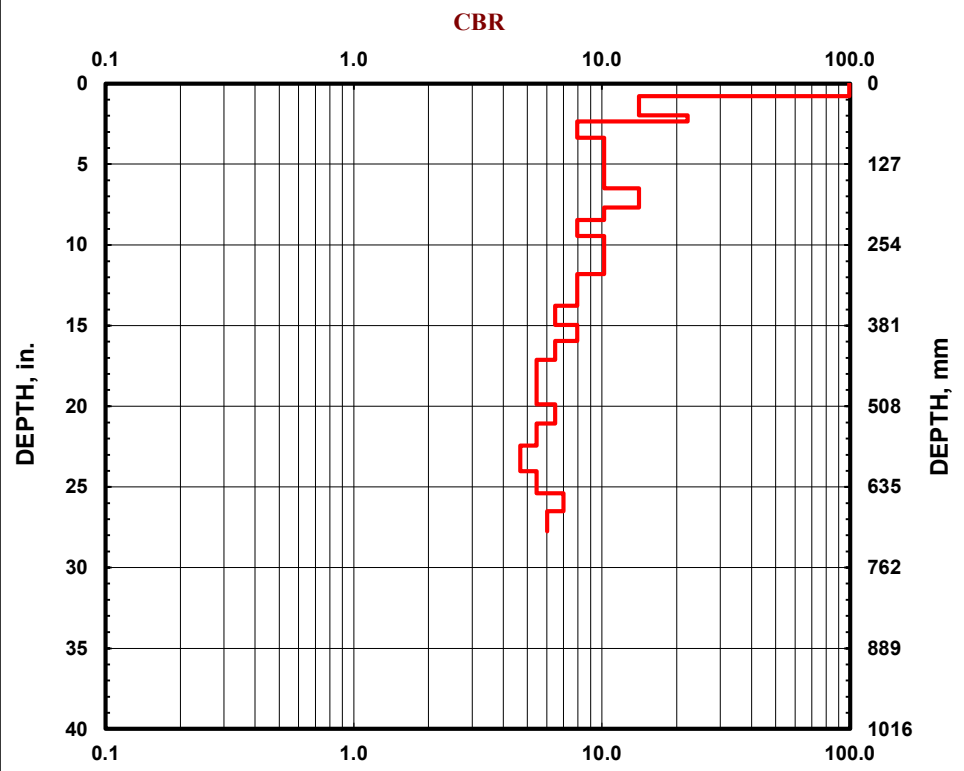
Project: Arrow Leaf Pavement
 Location: DCP-7 (@ 2")

Date: 21-Nov-23
 Soil Type(s): CLAY with Trace Sand/Gravel

- 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
0	20	1
1	35	1
1	50	1
1	60	1
1	85	1
1	105	1
1	125	1
1	145	1
1	165	1
1	180	1
1	195	1
1	215	1
1	240	1
1	260	1
1	280	1
1	300	1
1	325	1
1	350	1
1	380	1
1	405	1
1	435	1
1	470	1
1	505	1
1	535	1
1	570	1
1	610	1
1	645	1
1	673	1
1	705	1
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DCP TEST DATA

Project: Arrow Leaf Pavement
 Location: DCP-8 (start 6")

Date: 21-Nov-23
 Soil Type(s): FILL: Gravelly Clay with Sand

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
0	20	1
1	35	1
1	50	1
1	63	1
1	73	1
1	83	1
1	90	1
1	100	1
1	105	1
1	110	1
1	113	1
1	120	1
1	125	1
1	133	1
1	140	1
1	145	1
5	165	1
1	170	1
1	173	1
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