MEMO

Kansas Department of Transportation
Bureau of Structures and Geotechnical Services
Eisenhower State Office Building
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DATE: February 6, 2024

TO: Calvin Reed, P.E., Secretary of Transportation
Department of Transportation

FROM: Kyle Halverson, P.G., Chief Geologist
Bureau of Structures and Geotechnical Services

Bryan Pope, P.E., Geotechnical Engineer
Bureau of Structures and Geotechnical Services

Nat Velasquez, Jr., P.E., Pavement Design Leader
Bureau of Road Design

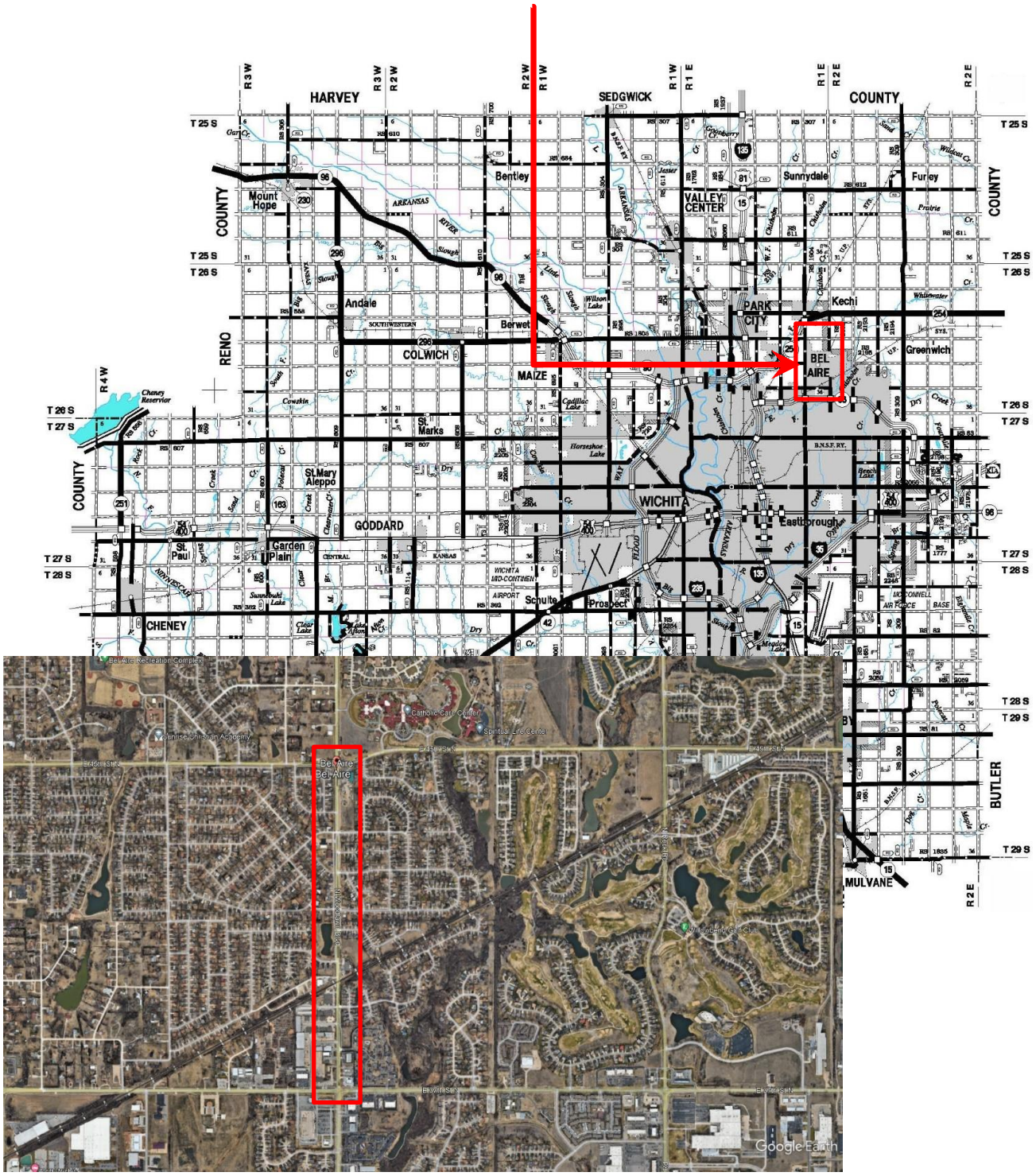
RE: 87 N-0678-01
Pavement Failure Investigation
N Woodlawn Blvd from 37th Street to 45th Street
Sedgwick County

At the request of the Department of Transportation Secretary, Calvin Reed, a subsurface investigation along Woodlawn Rd between 37th St and 45th St in the City of Bel Aire, Kansas was preformed to determine performance versus cost regarding the deteriorating roadway along this stretch. The investigation was performed by the KDOT Geotechnical, Geology, and Pavement Sections. The findings of that investigation are herewith in this report. All findings and recommendations are representative of the information collected and results from lab data collected during the investigation.

The pavement failure investigation has been conducted for N Woodlawn Blvd. in Sedgwick County. This report completes the involvement of the Geology Section, Geotechnical Section, and Pavement Design Section with this phase of the project. Please contact Mr. Kyle Halverson Kyle.Halverson@ks.gov, Mr. Bryan Pope Bryan.Pope@ks.gov, Mr. Luke Metheny Luke.Metheny@ks.gov ,or Mr. Nat Velasquez Nat.Velasquez@ks.gov at (785) 296-3531 should any questions regarding this report arise.
Attachments

c: Nick Squires, P.E., District 5 Engineer (email)
Duane Flug, P.E., District 5 Construction and Materials Engineer (email)
Mike Longshaw, P.E., Wichita Metro Engineer (email)
Jason Van Nice, P.E., Bureau Chief of Construction and Materials (email)
Mark Hurt, P.E., Bureau Chief of Structures and Geotechnical Services (email)
Judy Sprout, Senior Administrative Assistant (email)
Debbie Stanley, Senior Administrative Assistant (email)
Luke Metheny, P.E., Chief Geotechnical Engineer (email)

General Highway Map
Sedgwick County, Kansas
Project Number 87 N-0678-01



PROJECT SCOPE AND BACKGROUND

The project described above is a city project that KDOT forces were requested to assist in determining a suitable cost versus performance recommendation. The project began seeing pavement distress early on in construction, and as a result construction was halted. It was indicated that traffic was allowed to travel on the pavement before the final two-inch layer of HMA was placed which has led to further deterioration of the pavement. Additionally, KDOT reviewed construction inspection data and photographs prior to conducting the field investigation.

FIELD INVESTIGATION AND PROCEDURES

The field investigation consisted of performing power auger holes, sample holes, and pavement cores throughout the project. Dynamic Cone Penetrometer tests (DCPs) were conducted at pavement core locations as well as at select power auger borings. Select power auger borings were continued into the Wellington Shale Formation and were used to develop a profile of the subsurface materials throughout the project as well as to determine groundwater elevations. Three sample borings using hollow stem augers were conducted to collect undisturbed 3 ½-inch diameter Shelby tube samples of the subgrade material as well as to collect bag samples. Additionally, bag samples were collected at select power auger borings. Four-inch pavement cores taken by the Geotechnical and Pavement Sections were collected for further visual inspection**.**

SITE CONDITIONS AND FINDINGS

The pavement surface conditions along the site varied from good to very poor. The pavement that was investigated consisted of two layers. The final layer had not been placed in areas with large amounts of distress. The plan thicknesses for the two layers in place were 2.0 inches and 3.0 inches respectively. Rutting was found mainly in the right wheel path of the northbound lane. Visual analysis of the cores obtained in the right wheel path were determined to be thinner than the cores in the left wheel path and the cores in between the wheel paths. The pavement cores were determined to primarily be in good condition. However, several cores displayed separation at the tack layer. The majority of the cores with layer separation were in areas with significant pavement distress. The pavement layer separation in the right wheel path of the northbound lane was likely caused by shear stresses. A summary of the visual inspection data from these cores is attached. An aggregate base layer consisting of AB-3 material was found throughout the project with an underlying geogrid. The AB-3 aggregate was found to be well compacted based off of DCP blow counts and corresponding California Bearing Ratio (CBR) values. The geogrid was found in every power auger boring that penetrated the subgrade. The material below the geogrid varied throughout the project. The southern portion of the project, south of Station 56+00, contained mostly low plasticity clays in the subgrade. North of Station 56+00 the depth to shale decreased and the subgrade soils consisted of high plasticity clays with a trace amount of gypsum. Swell testing of Shelby tube and bag samples north of Station 56+00 indicated the high plasticity clays have significant swell potential. A summary of the laboratory swell data is attached. Soil samples taken throughout the project had liquid limits ranging from 40 to 68 with plasticity indexes ranging from 22 to 53. Underlying the soil is the Wellington Shale Formation. The depth from the top of pavement to the top of the “Wellington” varies from

14 feet at the south end of the project, to 2 feet at the north end of the project. Due to the degree of weathering, determining the top of the "Wellington" was difficult. The depth to groundwater from the top of pavement was found to vary from 10.5 feet at the south end of the project to 2.9 feet at the north end of the project. Field observations found that the groundwater was typically located near the bedrock/mantle interface within the roadway. An additional boring was performed east of the roadway outside of the cut section and found similar groundwater conditions. During the investigation, it was noted that holes to the right of the reinforced concrete box (RCB), running under the northbound lane, were holding water after the pavement was cored.

LABORATORY INVESTIGATION

The laboratory investigation consisted of routine and strength tests performed by AASHTO accredited members of the Geotechnical Section. Routine tests determined the grain size distribution, Atterberg limits, and specific gravity of the samples. Additionally, standard Proctor compaction tests were conducted to determine the optimum moisture and maximum dry density of the subgrade materials. These results were used to classify the soils according to both Kansas and Unified Soil Classifications. Strength testing consisted of unconfined compression (QU), resilient modulus (Res Mod), and one-dimensional swell testing. The strength tests were used to determine the design parameters of the existing subgrade. Swell tests were conducted to determine if the subgrade material has the potential to swell, as well as to predict the magnitude of potential swelling and under what conditions it can occur. A summary of the laboratory results are attached to this memo.

ANALYSIS OF FINDINGS

A total of 15 full depth HMA cores were obtained in the northbound lane in the rutted areas from Station 50+84.5 to 66+28 along the project. At five locations, cores were obtained in the right wheel path, between the wheel paths, and in the left wheel path. The purpose of the investigation was to determine if the pavement thickness varied across the lane. The core information is shown in the following table.

Core Location	Number of Samples	Average Thickness (in)	Minimum Thickness (in)	Maximum Thickness (in)
All Cores Combined	15	5.45	4.50	6.38
Right Wheel Path	5	5.15	4.50	5.88
Between Wheel Paths	5	5.68	5.13	6.25
Left Wheel Path	5	5.53	5.00	6.38

Four of the five cores in the right wheel path had one break in the tack layer ranging in depth from 1.375" to 2.375". One of the five cores in the left wheel path had one break in the tack layer at a depth of 2.625". One of the five cores between the wheel paths had one break in the tack layer at a depth of 2.75". The average thickness of the cores in the right wheel path were less than the average thickness of the cores in the left wheel path, and between the wheel paths.

Blow counts from Dynamic Cone Penetrometer (DCP) tests were correlated to California Bearing Ratio (CBR) values. In regions where little to no pavement distress has occurred, minimum subgrade CBR values were determined to range from 5.2 to 13.8. In areas with pavement distress, minimum subgrade CBR values were determined to range from 2.1 to 8.8 with one outlying CBR value of 21.8. Plots of the CBR values vs. depth are attached to this memo.

Subgrade moisture contents were found to vary from 13.7% to 30.1%. Optimum moisture values were determined from standard Proctor compaction tests conducted on subgrade cuttings. These results indicated that for soils south of Station 56+00 the optimum moisture is 16.4%. For soils north of Station 56+00 the optimum moisture is 19.0%. Furthermore, resilient modulus testing indicates that the resilient modulus is more than twice as high in regions without moisture issues.

Based on the analysis of the findings and current site conditions it can be discerned that the pavement failure is predominantly related to an over-saturated subgrade. The subgrade materials overall competency is lessened as the moisture content increases. In the areas where pavement distress is the most severe, the subgrade moisture content is 10% greater than optimum which led to a decrease in strength.

RECOMMENDATIONS

KDOT guidance was to determine possible repair costs vs. performance for the project site. Based on findings from the laboratory results and the field investigation, it is more appropriate for KDOT to provide recommendations that evaluate cost versus risk of significant failure due to the unknown approach stakeholders are going to take. When evaluating risk of significant failure, KDOT would look at the expected performance of a project for the anticipated design life.

The options below should not be viewed as the only options to consider; however, it should be used as a guide to determine how much risk stakeholders are willing to take, related to cost.

OPTION 1

Option 1 would consider a redesign of pavement thicknesses, subsurface drains, removal of all deleterious materials, subgrading, and subgrade stabilization in both the NB and SB lanes from Station 20+80.46 to Station 70+95.48.

OPTION 2

Option 2 would consider a redesign of pavement thicknesses, subsurface drains, removal of all deleterious materials, subgrading, and subgrade stabilization in both the NB and SB lanes for the region of the project from Station 40+98.74 to Station 70+95.48.

OPTION 3

Option 3 would consider a redesign of pavement thicknesses, subsurface drains, removal of all deleterious materials, subgrading, and subgrade stabilization in both the NB and SB lanes for the region of the project from Station 55+00 to Station 70+95.48.

OPTION 4

Option 4 would consist of a mill and overlay in both the NB and SB lanes from Station 40+98.74 to Station 70+95.48.

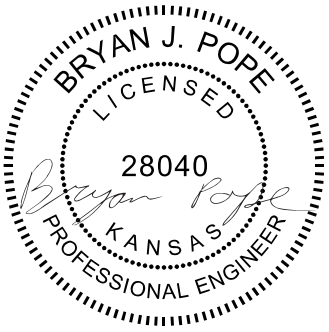
Figure 1 below compares the cost to anticipated risk of significant failure over the design life of the pavement. The estimated cost scale ranges from $500,000 to $8 million. The risk scale ranges from X to XXXX with X denoting the lowest anticipated risk for significant failure and XXXX denoting the highest anticipated risk for significant failure.

OPTION	EST. COST	RISK	Pavement Performance
Option 1	$8 Million	X	Minimal Risk of Potential of Pavement Failure for design life
Option 2	$5 Million	XX	Low Risk of Potential of Pavement Failure within 5-8 years
Option 3	$3 Million	XXX	Moderate Risk of Potential of Pavement Failure within 1-5 years
Option 4	$0.5 Million	XXXX	High Risk of Potential of Pavement Failure within 0-1 years

Figure 1: Comparisons of Options vs. Cost and Risk

Note: The scales used are not intended to represent actual percentage values

The options provided above are not an exhaustive list of options. Consideration of other options that fit the needs of stakeholders should be evaluated. Furthermore, the estimated costs provided above are based on an increase cost from previous project cost estimates.



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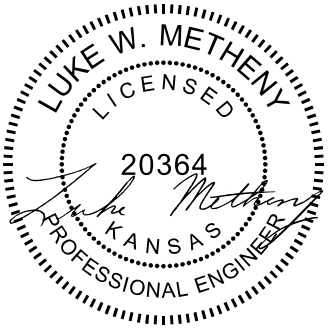


Feb 06, 2024

Kansas Department of Transportation

Project: N-0678-01
Location: Woodlawn Rd
County:

Hole ID PA01

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 40.8, 16.0' Rt CL
GPS 37.75793, -97.26237
Date 1/3/2024
Total Depth 16.7 ft.
GW Elev.N/A

Depth (ft)	Elevation (ft)	
0.0	1375.6	Asphalt
0.7	1374.9	"Base" Clayey Silty Gravel, dry, dense to med. Dense
1.0	1374.6	
1.7	1373.9	Clayey Silt, dark brown, slightly moist, "fill", geotextile @ 1.0'
		Silty Clay, dark brown, slightly moist, petroleum smell, push from 3.5-4.0. trace subrounded gravel
5.0	1370.6	Silty Clay, dark brown to black, slightly moist, stiff
9.0	1366.6	Silty Clay, dark brown to black, moist to wet, push from 10.1-13.2, soft, petroleum smell
13.2	1362.4	Shale, weathered, olive green, poor Structure, med hard to soft

TD 16.7 1358.9

Hole ID PA02

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 42.67, 24.0' Rt CL
GPS 37.75848, -97.26238
Date 1/3/2024
Total Depth 16 ft.
GW Elev.N/A

Depth (ft)	Elevation (ft)	
0.0	1373.8	Asphalt
0.7	1373.1	"Base" Clayey Silty Gravel, dry, dense to med. Dense
2.0	1371.8	Clayey Silt, dark brown to black, slightly moist, geotextile @ 2.0' @ 5' became moist
8.0	1365.8	Silty Clay, Soft, push, dark brown to black
9.0	1364.8	Silty Clay, dark brown to black, @ 10' free water, soft
14.0	1359.8	Shale, highly weathered, soft, olive green, wet, poor Structure

TD 16.0 1357.8

Hole ID PA03

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 43.58, 16.0' Rt CL
GPS 37.75867, -97.26239
Date 1/3/2024
Total Depth 1.4 ft.
GW Elev.N/A

Depth (ft)	Elevation (ft)	
0.0	1373.3	"Base" Clayey Silty Gravel, dry, dense to med. Dense, geotextile @ 0.8,
0.4	1373.0	TD 1.4' Hit top of RCB under roadway

TD 1.4 1371.9

Hole ID PA04

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 44.12, 24.0' Rt CL
GPS 37.75926, -97.26235
Date 1/3/2024
Total Depth 16.2 ft.
GW Elev.N/A

Depth (ft)	Elevation (ft)	
0.0	1373.1	Asphalt
0.5	1372.6	"Base" Clayey Silty Gravel, dry, dense to med. Dense, geotextile @ 1.0'
1.3	1371.8	Clayey Silt, dark brown to black, slightly moist, med stiff, @ 3'-4' push, soft
4.0	1369.1	Silty Clay, dark brown to black, med stiff, slightly moist
5.2	1367.9	Silty Clay, dark brown to black, med stiff, moist
6.0	1367.1	Silty Clay, black to dark brown, moist, med stiff to soft
9.2	1363.9	Shale, weathered, olive green to brown, moist, poor Structure

TD 16.2 1356.9

Kansas Department of Transportation

Project: N-0678-01
Location: Woodlawn Rd
County:

Hole ID PA05

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 45.74, 24.0' Rt CL
GPS 37.75926, -97.26238
Date 1/3/2024
Total Depth 15.2 ft.
GW Elev.1368.9

Depth (ft)	Elevation (ft)	
0.0	1373.9	Asphalt
0.5	1373.4	"Base" Clayey Silty Gravel, dry, dense to med. Dense, geotextile @ 1.0'
1.0	1372.9	Clayey Silt, dark brown, slightly moist, med stiff
4.5	1369.4	Silty Clay, dark brown to black, soft to med stiff, moist
7.6	1366.3	Silty Clay, dark brown, med stiff, wet, @ 10.1 free water, "residual clay"
12.5	1361.4	Shale, weathered, olive green to brown, wet, med hard to soft, poor Structure, @ 14.5 became med hard

TD 15.2 1358.7

Hole ID PA06

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 47.7, 30.0' Rt CL
GPS ,
Date 1/3/2024
Total Depth 16.5 ft.
GW Elev.N/A

Depth (ft)	Elevation (ft)	
0.0	1375.2	Asphalt
0.5	1374.7	"Base" Clayey Silty Gravel, dry, dense to med. Dense,
1.1	1374.1	Silty Clay, brown to dark brown, slightly moist, med stiff
11.7	1363.5	Shale Weathered, wet, poor Structure, med hard

TD 16.5 1358.7

Hole ID PA07

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 50.1, 24.0' Rt CL
GPS 37.76094, -97.26236
Date 1/3/2024
Total Depth 11.5 ft.
GW Elev.N/A

Depth (ft)	Elevation (ft)	
0.0	1377.2	Asphalt
0.5	1376.7	"Base" Clayey Silty Gravel, wet, med. Dense, geotextile
1.1	1376.1	Silty Clay, brown to grayish brown, wet, med stiff
8.8	1368.4	Shale Weathered, wet, poor Structure, med hard, olive green
10.2	1367.0	Shale, slightly weathered to weathered, wet, med hard, olive green, Structure

TD 11.5 1365.7

Hole ID PA08

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 52, 24.0' Rt CL
GPS 37.76103, -97.26235
Date 1/3/2024
Total Depth 16 ft.
GW Elev.1374.9

Depth (ft)	Elevation (ft)	
0.0	1378.9	Asphalt
0.5	1378.4	"Base" Clayey Silty Gravel, gray brown, slightly moist, med Dense, geotextile
1.3	1377.6	Silty Clay, dark brown, slightly moist, med stiff
5.0	1373.9	Silty Clay, dark brown, soft, moist
8.8	1370.1	Shale highly weathered to weathered, wet, poor Structure, soft to med hard

TD 16.0 1362.9

Kansas Department of Transportation

Project: N-0678-01
Location: Woodlawn Rd
County:

Hole ID PA09

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 55.6, 24.0' Rt CL
GPS 37.76199, -97.26237
Date 1/3/2024
Total Depth 16.1 ft.
GW Elev.1374.8

Depth (ft)	Elevation (ft)	
0.0	1380.8	Asphalt
0.5	1380.3	"Base" Clayey Silty Gravel, gray brown, slightly moist, med Dense, geotextile
1.4	1379.4	Silty Clay, brown, slightly moist, med stiff
4.0	1376.8	Silty Clay, brown, soft, wet, push 4.0'-9.8'
10.7	1370.1	Shale weathered, wet, med hard, Structure
11.1	1369.7	Shale, highly weathered, weft, soft, olive green, poorly Structure, push 11.1'-16.0'
16.0	1364.8	Shale, weathered, wet, med hard to soft, olive green, some structure

TD 16.1 1364.7

Hole ID PA10

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 56.38, 24.0' Rt CL
GPS 37.76219, -97.26239
Date 1/3/2024
Total Depth 11.5 ft.
GW Elev.1374.5

Depth (ft)	Elevation (ft)	
0.0	1381.0	Asphalt
0.6	1380.4	"Base" Clayey Silty Gravel, brown, slightly moist, med Dense, geotextile
1.3	1379.7	Silty Clay, brown, slightly moist, soft to med stiff
10.3	1370.7	Shale, weathered, wet, poor structure, soft to med hard

TD 11.5 1369.5

Hole ID PA11

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 58.22, 24.0' Rt CL
GPS 37.76273, -97.26241
Date 1/3/2024
Total Depth 11.7 ft.
GW Elev.N/A

Depth (ft)	Elevation (ft)	
0.0	1381.7	Asphalt
0.5	1381.2	"Base" Clayey Silty Gravel, brown, dry med Dense, geotextile
1.2	1380.5	Silty Clay, dark brown, slightly moist, med stiff
4.5	1377.2	Shale weathered, olive green to brown, poor structure, soft to med hard
7.0	1374.7	Shale, weathered, olive green, moist, some structure, soft to med hard

TD 11.7 1370.0

Hole ID PA12

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 61, 24.0' Rt CL
GPS 37.7635, -97.26239
Date 1/3/2024
Total Depth 11.5 ft.
GW Elev.1378.1

Depth (ft)	Elevation (ft)	
0.0	1383.1	Asphalt
0.6	1382.5	"Base" Clayey Silty Gravel, brown, dry med Dense, geotextile
1.3	1381.8	Silty Clay, olive brown, slight moist, med stiff "residual clay"
2.5	1380.6	Shale, weathered to highly weathered, soft, push @ 5'-6.5'
7.0	1376.1	Shale, weathered, olive brown, poor structure, soft to med hard, moist

TD 11.5 1371.6

Kansas Department of Transportation

Project: N-0678-01
Location: Woodlawn Rd
County:

Hole ID PA13

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 63, 24.0' Rt CL
GPS 37.76405, -97.26238
Date 1/3/2024
Total Depth 11 ft.
GW Elev.1377.8

Depth (ft)	Elevation (ft)	
0.0	1384.3	Asphalt
0.5	1383.8	"Base" Clayey Silty Gravel, brown, dry med Dense, geotextile
1.1	1383.2	Silty Clay, olive brown, slight moist, med stiff "residual clay"
3.5	1380.8	Shale, highly weathered, no structure, soft, push @ 5'-6.5'
8.5	1375.8	Shale with gypsum stringers, hard to med hard, moist olive brown

TD 11.0 1373.3

Hole ID PA14

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 66, 24.0' Rt CL
GPS 37.76487, -97.26237
Date 1/3/2024
Total Depth 11.1 ft.
GW Elev.N/A

Depth (ft)	Elevation (ft)	
0.0	1386.8	Asphalt
0.5	1386.3	"Base" Clayey Silty Gravel, brown, slightly moist, med Dense, geotextile
1.2	1385.6	Silty Clay, olive brown, slight moist, med stiff "residual clay"
3.5	1383.3	Shale, weathered to highly weathered, med hard to soft, olive brown
5.5	1381.3	Shale, weathered, med hard, olive, moist, poor structure
7.0	1379.8	Shale, slightly weathered, olive green to greenish gray, structure, med hard to hard

TD 11.1 1375.7

Hole ID PA15

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 68.95, 1.0' Rt CL
GPS 37.75567, -97.26246
Date 1/3/2024
Total Depth 11.5 ft.
GW Elev.1382.8

Depth (ft)	Elevation (ft)	
0.0	1390.1	Asphalt
0.5	1389.6	"Base" Clayey Silty Gravel, brown, slightly moist, med Dense, geotextile
1.2	1388.9	Silty Clay, olive brown, slight moist, med stiff "residual clay"
3.3	1386.8	Shale highly weathered, poor structure, soft, olive green, slightly moist
4.2	1385.9	Shale, weathered, med hard, olive, slightly moist, poor structure
8.7	1381.4	Shale, slightly weathered, olive brown, structure, med hard to hard, slightly moist to moist

TD 11.5 1378.6

Hole ID PA16

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 66, 5.0' Rt CL
GPS 37.76483, -97.26249
Date 1/3/2024
Total Depth 17 ft.
GW Elev.N/A

Depth (ft)	Elevation (ft)	
0.0	1387.2	Asphalt
0.5	1386.7	"Base" Clayey Silty Gravel, brown, dry, med Dense,
1.2	1386.0	Silty Clay, brown, slight moist, med stiff "residual clay"
2.5	1384.7	Shale weathered to highly weathered, poor structure, soft to med hard , olive green, slightly moist
5.0	1382.2	Shale, weathered to slightly weathered, med hard, slightly moist, @8.5 became wet
16.0	1371.2	Shale, slightly weathered, med hard to hard, structure

TD 17.0 1370.2

Kansas Department of Transportation

Project: N-0678-01
Location: Woodlawn Rd
County:

Hole ID PA17

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 63.5, 3.0' Rt CL
GPS ,
Date 1/3/2024
Total Depth 11 ft.
GW Elev.N/A

Depth (ft)	Elevation (ft)	
0.0	1385.0	Asphalt
0.5	1384.5	"Base" Clayey Silty Gravel, brown, slightly moist, med Dense
0.8	1384.2	Silty Clay, brown, slight moist, med stiff "residual clay"
2.8	1382.2	Shale highly weathered, olive brown, soft to med hard, slightly moist
7.2	1377.8	Shale, weathered, olive brown, med hard, slightly moist, some structure

TD 11.0 1374.0

Hole ID PA18

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 61.5, 3.0' Rt CL
GPS ,
Date 1/3/2024
Total Depth 11.5 ft.
GW Elev.N/A

Depth (ft)	Elevation (ft)	
0.0	1384.0	Asphalt
0.6	1383.4	"Base" Clayey Silty Gravel, brown, dry, med Dense
1.2	1382.8	Silty Clay, brown, slight moist, med stiff "residual clay"
2.0	1382.0	Shale, weathered, greenish gray to olive green, med hard to soft, slightly moist
5.5	1378.5	Shale, slightly weathered to weathered, med hard, some structure, slightly moist
6.8	1377.2	Shale, non-weathered, hard, olive brown, structured, slightly moist

TD 11.5 1372.5

Hole ID PA19

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 58.75, 6.0' Rt CL
GPS ,
Date 1/3/2024
Total Depth 7 ft.
GW Elev.1380.2

Depth (ft)	Elevation (ft)	
0.0	1383.1	Asphalt
0.6	1382.5	"Base" Clayey Silty Gravel, brown, dry, med Dense, geotextile
1.1	1382.0	Silty Clay, brown, slight moist, med stiff to stiff "residual clay"
2.4	1380.7	Shale, weathered, olive brown, slightly moist, some structure, med hard

TD 7.0 1376.1

Hole ID PA20

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 56.38, 6.0' Rt CL
GPS ,
Date 1/3/2024
Total Depth 12 ft.
GW Elev.N/A

Depth (ft)	Elevation (ft)	
0.0	1381.7	Asphalt
0.5	1381.2	"Base" Clayey Silty Gravel, brown, slightly moist to dry, med Dense, geotextile
1.2	1380.5	Silty Clay, brown, slight moist, med stiff, "residual clay"
3.2	1378.5	Shale, weathered, soft to med hard, poor structure, greenish gray
4.2	1377.5	Shale, slightly weathered, med hard, slightly moist, structure

TD 12.0 1369.7

Kansas Department of Transportation

Project: N-0678-01
Location: Woodlawn Rd
County:

Hole ID PA21

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 53, 5.0' Rt CL
GPS ,
Date 1/3/2024
Total Depth 16.7 ft.
GW Elev.1368.6

Depth (ft)	Elevation (ft)	
0.0	1380.2	Asphalt
0.5	1379.7	"Base" Clayey Silty Gravel, brown, slightly moist to dry, med Dense, geotextile
1.1	1379.1	Silty Clay, brown, slight moist, med stiff, "residual clay"
4.2	1376.0	Silty Clay, brown, moist, soft, med stiff
12.5	1367.7	Shale, highly weathered, wet, med hard to soft, olive green, poor structure

TD 16.7 1363.5

Hole ID PA22

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 50, 6.0' Rt CL
GPS ,
Date 1/3/2024
Total Depth 15 ft.
GW Elev.1368.8

Depth (ft)	Elevation (ft)	
0.0	1377.8	Asphalt
0.6	1377.2	"Base" Clayey Silty Gravel, brown, slightly moist to dry, dense to med Dense, geotextile
1.1	1376.7	Silty Clay, brown, slight moist, med stiff, "residual clay"
3.5	1374.3	Silty Clay, grayish brown, slightly moist to moist, med stiff, @ 7.5 became wet
10.4	1367.4	Shale, weathered, soft, wet poor structure,
13.0	1364.8	Shale, weathered to slightly weathered, structure, med hard

TD 15.0 1362.8

Hole ID PA23

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 46.25, 6.0' Rt CL
GPS ,
Date 1/3/2024
Total Depth 15 ft.
GW Elev.1366.9

Depth (ft)	Elevation (ft)	
0.0	1374.7	Asphalt
0.5	1374.2	"Base" Clayey Silty Gravel, gray brown, slightly moist to dry, dense to med Dense, geotextile
1.1	1373.6	Silty Clay, brown, slight moist, med stiff, @ 2.5 became stiff
7.7	1367.0	Silty Clay, brown, wet, soft to med stiff
11.3	1363.4	Shale, weathered, olive green to brown, soft, poor structure, wet
12.7	1362.0	Shale, weathered to slightly weathered, med hard, structure, wet

TD 15.0 1359.7

Hole ID PA24

Geologist: K. Halverson, P.G.
Driller: J. Burns
Station 44.16, 5.0' Rt CL
GPS ,
Date 1/3/2024
Total Depth 17 ft.
GW Elev.N/A

Depth (ft)	Elevation (ft)	
0.0		Asphalt
0.5		"Base" Clayey Silty Gravel, gray brown to dark brown, slightly moist, dense, geotextile
1.1		Silty Clay, dark brown, slight moist, med stiff,
2.8		Silty Clay, dark brown, slightly moist, med stiff, @ 4.0' became soft
7.9		Silty Clay, dark grayish brown, slightly moist, med stiff, @ 9.0' became moist
12.5		Shale weathered, soft to med hard, wet, poor structure

TD 17.0

Investigation Type:	Pavement Failure	**Subsurface Exploration and Sampling**	Sheet: 1 of 1
Probing Equipment:	CME-45C		Sampling Equipment
Driller: J. Dulin	Eng'r: K. Brown		Driller / Eng'r
Date Started 1/4/2024	Date Competed 1/4/2024	Proj. No.: 87 N-0678-01	Date Started / Date Completed
		Location:	

Material Type: Sand, Silt, Clay, Shale, Limestone, Ground Water Reading

Field Test Type: PP = Pocket Penetrometer; TV = Torvane Shear Device; SPT = Standard Penetration (blows/foot); VS = Vane Shear; IBS = Iowa Borehole Shear

Sample Condition: G=Good, F=Fair, P=Poor, L=Lost, D=Disturbed, S=Saturated, U=Unstable, R=Refused, C=Cracked, B=Broken

Probe Data

Hole Number: B-1

Station: 67+64 CL Distance: 44.0' Rt

Top Hole Elevation: 1390.8'

Depth Elev (ft)	Log	Classification and Description of Materials Comments	Ident.
0		Dark Brown Silty Clay with gravel (Fill), Moist, Slightly Soft	
2		Dark Gray Silty Clay, Moist, Slightly Soft	1.5'
4		Brown Silty Clay, Slightly Moist, Slightly Soft	3.0'
6		Reddish Brown Silty Clay (HW Shale), Slightly Moist, Firm	5.0'
8		Olive Green Weathered Shale, Slightly Moist, Firm	7.5'
10		With Red Mottling after 10'	
11		Bottom of Boring, Stopped in Same T.D. = 11.1	11.1'

Sample Data

Hole No.	Sta.	T.H.E.	Sample Number	Depth of Retained Sample	Condition	Pushed Recovered

Investigation Type:	Pavement Failure	**Subsurface Exploration and Sampling**		Sheet: 1 of 1	
Probing Equipment:	CME-45C			Sampling Equipment:	CME-45C
Driller: J. Dulin	Eng'r: K. Brown			Driller: J. Dulin	Eng'r: K. Brown
Date Started 1/3/2024	Date Competed 1/3/2024	Proj. No.: 87 N-0678-01		Date Started 1/3/2024	Date Completed 1/3/2024
		Location:			

Material Type: Sand, Silt, Clay, Shale, Limestone, Ground Water Reading

Field Test Type: PP = Pocket Penetrometer; TV = Torvane Shear Device; SPT = Standard Penetration (blows/foot); VS = Vane Shear; IBS = Iowa Borehole Shear

Sample Condition: G=Good, F=Fair, P=Poor, L=Lost, D=Disturbed, S=Saturated, U=Unstable, R=Refused, C=Cracked, B=Broken

Probe Data

Hole Number: C3

Station: 30+00 CL Distance: 24.0' Rt

Top Hole Elevation: 1373.8'

Depth Elev (ft)	Log	Classification and Description of Materials Comments	Ident.
0		Asphalt Pavement	
1		AB-3 Base	0.6'
2		Dark Brown Silty Clay, Slightly Moist, Firm to Stiff	1.2'
5		Brown Silty Clay, Slightly Moist, Firm	5.0'
8		Light Brown Silty Clay (HW Shale), Slightly Moist, Stiff	8.0'
10		WT=10.5'	
15		Tan Weathered Sandy Shale, Stiff	14.4'
17		Bottom of Boring, Stopped in Same T.D. = 16.6	16.6'

Sample Data

Hole No.: CME-1				Hole No.				Hole No.			
Sta.: 30+00				Sta.				Sta.			
T.H.E.: 1378.8'				T.H.E.				T.H.E.			
Sample Number	Depth of Retained Sample	Condition	Pushed Recovered	Sample Number	Depth of Retained Sample	Condition	Pushed Recovered	Sample Number	Depth of Retained Sample	Condition	Pushed Recovered
SH-1	1.4' - 3.4' PP=3.25	G	2.0' / 2.0'								
SH-2	3.4' - 5.4' PP=2.75	G	2.0' / 2.0'								

Investigation Type:	Pavement Failure		
Probing Equipment:	CME-45C		
Driller: J. Dulin	Eng'r: K. Brown		
Date Started 1/4/2024	Date Competed 1/4/2024		

Subsurface Exploration and Sampling

Proj. No.:	87 N-0678-01		
Location:			

Sheet: 1	of 1		
Sampling Equipment:	CME-45C		
Driller: J. Dulin	Eng'r: K. Brown		
Date Started 1/4/2024	Date Completed 1/4/2024		

Material Type: Sand, Silt, Clay, Shale, Limestone, Ground Water Reading

Field Test Type: PP = Pocket Penetrometer; TV = Torvane Shear Device; SPT = Standard Penetration (blows/foot); VS = Vane Shear; IBS = Iowa Borehole Shear

Sample Condition: G=Good, F=Fair, P=Poor, L=Lost, D=Disturbed, S=Saturated, U=Unstable, R=Refused, C=Cracked, B=Broken

Probe Data

Hole Number: CME-2

Station: 56+30 | CL Distance: 17.9' Rt

Top Hole Elevation: 1380.8'

Depth Elev (ft)	Log	Classification and Description of Materials Comments	Ident.
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			

Sample Data

Hole No.: CME-2 | Sta.: 56+30 | T.H.E.: 1380.8'

Hole No. _____ | Sta. _____ | T.H.E.

Hole No. _____ | Sta. _____ | T.H.E.

Sample Number	Depth of Retained Sample	Condition	Pushed / Recovered
SH-3	1.5' - 3.5' PP=0.75	F	2.0' / 1.1'
SH-4	3.5' - 5.5' PP=1.00	F	2.0' / 1.0'

Sample Number	Depth of Retained Sample	Condition	Pushed / Recovered

Sample Number	Depth of Retained Sample	Condition	Pushed / Recovered

Investigation Type:	Pavement Failure	**Subsurface Exploration and Sampling**		Sheet: 1 of 1	
Probing Equipment:	CME-45C			Sampling Equipment:	CME-45C
Driller: J. Dulin	Eng'r: K. Brown			Driller: J. Dulin	Eng'r: K. Brown
Date Started 1/4/2024	Date Competed 1/4/2024	Proj. No.: 87 N-0678-01		Date Started 1/4/2024	Date Completed 1/4/2024
		Location:			

Material Type: Sand, Silt, Clay, Shale, Limestone, Ground Water Reading

Field Test Type: PP = Pocket Penetrometer; TV = Torvane Shear Device; SPT = Standard Penetration (blows/foot); VS = Vane Shear; IBS = Iowa Borehole Shear

Sample Condition: G=Good, F=Fair, P=Poor, L=Lost, D=Disturbed, S=Saturated, U=Unstable, R=Refused, C=Cracked, B=Broken

Probe Data

Hole Number: CME-3

Station: 62+81 CL Distance: 1.0' Rt

Top Hole Elevation: 1384.5'

Sample Data

Hole No.: CME-3 Sta.: 62+81 T.H.E.: 1384.5'

Hole No. Sta. T.H.E.

Hole No. Sta. T.H.E.

Depth Elev (ft)	Log	Classification and Description of Materials Comments	Ident.	Sample Number	Depth of Retained Sample	Condition	Pushed / Recovered
0							
1							
2				SH-5	1.5' - 3.5' PP=2.75	G	2.0' / 2.0'
3							
4				SH-6	3.5' - 5.5' PP=3.25	G	2.0' / 2.0'
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							

Location	Station	Station	Offset	Left Lane	Center Lane	Right Lane	Estimated Rut Depth (ft)	Min CBR	Minimum CBR Below Aggregate Layer	Aggregate Thickness (inches)	Pavement Thickness (inches)	Soft Zone Thickness (inches) (CBR<5)
C1	34+50	3450	18.4' LT	X				5.2	5.2	7.92	7.2	0
C2	25+00	2500	17.0' LT	X				4.0	7.2	8.64	7.44	0
C3	30+00	3000	24.7' RT			X		8.2	8.2	8.64	6.48	0
C4	44+42	4442	16.4' RT			X	0.05	5.7	5.7	6.48	5.04	0
C5	47+39.5	4739.5	22.9' RT			X	0	5.2	5.2	6	6.24	0
C6	50+27	5027	17.7' RT			X	0.08	2.3	2.3	5.76	5.28	4
C7	54+66	5466	17.7' RT			X	0.07	8.2	8.2	7.44	5.04	0
C8	56+34	5634	18.7' RT			X	0.35	2.6	2.6	7.08	5.64	12
C9	61+03	6103	17.9' RT			X	0.14	4.7	4.7	6.24	5.76	3.5
C10	63+07	6307	17.3' RT			X	0.27	2.6	2.6	6	5.52	9
C11	65+96	6596	17.9' RT			X	0.36	4.4	4.4	7.32	5.76	5
C12	69+00	6900	1' RT		X			4.4	7.2	8.04	6	1
C13	63+11.8	6311.8	1' RT		X			3.8	3.8	4.68	4.68	2.5
C14	56+39	5639	CL		X			3.8	7.2	5.28	7.2	1.2
C15	50+24	5024	CL		X			5.7	5.7	6.48	6	0
C16	47+40	4740	CL		X			8.2	8.2	3	6	0
C17	66+12	6612	13.0' LT	X				4.4	4.4	7.08	7.2	1
C18	62+98	6298	13.5' LT	X				2.5	2.5	5.76	7.2	2
C19	56+39	5639	13.0 LT	X				3.8	5.7	7.2	7.2	3.7
C20	47+40	4740	14.0 LT	X				6.4	7.2	6.96	6.6	0
C21	39+95	3995	14.0' LT	X				4.4	13.8	8.76	6	0

Kansas Department of Transportation

Report of sample of Soils

Laboratory No. 24-0024

Date Reported. January 26, 2024

Date Received. January 5, 2024

Specification No _____ Quantity 11 BS, 6 SH

Source of material Sedgwick

Sample from Subgrade

Submitted by Bryan Pope

Identification marks Tags on Samples

Project or POV 87 N-0678-01 ACT 134

Type of construction Pavement Failure

TEST RESULTS

Please see attached Routine, Standard Compaction, and Resilient Modulus test results.

Luke Metheny
File 18-3

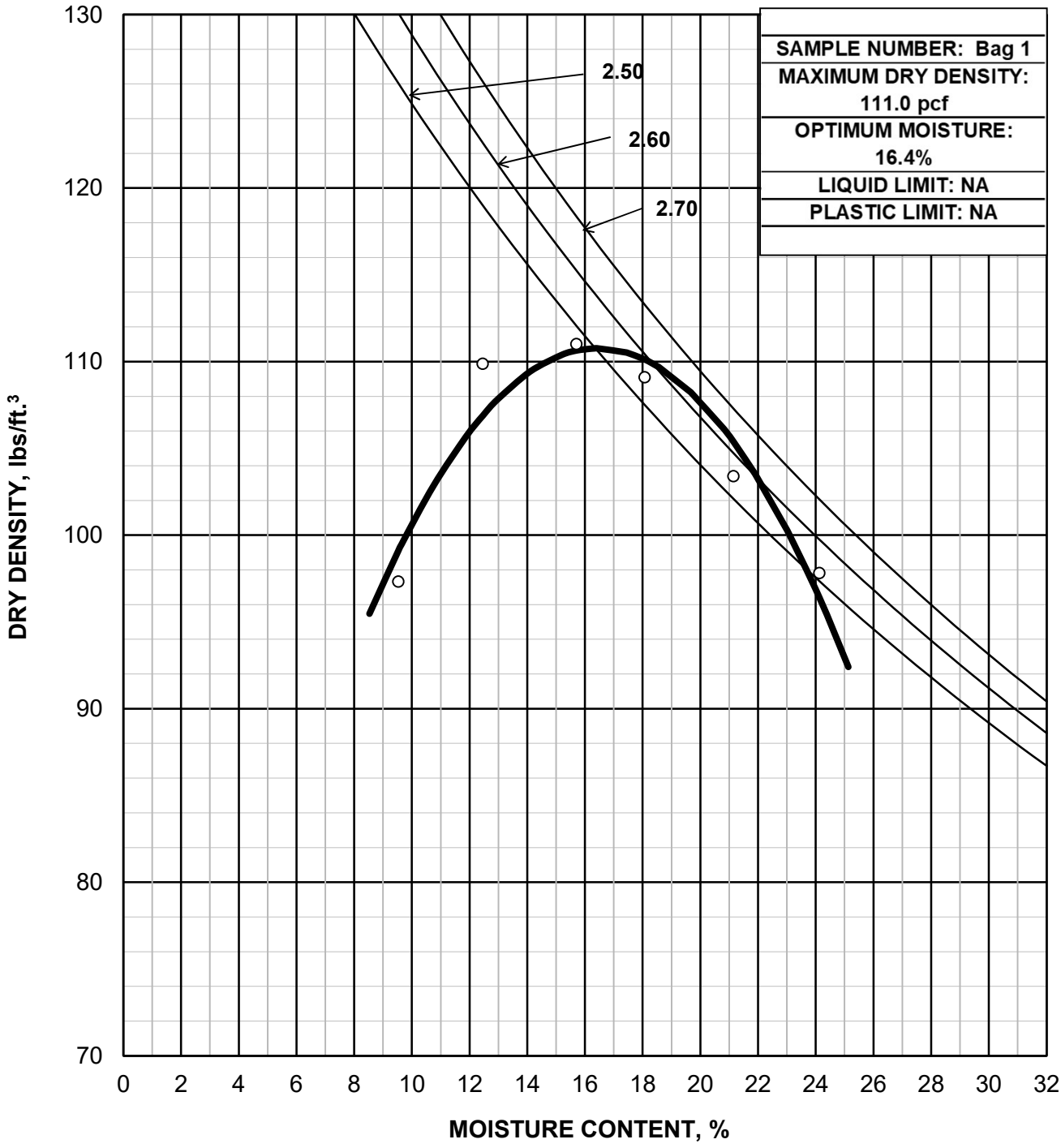
Reported by: Bryan Pope

Title: Bryan Pope, P.E., Geotechnical Engineer

KANSAS DEPARTMENT OF TRANSPORTATION

REPORT OF SOIL COMPACTION TESTS

SUBMITTED BY	Bryan Pope	**ADDRESS**	700 SW Harrison	**LAB. NO**	24-0024
PROJECT	87 N-0678-01	**COUNTY**	Sedgwick	**DATE**	1-10-24



TEST METHOD AASHTO-T99 Method A

REMARKS

BY Bryan Pope

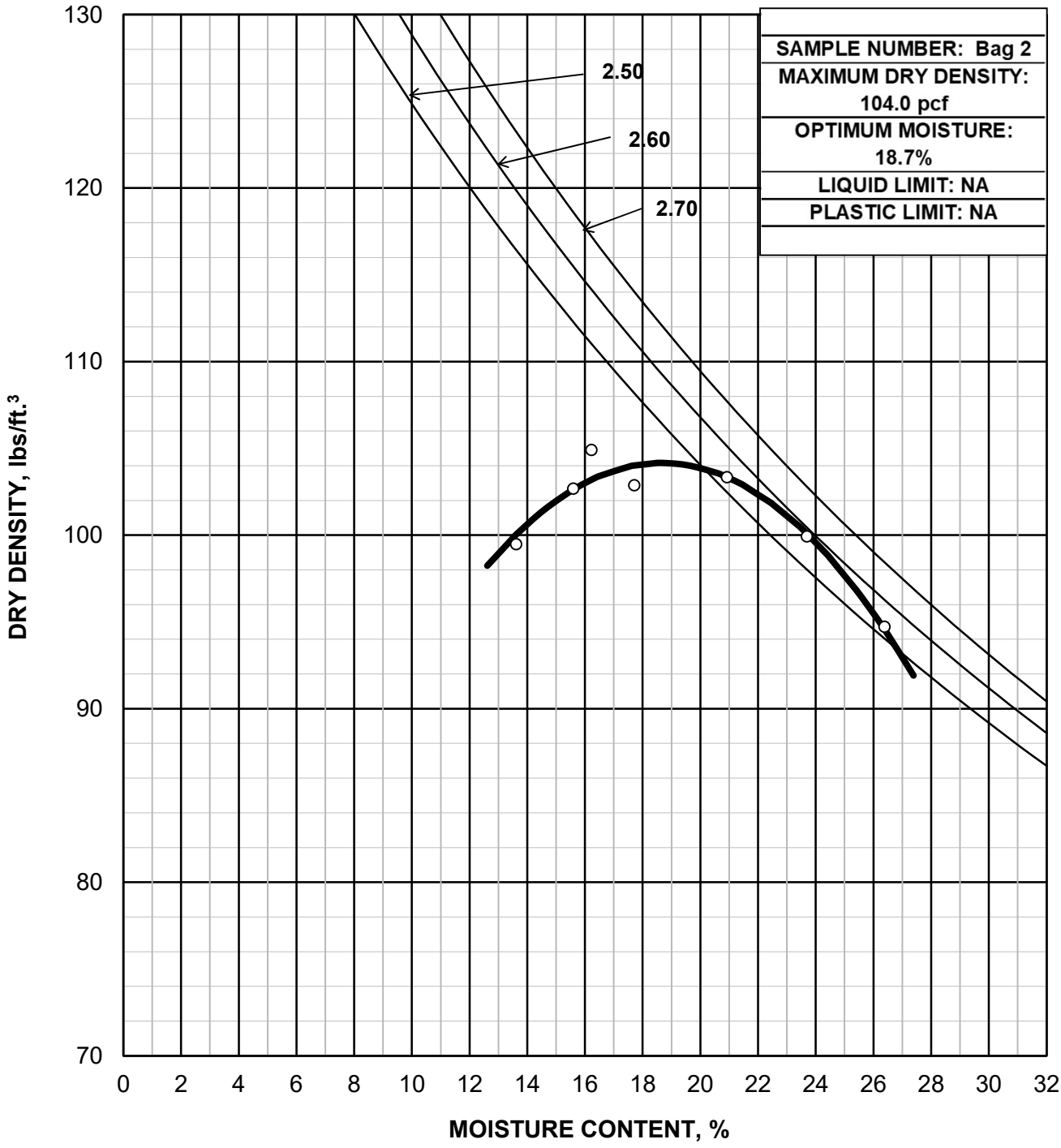
Bryan Pope, P.E., Geotechnical Engineer

D.O.T. Form No. 638

KANSAS DEPARTMENT OF TRANSPORTATION

REPORT OF SOIL COMPACTION TESTS

SUBMITTED BY	Bryan Pope	**ADDRESS**	700 SW Harrison	**LAB. NO**	24-0024
PROJECT	87 N-0678-01	**COUNTY**	Sedgwick	**DATE**	1-26-24



TEST METHOD AASHTO-T99 Method A

REMARKS

BY Bryan Pope

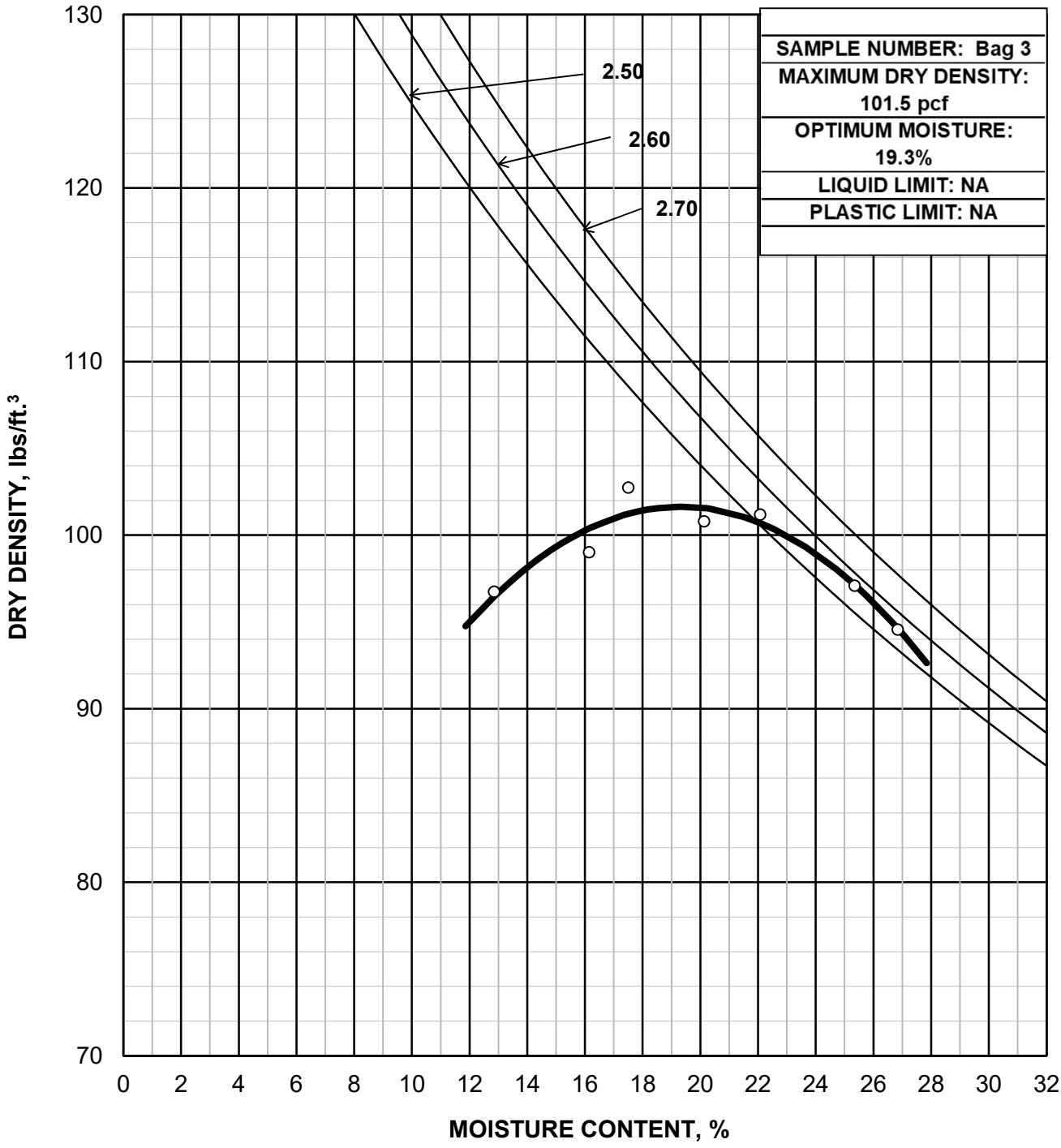
Bryan Pope, P.E., Geotechnical Engineer

D.O.T. Form No. 638

KANSAS DEPARTMENT OF TRANSPORTATION

REPORT OF SOIL COMPACTION TESTS

SUBMITTED BY	Bryan Pope	**ADDRESS**	700 SW Harrison	**LAB. NO**	24-0024
PROJECT	87 N-0678-01	**COUNTY**	Sedgwick	**DATE**	1-26-24



TEST METHOD AASHTO-T99 Method A

REMARKS

BY Bryan Pope

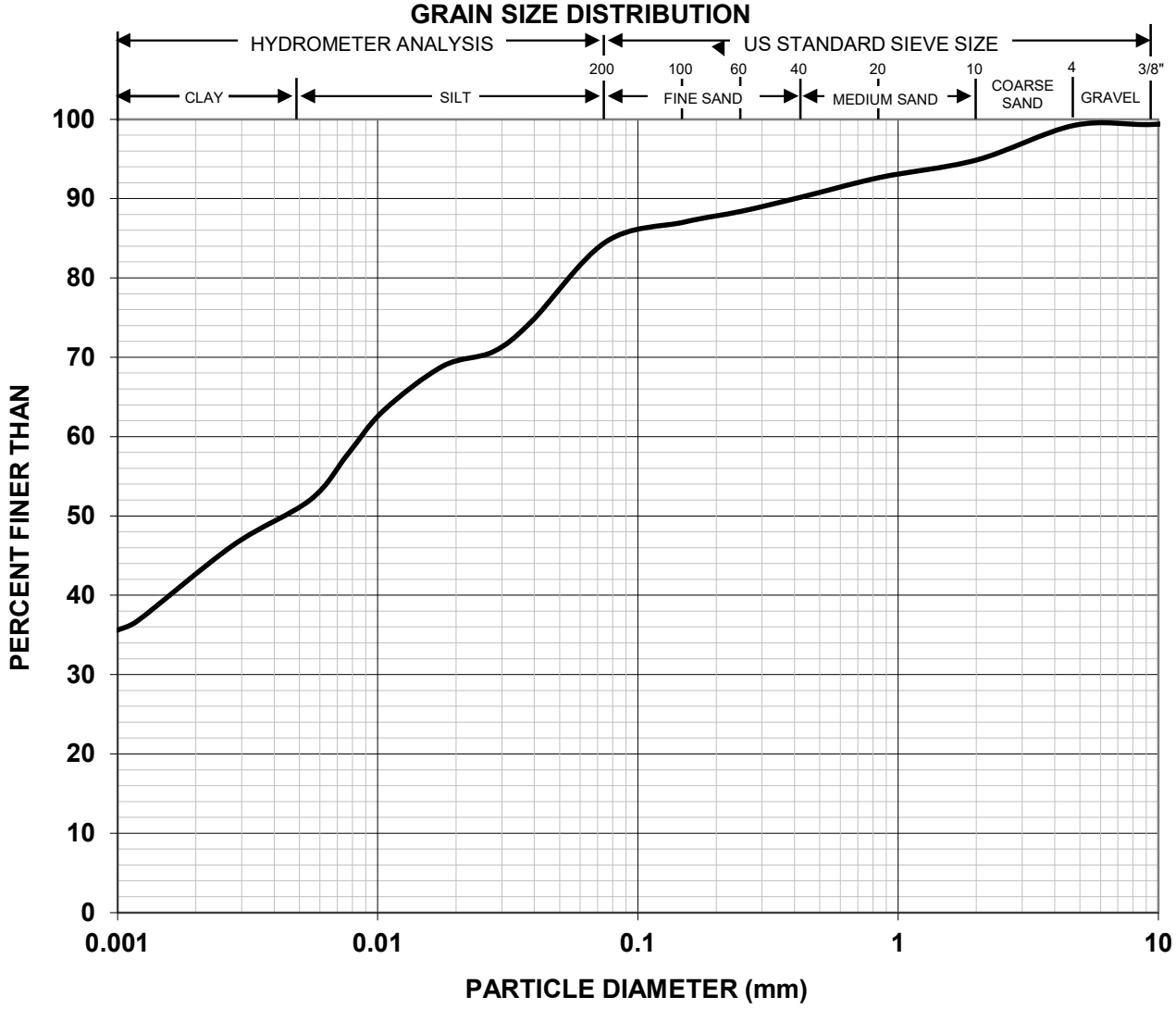
Bryan Pope, P.E., Geotechnical Engineer

D.O.T. Form No. 638

KANSAS DEPARTMENT OF TRANSPORTATION
REPORT OF SOIL TESTS

SUBMITTED BY: Bryan Pope		**ADDRESS:**	700 SW Harrison St	**LAB NO.**	24-0024
PROJECT:	87 N-0678-01	**COUNTY:**	Sedgwick	**DATE:**	1/11/24

GRAIN SIZE DISTRIBUTION



PHYSICAL PROPERTIES

SAMPLE NUMBER	STATION	CL DIST.	DEPTH (ft)	L.L.	P.L.	P.I.	% RET. ON 10 SEIVE	SPEC. GRAV. (PASS NO. 10)	CLASS KS/UNIF.
Bag 4	66+12	13' LT	1.5'-2.5'	64	24	40	5.1	2.67	C / CH

Test Method: AASHTO T-88 (Iowa Air Dispersion)

REMARKS

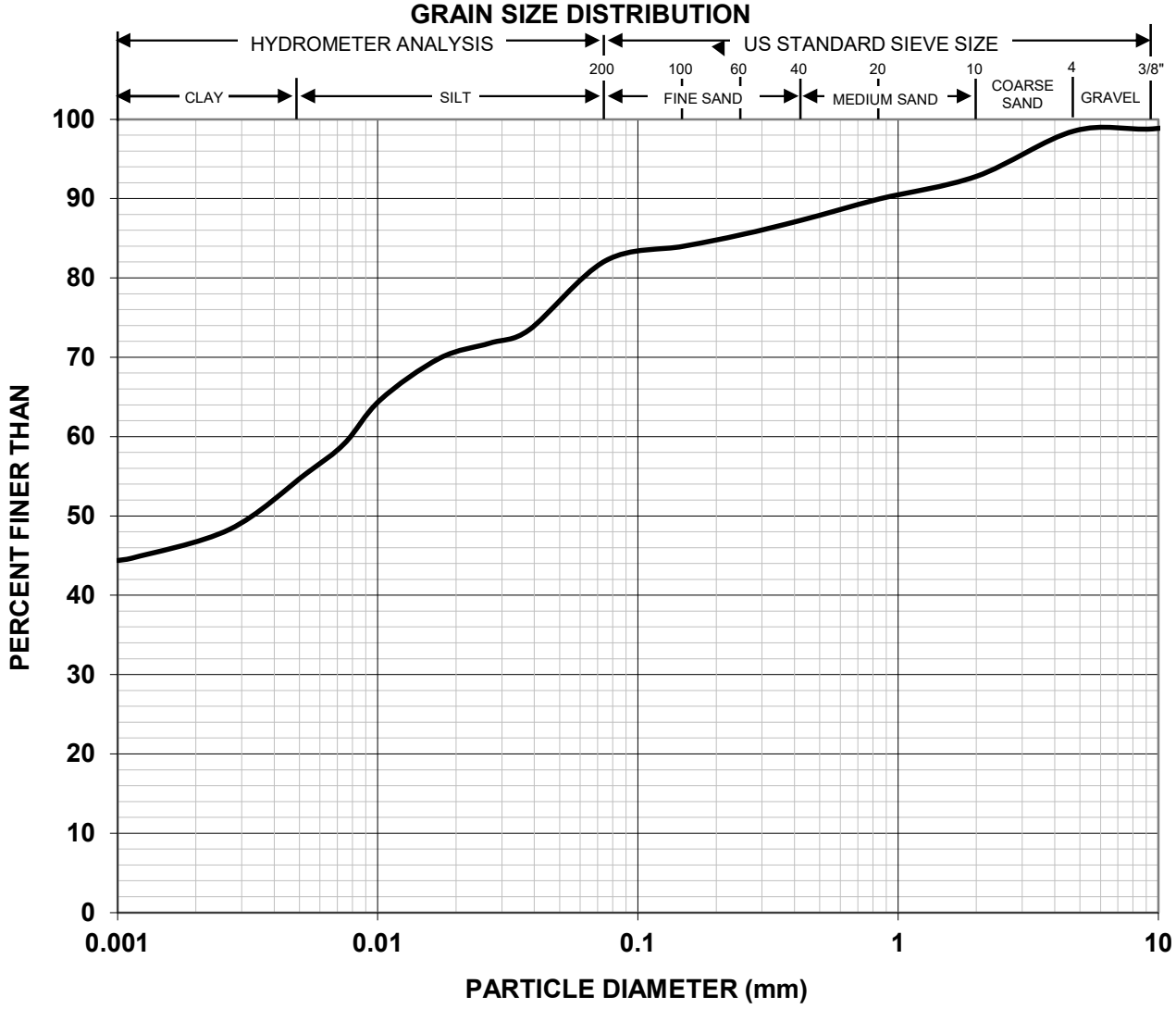
By Bryan Pope

Bryan Pope, P.E., Geotechnical Engineer

KANSAS DEPARTMENT OF TRANSPORTATION
REPORT OF SOIL TESTS

SUBMITTED BY: Bryan Pope		**ADDRESS:**	700 SW Harrison St	**LAB NO.**	24-0024
PROJECT:	87 N-0678-01	**COUNTY:**	Sedgwick	**DATE:**	1/16/24

GRAIN SIZE DISTRIBUTION



PHYSICAL PROPERTIES

SAMPLE NUMBER	STATION	CL DIST.	DEPTH (ft)	L.L.	P.L.	P.I.	% RET. ON 10 SEIVE	SPEC. GRAV. (PASS NO. 10)	CLASS KS/UNIF.
Bag Sample 5	62+98	13.5' LT	1.5'-2.5'	68	27	41	7.2	2.71	C / CH

Test Method: AASHTO T-88 (Iowa Air Dispersion)

REMARKS

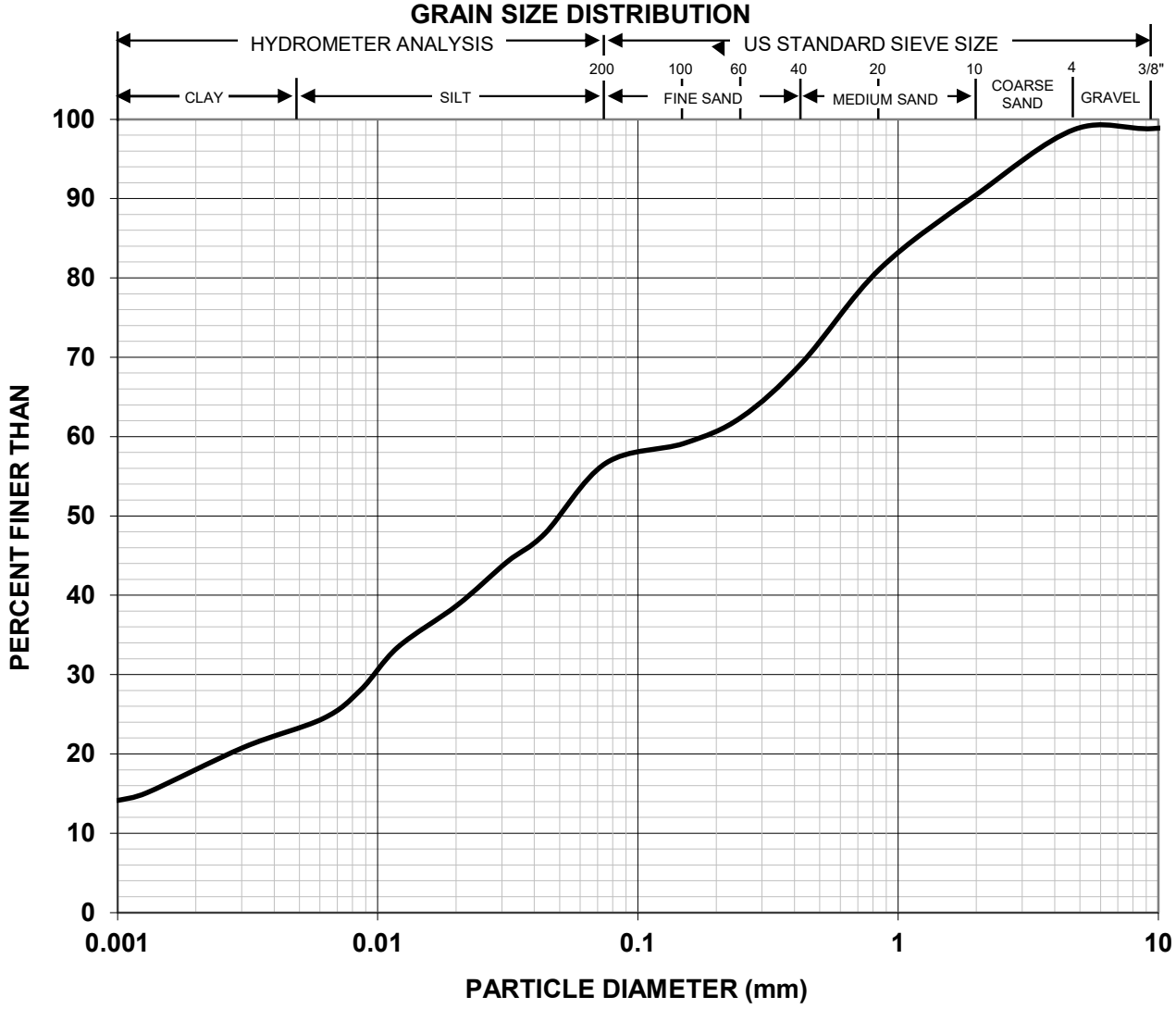
By Bryan Pope

Bryan Pope, P.E., Geotechnical Engineer

KANSAS DEPARTMENT OF TRANSPORTATION
REPORT OF SOIL TESTS

SUBMITTED BY: Bryan Pope		**ADDRESS:**	700 SW Harrison St	**LAB NO.**	24-0024
PROJECT:	87 N-0678-01	**COUNTY:**	Sedgwick	**DATE:**	1/11/24

GRAIN SIZE DISTRIBUTION



PHYSICAL PROPERTIES

SAMPLE NUMBER	STATION	CL DIST.	DEPTH (ft)	L.L.	P.L.	P.I.	% RET. ON 10 SEIVE	SPEC. GRAV. (PASS NO. 10)	CLASS KS/UNIF.
Bag Sample 6	47+40	14' LT	1.5'-2.5'	40	17	23	9.5	2.63	CL / CL

Test Method: AASHTO T-88 (Iowa Air Dispersion)

REMARKS

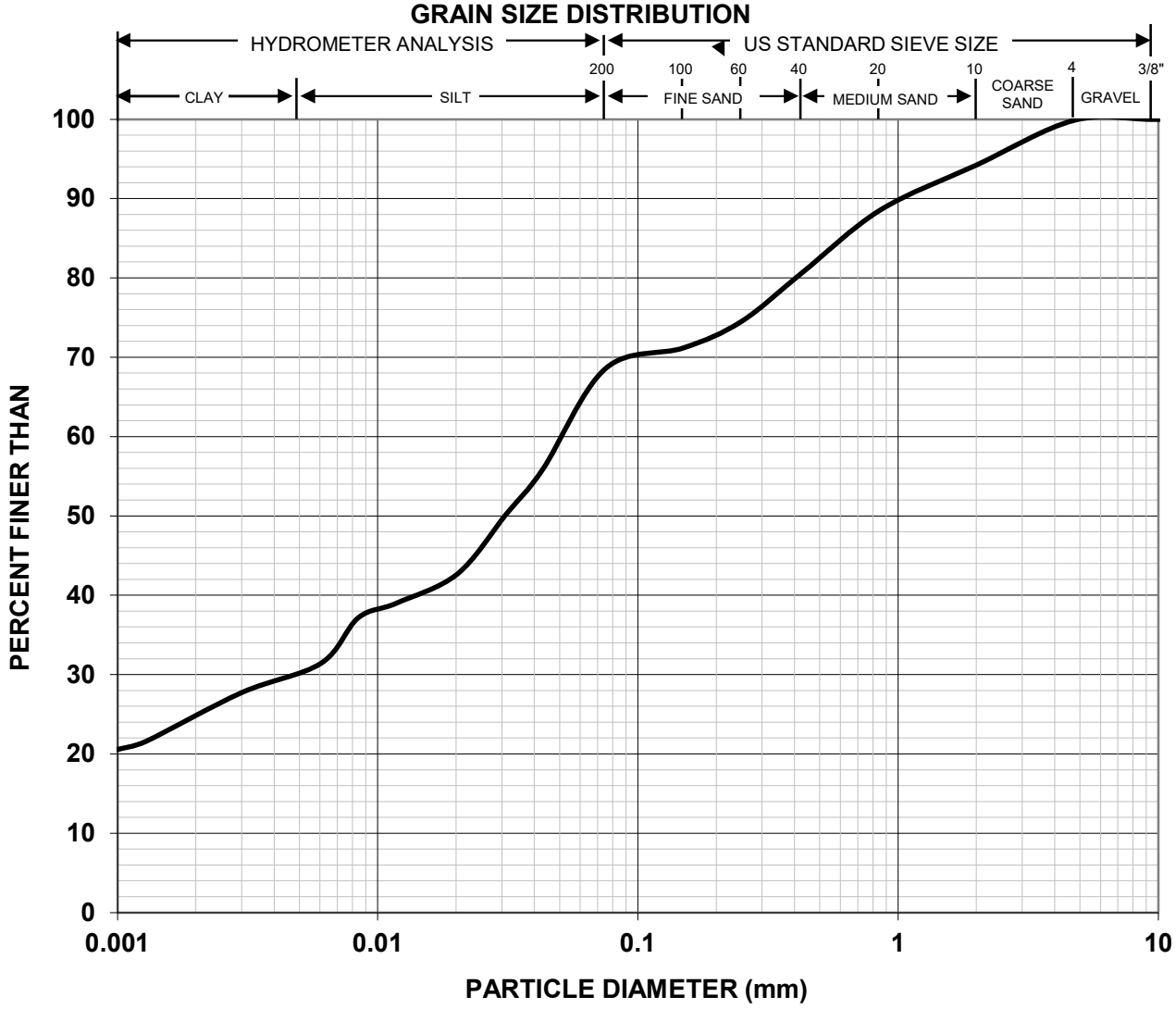
By Bryan Pope

Bryan Pope, P.E., Geotechnical Engineer

KANSAS DEPARTMENT OF TRANSPORTATION
REPORT OF SOIL TESTS

SUBMITTED BY: Bryan Pope		**ADDRESS:**	700 SW Harrison St	**LAB NO.**	24-0024
PROJECT:	87 N-0678-01	**COUNTY:**	Sedgwick	**DATE:**	1/11/24

GRAIN SIZE DISTRIBUTION



PHYSICAL PROPERTIES

SAMPLE NUMBER	STATION	CL DIST.	DEPTH (ft)	L.L.	P.L.	P.I.	% RET. ON 10 SEIVE	SPEC. GRAV. (PASS NO. 10)	CLASS KS/UNIF.
G Bag Sample 1	44+12	24' RT	1.3'-2.3'	46	18	28	5.7	2.61	C / CL

Test Method: AASHTO T-88 (Iowa Air Dispersion)

REMARKS

By Bryan Pope

Bryan Pope, P.E., Geotechnical Engineer

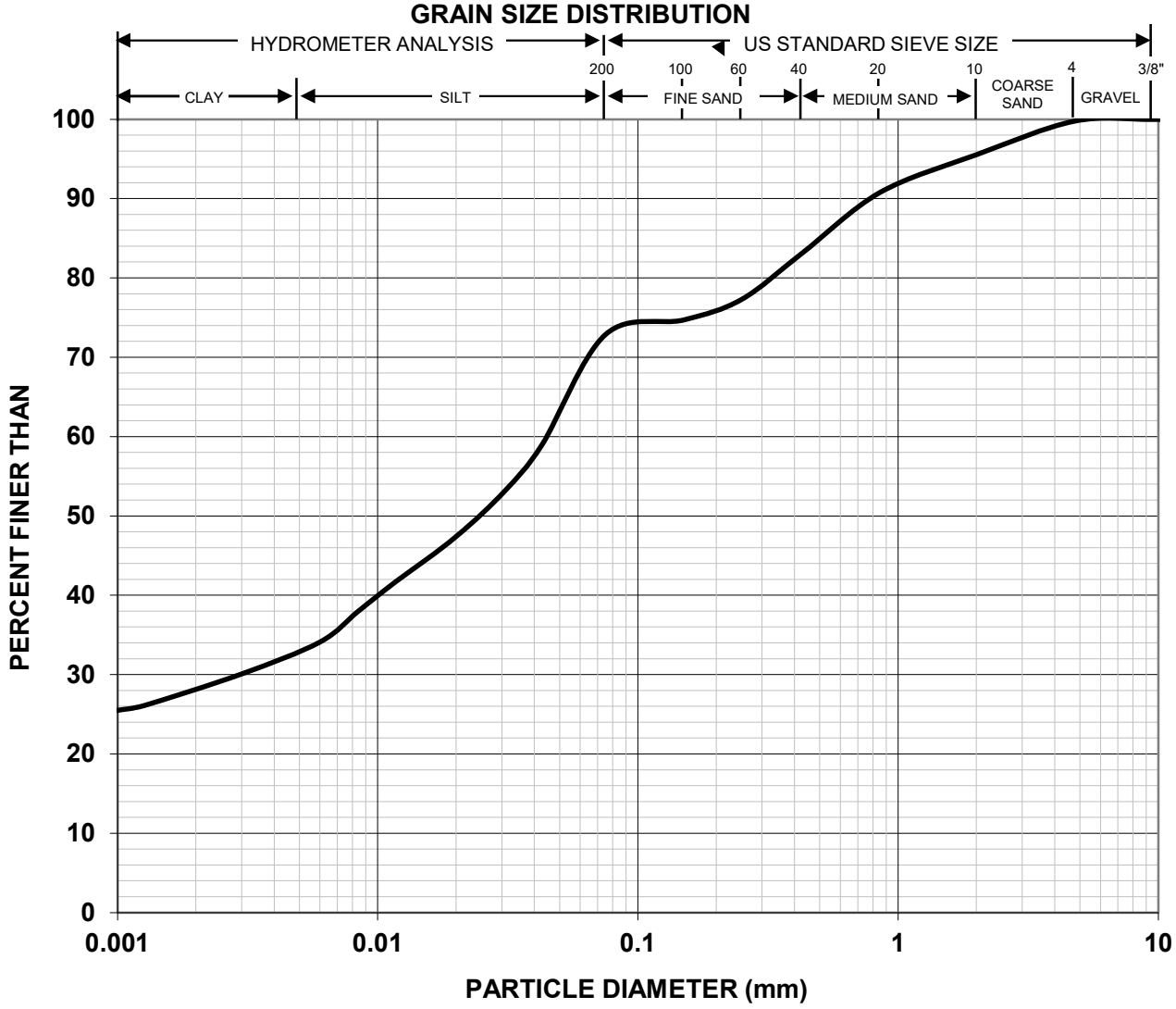
Rev. 3-99

D.O.T. NO. 635

KANSAS DEPARTMENT OF TRANSPORTATION
REPORT OF SOIL TESTS

SUBMITTED BY: Bryan Pope		**ADDRESS:**	700 SW Harrison St	**LAB NO.**	24-0024
PROJECT:	87 N-0678-01	**COUNTY:**	Sedgwick	**DATE:**	1/11/24

GRAIN SIZE DISTRIBUTION



PHYSICAL PROPERTIES

SAMPLE NUMBER	STATION	CL DIST.	DEPTH (ft)	L.L.	P.L.	P.I.	% RET. ON 10 SEIVE	SPEC. GRAV. (PASS NO. 10)	CLASS KS/UNIF.
G Bag Sample 2	45+74	24' RT	4'-5'	50	20	30	4.4	2.61	C / CH

Test Method: AASHTO T-88 (Iowa Air Dispersion)

REMARKS

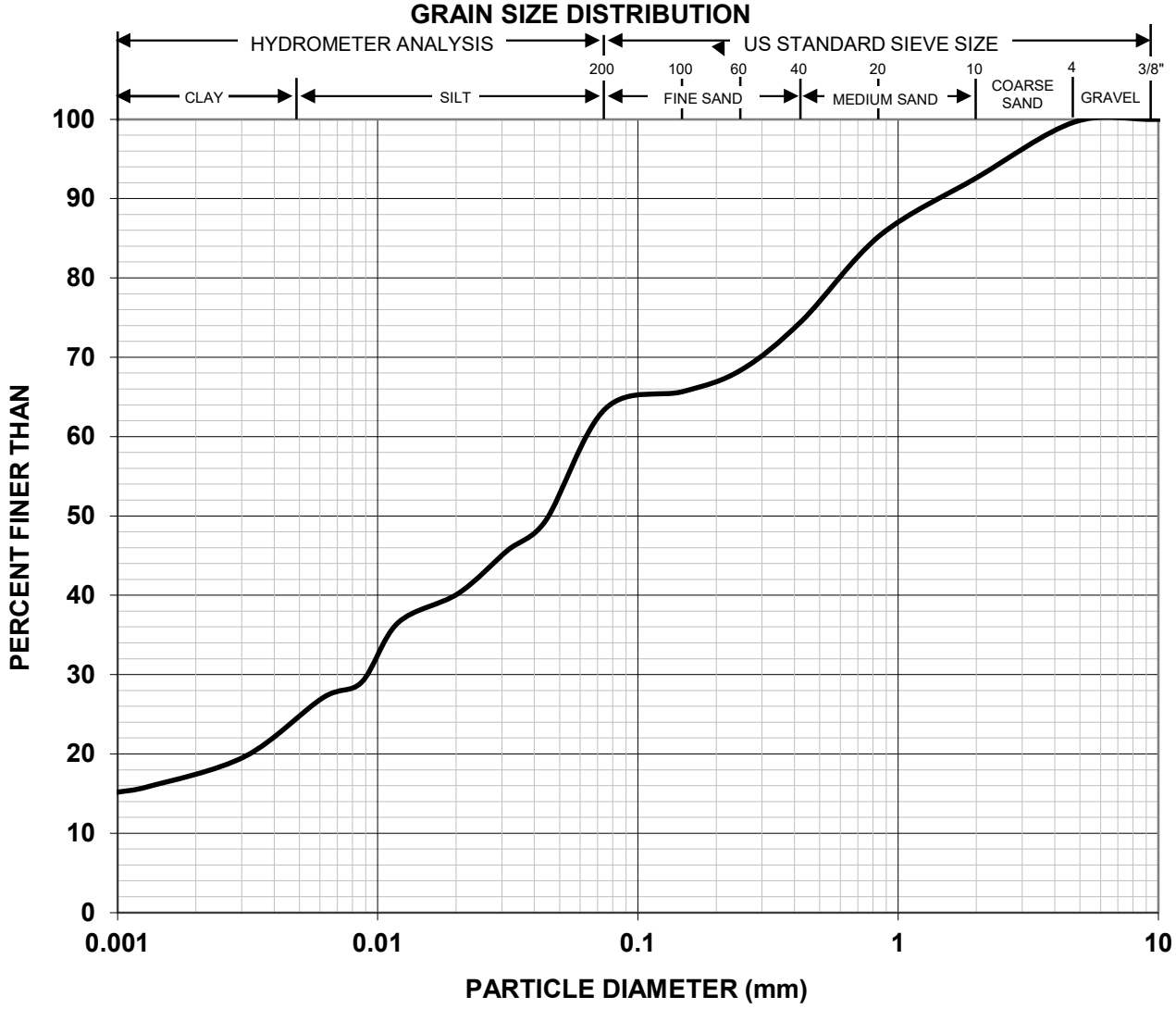
By Bryan Pope

Bryan Pope, P.E., Geotechnical Engineer

KANSAS DEPARTMENT OF TRANSPORTATION
REPORT OF SOIL TESTS

SUBMITTED BY: Bryan Pope		**ADDRESS:**	700 SW Harrison St	**LAB NO.**	24-0024
PROJECT:	87 N-0678-01	**COUNTY:**	Sedgwick	**DATE:**	1/11/24

GRAIN SIZE DISTRIBUTION



PHYSICAL PROPERTIES

SAMPLE NUMBER	STATION	CL DIST.	DEPTH (ft)	L.L.	P.L.	P.I.	% RET. ON 10 SEIVE	SPEC. GRAV. (PASS NO. 10)	CLASS KS/UNIF.
G Bag Sample 3	47+70	24' RT	1'-2'	44	18	26	7.4	2.6	CL / CL

Test Method: AASHTO T-88 (Iowa Air Dispersion)

REMARKS

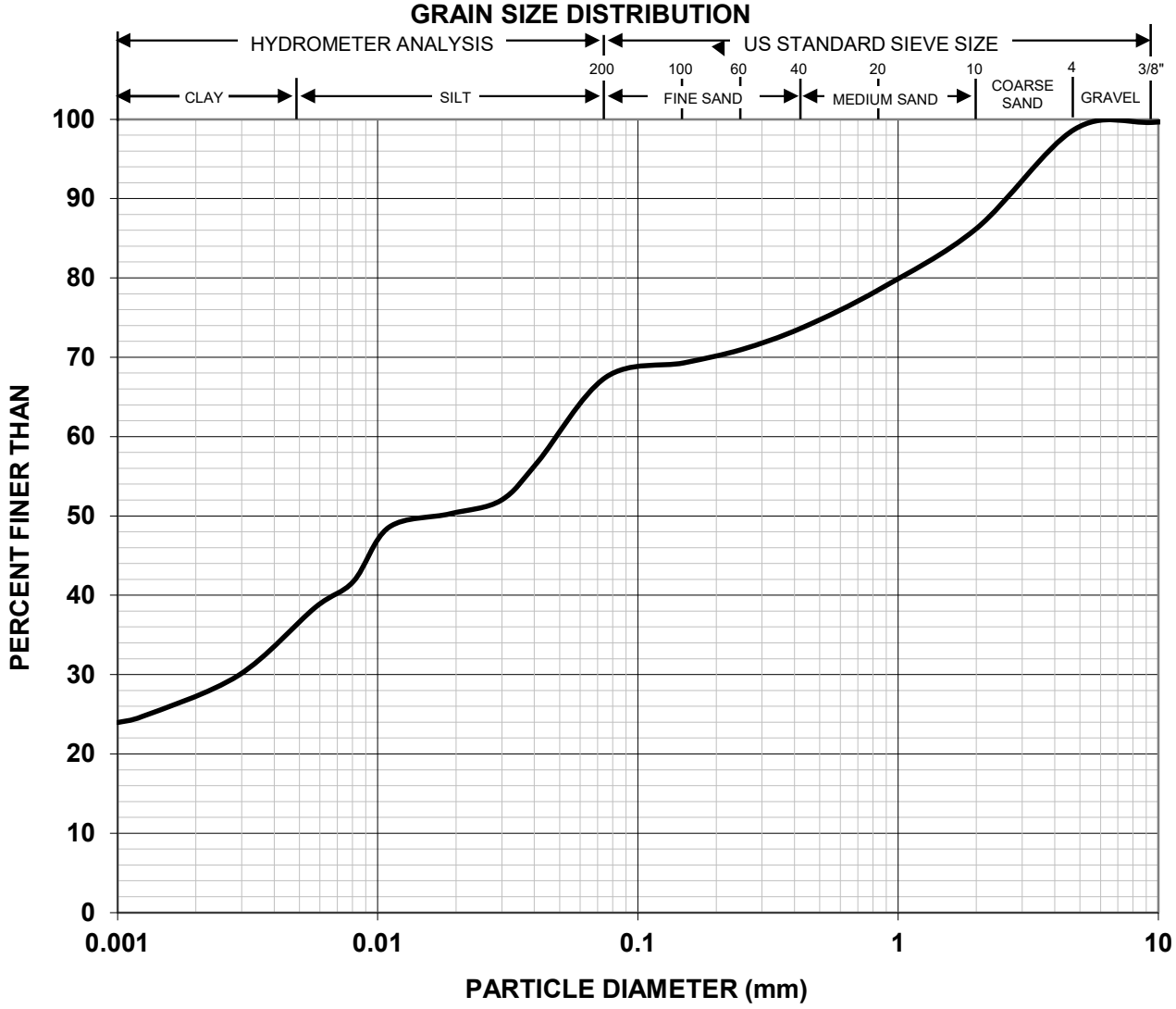
By Bryan Pope

Bryan Pope, P.E., Geotechnical Engineer

KANSAS DEPARTMENT OF TRANSPORTATION
REPORT OF SOIL TESTS

SUBMITTED BY: Bryan Pope		**ADDRESS:**	700 SW Harrison St	**LAB NO.**	24-0024
PROJECT:	87 N-0678-01	**COUNTY:**	Sedgwick	**DATE:**	1/11/24

GRAIN SIZE DISTRIBUTION



PHYSICAL PROPERTIES

SAMPLE NUMBER	STATION	CL DIST.	DEPTH (ft)	L.L.	P.L.	P.I.	% RET. ON 10 SEIVE	SPEC. GRAV. (PASS NO. 10)	CLASS KS/UNIF.
G Bag Sample 4	55+60	24' RT	1.4'-2.4'	49	21	28	13.7	2.64	C / CL

Test Method: AASHTO T-88 (Iowa Air Dispersion)

REMARKS

By Bryan Pope

Bryan Pope, P.E., Geotechnical Engineer

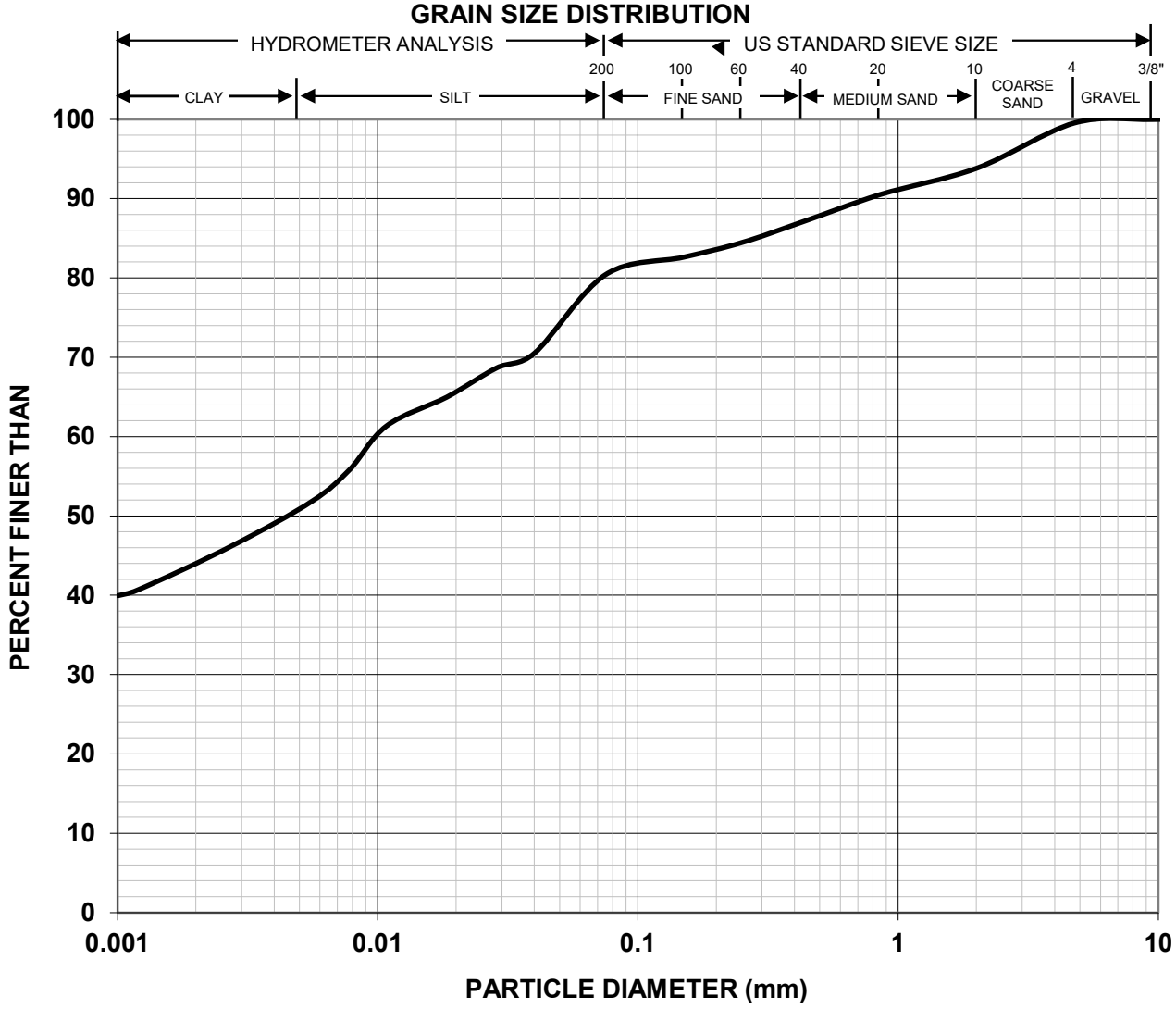
Rev. 3-99

D.O.T. NO. 635

KANSAS DEPARTMENT OF TRANSPORTATION
REPORT OF SOIL TESTS

SUBMITTED BY: Bryan Pope		**ADDRESS:**	700 SW Harrison St	**LAB NO.**	24-0024
PROJECT:	87 N-0678-01	**COUNTY:**	Sedgwick	**DATE:**	1/16/24

GRAIN SIZE DISTRIBUTION



PHYSICAL PROPERTIES

SAMPLE NUMBER	STATION	CL DIST.	DEPTH (ft)	L.L.	P.L.	P.I.	% RET. ON 10 SEIVE	SPEC. GRAV. (PASS NO. 10)	CLASS KS/UNIF.
G Bag Sample 5	56+38.5	24' RT	1.5'-3.0'	67	26	41	6.2	2.62	C / CH

Test Method: AASHTO T-88 (Iowa Air Dispersion)

REMARKS

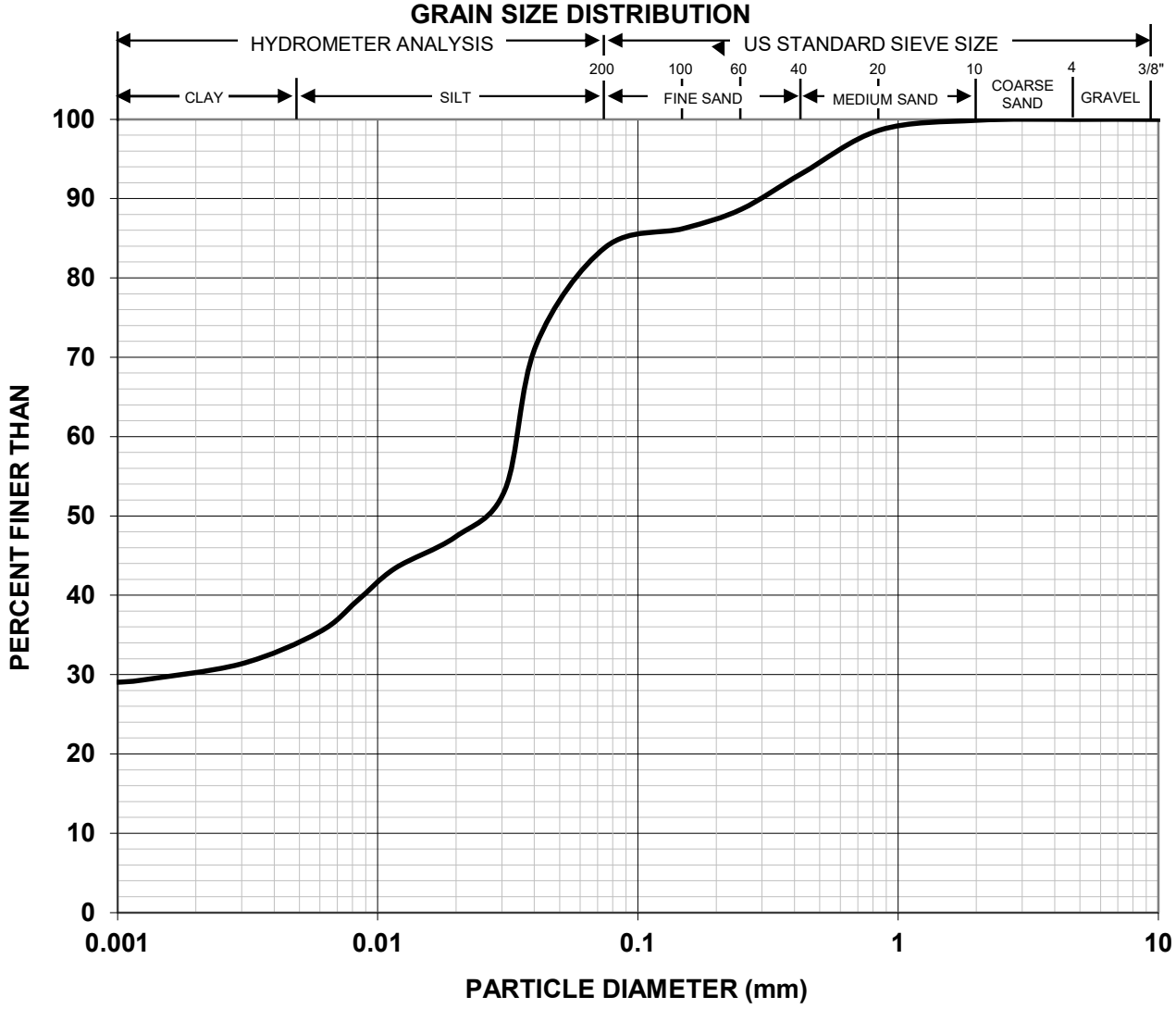
By Bryan Pope

Bryan Pope, P.E., Geotechnical Engineer

KANSAS DEPARTMENT OF TRANSPORTATION
REPORT OF SOIL TESTS

SUBMITTED BY: Bryan Pope		**ADDRESS:**	700 SW Harrison St	**LAB NO.**	24-0024
PROJECT:	87 N-0678-01	**COUNTY:**	Sedgwick	**DATE:**	1/16/24

GRAIN SIZE DISTRIBUTION



PHYSICAL PROPERTIES

SAMPLE NUMBER	STATION	CL DIST.	DEPTH (ft)	L.L.	P.L.	P.I.	% RET. ON 10 SEIVE	SPEC. GRAV. (PASS NO. 10)	CLASS KS/UNIF.
SH-1	30+00	24' RT	1.4'-3.4'	54	20	34	0.1	2.65	C / CH

Test Method: AASHTO T-88 (Iowa Air Dispersion)

REMARKS

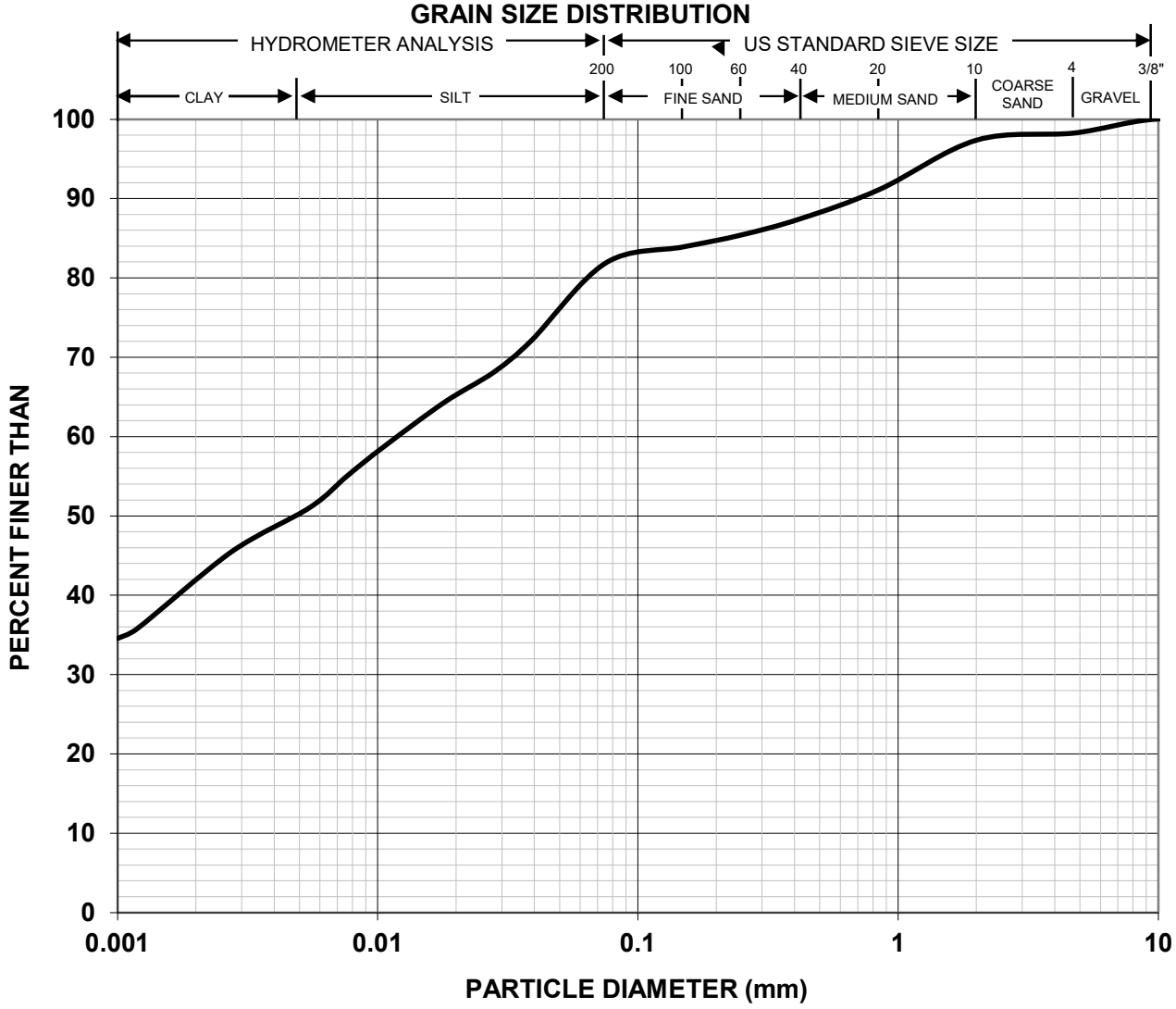
By Bryan Pope

Bryan Pope, P.E., Geotechnical Engineer

KANSAS DEPARTMENT OF TRANSPORTATION
REPORT OF SOIL TESTS

SUBMITTED BY: Bryan Pope		**ADDRESS:**	700 SW Harrison St	**LAB NO.**	24-0024
PROJECT:	87 N-0678-01	**COUNTY:**	Sedgwick	**DATE:**	1/16/24

GRAIN SIZE DISTRIBUTION



PHYSICAL PROPERTIES

SAMPLE NUMBER	STATION	CL DIST.	DEPTH (ft)	L.L.	P.L.	P.I.	% RET. ON 10 SEIVE	SPEC. GRAV. (PASS NO. 10)	CLASS KS/UNIF.
SH-3	56+30	17.9' RT	1.5'-3.5'	49	27	22	2.6	2.71	C / CL

Test Method: AASHTO T-88 (Iowa Air Dispersion)

REMARKS

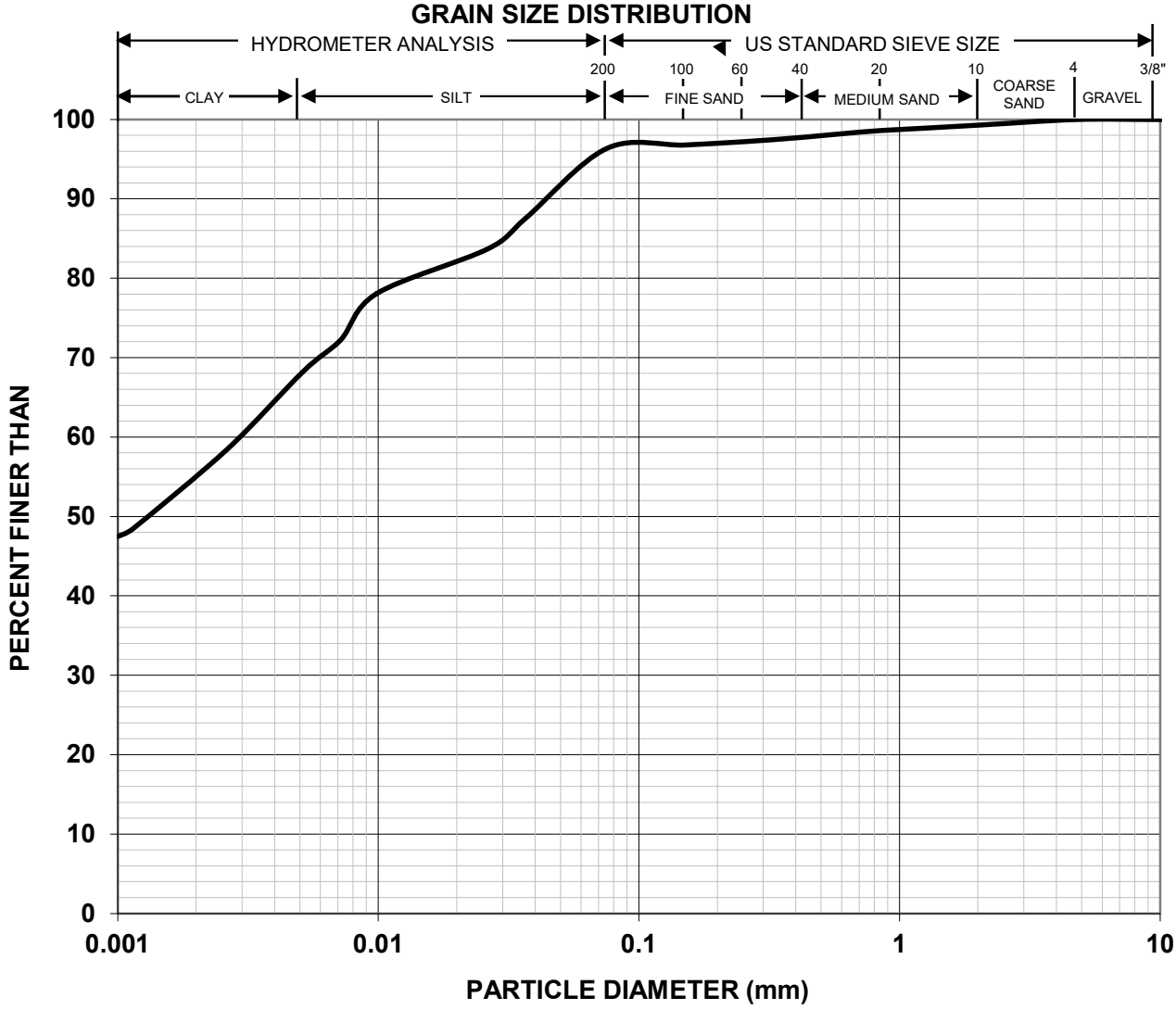
By Bryan Pope

Bryan Pope, P.E., Geotechnical Engineer

KANSAS DEPARTMENT OF TRANSPORTATION
REPORT OF SOIL TESTS

SUBMITTED BY: Bryan Pope		**ADDRESS:**	700 SW Harrison St	**LAB NO.**	24-0024
PROJECT:	87 N-0678-01	**COUNTY:**	Sedgwick	**DATE:**	1/26/23

GRAIN SIZE DISTRIBUTION



PHYSICAL PROPERTIES

SAMPLE NUMBER	STATION	CL DIST.	DEPTH (ft)	L.L.	P.L.	P.I.	% RET. ON 10 SEIVE	SPEC. GRAV. (PASS NO. 10)	CLASS KS/UNIF.
SH-5	62+81	1' LT	1.5'-3.5'	67	14	53	0.7	2.71	C / CH

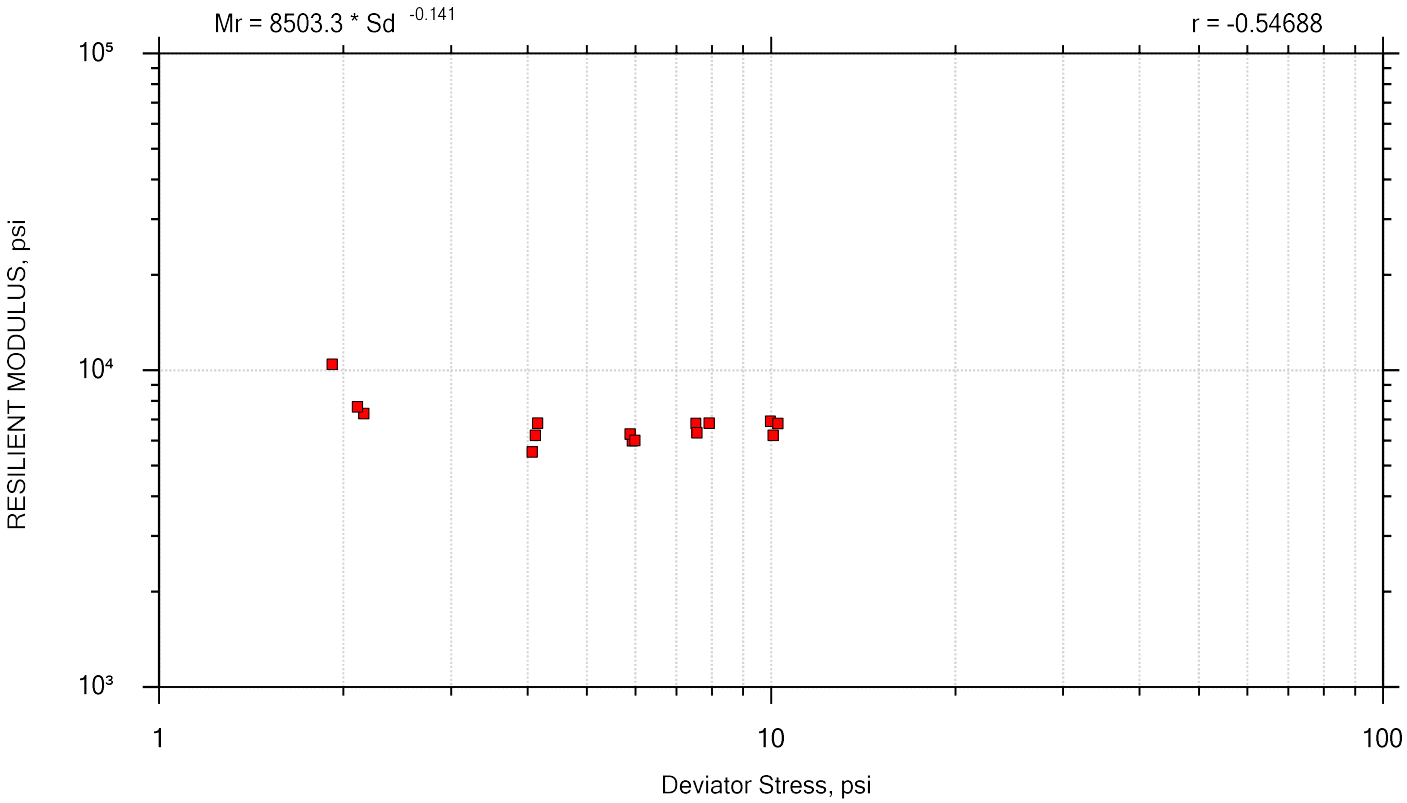
Test Method: AASHTO T-88 (Iowa Air Dispersion)

REMARKS

By Bryan Pope

Bryan Pope, P.E., Geotechnical Engineer

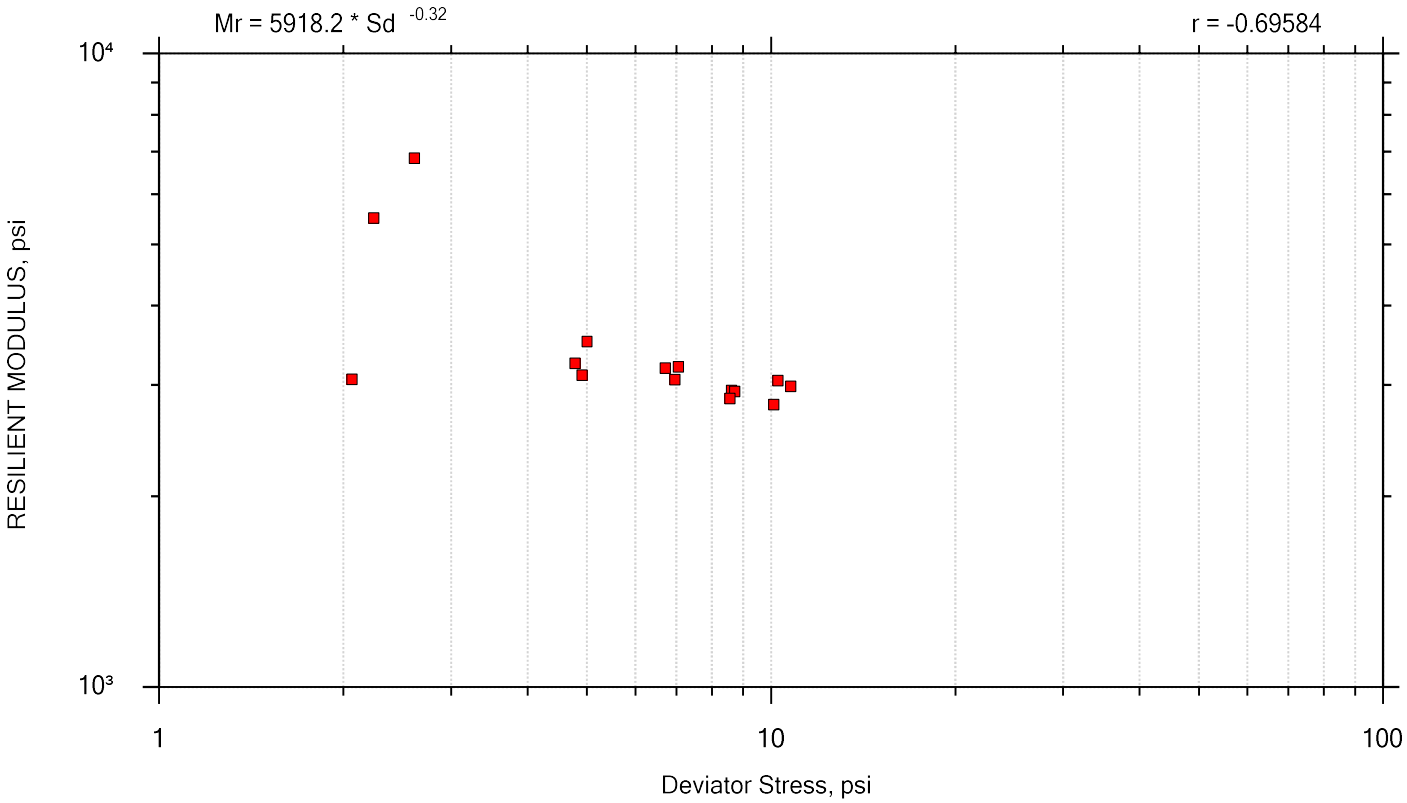
RM SUMMARY REPORT



Confining Stress S3 (psi)	Nom. Max. Deviator Stress (psi)	Mean Deviator Stress (psi)	Std. Dev. Deviator Stress (psi)	Mean Bulk Stress (psi)	Mean Resilient Strain (%)	Std. Dev. Resilient Strain (%)	Mean Resilient Modulus (psi)	Std. Dev. Resilient Modulus (psi)
5.722	2	1.917	0.1146	19.08	0.03	0.01	10440	11817
5.721	4	4.067	0.0993	21.23	0.07	0.00	5522.2	284.41
5.722	6	5.931	0.1661	23.1	0.09	0.00	5999.8	217.73
5.709	8	7.532	0.1426	24.66	0.10	0.01	6798.8	275.27
5.676	10	10.07	0.2039	27.1	0.15	0.00	6230.9	130.4
3.63	2	2.16	0.0785	13.05	0.03	0.01	7304.2	1444.5
3.681	4	4.117	0.2398	15.16	0.06	0.01	6233.3	1112.2
3.713	6	5.881	0.0990	17.02	0.08	0.00	6295.4	303.93
3.712	8	7.561	0.1249	18.7	0.11	0.00	6346.7	329.64
3.7	10	9.972	0.1870	21.07	0.13	0.01	6912.4	405.25
2.061	2	2.11	0.1659	8.293	0.03	0.00	7671.2	1127.5
2.058	4	4.155	0.1301	10.33	0.06	0.01	6818.1	686.47
2.058	6	5.991	0.1480	12.16	0.09	0.00	6013.8	278.76
2.058	8	7.916	0.1355	14.09	0.10	0.00	6819.5	170.74
2.056	10	10.26	0.1774	16.42	0.14	0.00	6796.7	134.43

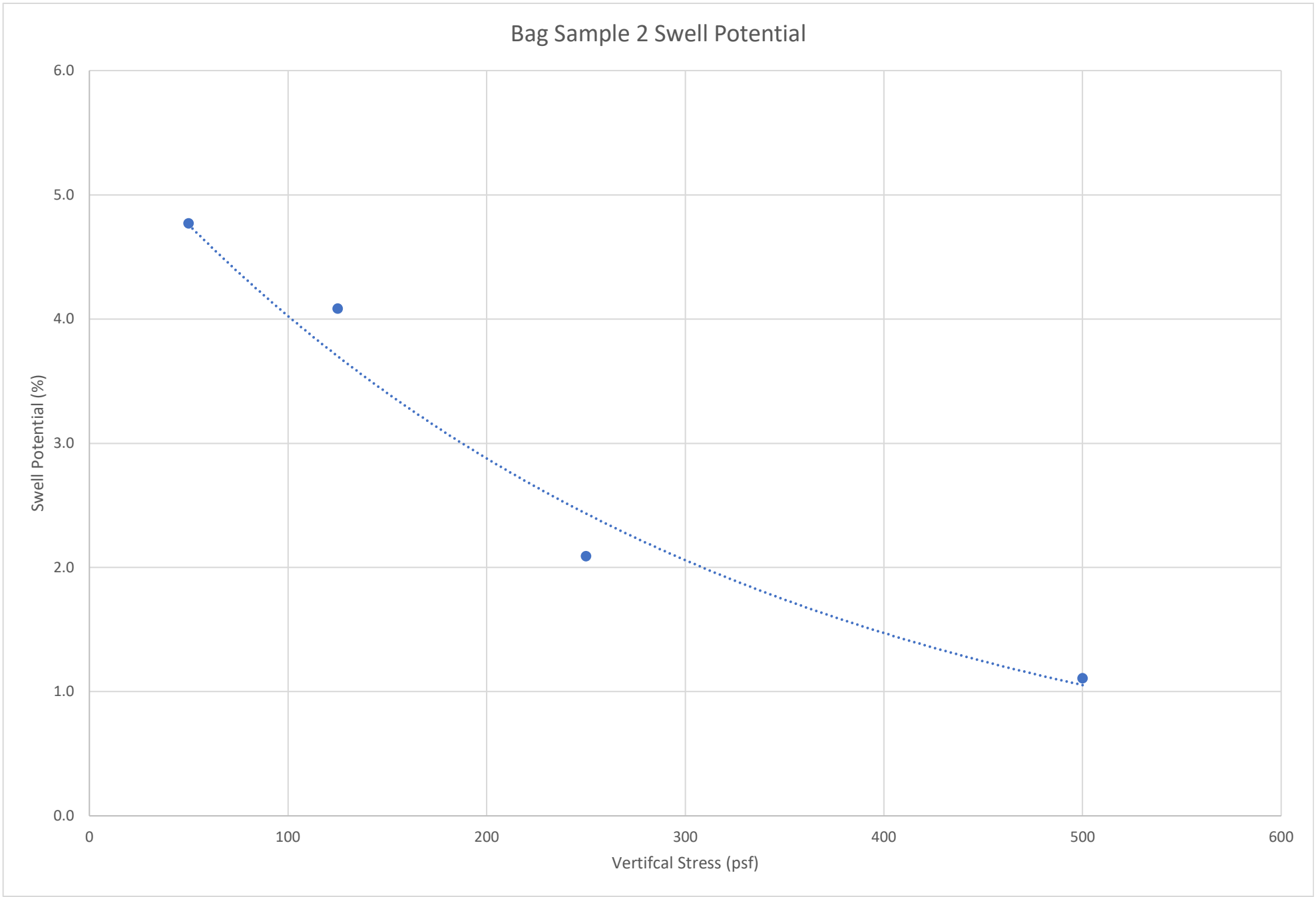
Project:	Location: SG	Project No.: N-0678-01
Boring No.:	Tested By: SS	Checked By:
Sample No.: SH-1	Test Date: 1/10/2024	Depth: 1.4-3.4
Test No.: 24-0024	Sample Type:	Elevation:
Description:		
Remarks:		
File: C:\Users\bpope\Desktop\24-0024\24-0024 Res Mods\24-0024 SH-1.dat		

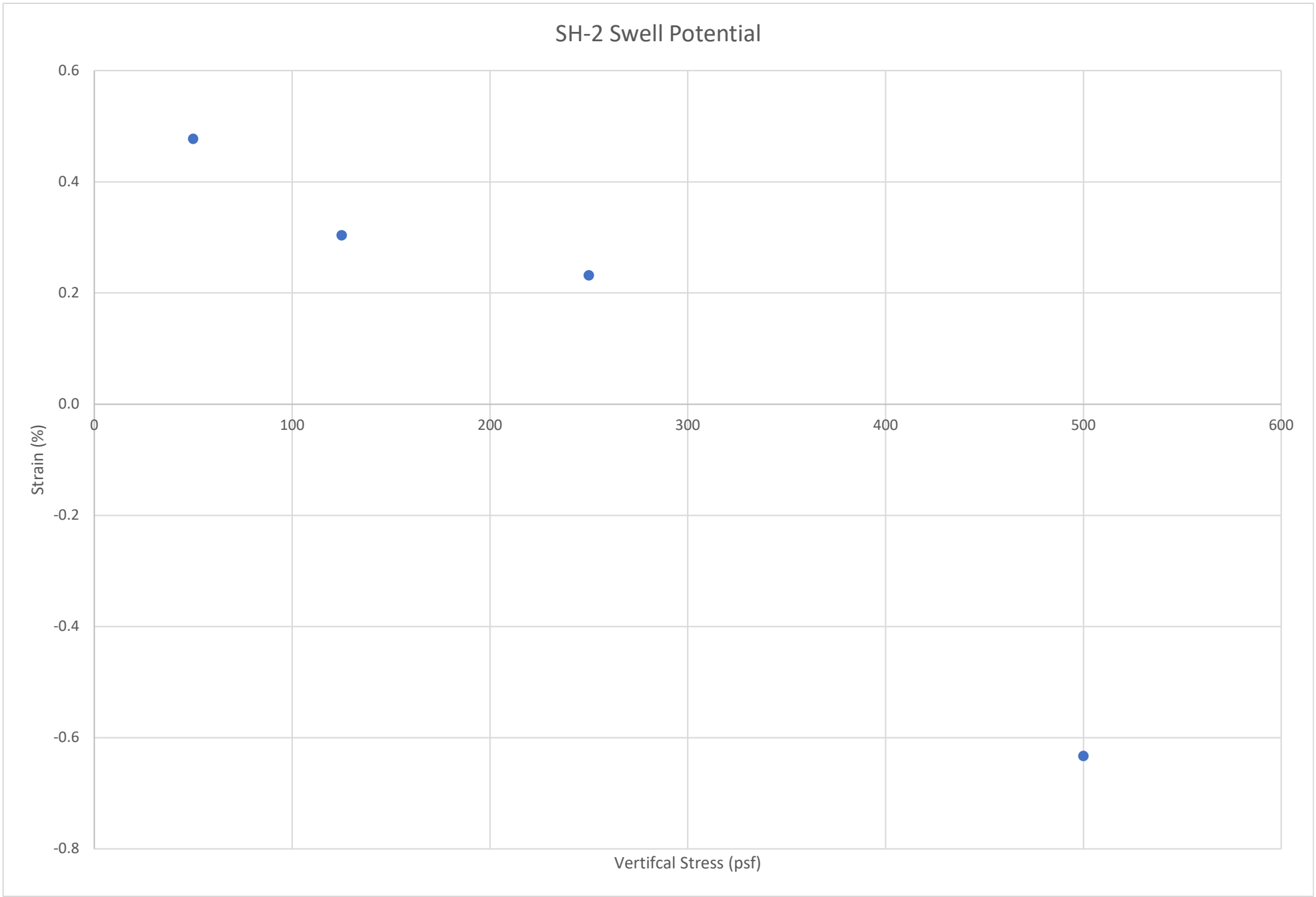
RM SUMMARY REPORT

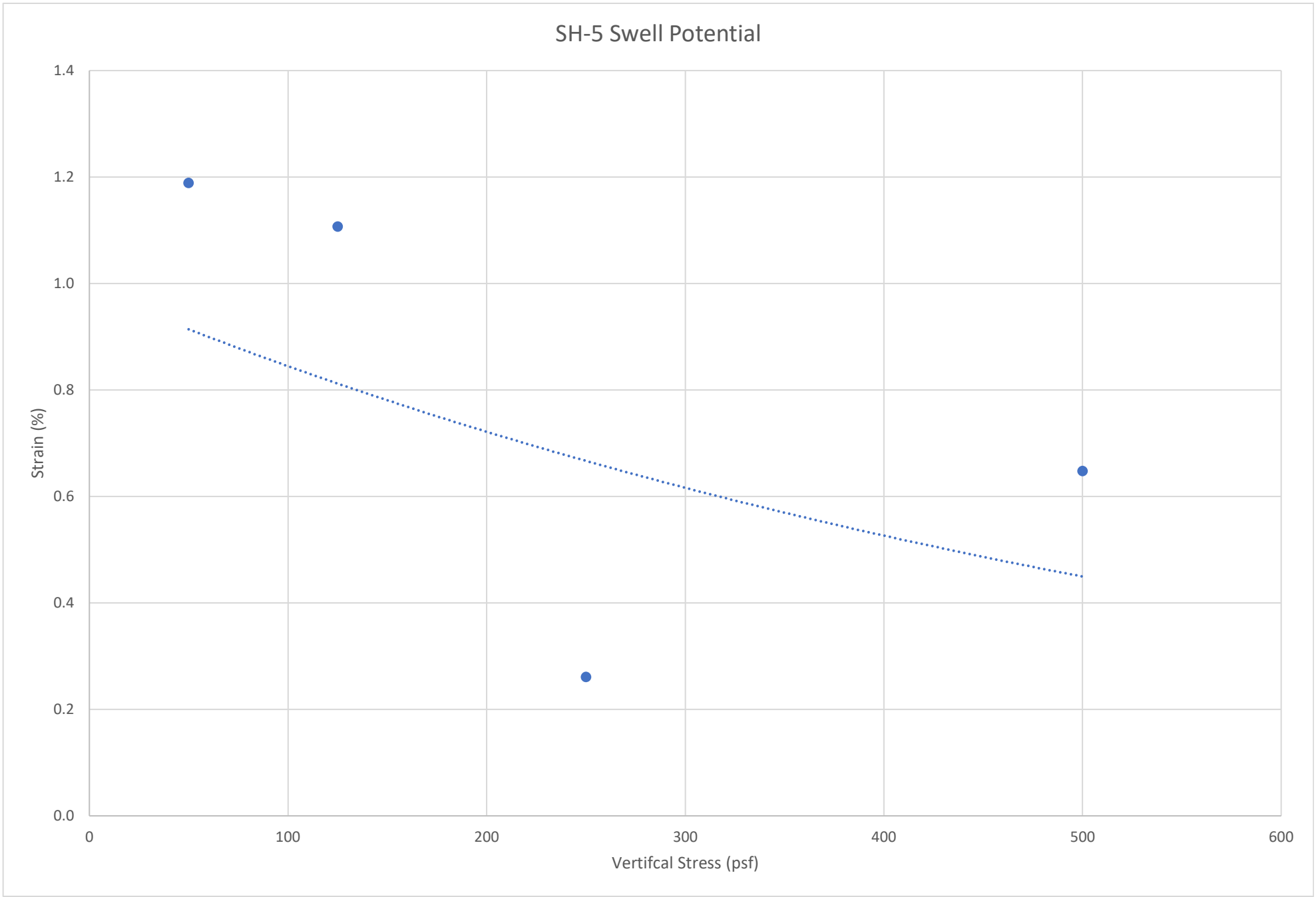


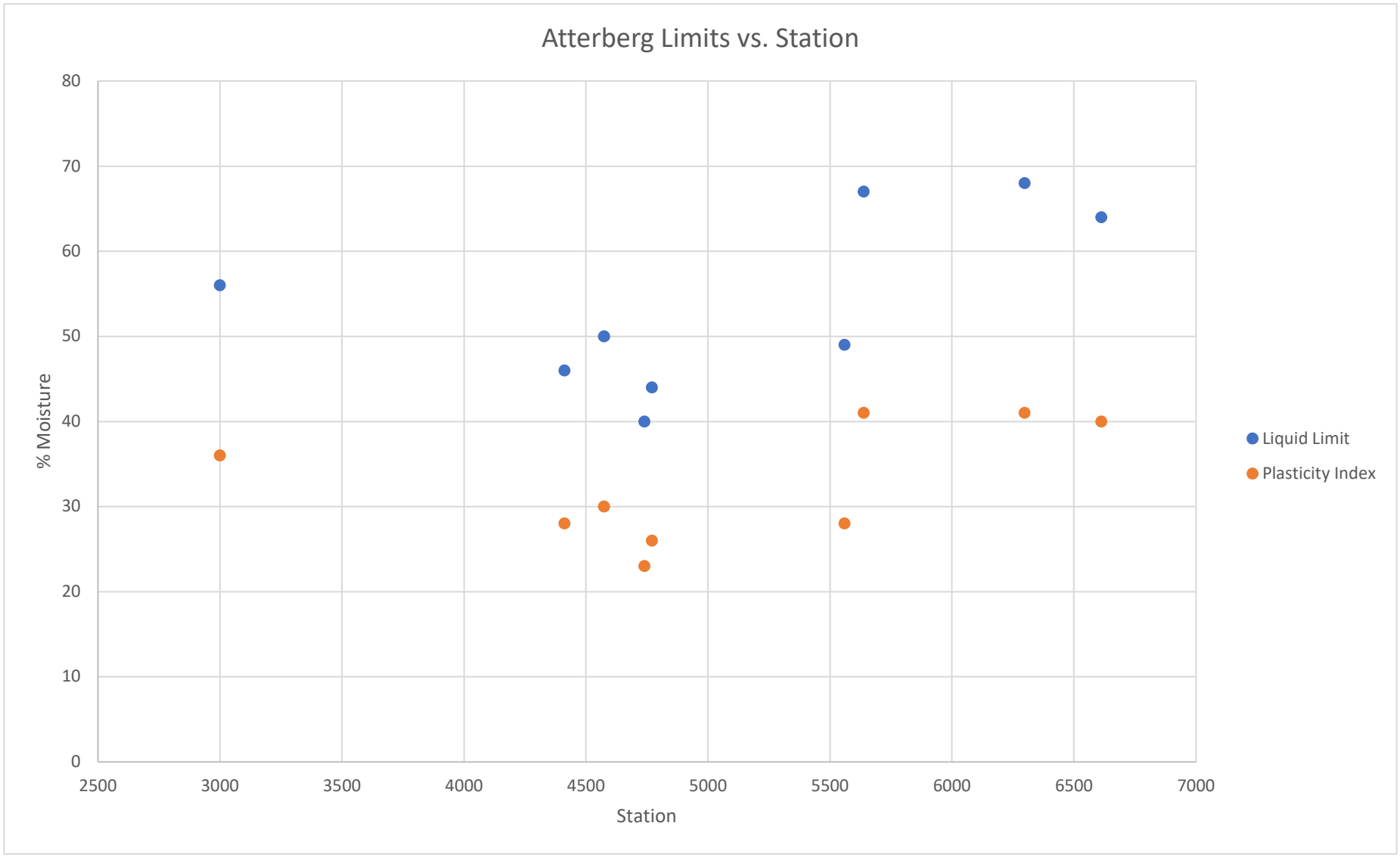
Confining Stress S3 (psi)	Nom. Max. Deviator Stress (psi)	Mean Deviator Stress (psi)	Std. Dev. Deviator Stress (psi)	Mean Bulk Stress (psi)	Mean Resilient Strain (%)	Std. Dev. Resilient Strain (%)	Mean Resilient Modulus (psi)	Std. Dev. Resilient Modulus (psi)
5.689	2	2.065	0.2055	19.13	0.06	0.01	3062.3	776.73
5.723	4	4.908	0.1810	22.08	0.15	0.00	3108.2	187.16
5.707	6	7.056	0.2243	24.18	0.20	0.02	3201.3	269.56
5.704	8	8.614	0.3480	25.73	0.27	0.02	2937.2	361.57
5.722	10	10.26	0.3167	27.43	0.31	0.03	3047.5	280.8
3.652	2	2.243	0.3369	13.2	0.04	0.00	5502.7	1358.2
3.641	4	5.002	0.3635	15.93	0.13	0.01	3512.7	332.04
3.717	6	6.965	0.1516	18.11	0.21	0.01	3058.8	147.17
3.69	8	8.721	0.3816	19.79	0.27	0.02	2928.7	223.71
3.665	10	10.1	0.0713	21.09	0.33	0.02	2791.1	147.88
2.029	2	2.612	0.4837	8.699	0.04	0.01	6836.7	1578.6
2.028	4	4.779	0.1425	10.86	0.14	0.01	3244	355.59
2.026	6	6.717	0.1958	12.79	0.20	0.02	3186.4	454.07
2.025	8	8.561	0.3291	14.64	0.27	0.01	2854.2	141.61
2.026	10	10.76	0.6481	16.84	0.34	0.03	2982.2	142.12

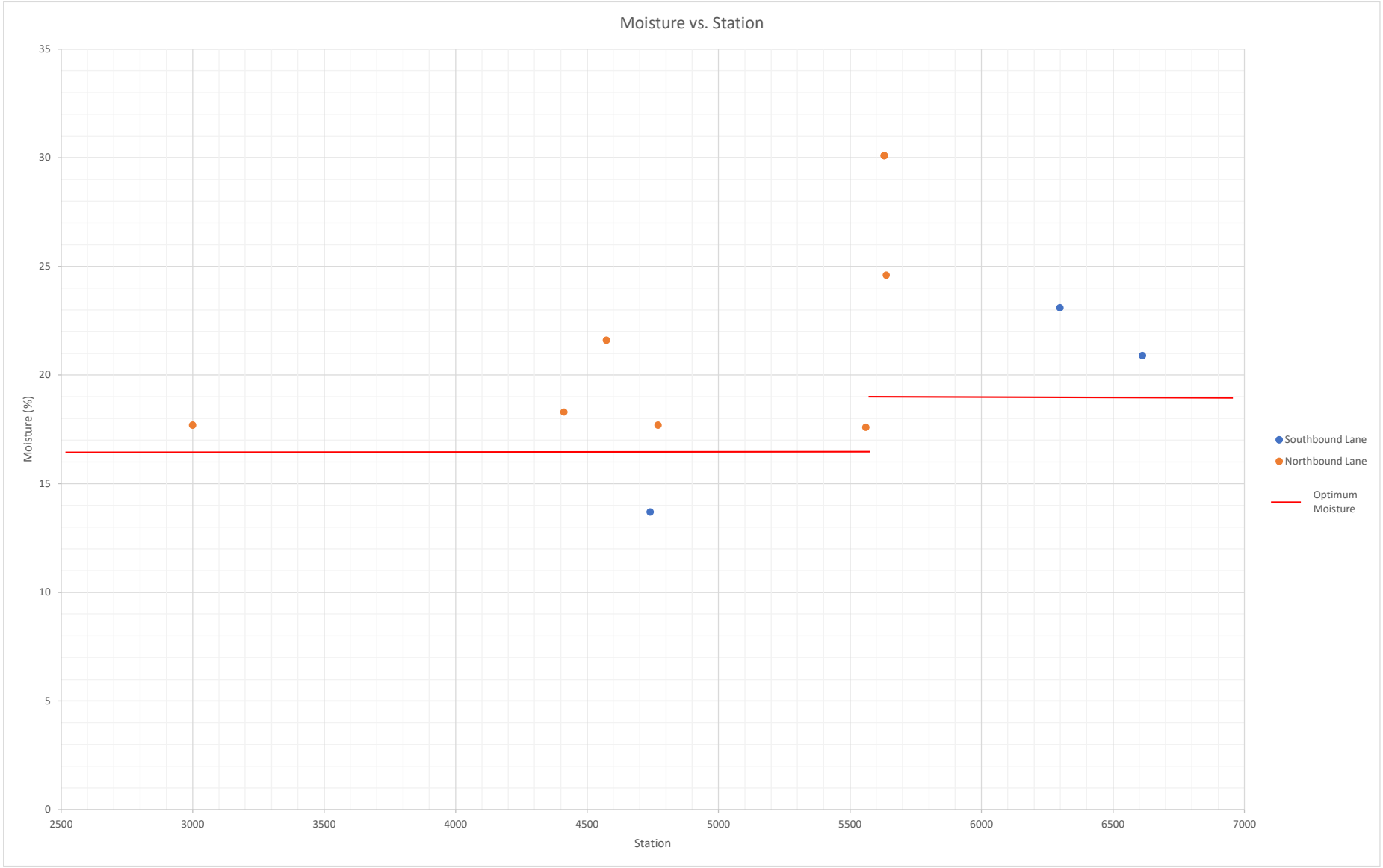
Project:	Location: SG	Project No.: N-0678-01
Boring No.:	Tested By: SS	Checked By:
Sample No.: SH-5	Test Date: 1/8/2024	Depth: 1.5-7.5
Test No.: 24-0024	Sample Type:	Elevation:
Description:		
Remarks:		
File: C:\Users\bpope\Desktop\24-0024 SH-5.dat		

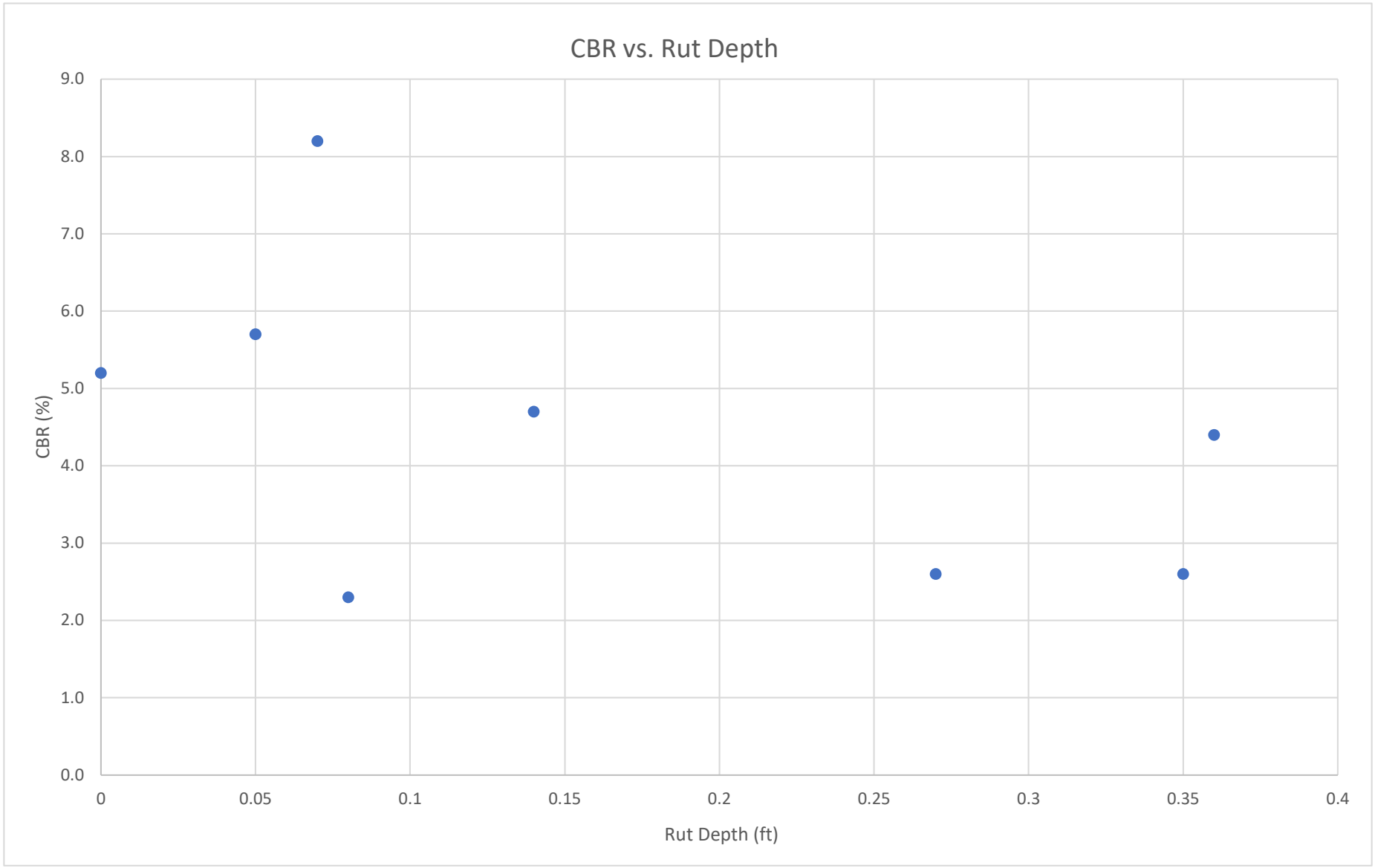

Bag Sample 2 Swell Potential
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Swell Potential (%)
0
100
200
300
400
500
600
Vertifcal Stress (psf)

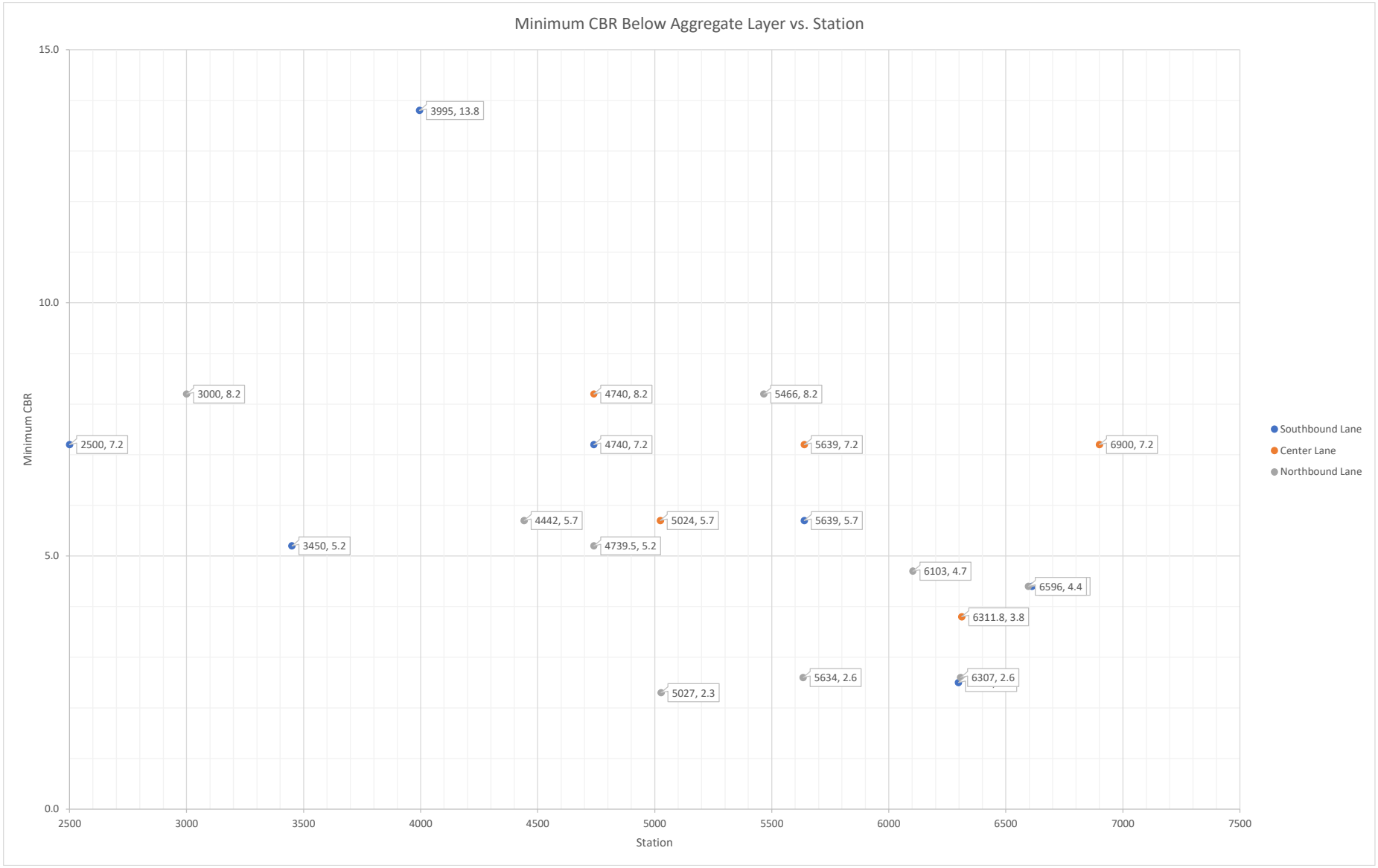

SH-2 Swell Potential
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
0
100
200
300
400
500
600
Strain (%)
Vertifcal Stress (psf)


SH-5 Swell Potential
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Strain (%)
0
100
200
300
400
500
600
Vertifcal Stress (psf)


Atterberg Limits vs. Station
% Moisture
Station
0
10
20
30
40
50
60
70
80
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
Liquid Limit
Plasticity Index


Moisture vs. Station
Moisture (%)
35
30
25
20
15
10
5
0
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
Station
Southbound Lane
Northbound Lane
Optimum Moisture

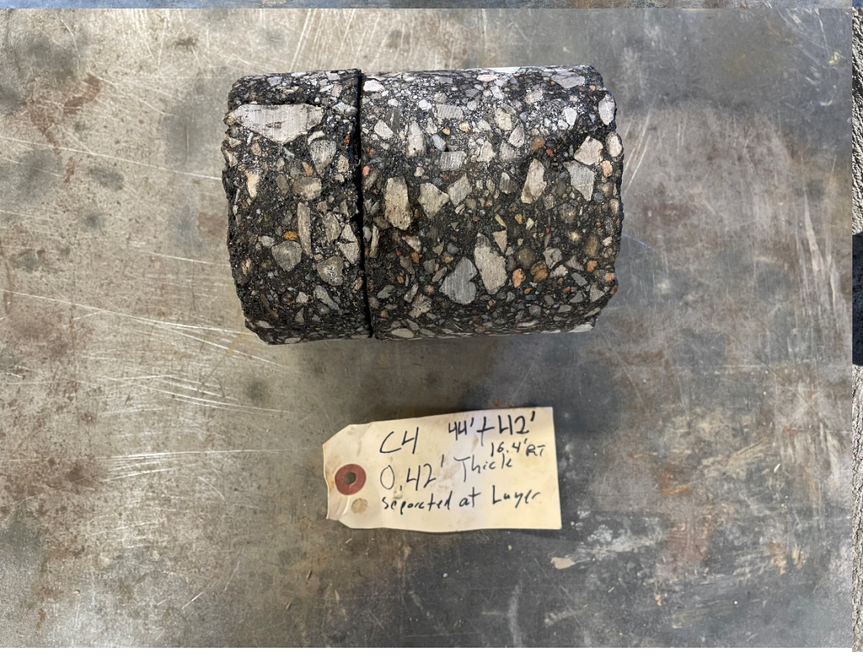

CBR vs. Rut Depth
CBR (%)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
Rut Depth (ft)


Minimum CBR Below Aggregate Layer vs. Station
15.0
10.0
5.0
0.0
Minimum CBR
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
7500
Station
3995, 13.8
3000, 8.2
4740, 8.2
5466, 8.2
2500, 7.2
4740, 7.2
5639, 7.2
6900, 7.2
4442, 5.7
5024, 5.7
5639, 5.7
3450, 5.2
4739.5, 5.2
6103, 4.7
6596, 4.4
6311.8, 3.8
5634, 2.6
6307, 2.6
5027, 2.3
Southbound Lane
Center Lane
Northbound Lane


1-3-24
C-1 18.4' RT
Sta 34+50


1-3-24 Woodlawn
C-2 Ave.
Sta 25+00
17' RT


C3
0.54'
70+00
24.7'


C4 44'+42'
16.4'RT
0.42' Thick
Separated at Layer


C5 47+39.5
22.4'RT
0.52'


C6 50+27
17.7 RT
0.44'


C7 54+66
17.7'RT
0.42'


C8 56+34
18.7'RT
0.47'


C9 61+03
17.9'RT
0.48'


C10
Sta 63+07
17.3' RT
0.46'

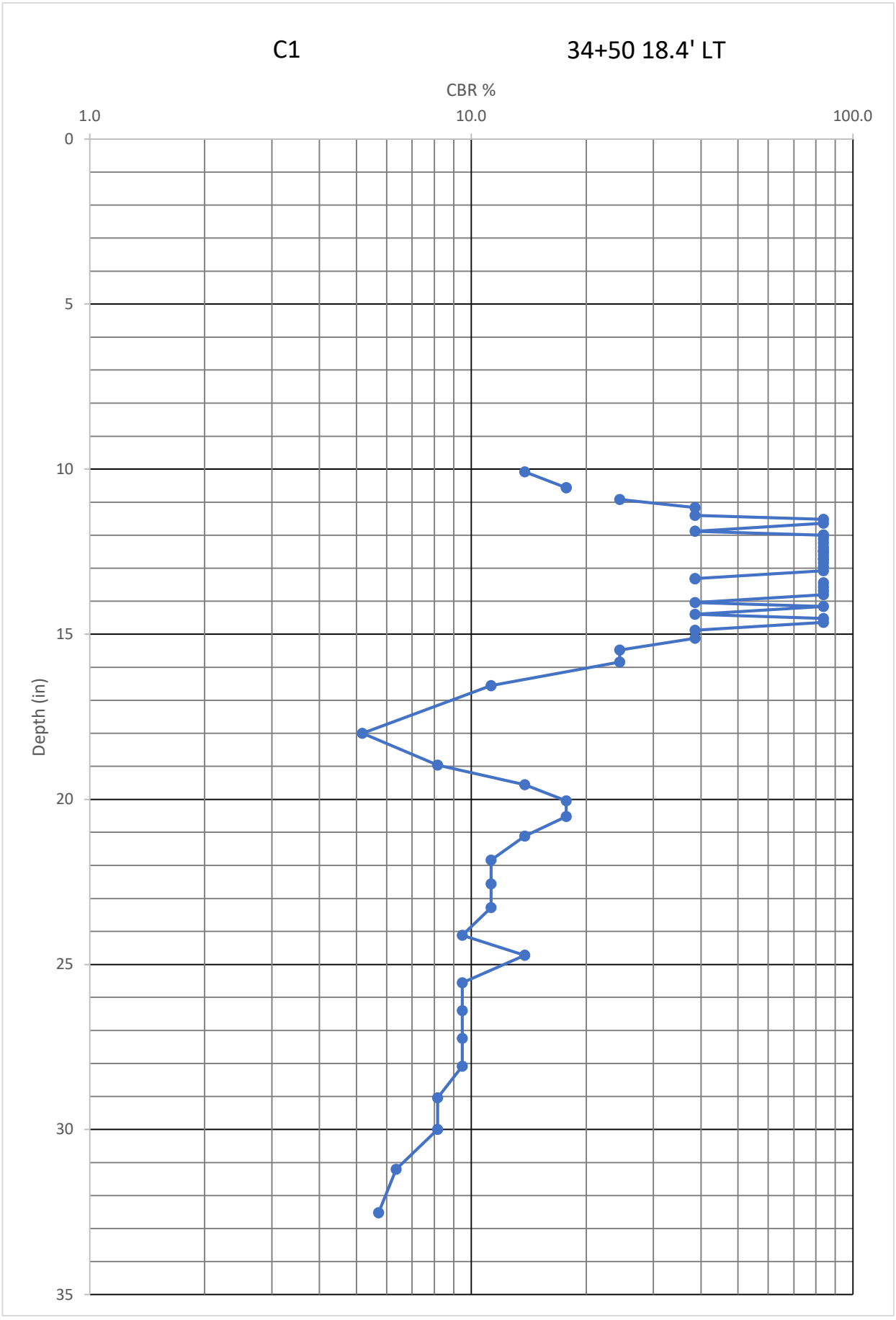

C11
0.48' Thick

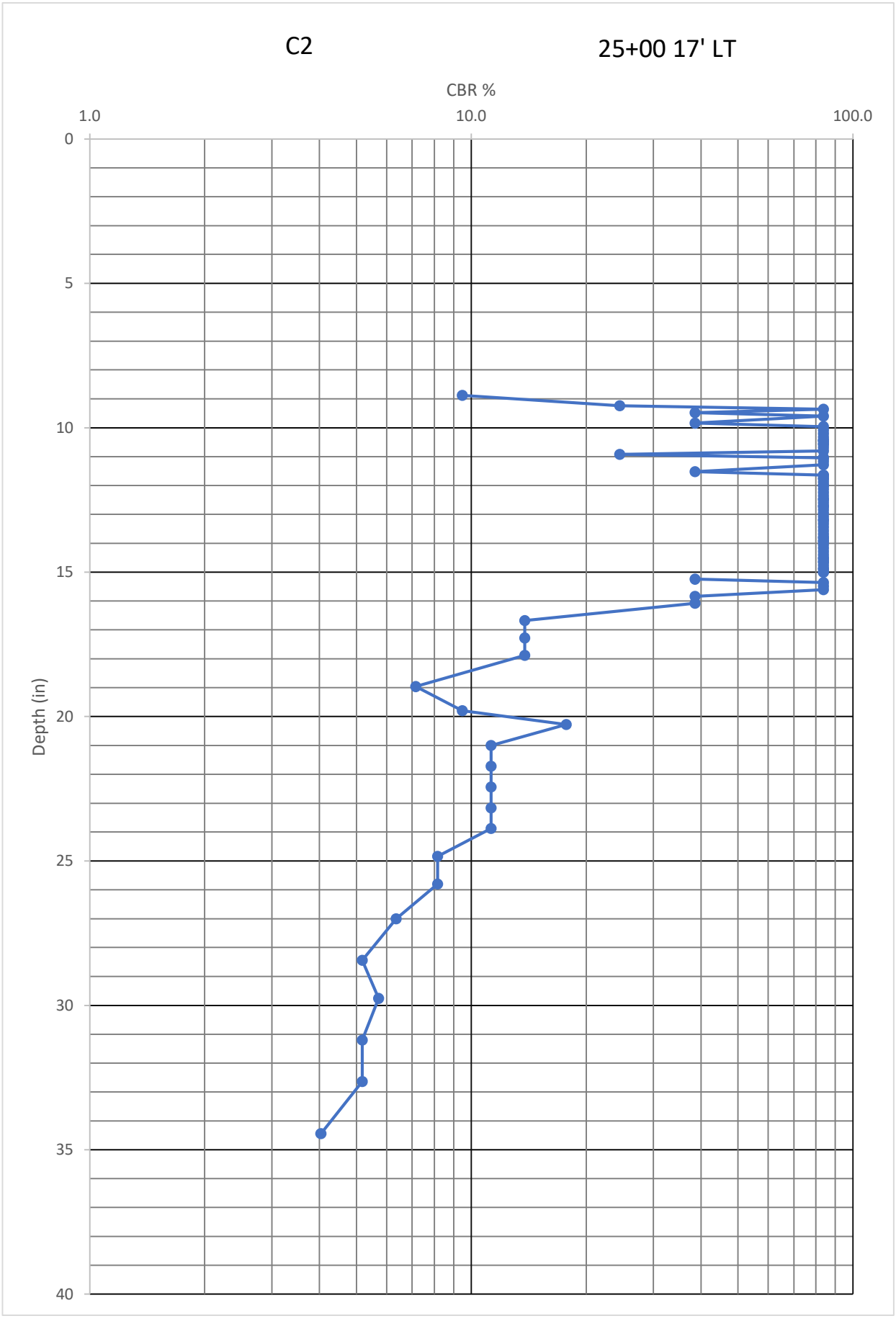

C13
0.39'

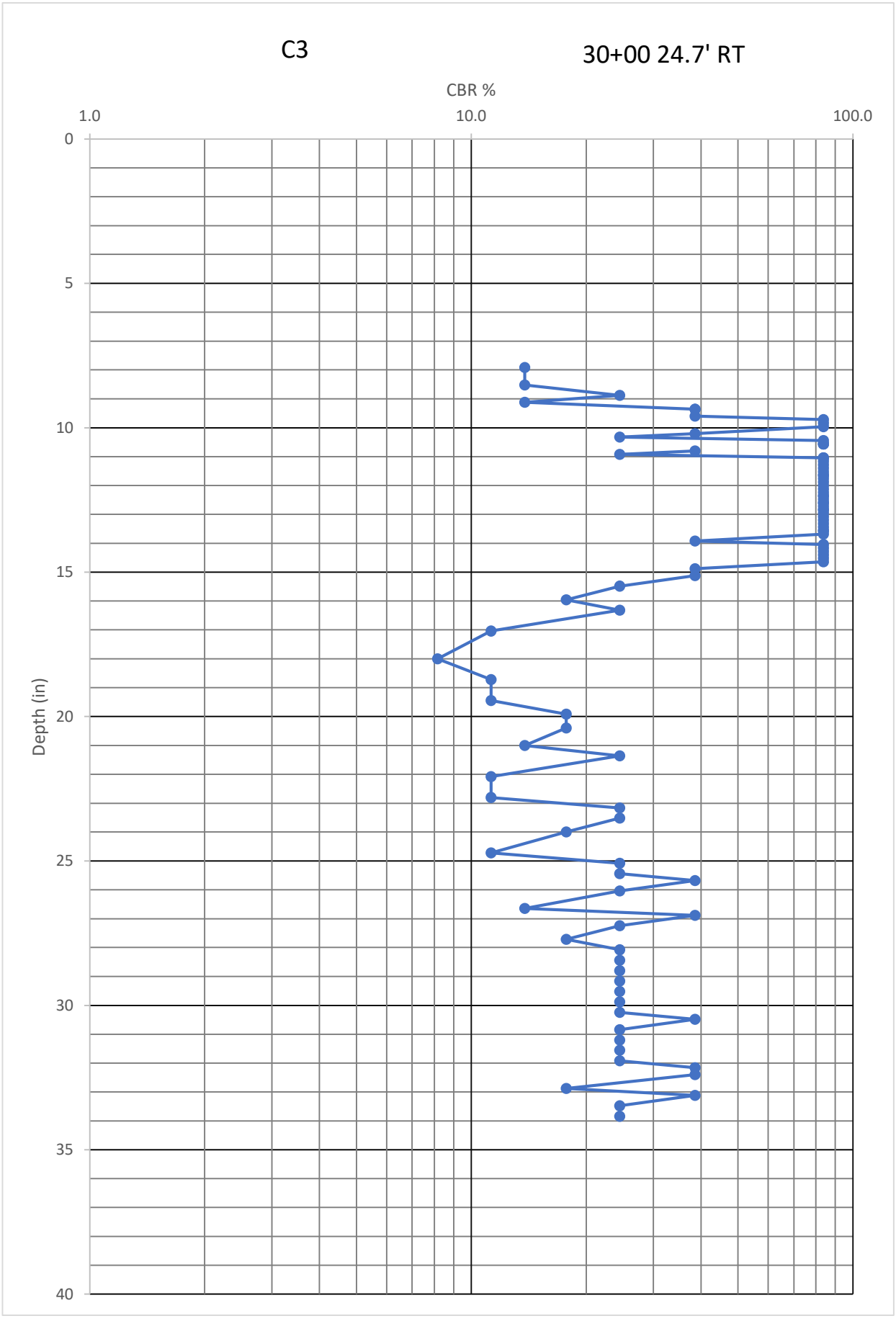
Cores C17, C18, C20, and C21 were mislabeled N-0678-02. The correct project number is N-0678-01.

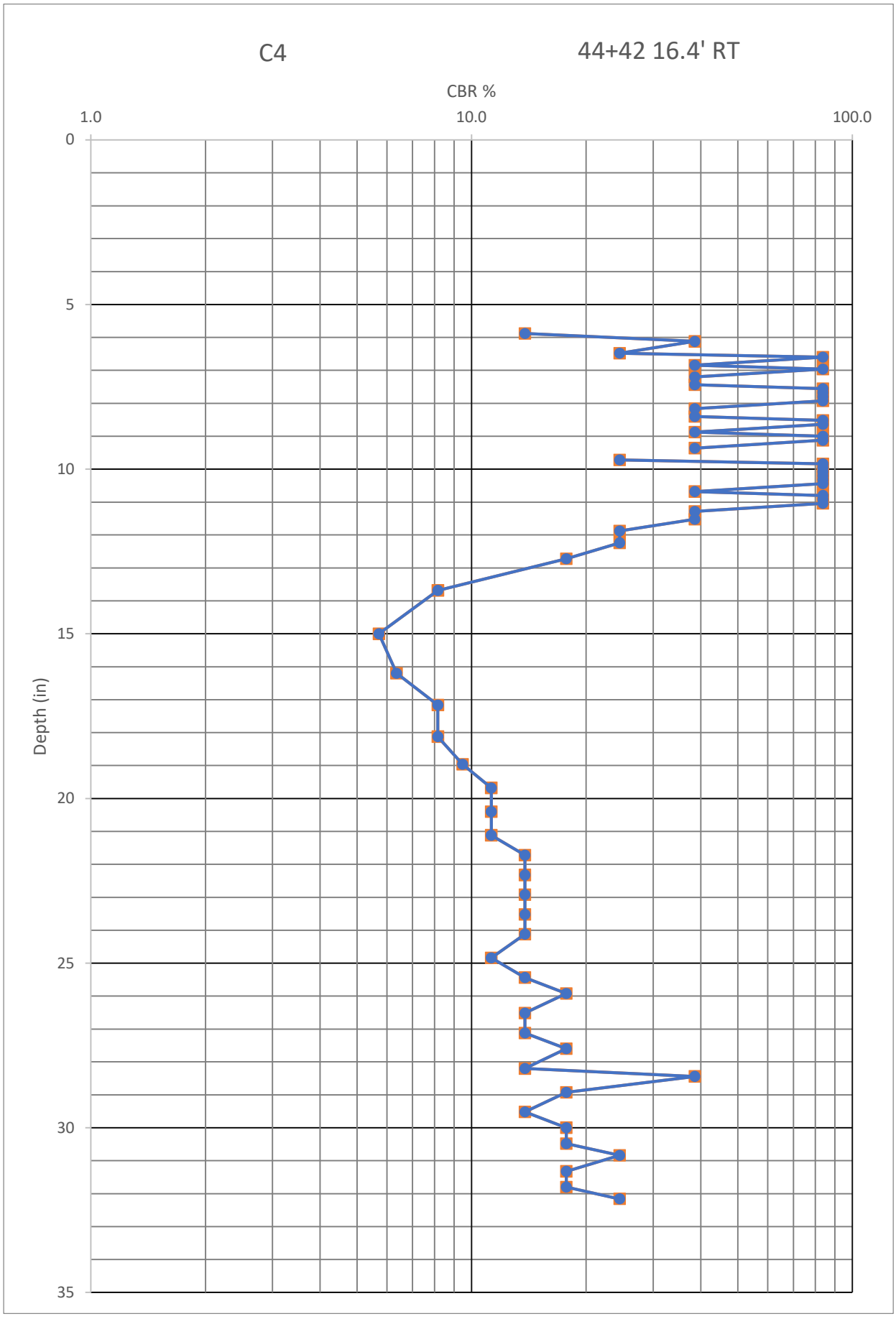
Woodlawn Avenue
City of Bel Aire - Segdwick County
87 N-0678-01
All Cores in NB Lane

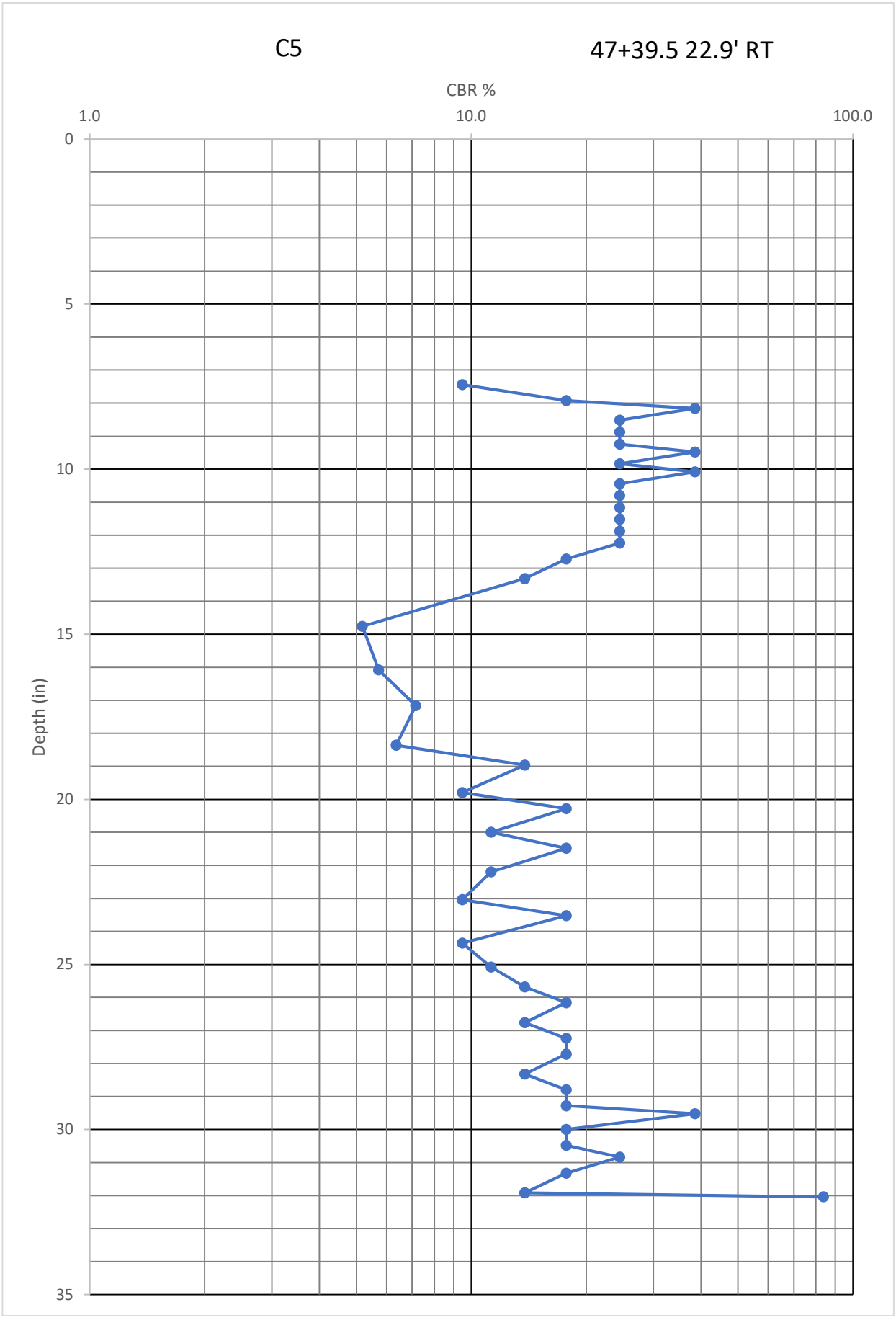
Core No.	Station	Lane	Wheel Path Location	Distance from CL	Minimum CBR	Depth of Core	Core Condition (in)			Top Lift Thickness	Bottom Lift Thickness	AB-3 Thickness	Description of Core Condition
				(ft)		(in)	Good	Fair	Poor	(in)	(in)	(in)	
2A	50+84.5	NB	Right	17'-4" Rt	2.4	4.500	0.000	4.500	0.000	1.375	3.125		4.5" of HMA; break @ 1.375"; 5" of AB-3 extracted; slippage cracks on top surface
2B	50+84.5	NB	Between	12'-8" Rt	4.6	5.375	5.375	0.000	0.000	1.563	3.813	6.800	
2C	50+84.5	NB	Left	10'-0" Rt	7.0	5.125	5.125	0.000	0.000	1.375	3.750	5.200	
3A	51+68.5	NB	Right	17'-3" Rt	5.8	4.500	0.000	4.500	0.000	1.375	3.125	8.600	Crack in top of core
3B	51+68.5	NB	Between	12'-9" Rt	2.9	5.125	5.125	0.000	0.000	1.625	3.500		Some subgrade material in bag
3C	51+68.5	NB	Left	9'-11" Rt	4.0	5.125	5.125	0.000	0.000	1.500	3.625	7.500	
4A	55+61	NB	Right	17'-5.5" Rt	4.3	5.875	5.875	0.000	0.000	1.750	4.125	7.200	Break in tack layer @ 1.75"
4B	55+61	NB	Between	13'-0" Rt	8.8	6.250	6.250	0.000	0.000	1.875	4.375	6.600	
4C	55+61	NB	Left	9'-9" Rt	21.8	6.375	6.375	0.000	0.000	1.875	4.500	5.300	
5A	62+69	NB	Right	17'-3" Rt	3.1	5.875	5.875	0.000	0.000	2.375	3.500	6.800	Break in tack layer @ 2.375"
5B	62+69	NB	Between	13'-4" Rt	2.1	6.250	6.250	0.000	0.000	2.750	3.500	6.900	Break in tack layer @ 2.75"
5C	62+69	NB	Left	10'-1" Rt	3.8	6.000	6.000	0.000	0.000	2.625	3.375	6.100	Break in tack layer @ 2.625"
6A	66+28	NB	Right	16'-10" Rt	2.1	5.000	0.000	5.000	0.000	1.875	3.125	5.300	Slippage cracks on top surface; break in tack layer @ 1.875"
6B	66+28	NB	Between	13'-0" Rt	3.8	5.375	5.375	0.000	0.000	2.375	3.000	6.800	
6C	66+28	NB	Left	9'-8" Rt	3.8	5.000	5.000	0.000	0.000	2.375	2.625	6.700	

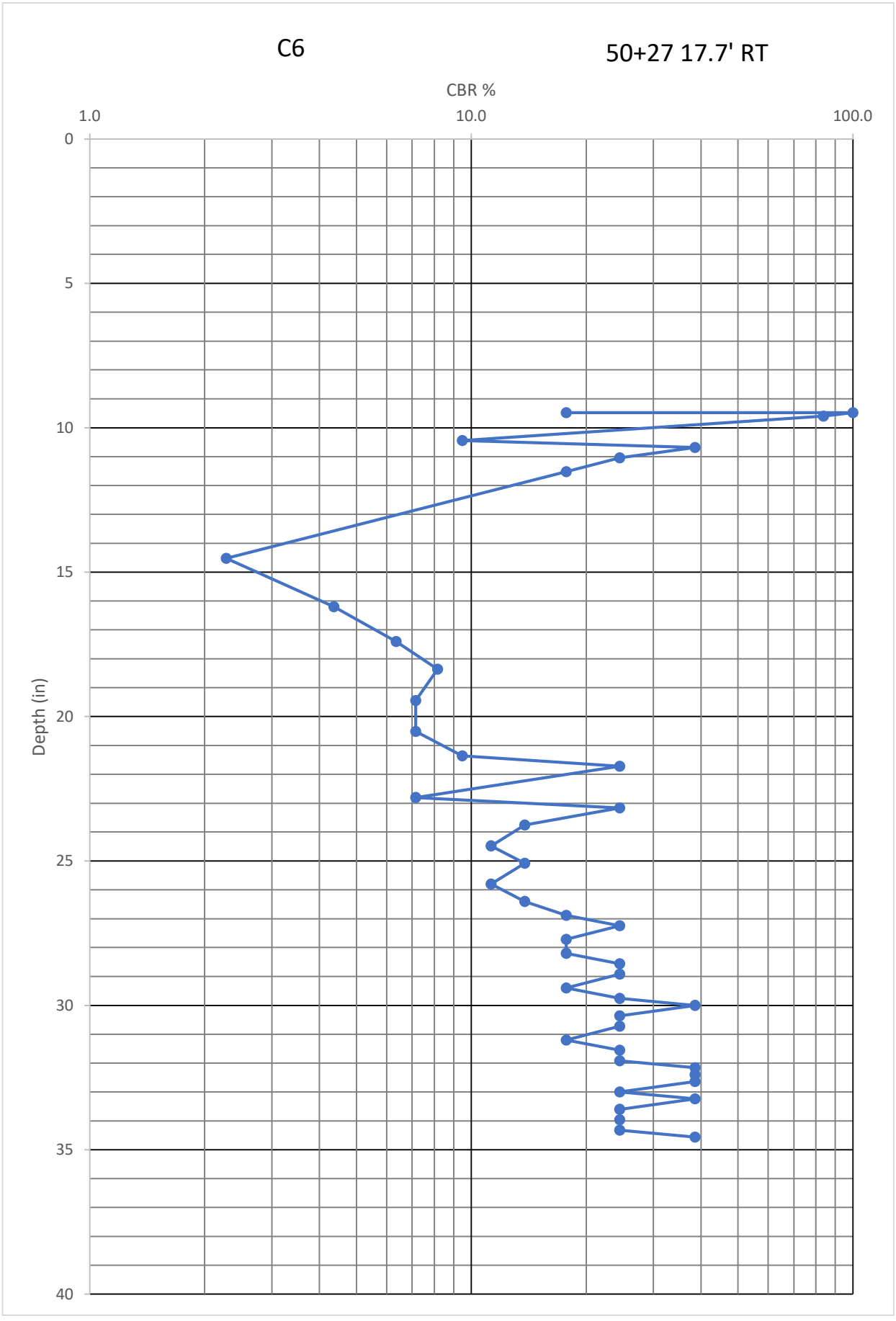

C1
34+50 18.4' LT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
Depth (in)

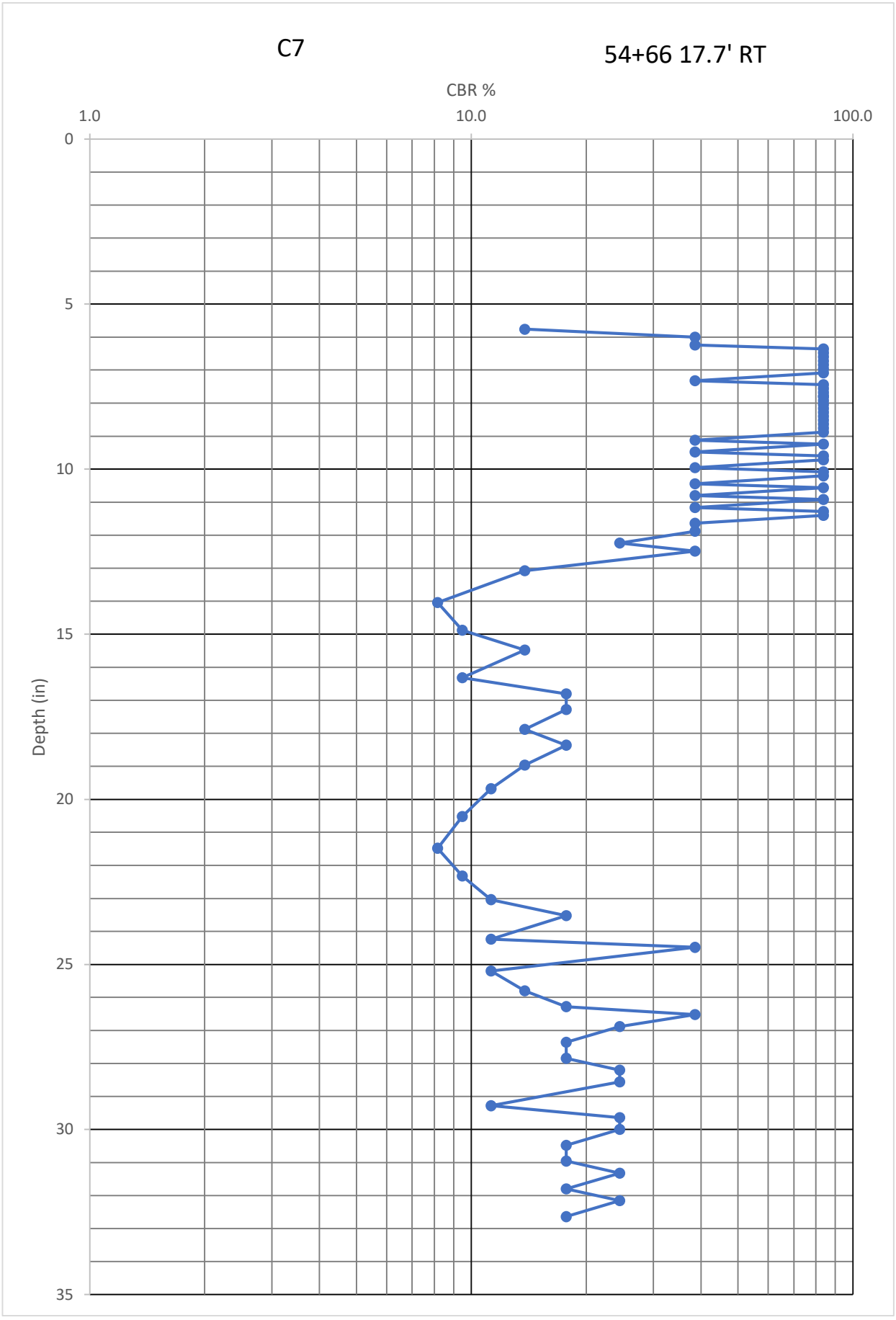

C2
25+00 17' LT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
40
Depth (in)

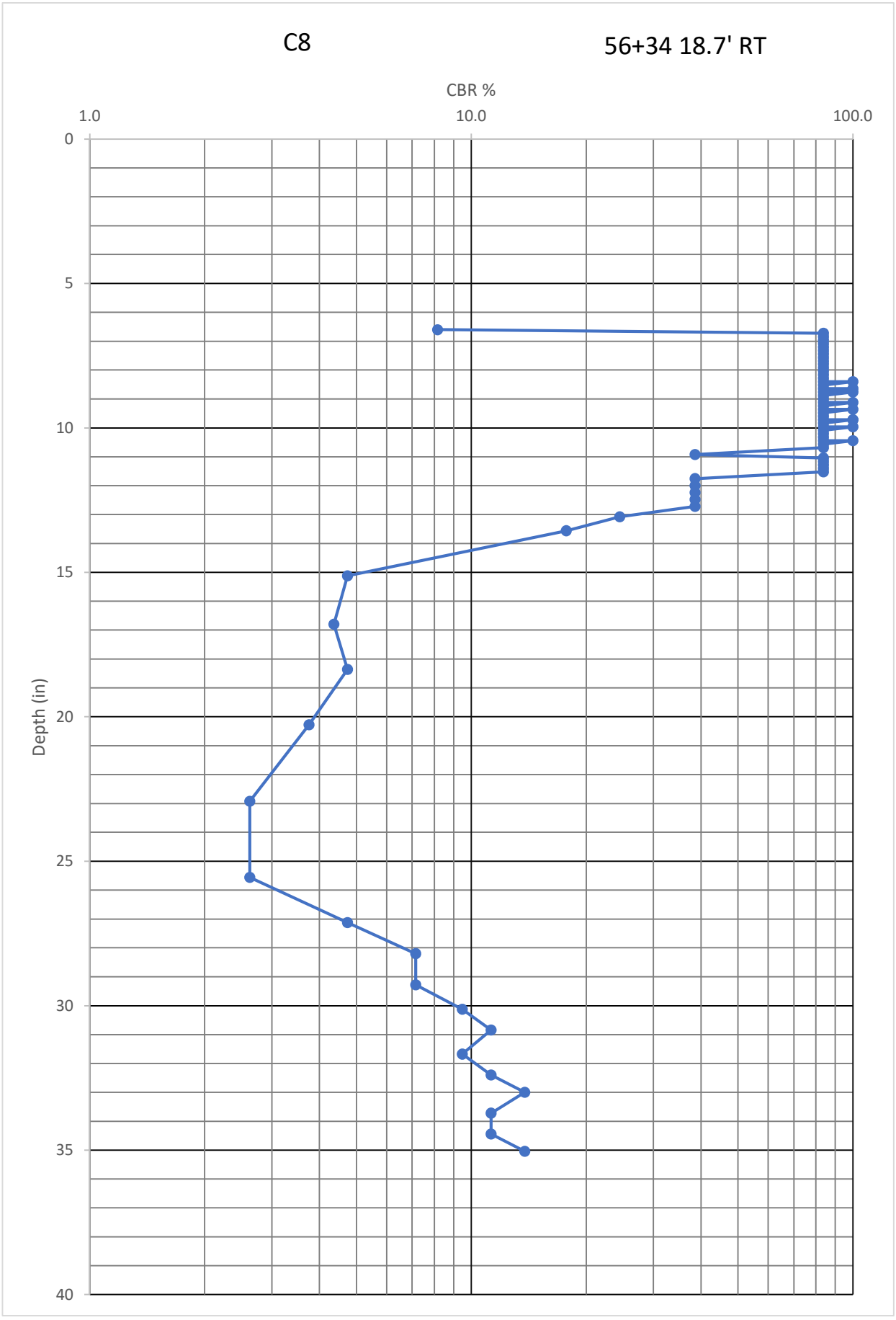

C3
30+00 24.7' RT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
40
Depth (in)

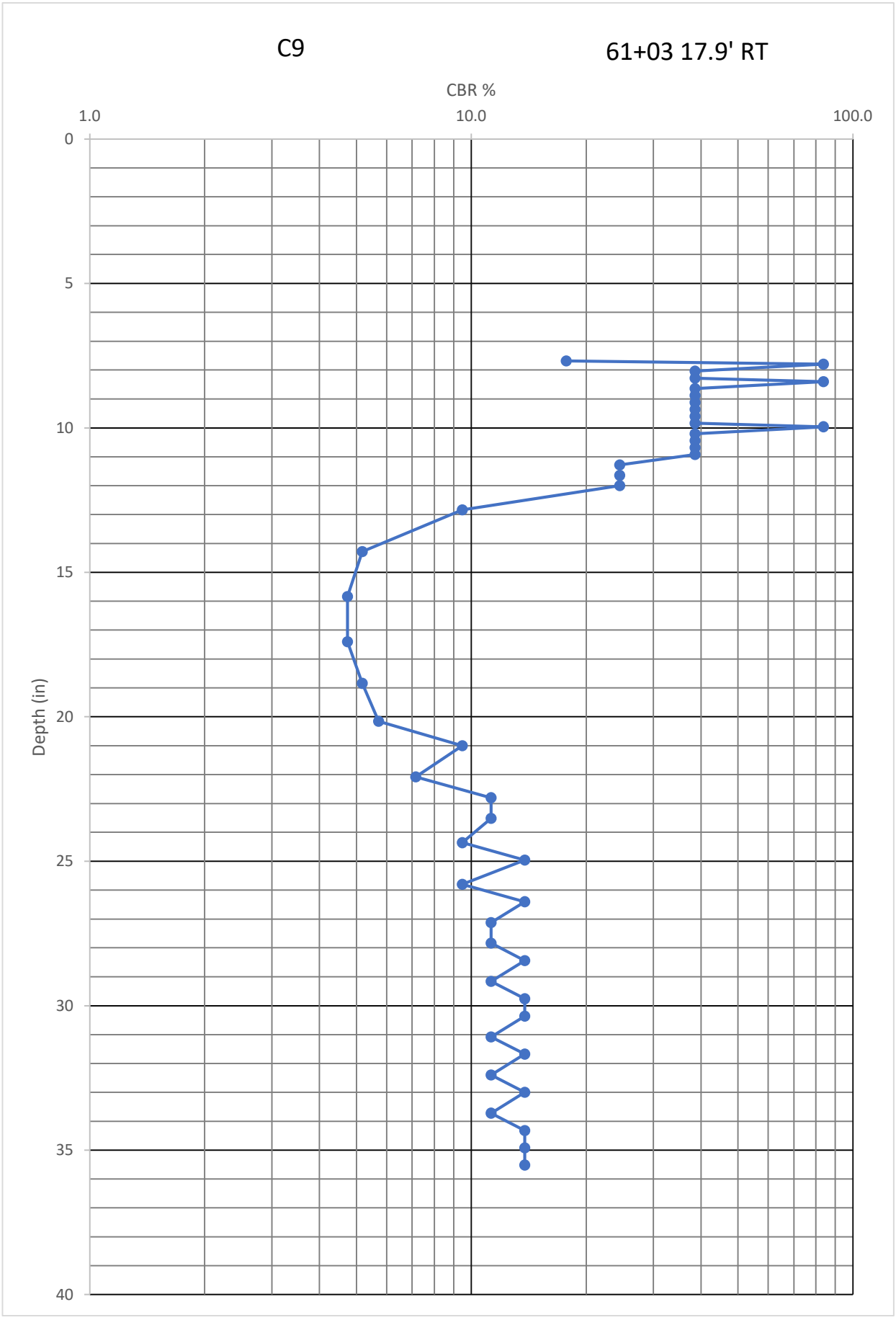

C4
44+42 16.4' RT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
Depth (in)

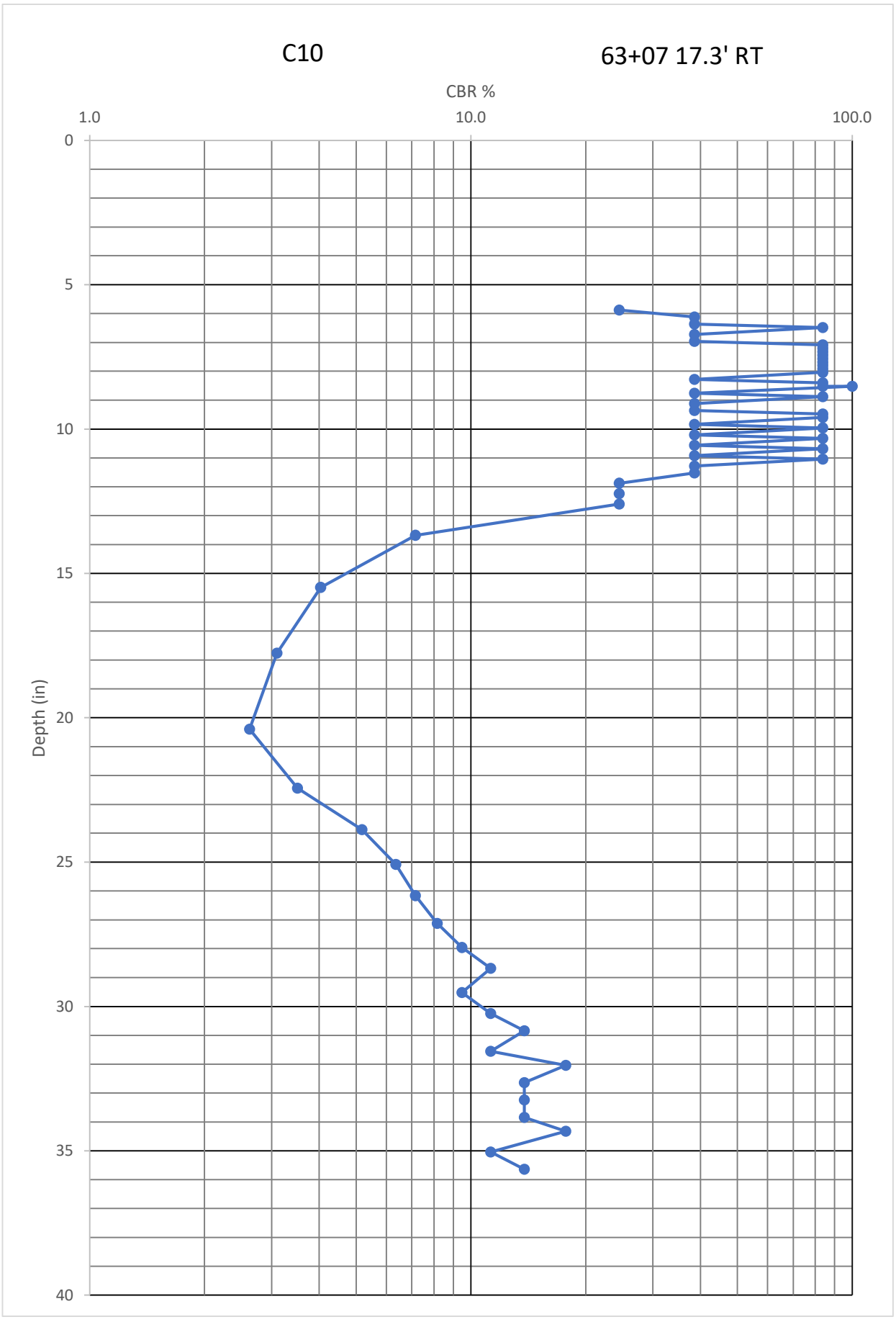

C5
47+39.5 22.9' RT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
Depth (in)

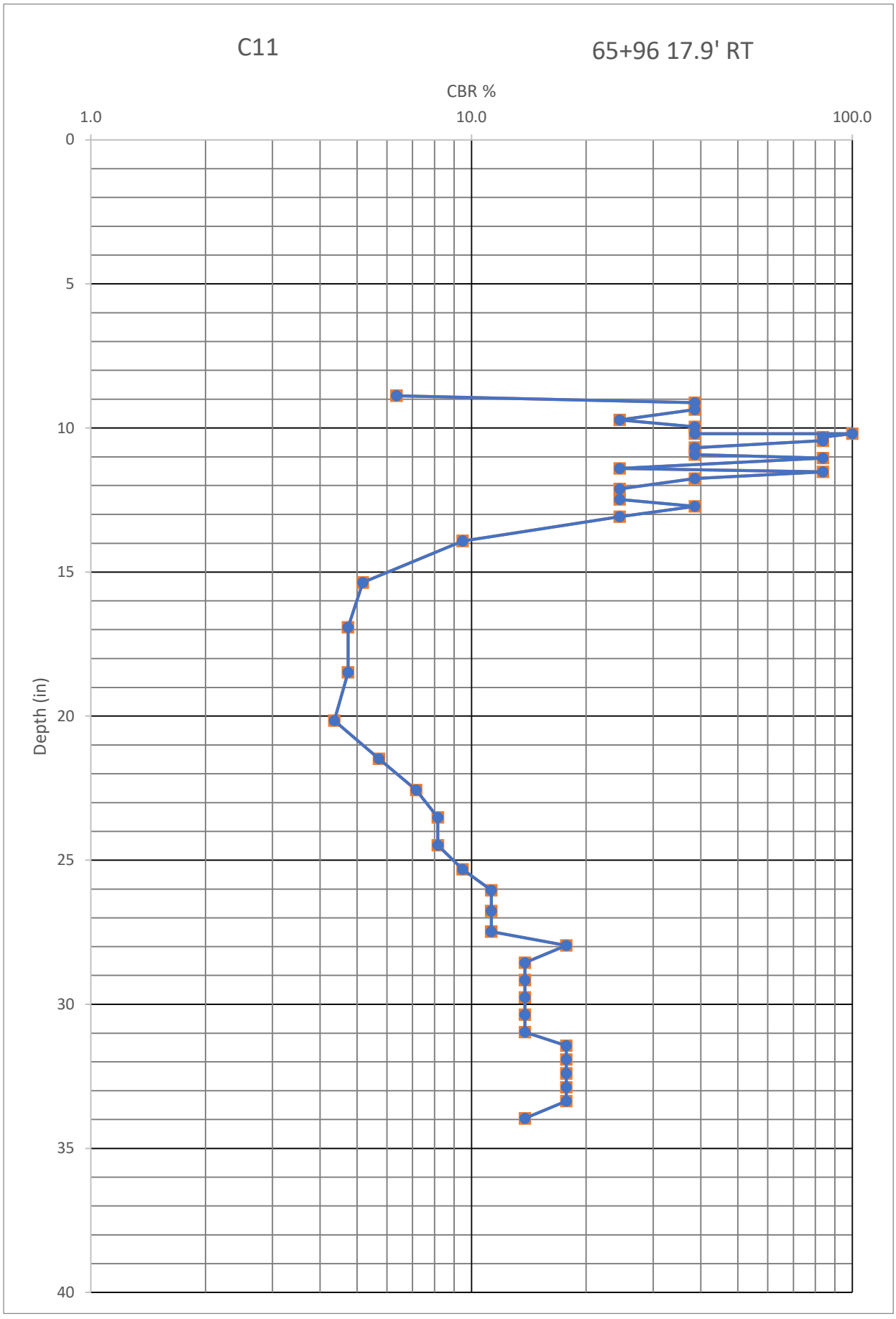

C6
50+27 17.7' RT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
40
Depth (in)

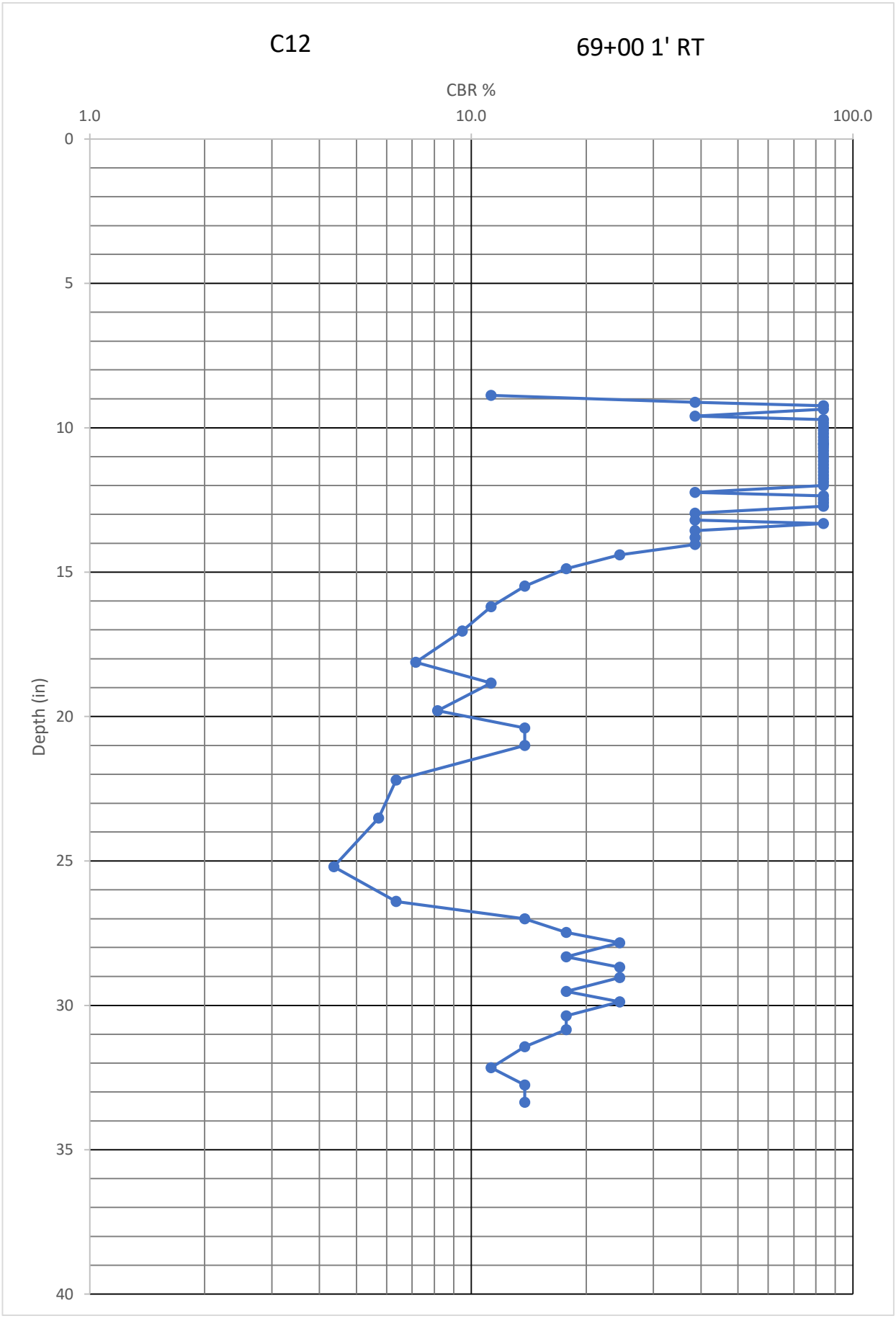

C7
54+66 17.7' RT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
Depth (in)

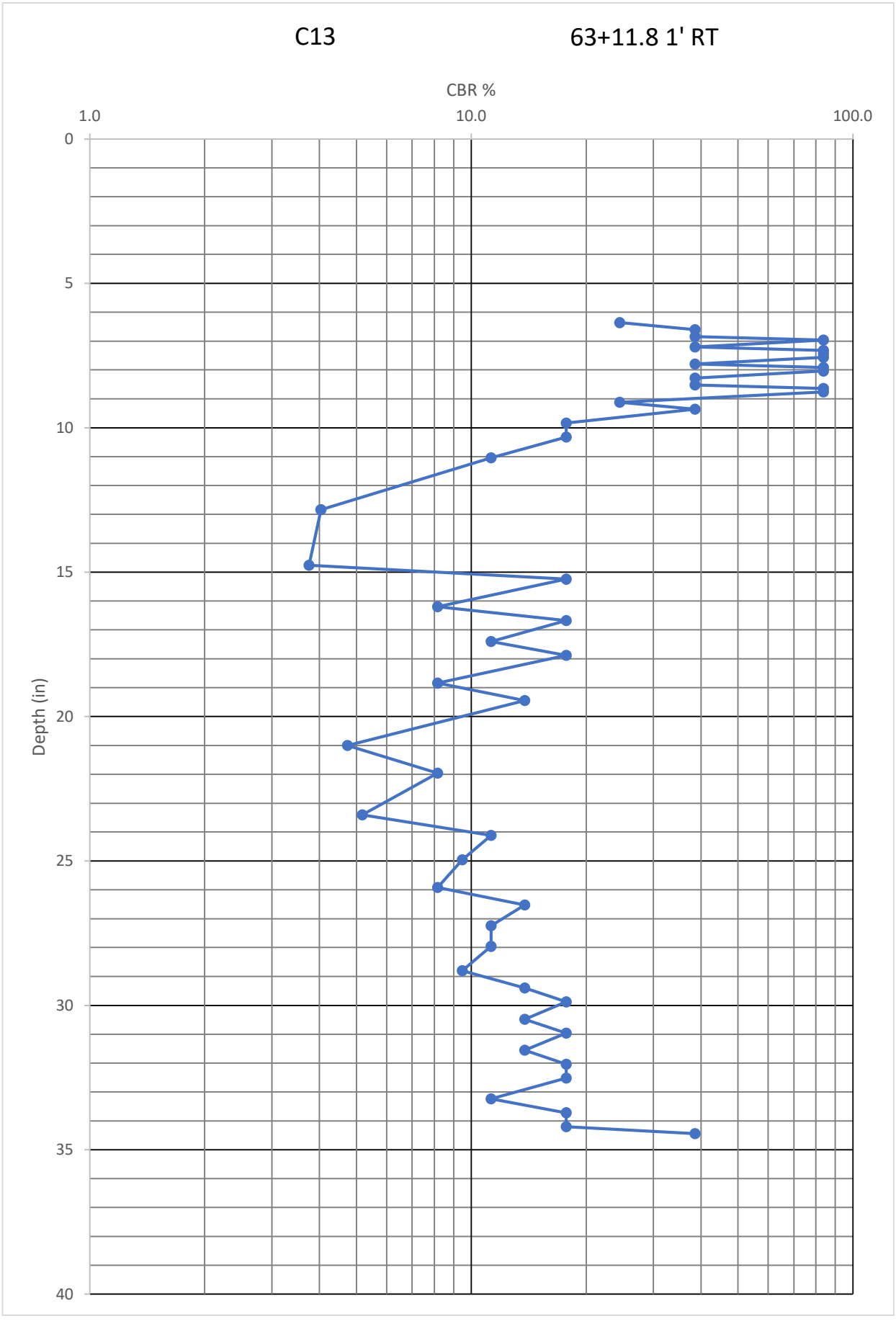

C8
56+34 18.7' RT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
40
Depth (in)

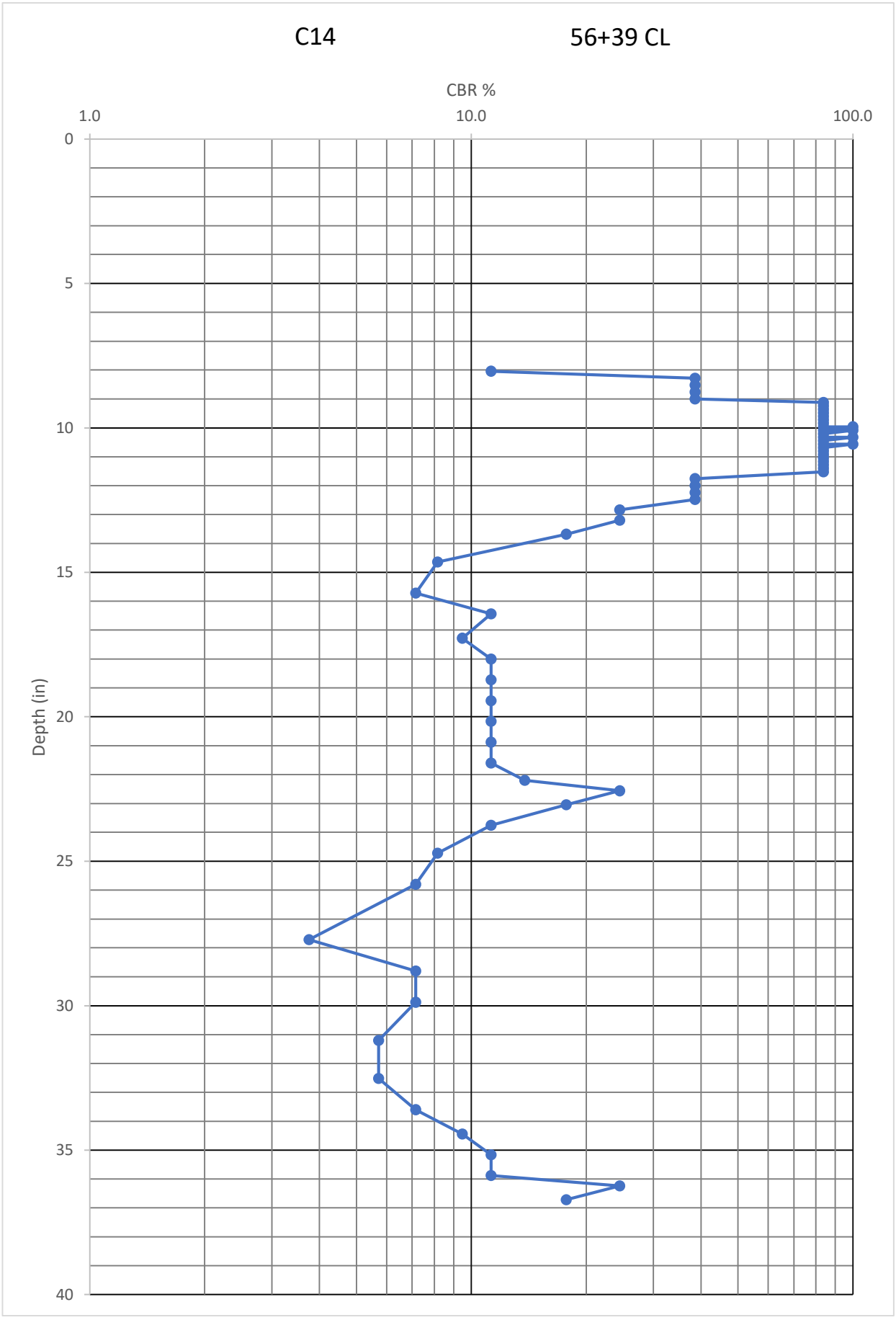

C9
61+03 17.9' RT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
40
Depth (in)

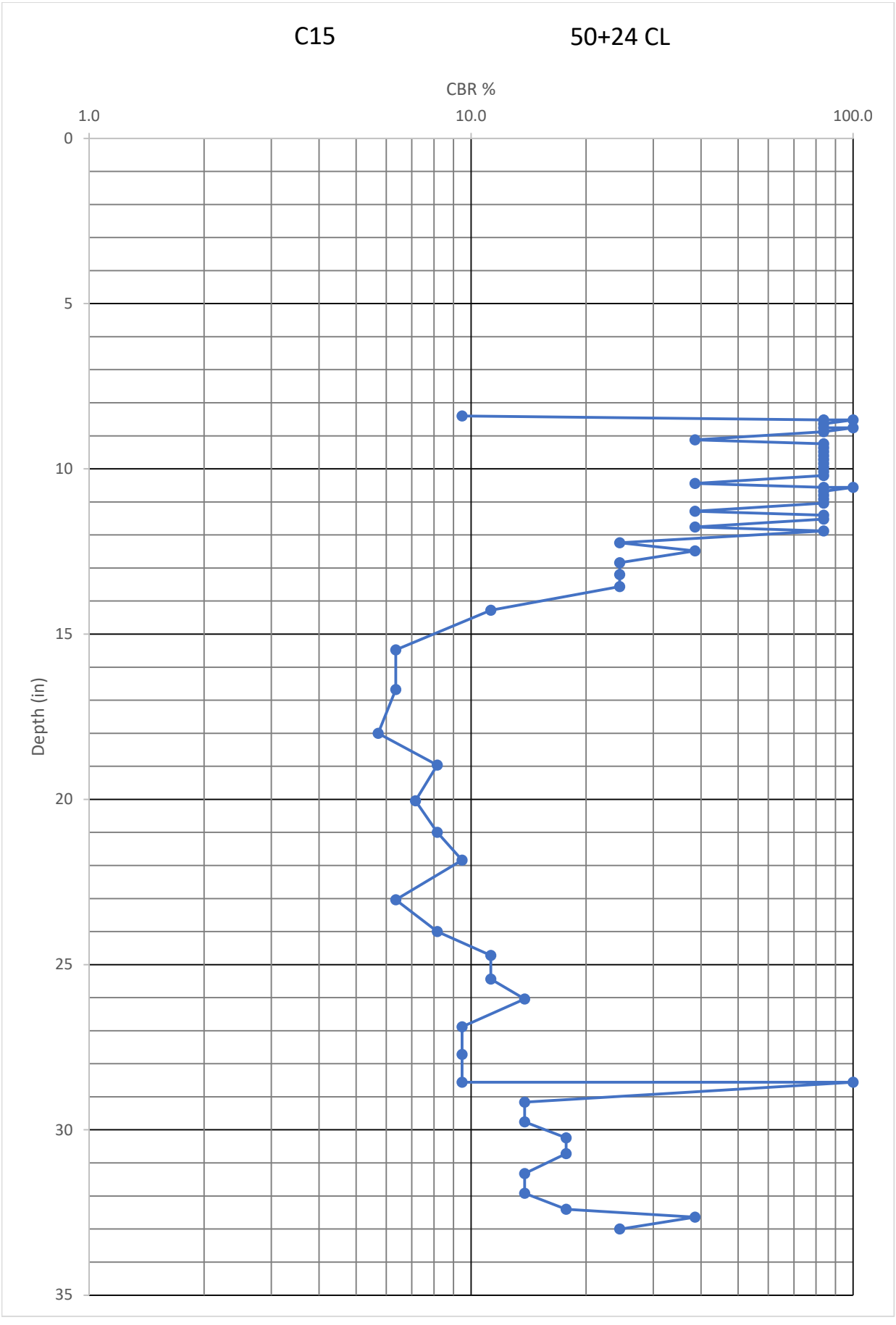

C10
63+07 17.3' RT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
40
Depth (in)

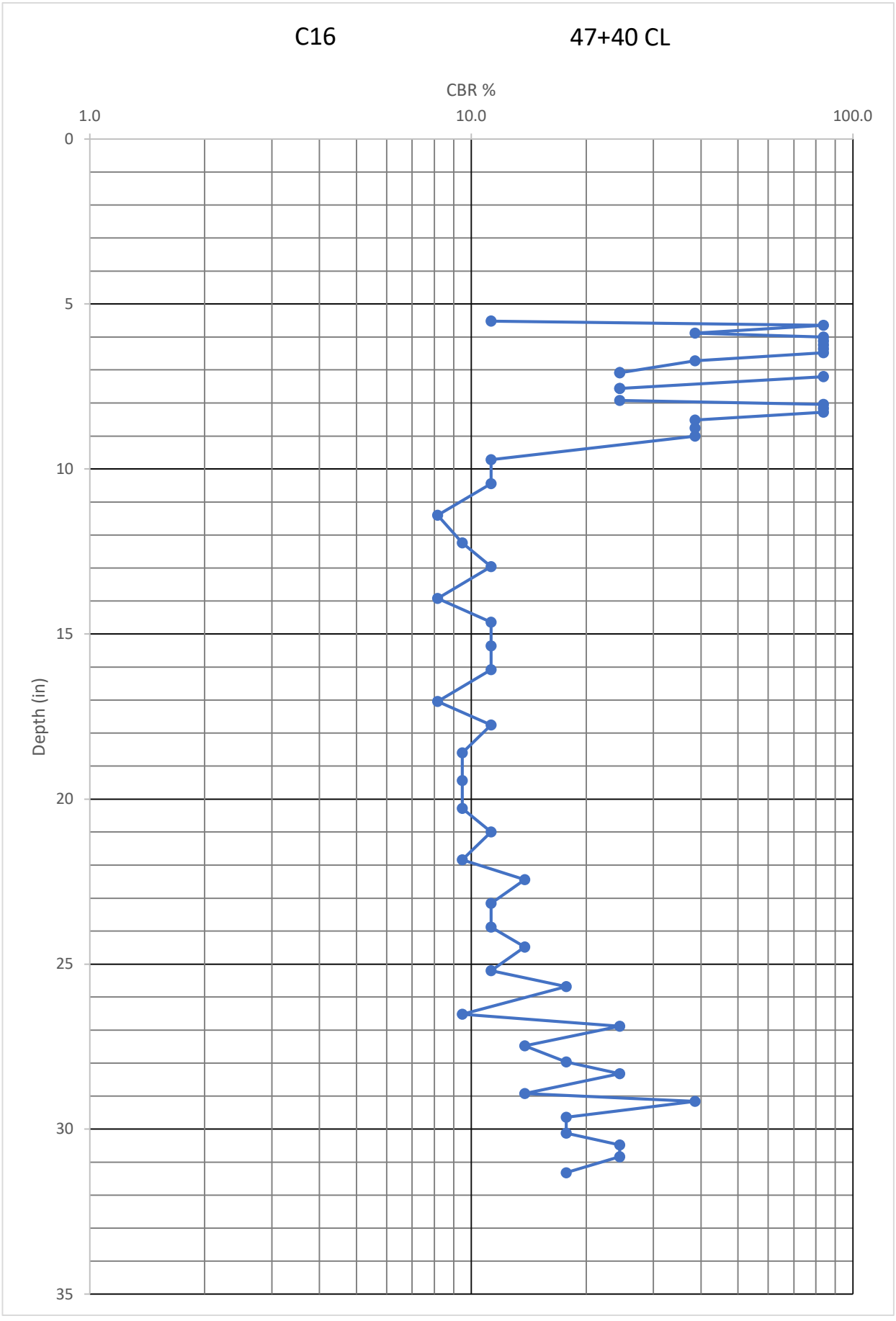

C11
65+96 17.9' RT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
40
Depth (in)

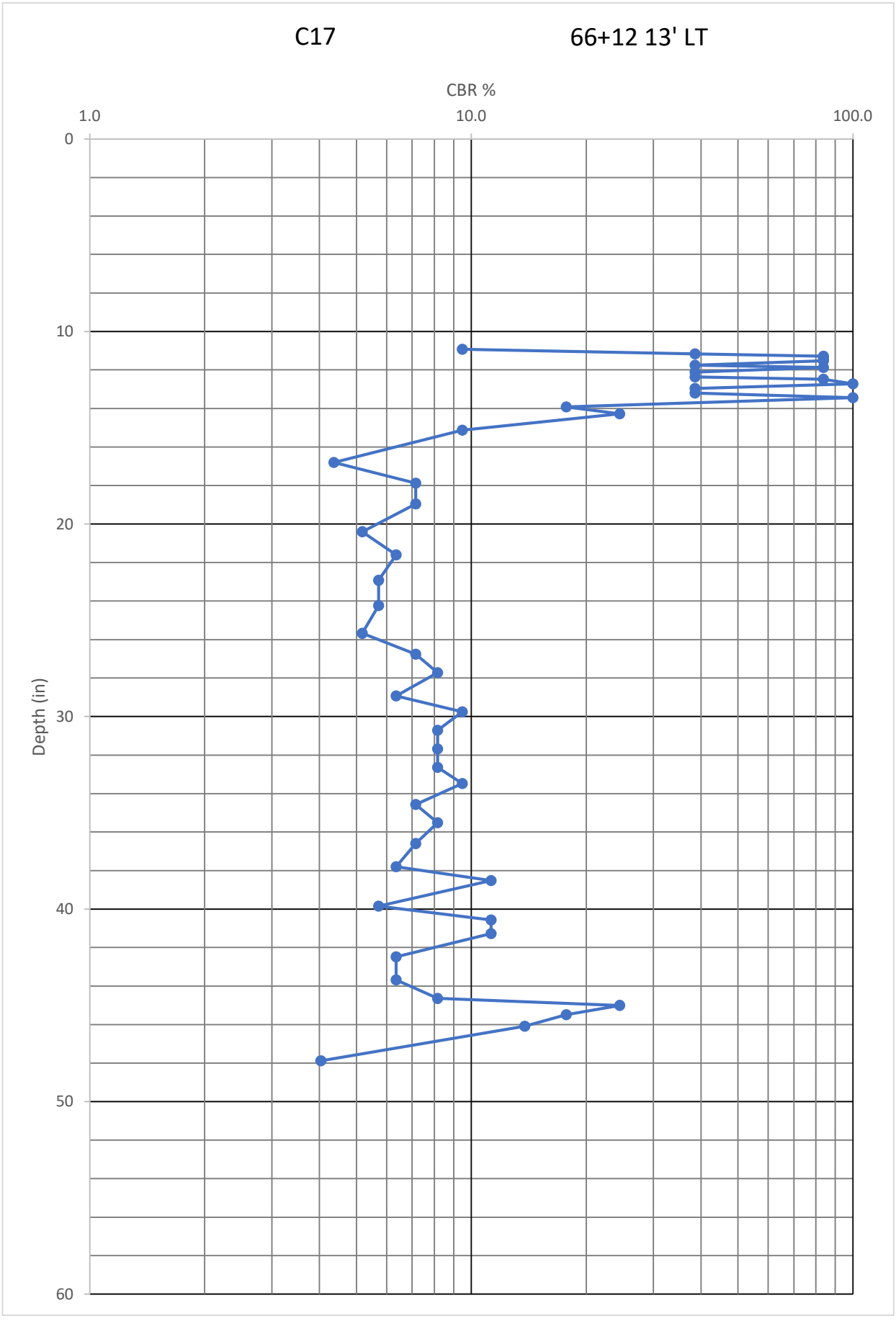

C12
69+00 1' RT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
40
Depth (in)

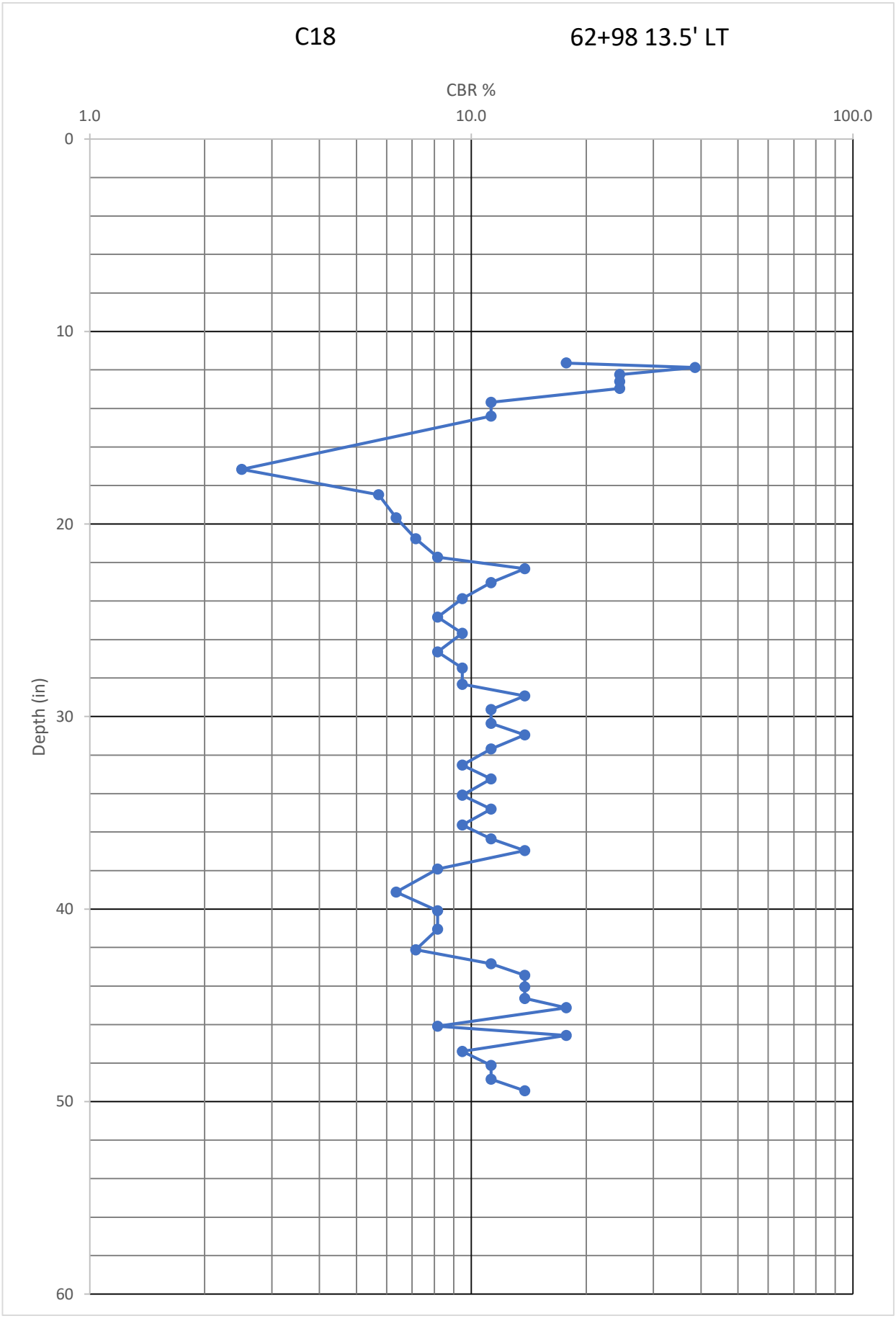

C13
63+11.8 1' RT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
40
Depth (in)

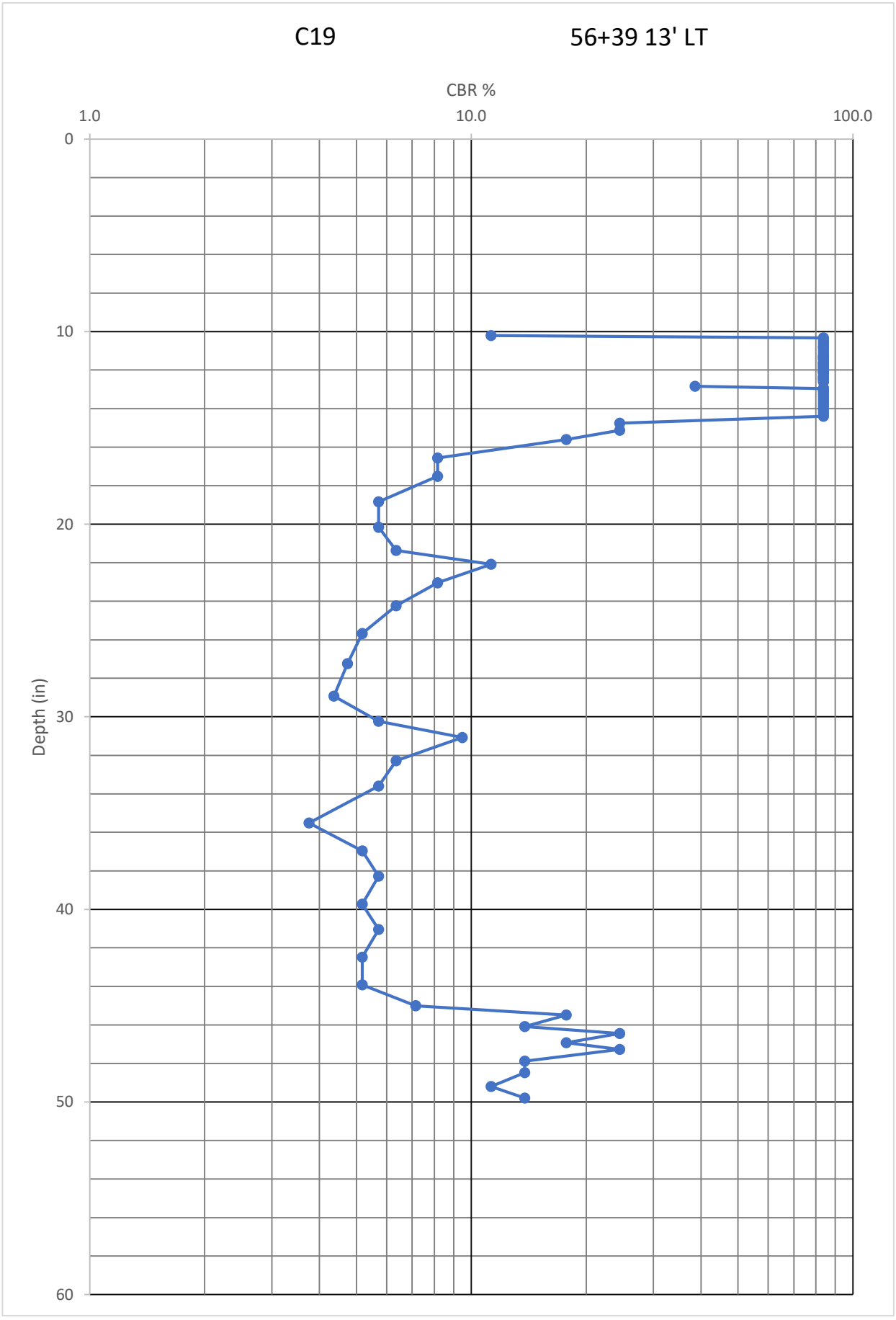

C14
56+39 CL
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
40
Depth (in)

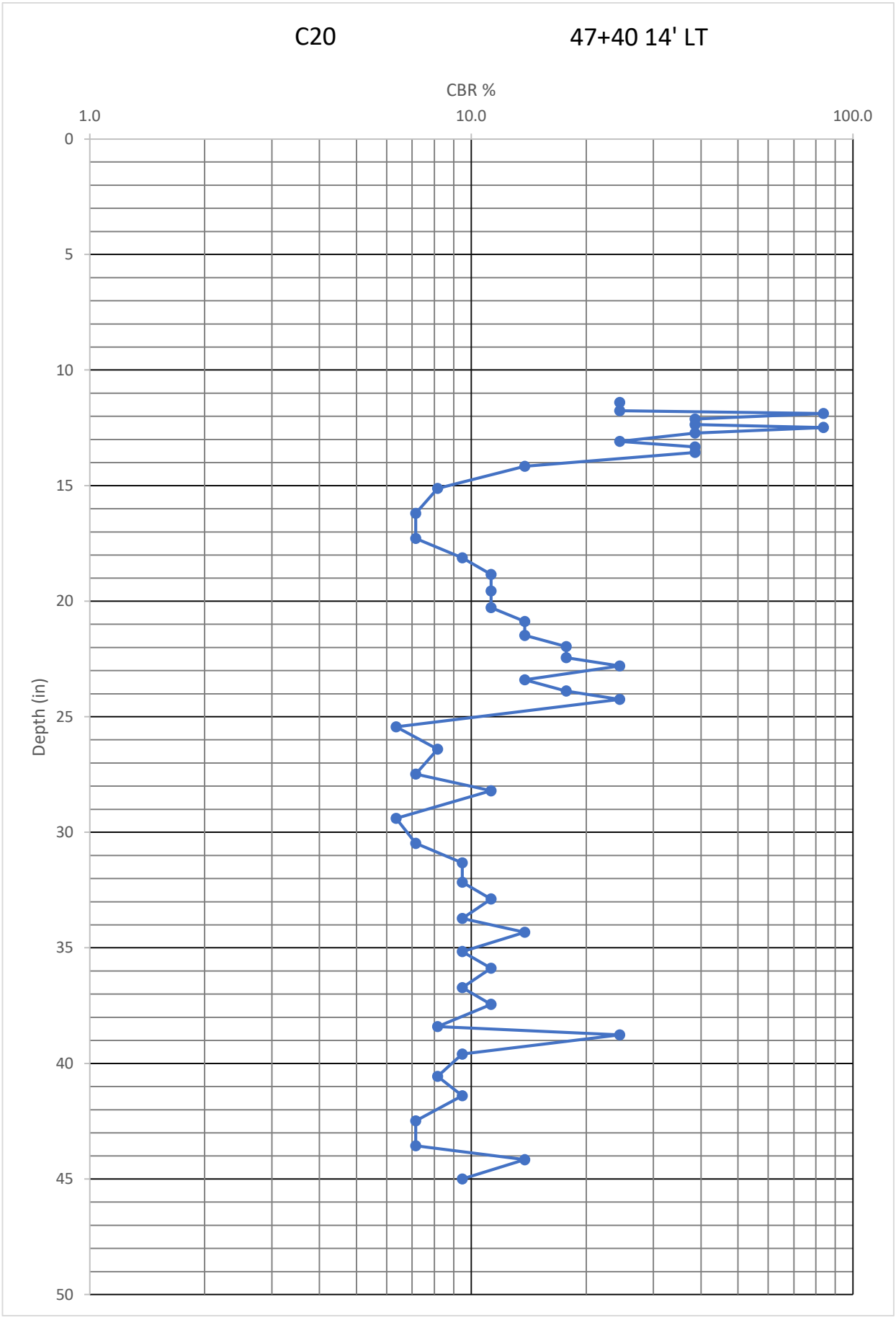

C15
50+24 CL
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
Depth (in)

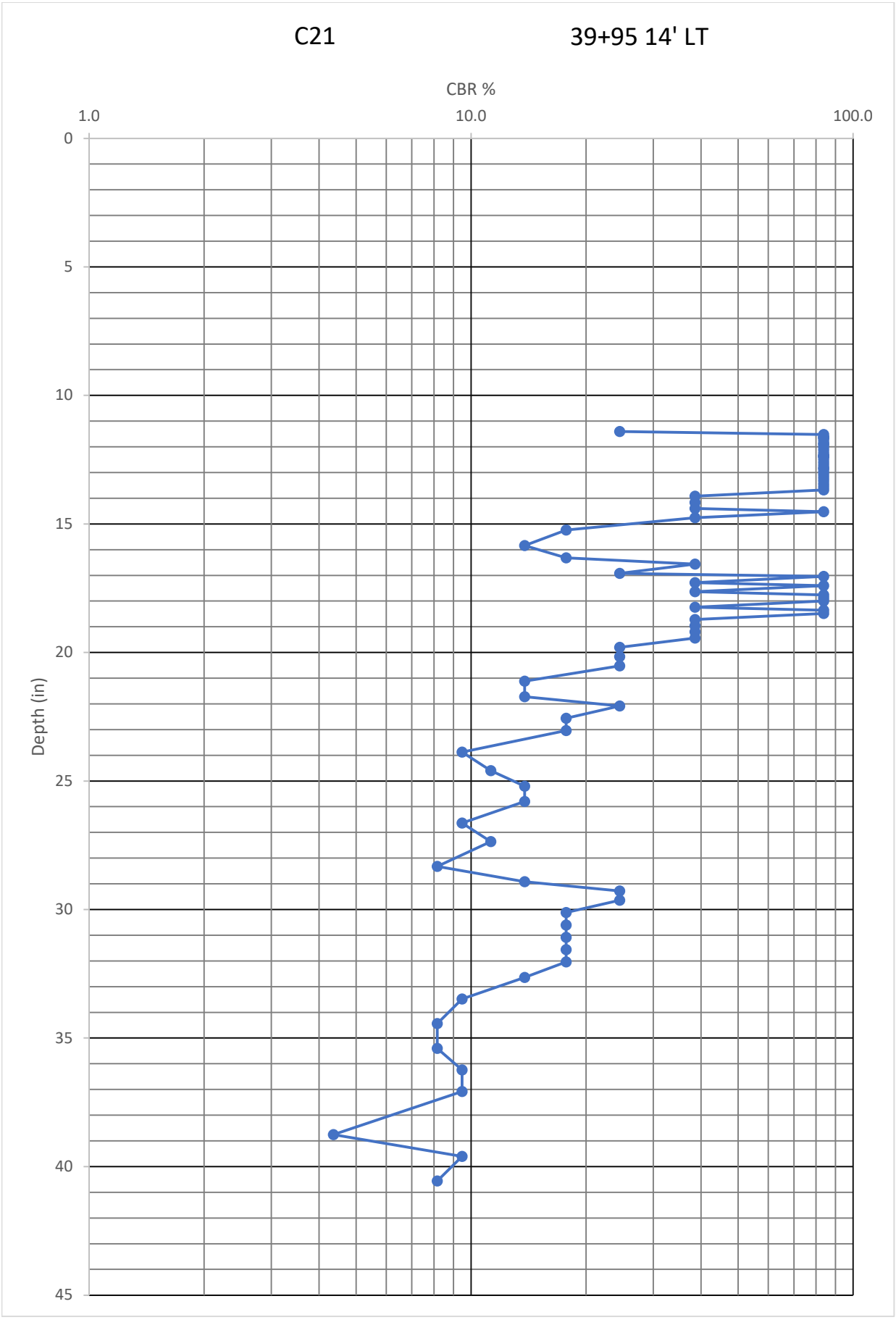

C16
47+40 CL
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
Depth (in)

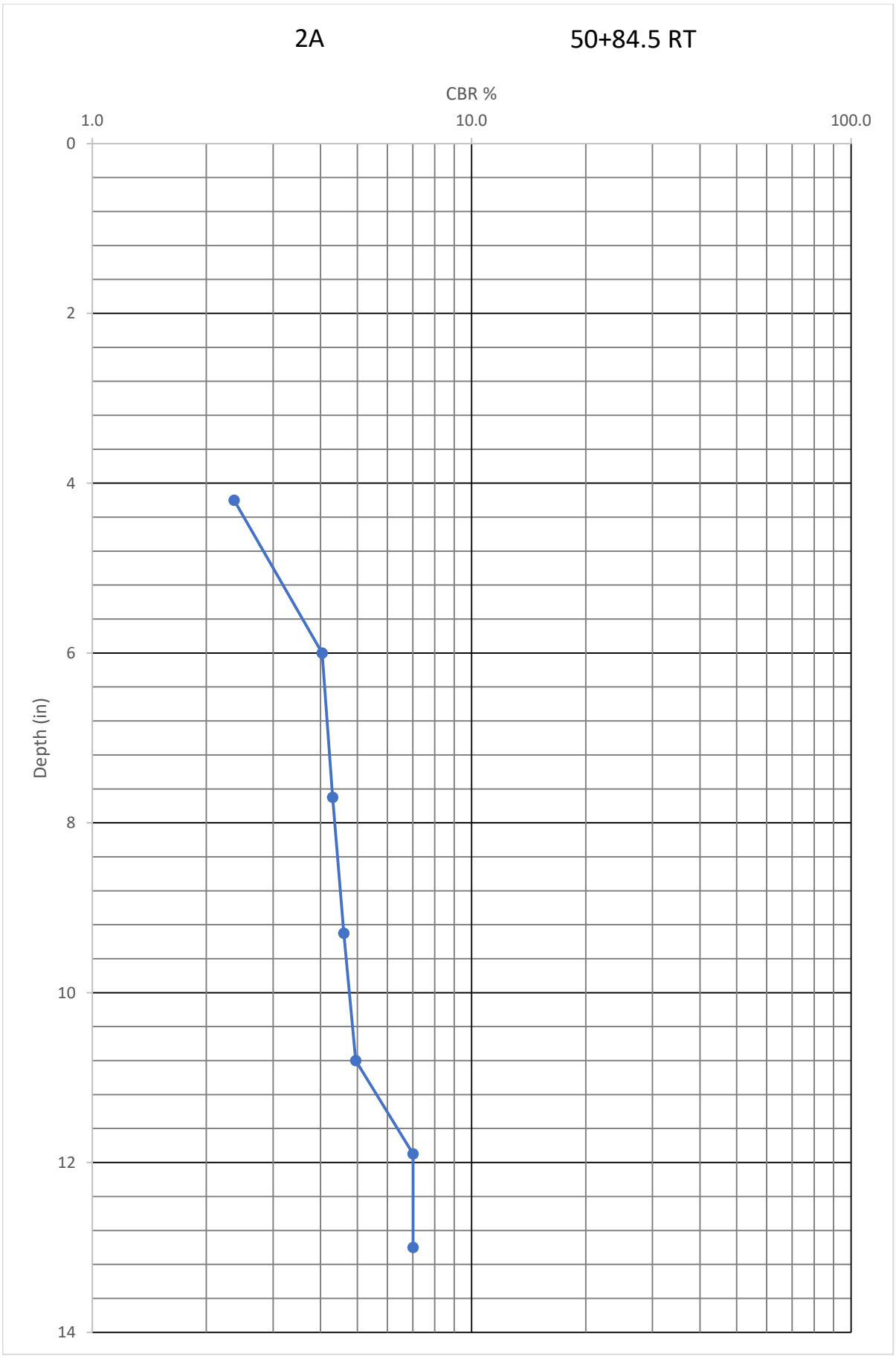

C17
66+12 13' LT
CBR %
1.0
10.0
100.0
0
10
20
30
40
50
60
Depth (in)

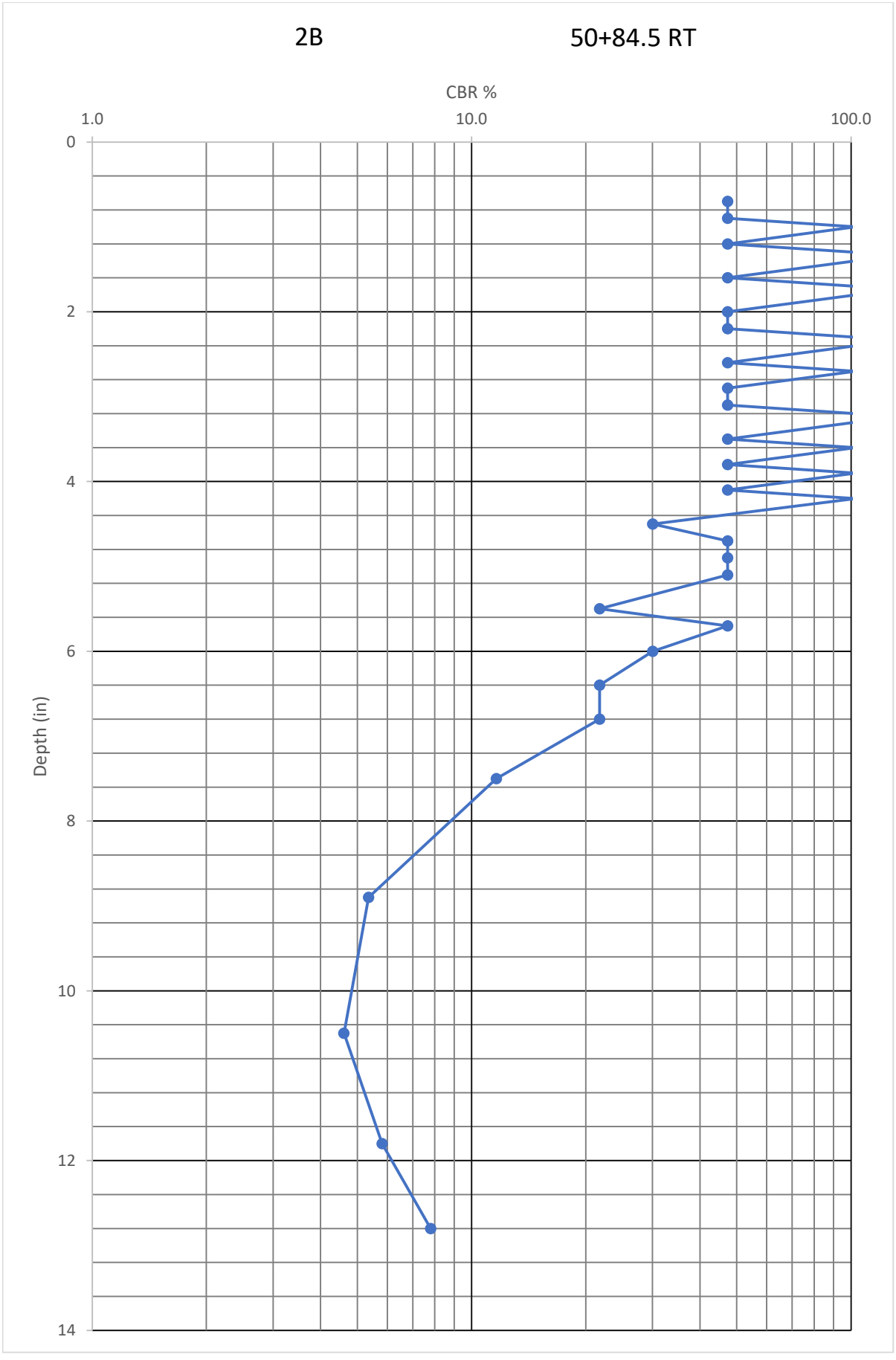

C18
62+98 13.5' LT
CBR %
1.0
10.0
100.0
0
10
20
30
40
50
60
Depth (in)

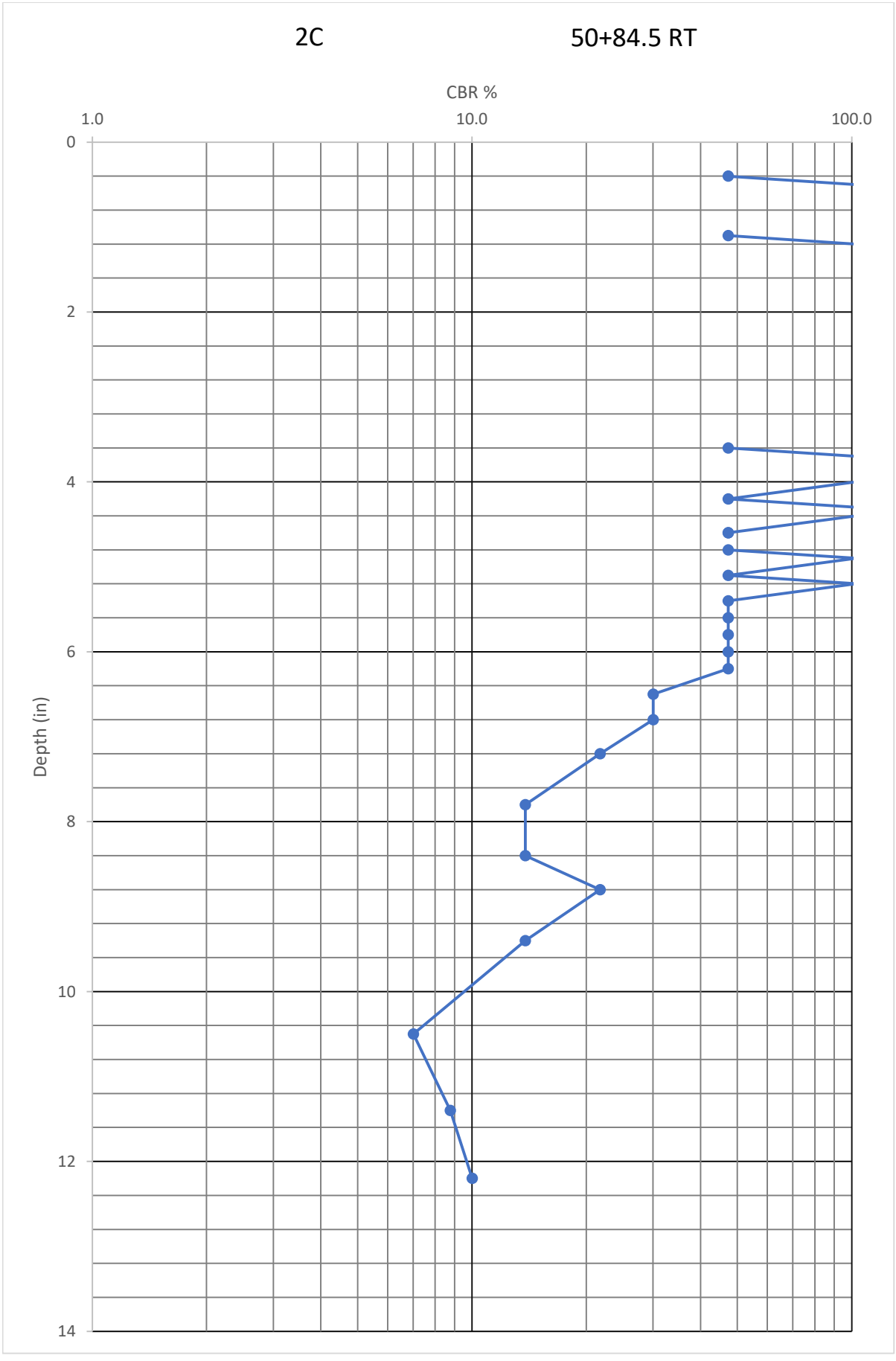

C19
56+39 13' LT
CBR %
1.0
10.0
100.0
0
10
20
30
40
50
60
Depth (in)

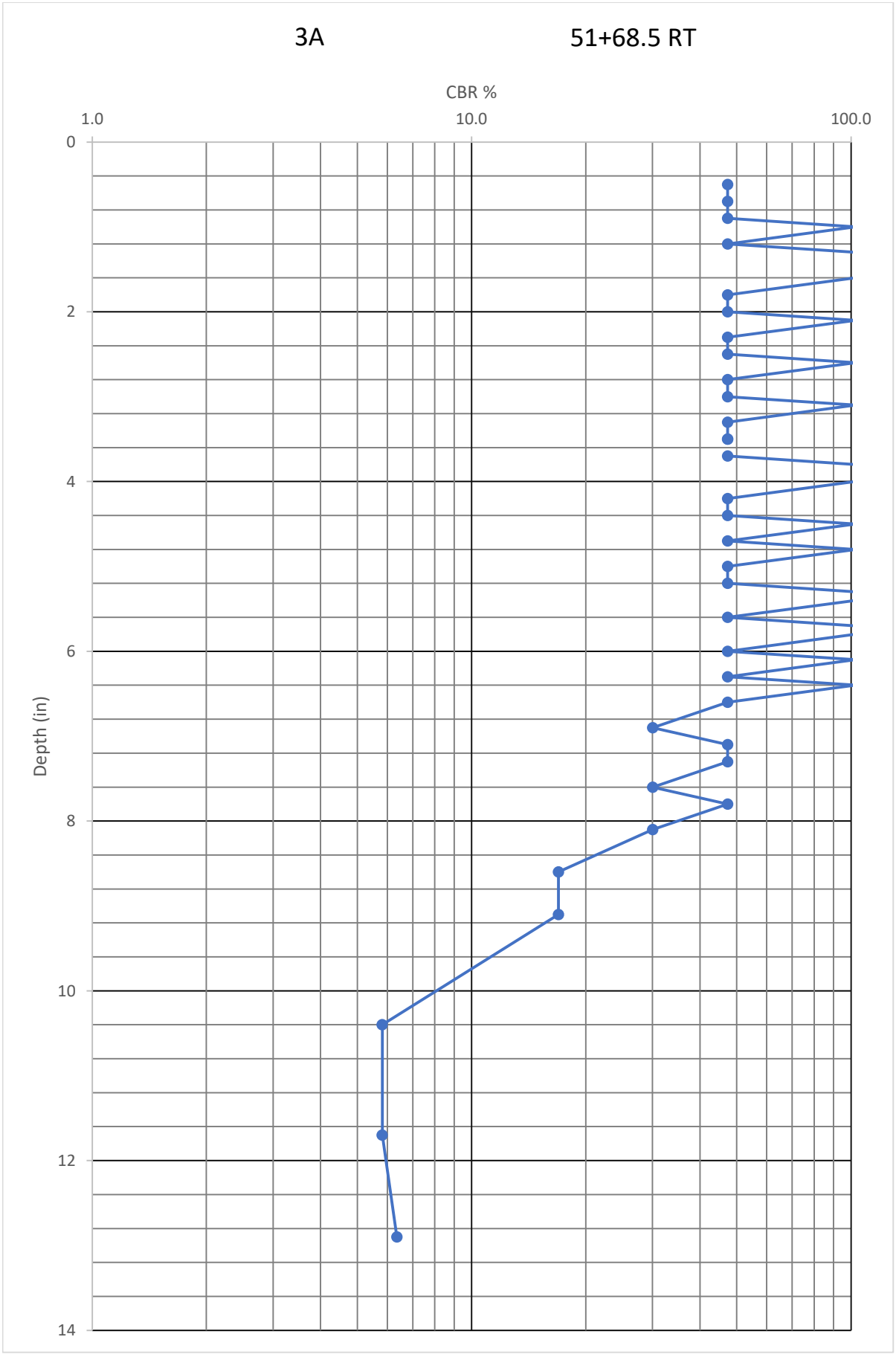

C20
47+40 14' LT
CBR %
1.0
10.0
100.0
Depth (in)
0
5
10
15
20
25
30
35
40
45
50

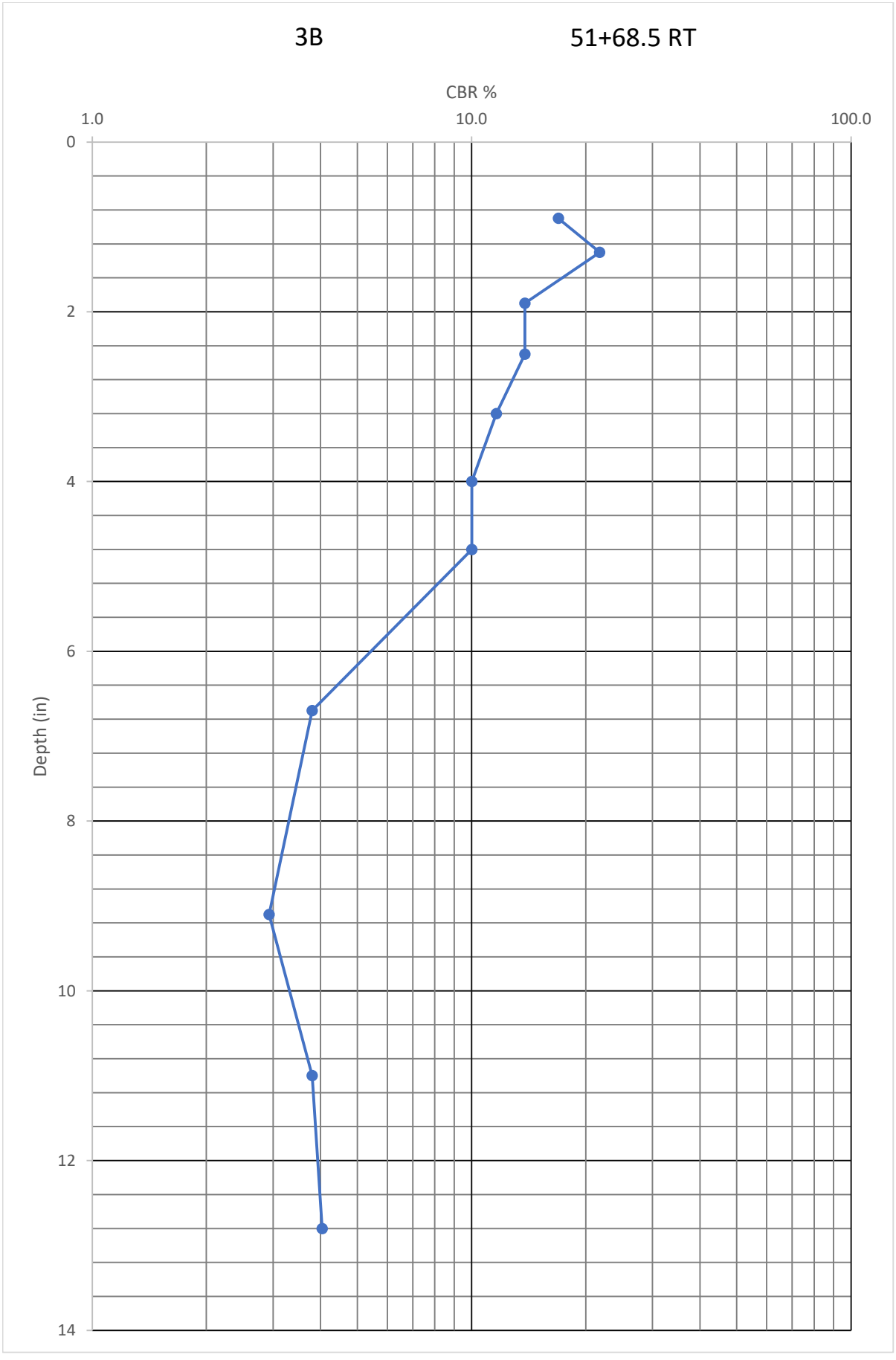

C21
39+95 14' LT
CBR %
1.0
10.0
100.0
0
5
10
15
20
25
30
35
40
45
Depth (in)

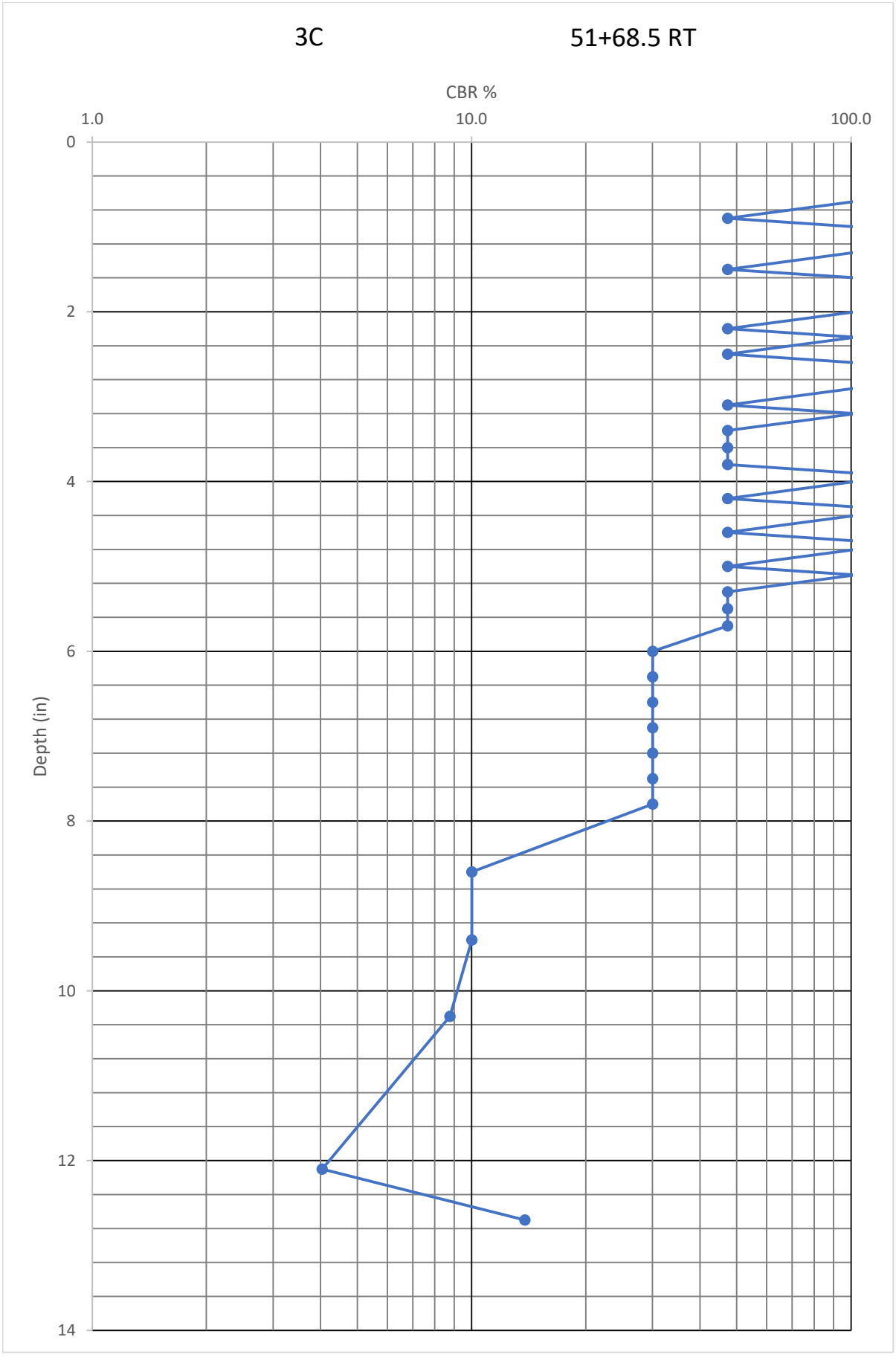

2A
50+84.5 RT
CBR %
1.0
10.0
100.0
0
2
4
6
8
10
12
14
Depth (in)


2B
50+84.5 RT
CBR %
1.0
10.0
100.0
0
2
4
6
8
10
12
14
Depth (in)

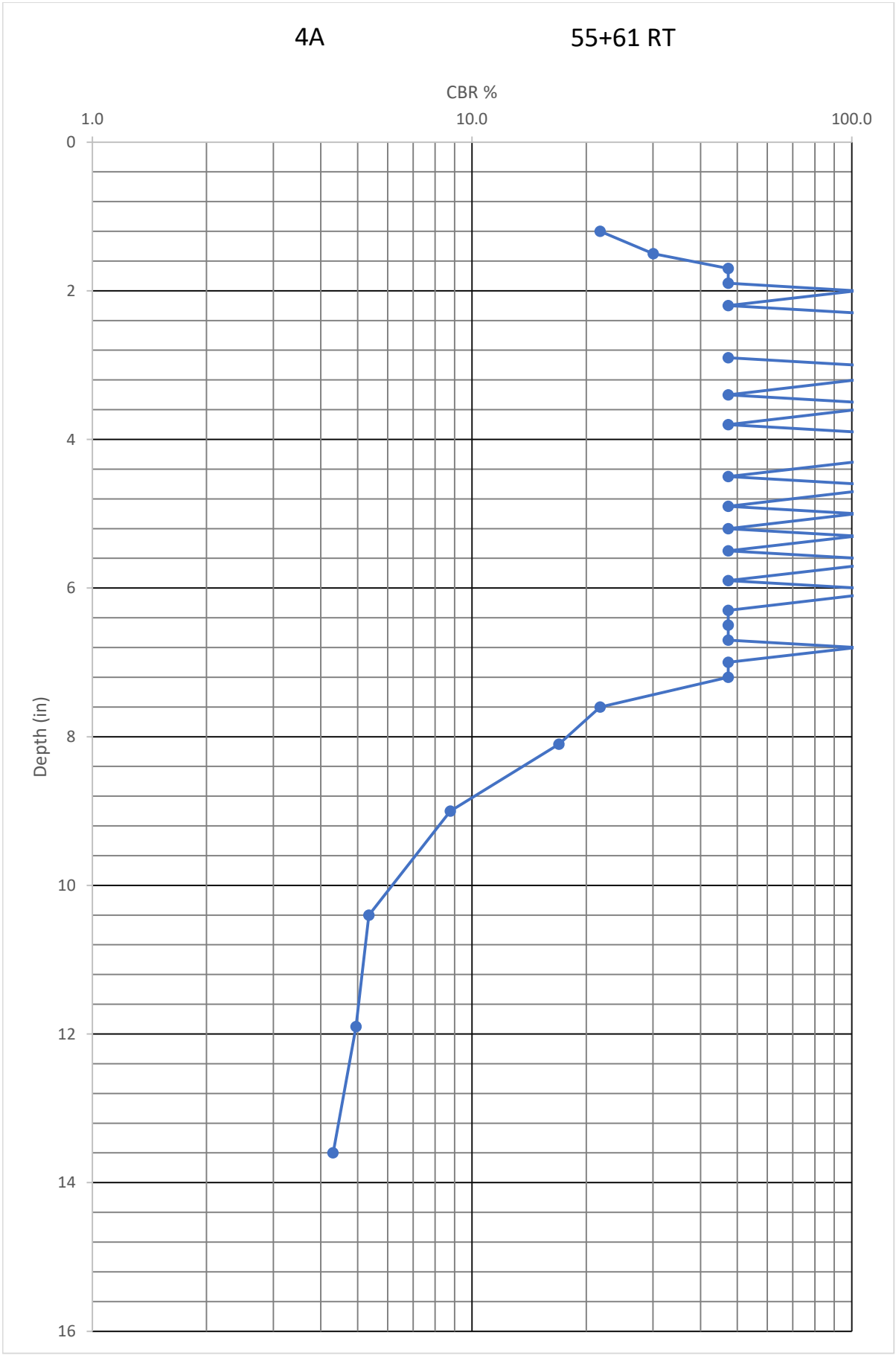

2C
50+84.5 RT
CBR %
1.0
10.0
100.0
0
2
4
6
8
10
12
14
Depth (in)

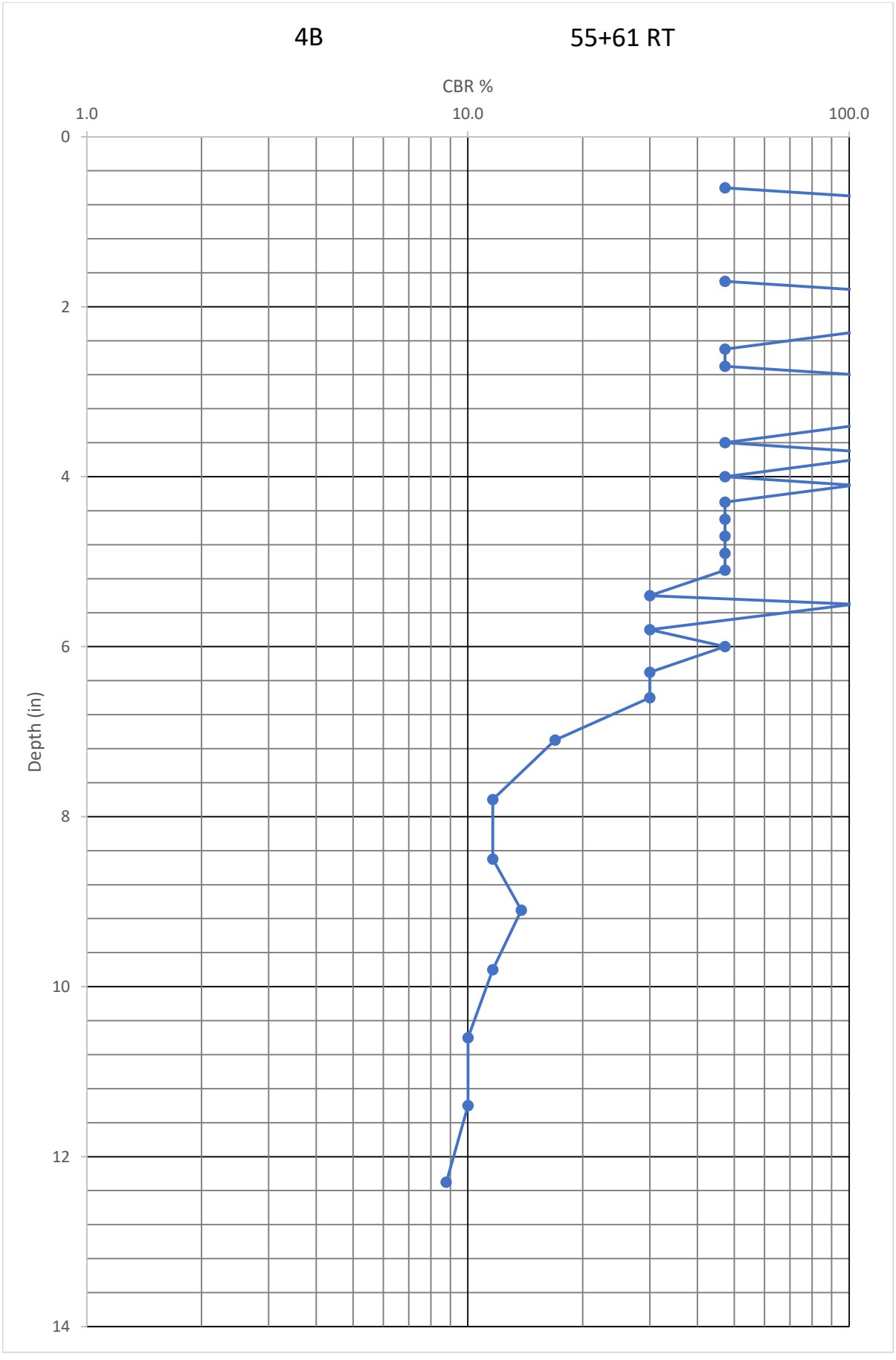

3A
51+68.5 RT
CBR %
1.0
10.0
100.0
0
2
4
6
8
10
12
14
Depth (in)

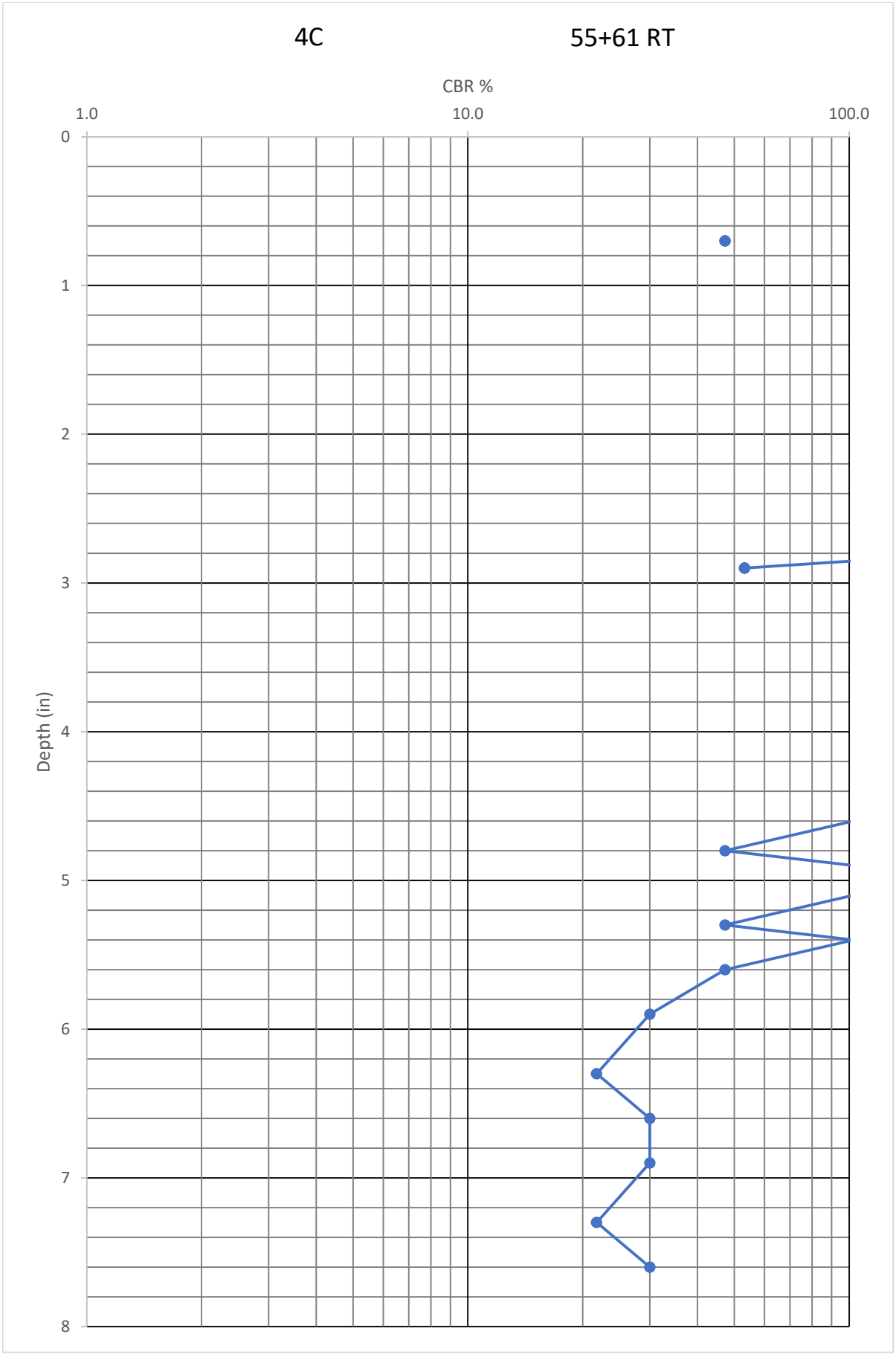

3B
51+68.5 RT
CBR %
1.0
10.0
100.0
0
2
4
6
8
10
12
14
Depth (in)

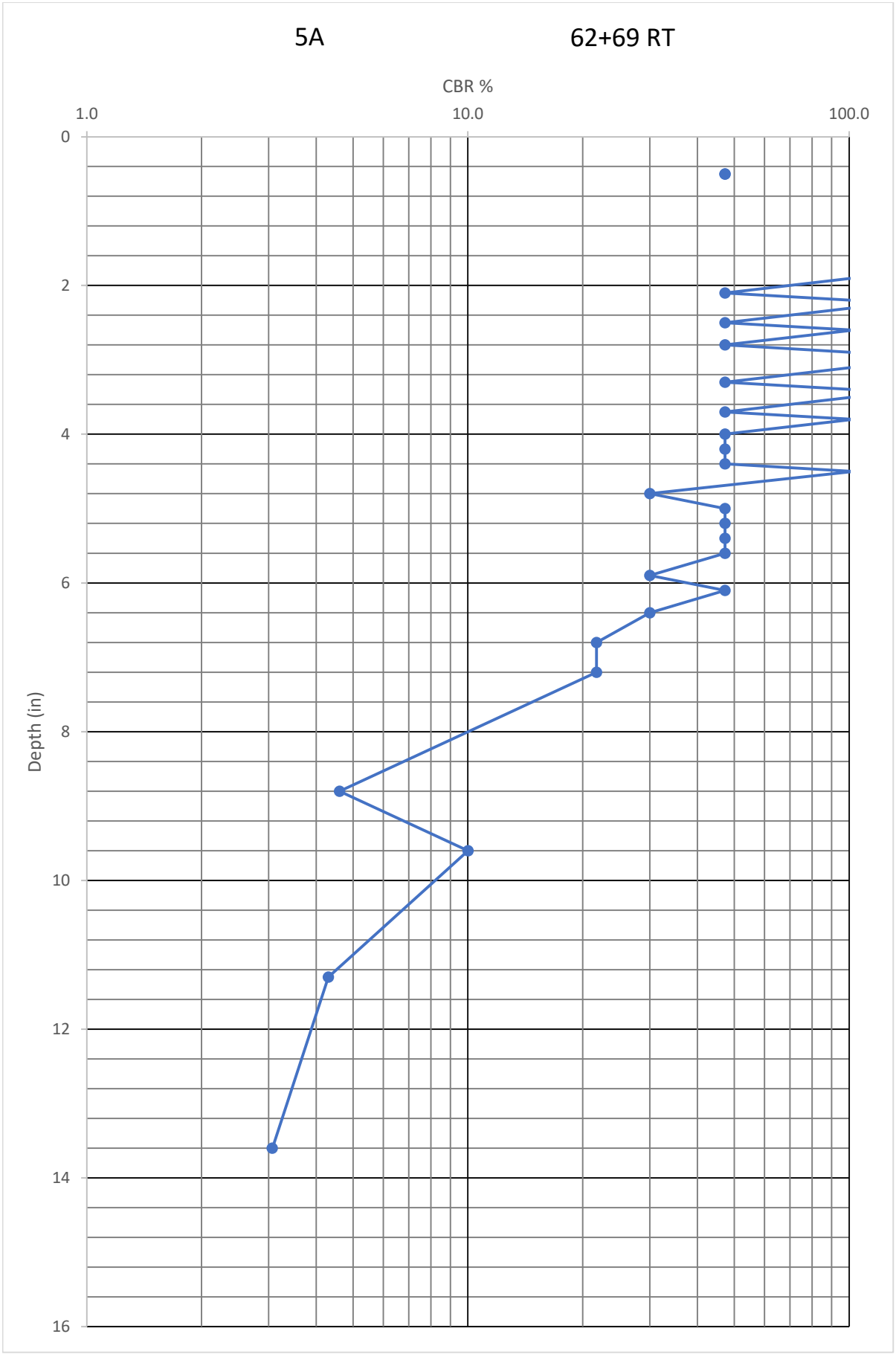

3C
51+68.5 RT
CBR %
1.0
10.0
100.0
0
2
4
6
8
10
12
14
Depth (in)

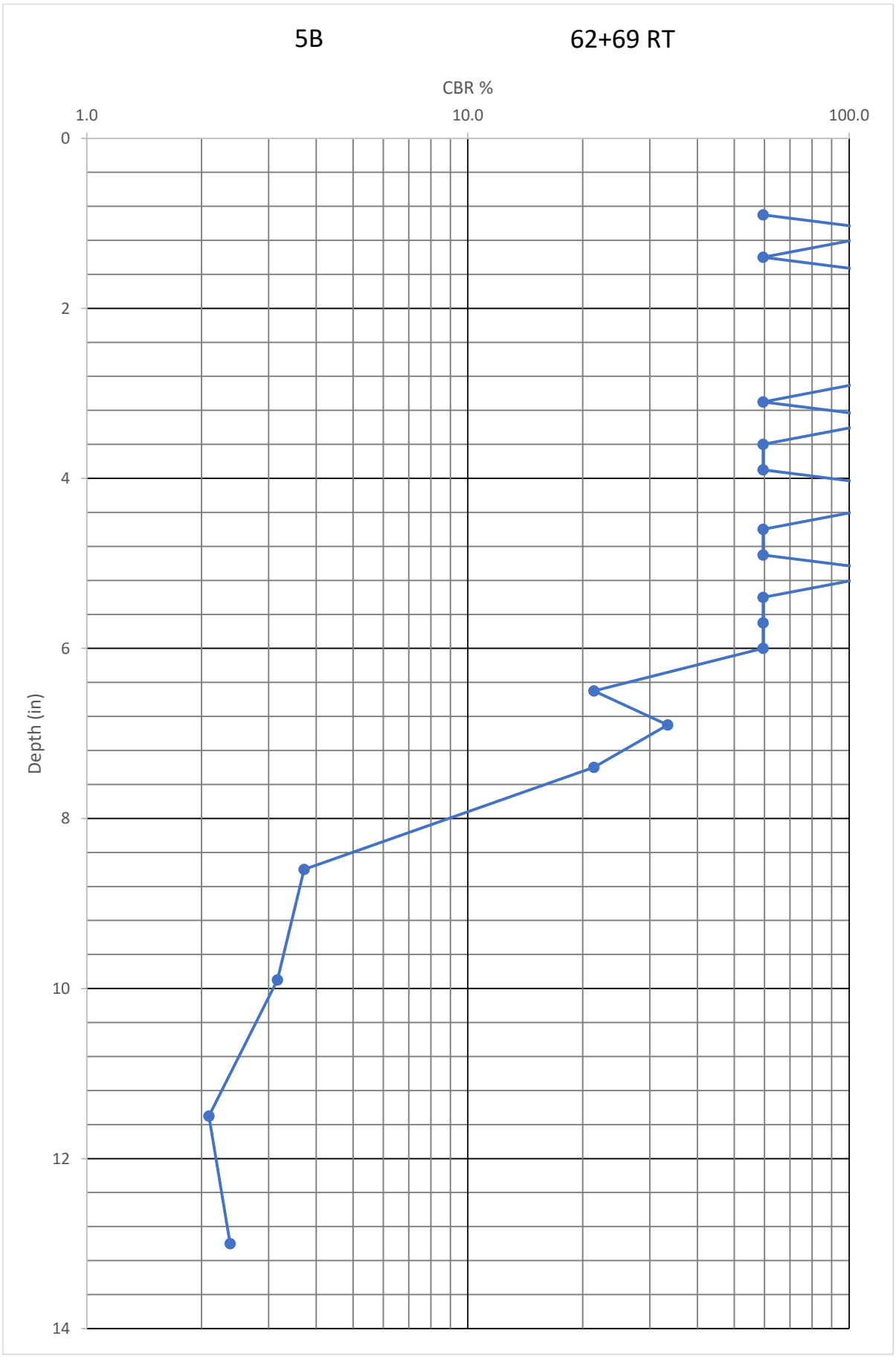
4A 55+61 RT

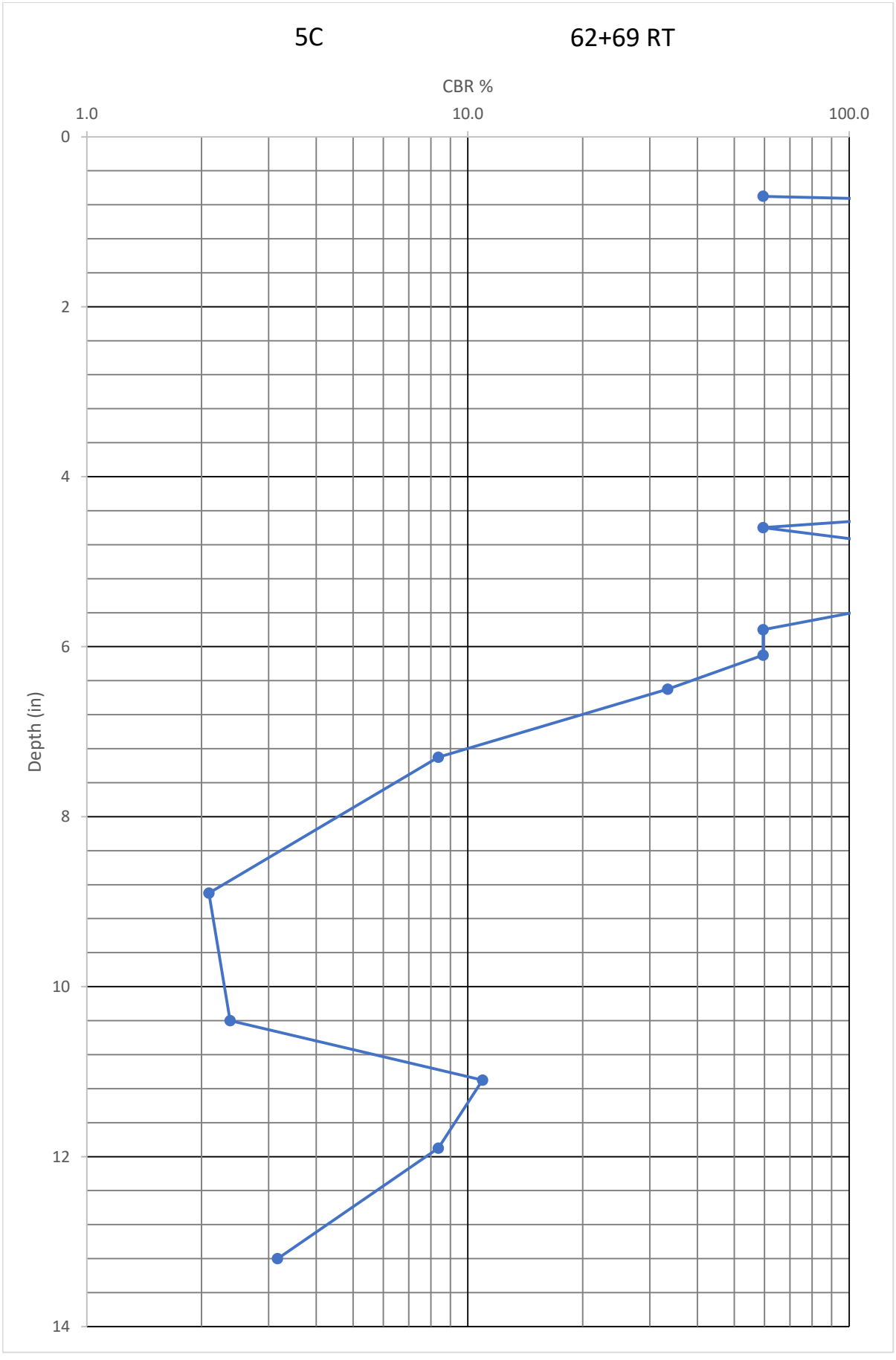


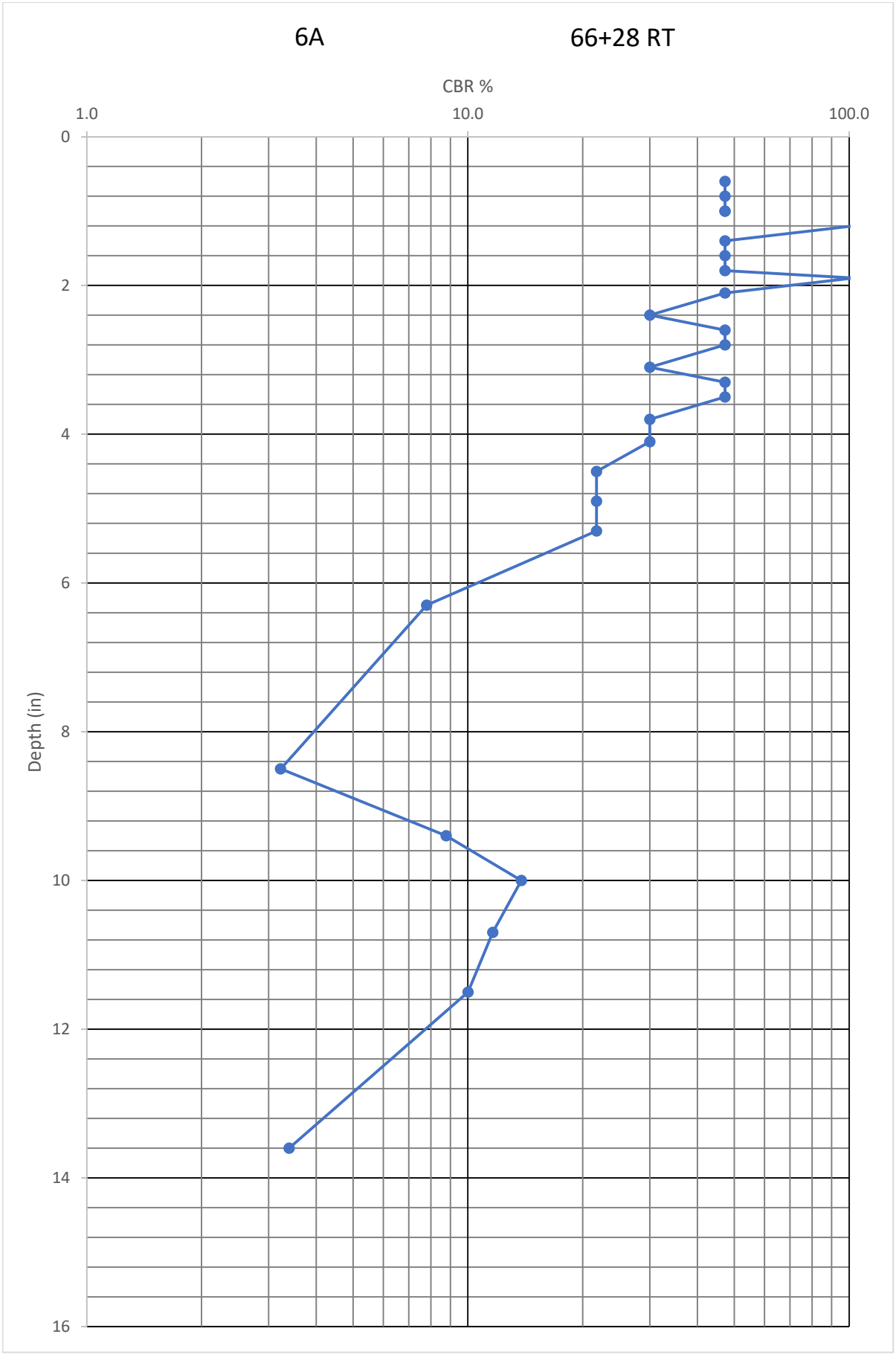

4B
55+61 RT
CBR %
1.0
10.0
100.0
0
2
4
6
8
10
12
14
Depth (in)

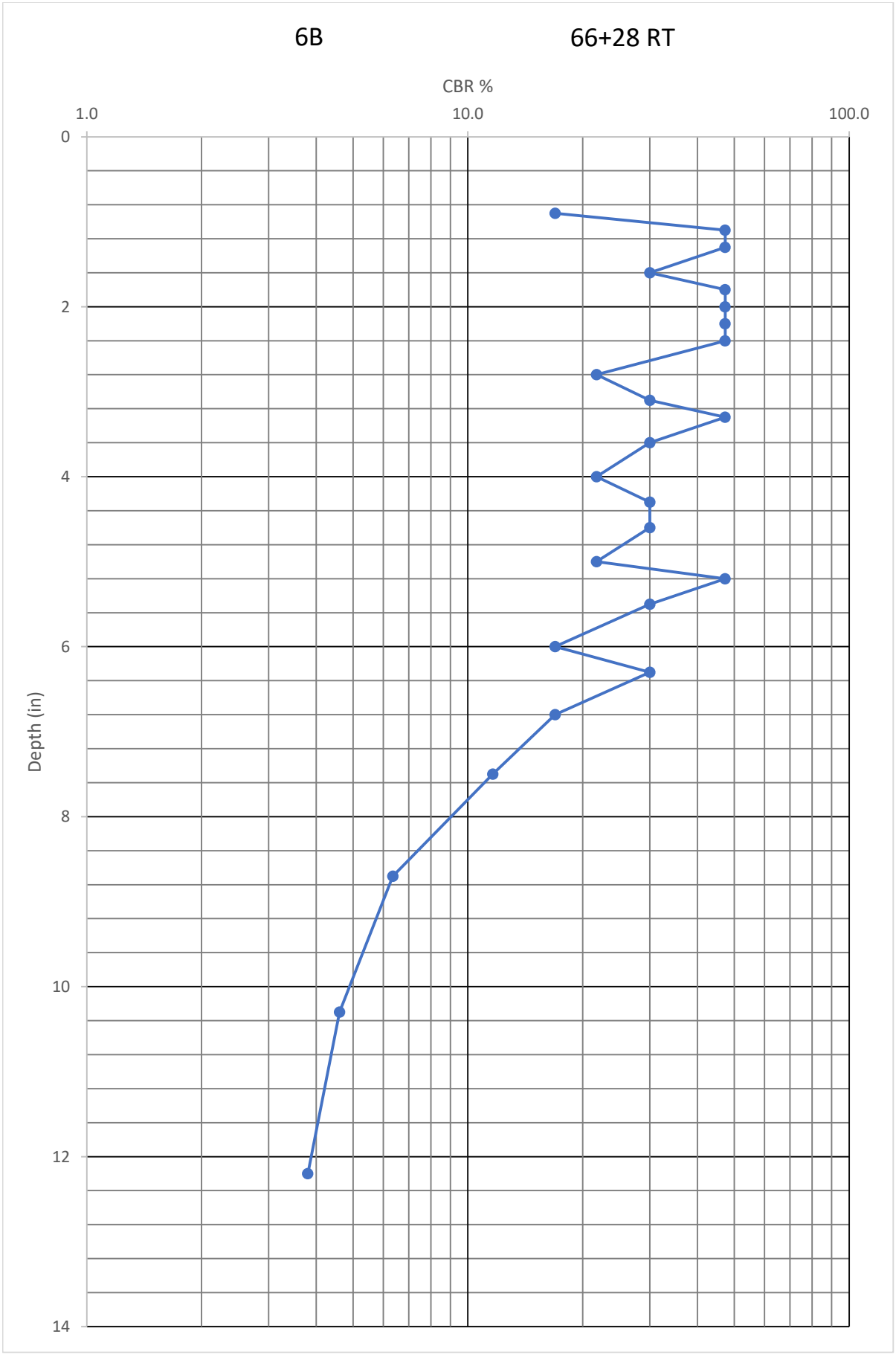

4C
55+61 RT
CBR %
1.0
10.0
100.0
Depth (in)
0
1
2
3
4
5
6
7
8

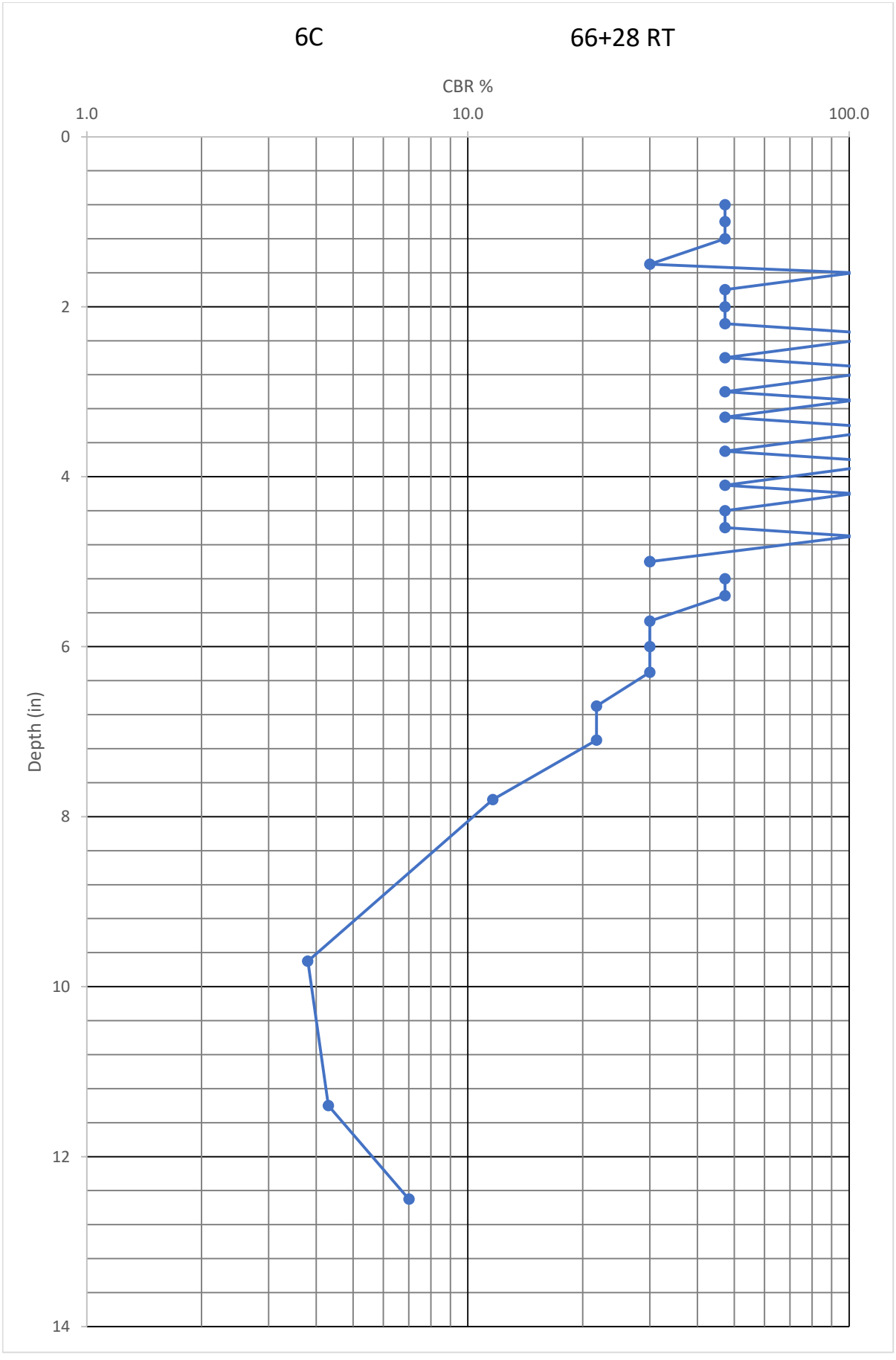

5A
62+69 RT
CBR %
1.0
10.0
100.0
Depth (in)
0
2
4
6
8
10
12
14
16


5B
62+69 RT
CBR %
1.0
10.0
100.0
0
2
4
6
8
10
12
14
Depth (in)


5C
62+69 RT
CBR %
1.0
10.0
100.0
0
2
4
6
8
10
12
14
Depth (in)


6A
66+28 RT
CBR %
1.0
10.0
100.0
Depth (in)
0
2
4
6
8
10
12
14
16


6B
66+28 RT
CBR %
1.0
10.0
100.0
0
2
4
6
8
10
12
14
Depth (in)


6C
66+28 RT
CBR %
1.0
10.0
100.0
0
2
4
6
8
10
12
14
Depth (in)