



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

PAT MCCRORY
GOVERNOR

ANTHONY J. TATA
SECRETARY

April 10, 2013

MEMORANDUM TO: Judith Corley-Lay, P.E., Ph.D.
State Pavement Management Engineer

J. A. Bennett, P. E.
State Roadway Design Engineer

FROM: 
John L. Pilschuk, P.E., P.G.
State Geotechnical Engineer

STATE PROJECT: 34506.1.1 (R-2814C) - Turnkey
F. A. PROJECT: STP-401(4)
COUNTY: Wake
DESCRIPTION: US 401 from NC 96 to SR 1103

SUBJECT: Geotechnical Recommendations for Pavement Design

This report contains pavement design recommendations for the above referenced project. The proposed work consists of constructing two additional lanes on new location and widening the existing two-lane roadway to construct a four-lane divided roadway with center turn lanes.

The length of this project is 6.43 miles

Soils: The predominant soil types for the project consists of residual silty sands (A-2-4), sandy silt (A-4) and silty clays (A-7-5, A-7-6). Bulk sample were collected and tested for Resilient Modulus and chemical stabilization. The Resilient Modulus results were not returned at the time of this report. The project mainline is approximately 55 percent embankment. The design soil types are sandy/clayey silts.

CHEMICAL RESULTS				
UNCONFINED COMPRESSIVE STRENGTHS				
4% LIME			8% CEMENT	
MR-1X (A-5)	MR-2X (A-7-5)	MR-3X (A-4)	MR-1X (A-5)	MR-3X (A-4)
97 psi	87 psi	167 psi	233 psi	469 psi

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GEOTECHNICAL ENGINEERING UNIT
1589 MAIL SERVICE CENTER
RALEIGH NC 27699-1589

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LOCATION:
CENTURY CENTER COMPLEX
ENTRANCE B-2
1020 BIRCH RIDGE DRIVE
RALEIGH NC

PAVEMENT CORES FOR

ATTACHMENT 2

34506.1.1, R-2814C, Wake County

LINE	STATION	ABC (in)	LAYER THICKNESS (in)	LAYERS	REMARKS
L	43+75 LT OSL (WDNG)	NE	4 1/2	S	3 lifts
			5 1/2	B	1 lift
L	43+75 LTL (OML)	SAND	3	S	2 lifts, low severity stripping
			6 3/4	OML	Original asphalt has what appears as a mat seals on top and bottom of larger stone and a lift of surface in the middle. The layer has a higher AC content.
L	81+00 LT PS	SAND	3	S	2 lifts, low severity stripping in top lift.
			6	B	1 lift, high severity stripping
L	81+00 LT LN (O) (OML)	SAND	5	S	4 lifts, full depth crack, delaminated between lifts 3 and 4. Lifts 3-4 have high severity stripping
			3 1/2	OML	Original asphalt has what appears as a mat seals on top and bottom of larger stone and a lift of surface in the middle. The layer has a higher AC content. 81+00 RT LN Ref 81+00 LT LN (bottom 31/2
L	81+00 LT LN (I) (OML)	SAND	4 1/2	S	4 lifts, second lift has moderate severity stripping and has separated between the layer.
			3	OML	Original asphalt has what appears as a mat seals on top and bottom of larger stone and a lift of surface in the middle. Low severity stripping in top 2 lifts.
L	81+00 RT LN (OML)	SAND	-	-	Top 3 inches surface the remaining core is crumbled reference sta. 81+00 LT for description.
L	120+00 RT LN (WDNG)	SAND	1 1/2	S	1 lift
			2	I	1 lift
			3 1/2	B	1 lift
L	122+00 LT LN (WDNG)	NE	2 1/4	S	2 lifts
			2 1/2	I	1 lift
			4 3/4	B	1 lift
L	135+00 LT PS	NE	3	S	2 lifts, Top lift has low severity stripping
			5	B	1 lift, moderate severity stripping with some loss of aggregate
			4 1/4	S	4 lifts
L	135+00 LT LN (O) (OML)	SAND	3 1/2	OML	Original asphalt has what appears as a mat seals on top and bottom of larger stone and a lift of surface in the middle. Low severity stripping in top 2 lifts. 6 1/4 in. bottom-up crack.
L	135+00 LT LN (I) (OML)	SAND	4	S	4 lifts
			3	OML	Original asphalt has what appears as a mat seals on top and bottom of larger stone and a lift of surface in the middle.
L	135+00 RT PS	SAND	3	S	3 lifts, low severity stripping in top 1 in.
			4	B	1 lift, moderate to high severity stripping with some loss of aggregate

PAVEMENT CORES FOR

34506.1.1, R-2814C, Wake County

ATTACHMENT 2

LINE	STATION	ABC (in)	LAYER THICKNESS (IN)	LAYERS	REMARKS
L	193+00 RT PS	NE	3 5 4 3/4	S B S	3 lifts, low severity stripping in top 1 in. 1 lift 4 lifts
L	193+00 RT LN (O) (OML)	SAND	3 1/2	OML	Original asphalt has what appears as a mat seals on top and bottom of larger stone and a lift of surface in the middle.
L	193+00 RT LN (I) (OML)	SAND	4	S	4 lifts, lift 3 is detached from lift 2 and lifts 3 and 4 appear dry and brittle. Low to moderate stripping in 3 and 4. These lifts may be problematic during milling in some areas.
L	215+00 RT LN (WDNG)	SAND	3 9 3/4	I B	Original asphalt has what appears as a mat seals on top and bottom of larger stone and a lift of surface in the middle. 3 lifts, low severity stripping 1 lift, low severity stripping 1 lift, low severity stripping
L	217+00 LT LN (WDNG)	SAND	3 9	S B	2 Lifts, low severity stripping 1 lift, low severity stripping
L	217+16 LTL (OML)	SAND	7 3 1/2	S OML	5 lifts, some low severity stripping, lift 3 and 4 seperated. Original asphalt has what appears as a mat seals on top and bottom of larger stone and a lift of surface in the middle.
L	268+25 RT PS	NE	3 1/4 5 1/4	S B	3 lifts, low severity stripping in top 1 in. 1 lift
L	268+25 RT LN (O)	SAND	4	S	3 lifts,
L	268+25 RT LN (I)	SAND	3 4	OML S	Original asphalt has what appears as a mat seals on top and bottom of larger stone and a lift of surface in the middle. 3 lifts
L	297+50 LT PS	NE	3 1/2	OML	Original asphalt has what appears as a mat seals on top and bottom of larger stone and a lift of surface in the middle.
L	300+50 RTL (LT)	NE	4 3/4	S	3 lifts, low severity stripping along contacts of lifts
L	321+00 LT PS	NE	4 3/4	S	Ref. 297+50 LT PS
L	321+00 LT LN (O)	NE	3 3/4 4 4 1/2	S B S	3 lifts, top lift has low to moderate severity stripping 1 lift, moderate to high severity stripping 4 lifts, full depth crack, lifts 2 and 3 have seperated
L	321+00 LT LN (I)	NE	3 1/4 5 2 1/2	OML S OML	Original asphalt has what appears as a mat seals on top and bottom of larger stone and a lift of surface in the middle. 4 lifts Original asphalt has what appears as a mat seals on top and bottom of larger stone and a lift of surface in the middle.

OML = Original Mainline

PAVEMENT CORES FOR

34506.1.1, R-2814C, Wake County

ATTACHMENT 2

LINE	STATION	ABC (in)	LAYER THICKNESS (IN)	LAYERS	REMARKS
L	356+50 RT LN (WDNG)	SAND	2	S	2 lifts
L	365+50 RT PS	SAND	7 1/2	B	1 lift, low severity stripping at 4 inches
L	360+00 LTL (OML)	SAND	7 1/2	-	Ref. 356+50 RT LN
L	360+00 LTL (OML)	SAND	5	S	4 lifts
L	360+00 LT LN (WDNG)	SAND	2	OML	Original asphalt has what appears as a mat seals on top and bottom of larger stone and a lift of surface in the middle. 5 in bottom-up crack.
L	360+00 LT LN (WDNG)	SAND	2 1/2	S	2 lifts
L	360+00 LT LN (WDNG)	SAND	5 1/4	B	1 lift, bottom 2 inches has moderate severity stripping

DESIGN AND CONSTRUCTION RECOMMENDATIONS

I. Embankment Stability

A. Geotextile for Pavement Stabilization

The following areas may need Geotextile for Pavement Stabilization. These areas should be investigated during construction.

<u>LINE</u>	<u>STATIONS</u>
-L-	64+00 - 66+00
-L-	106+50 - 108+50
-L-	136+00 - 138+00
-L-	205+50 - 207+50
-L-	229+50 - 231+00

Recommend 4,200 square yards of Geotextile for Pavement Stabilization for these areas.

II. Subgrade Stability

A. Stabilize subgrade for the proposed lanes on new location as follows:

(a) Lime stabilization (method-slurry) 40% of project; 20lbs/yd² @ 8 in. depth.

(b) Cement Stabilization 60% of project; 55lbs/yd² @ 7 in. depth.

B. Stabilizer Aggregate

Recommend a quantity of 500 tons of stabilizer aggregate be included in the project contract as a contingency item.

III. Miscellaneous

A. Proof Rolling

It is recommended that proof rolling be performed on this project and should conform to Standard Specifications, Section 260.

B. Recommend a quantity of 15 tons of blotting sand be included in the project contract as a contingency item.

Note: For additional recommendations and quantities refer to the forthcoming Geotechnical Report- Final Design and Construction Recommendations.

JLP/JBB

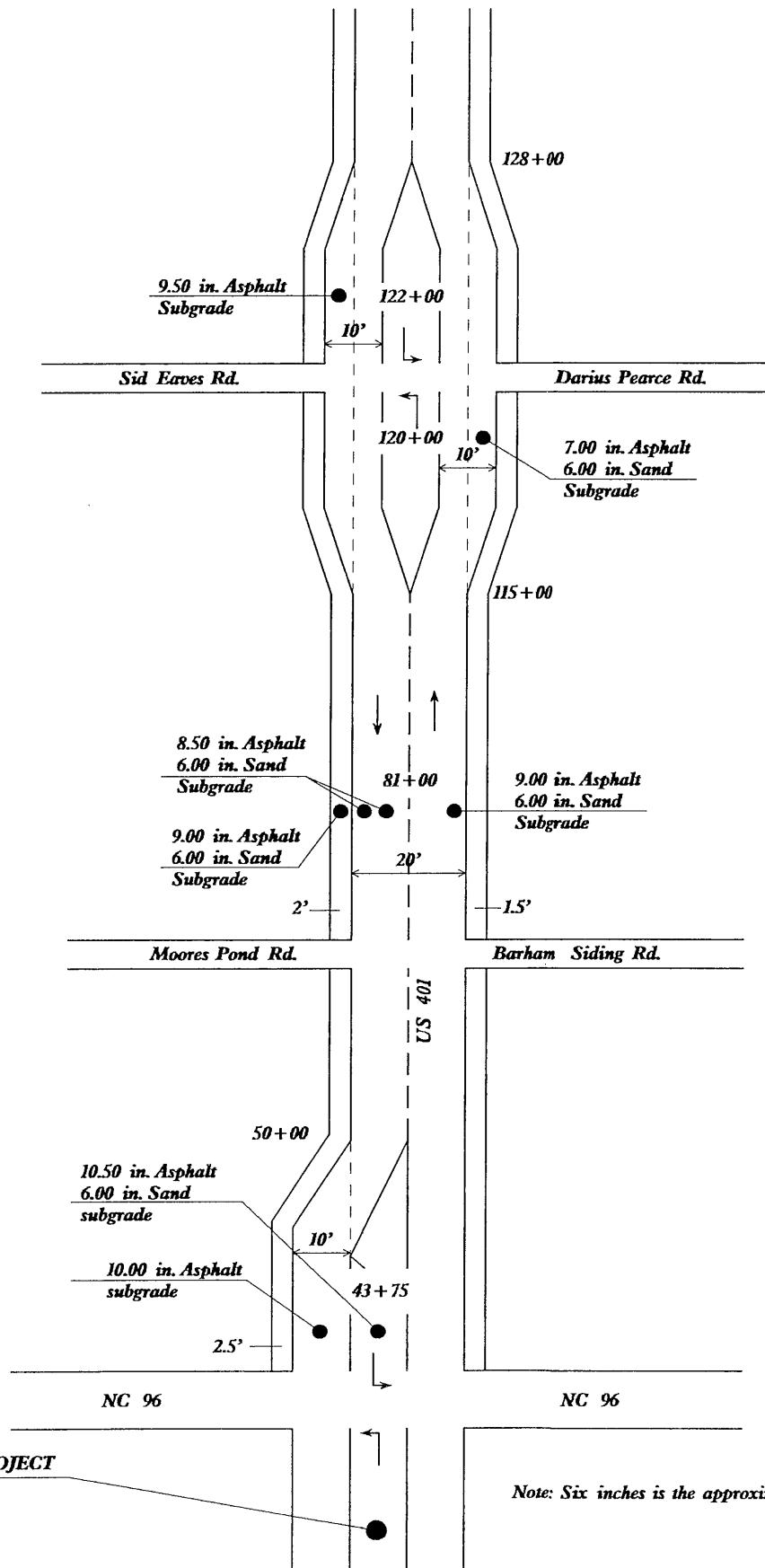
Attachments:

1. Pavement Design Sketch	3
2. Core Evaluation Sheet	3
3. Dynamic Cone Penetrometer Tests	12
4. Core Photographs	4

Item Number	Description	Quantity	Comment
Generic	Geotextile for Pavement Stabilization	4,200 SY	See Section I. Item A.
1110000000-E	Stabilizer Aggregate	500 TONS	See Section II. Item B.
0192000000-N	Proof Rolling	HR	See Section III. Item A.
2143000000-E	Blotting Sand	15 TONS	Section III. Item B.

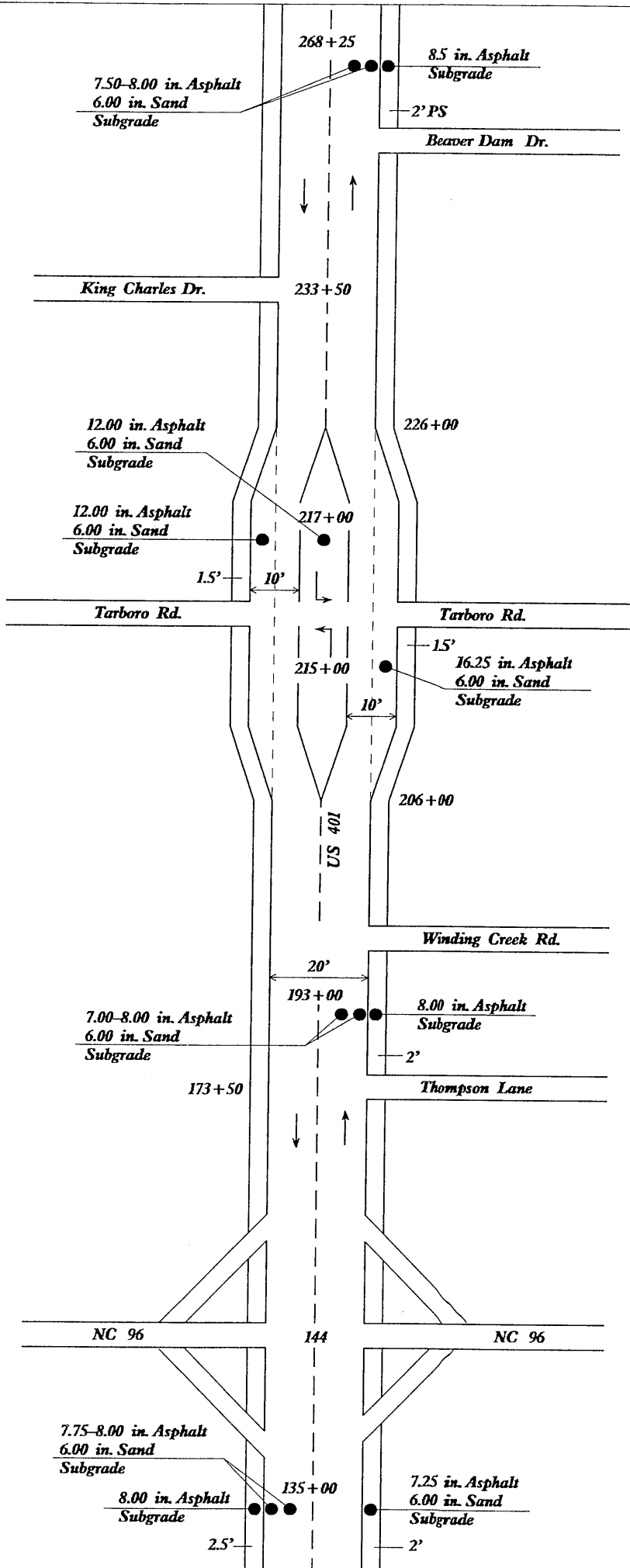
State Project No.: 34506.1.1 (R-2814C) Wake County

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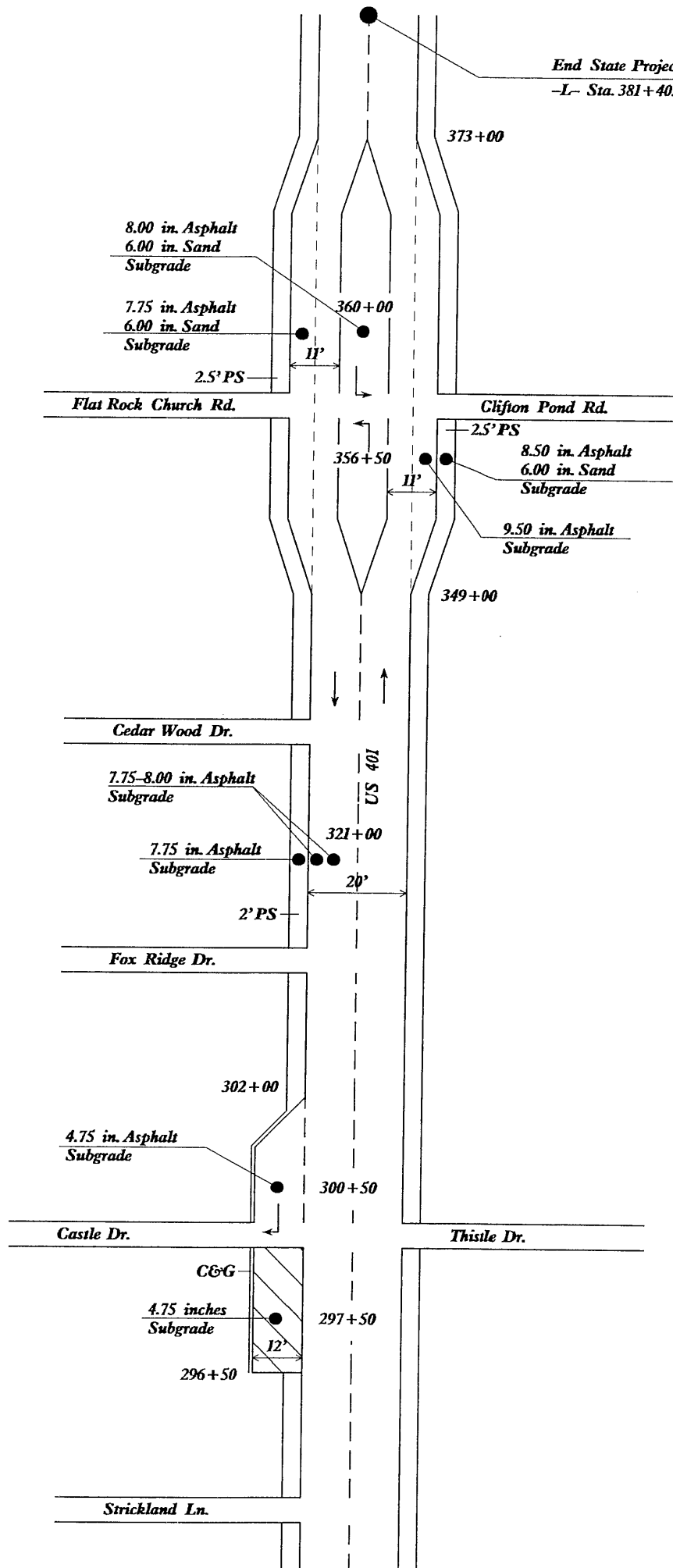


BEGIN STATE PROJECT
-L- STA. 33+00

Note: Six inches is the approximate thickness of the sand layer.



End State Project
-L- Sta. 381+40.55

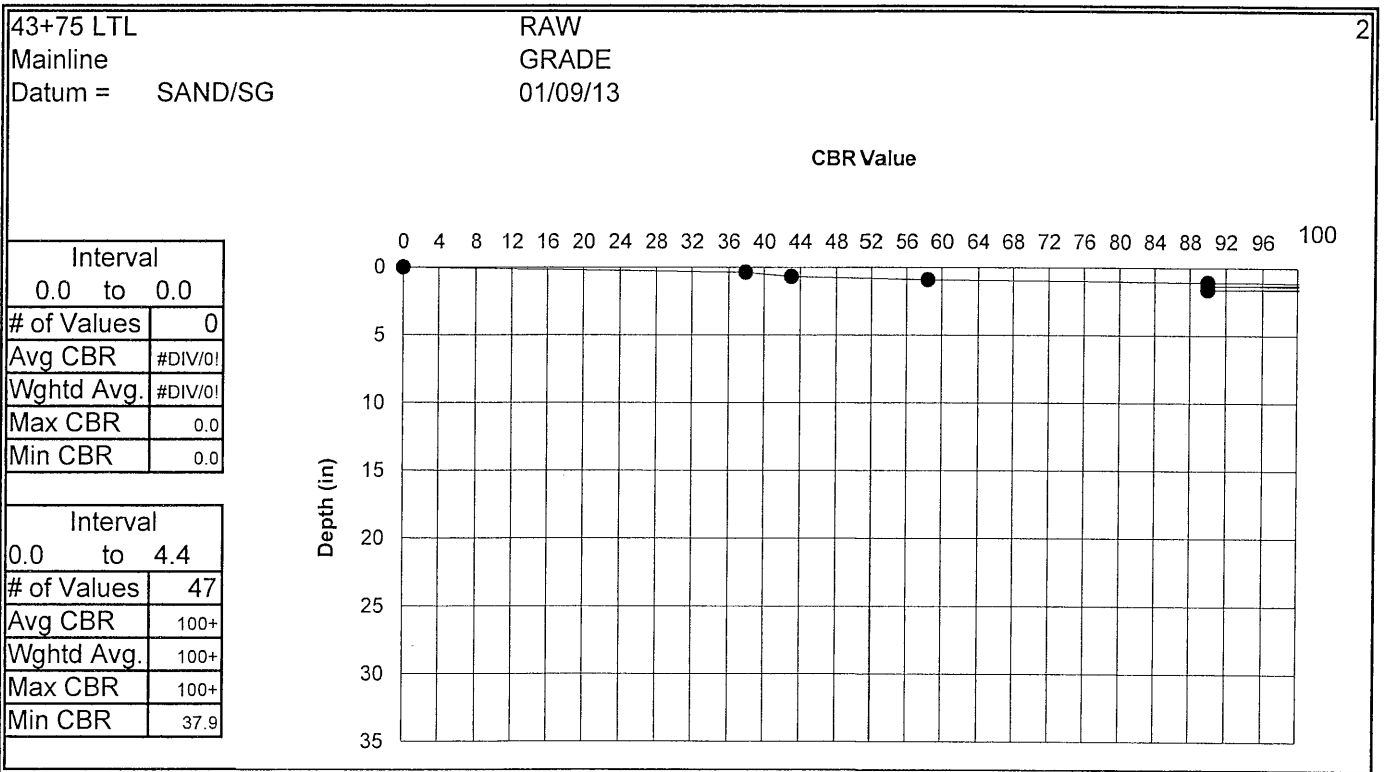
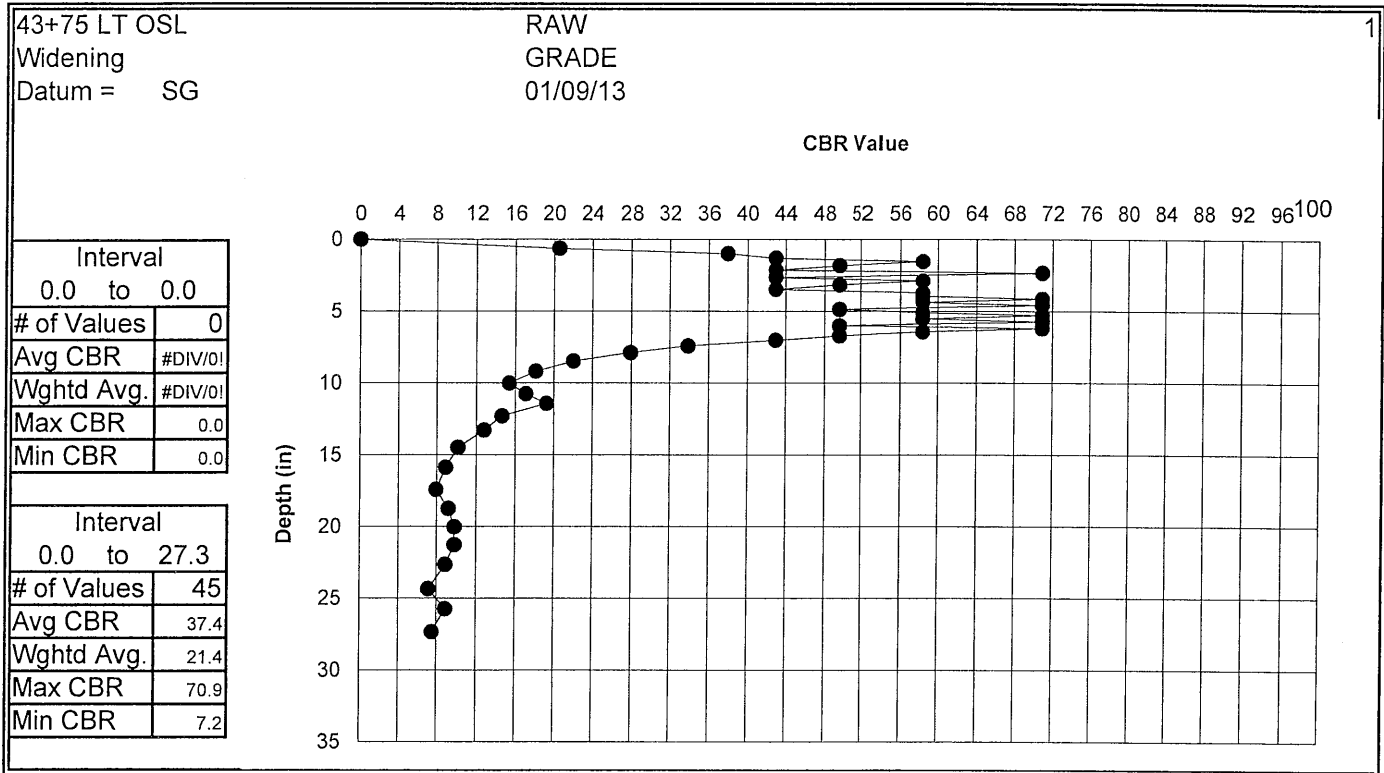


**CONE PENETROMETER RESULTS
NC - DOT, GEOTECHNICAL ENGINEERING UNIT**

PROJECT NO.	34506.1.1
PROJECT ID	R-2814C
ROUTE	US 401
COUNTY	WAKE

GEOLOGIST	JBB
GEOTECHS	F&R

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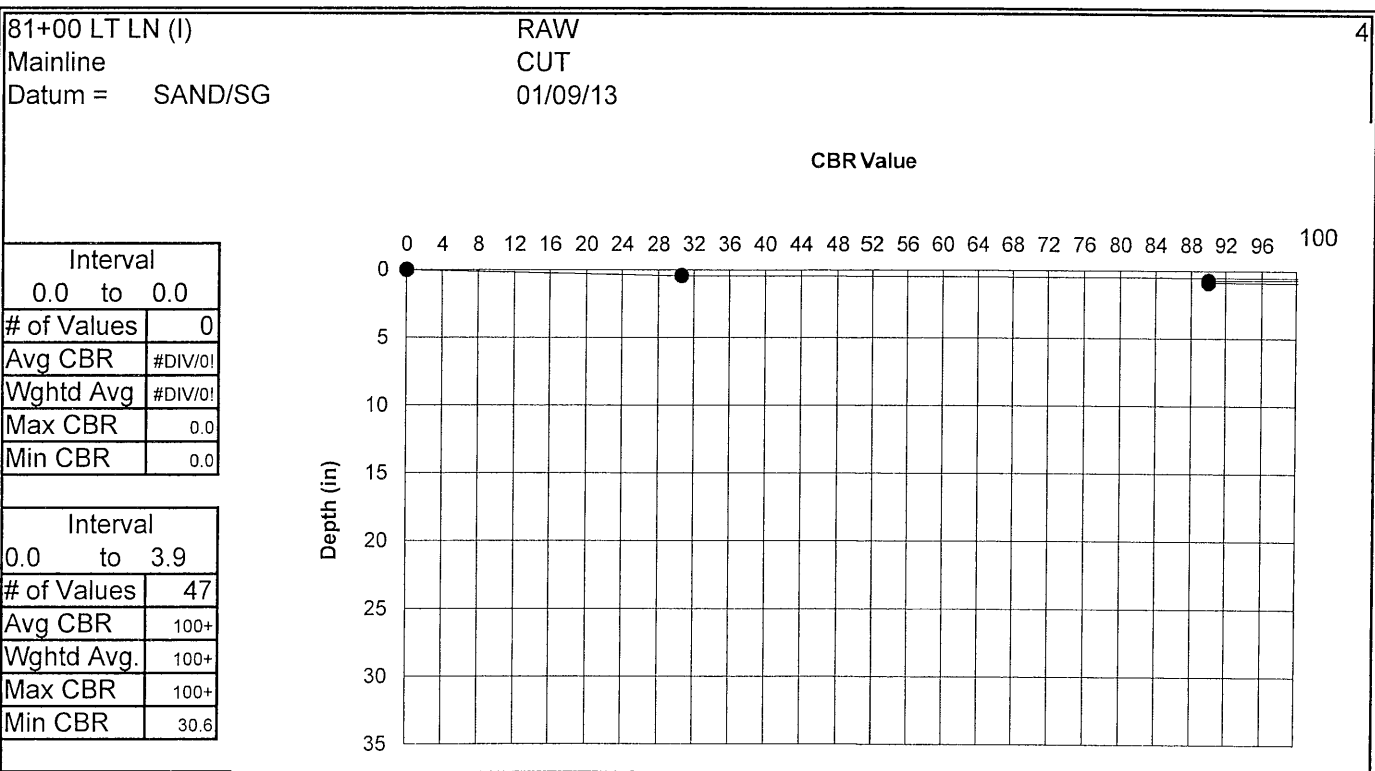
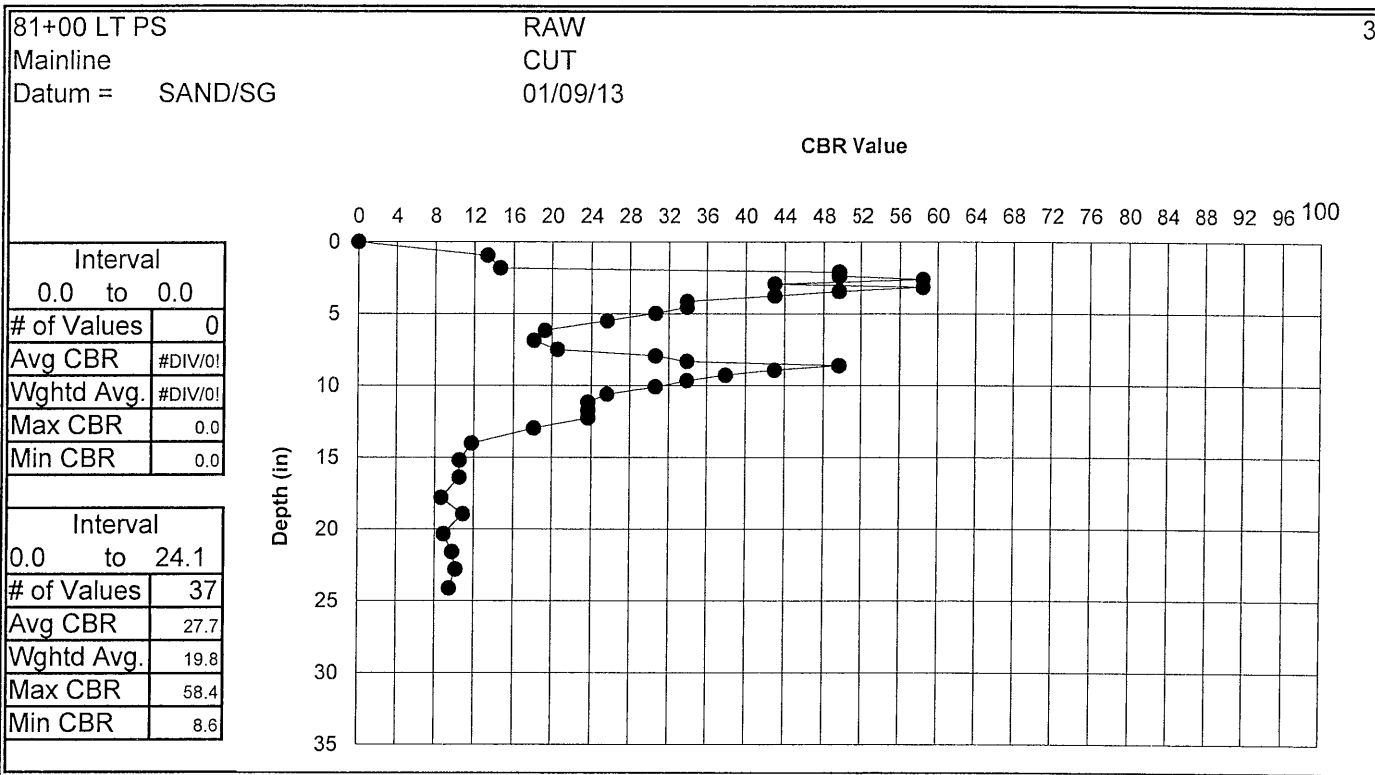


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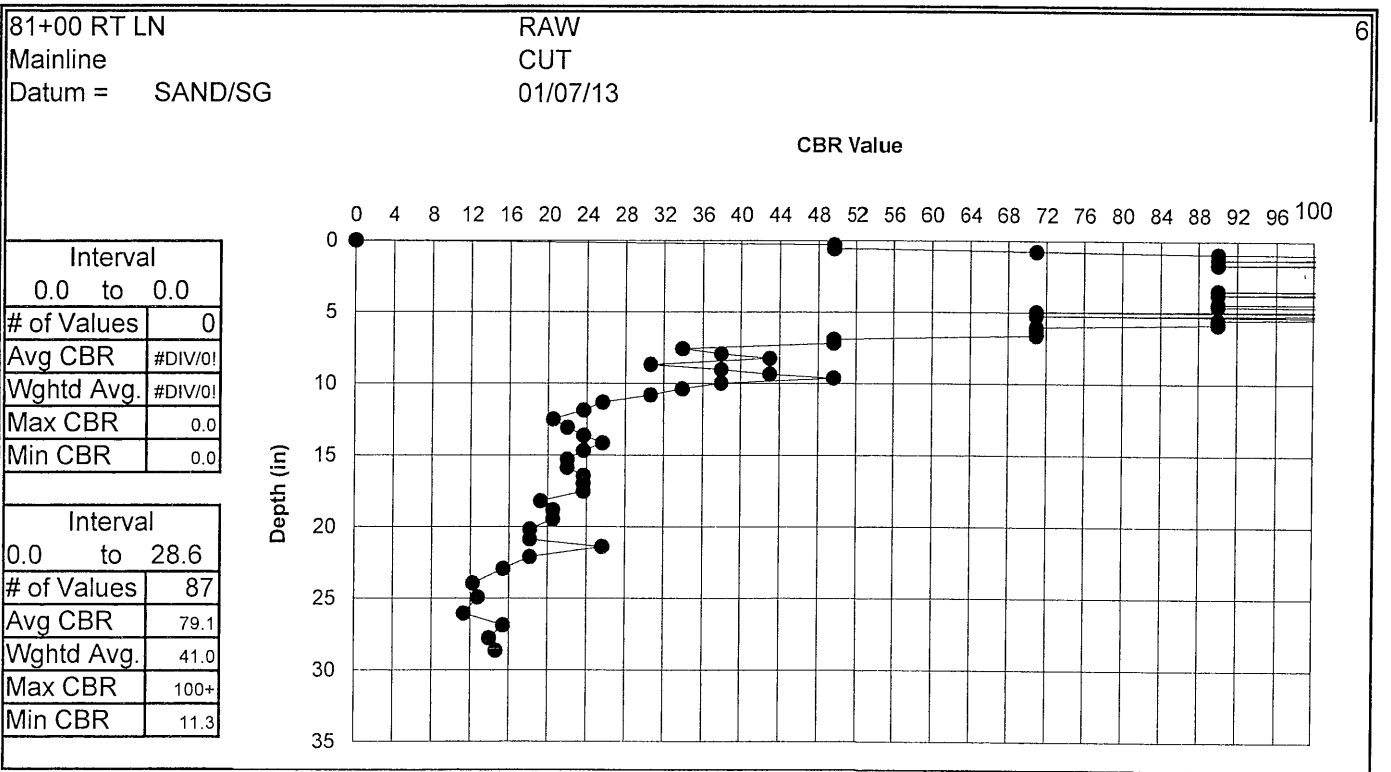
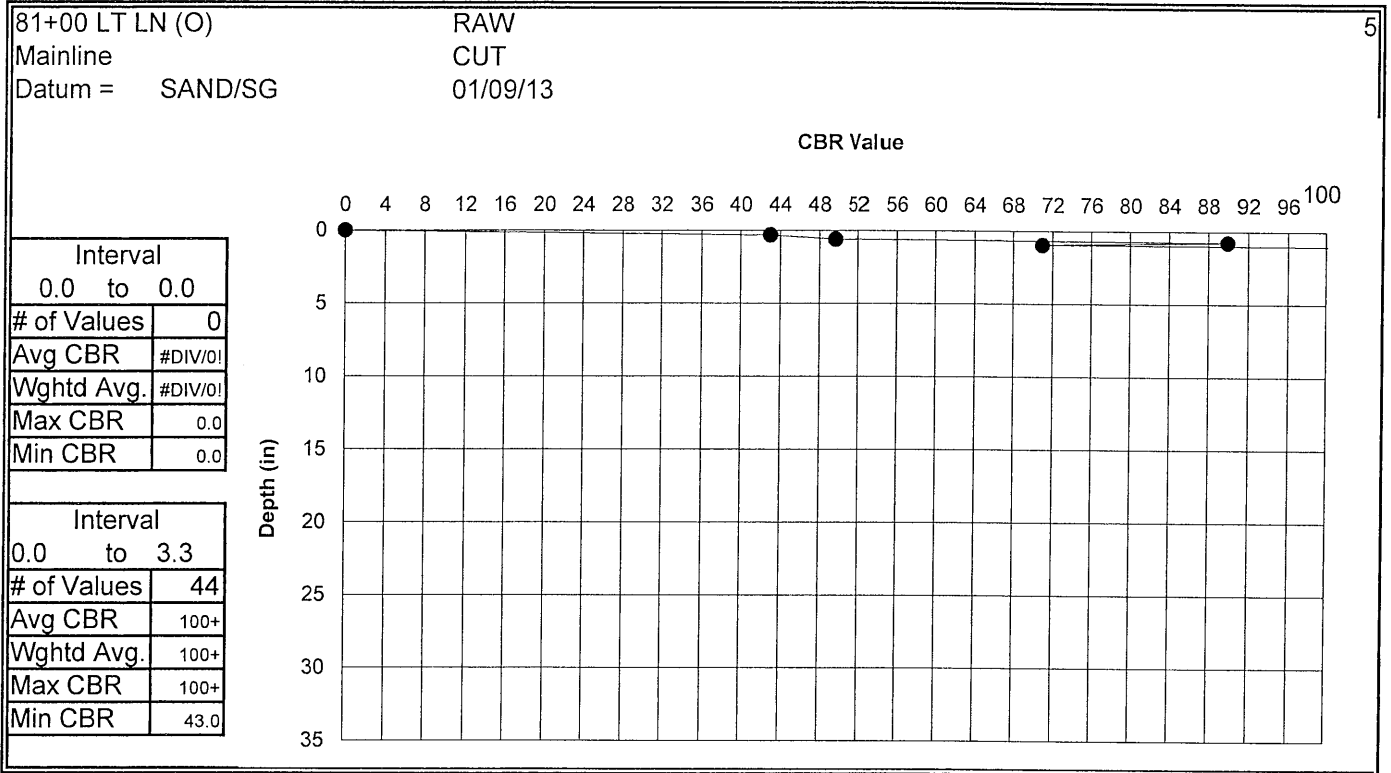


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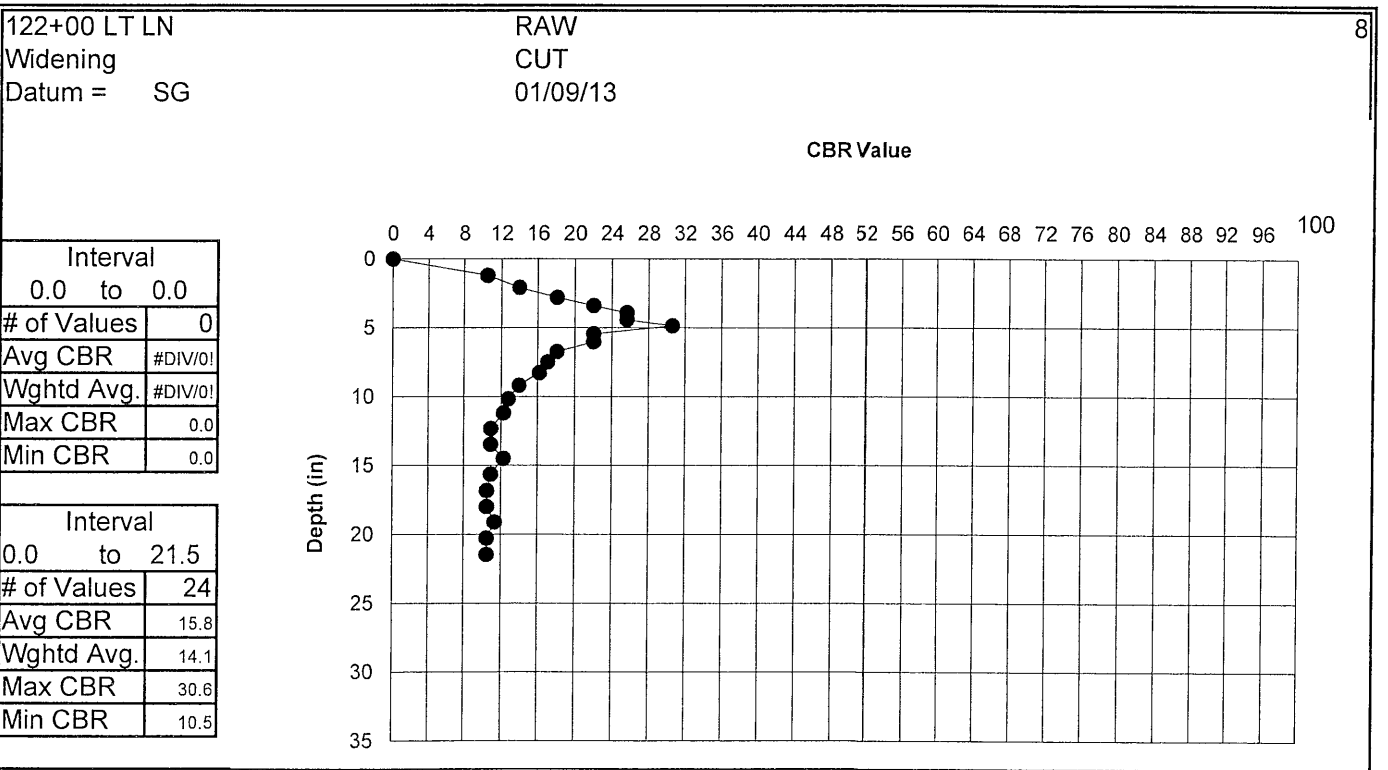
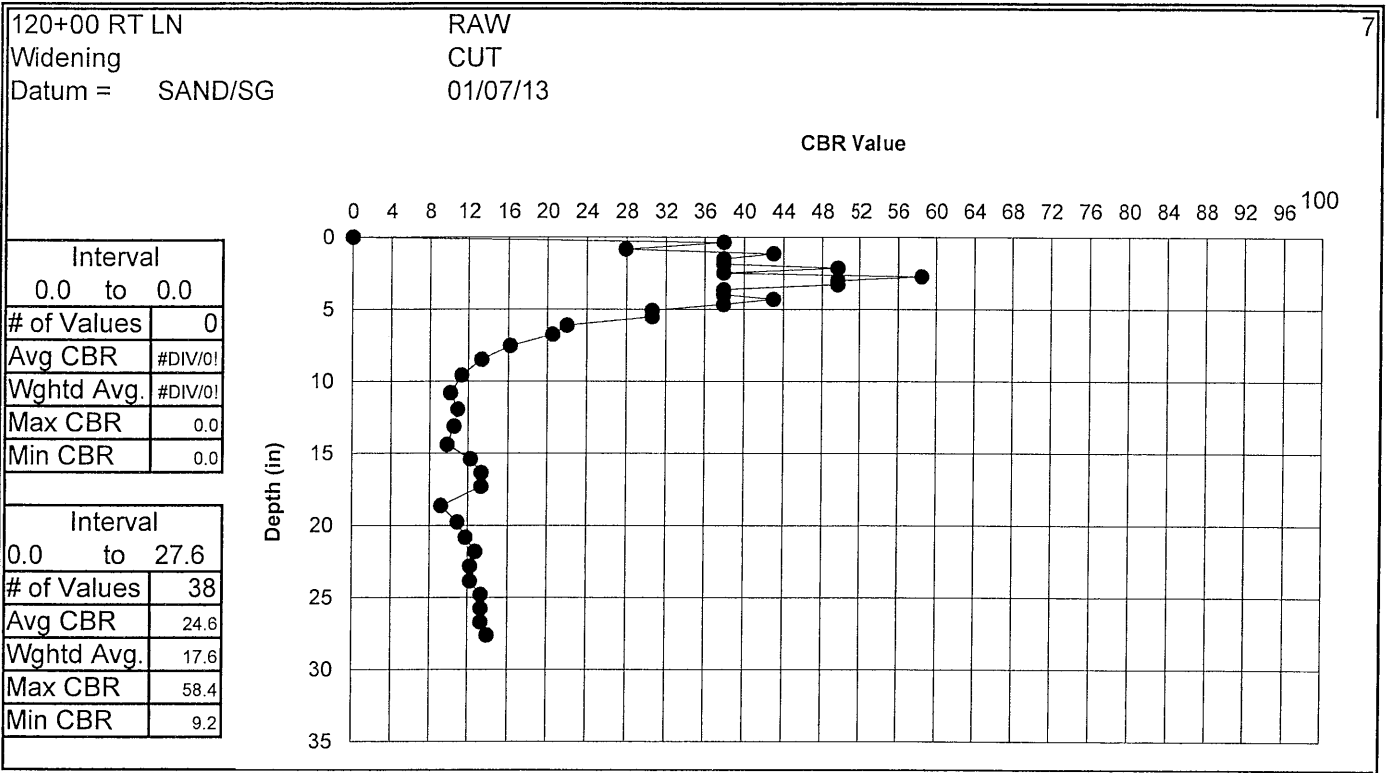


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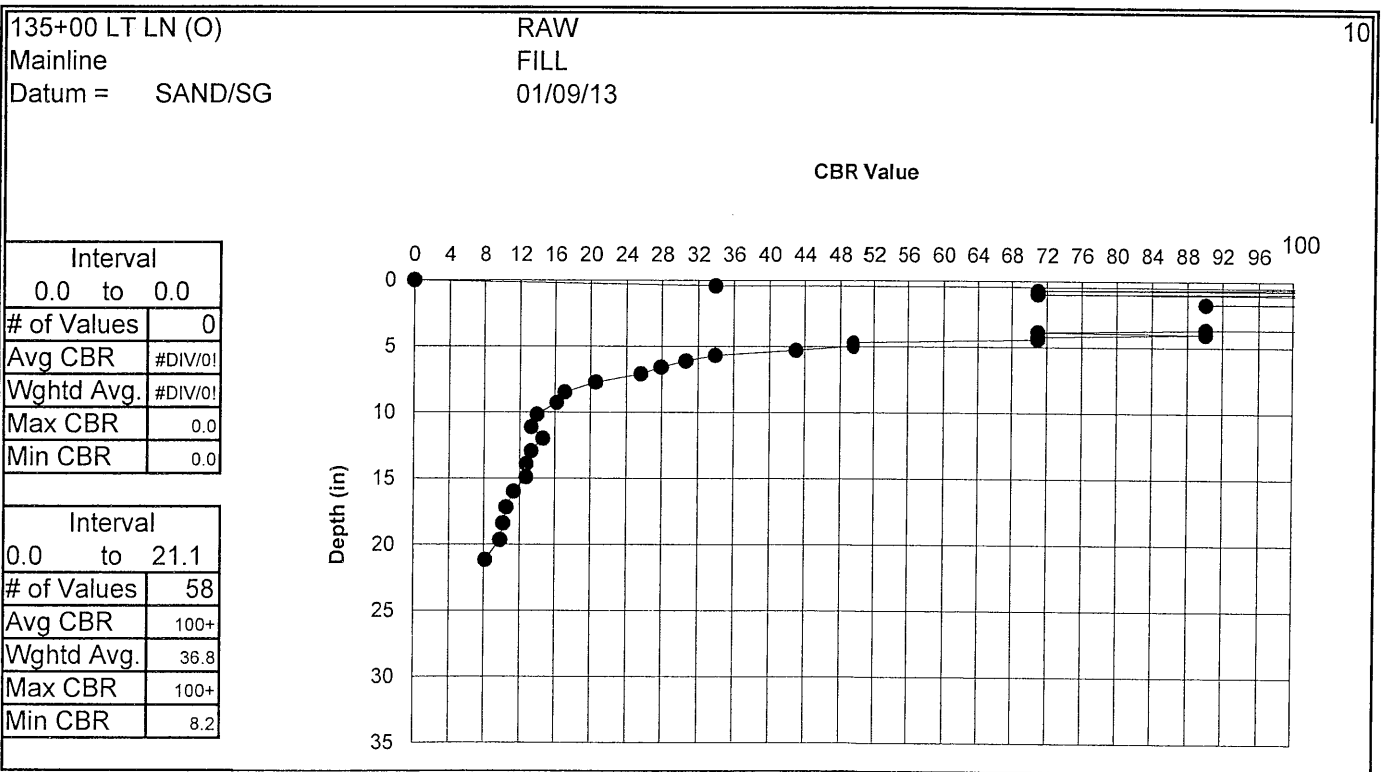
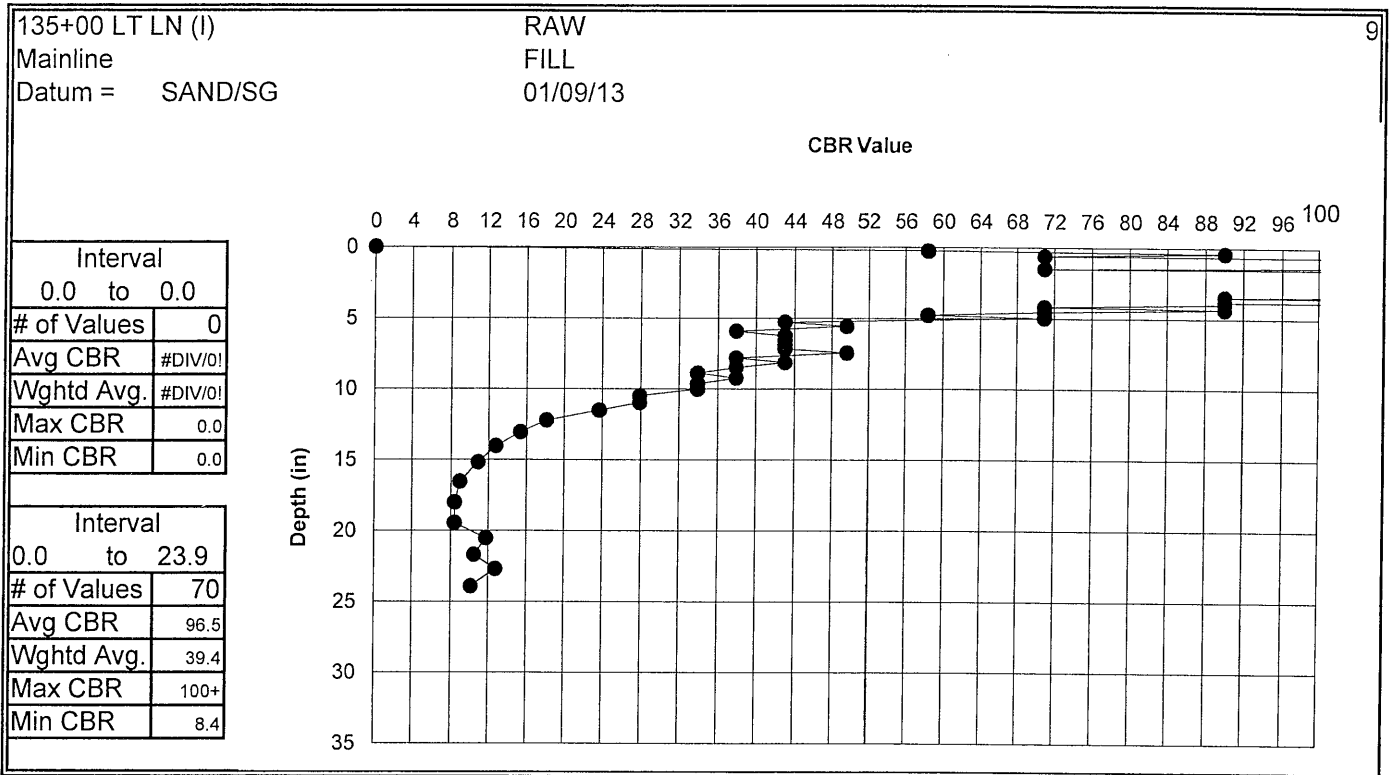


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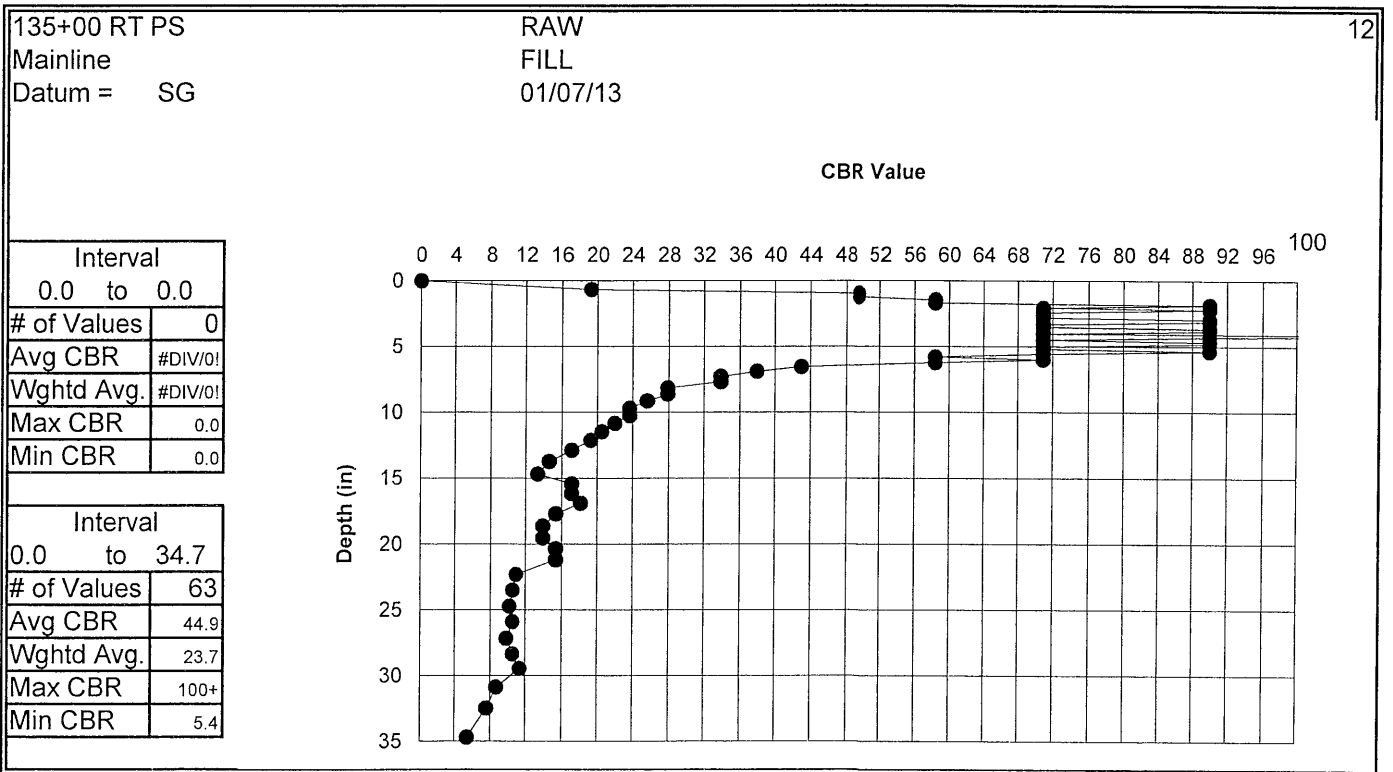
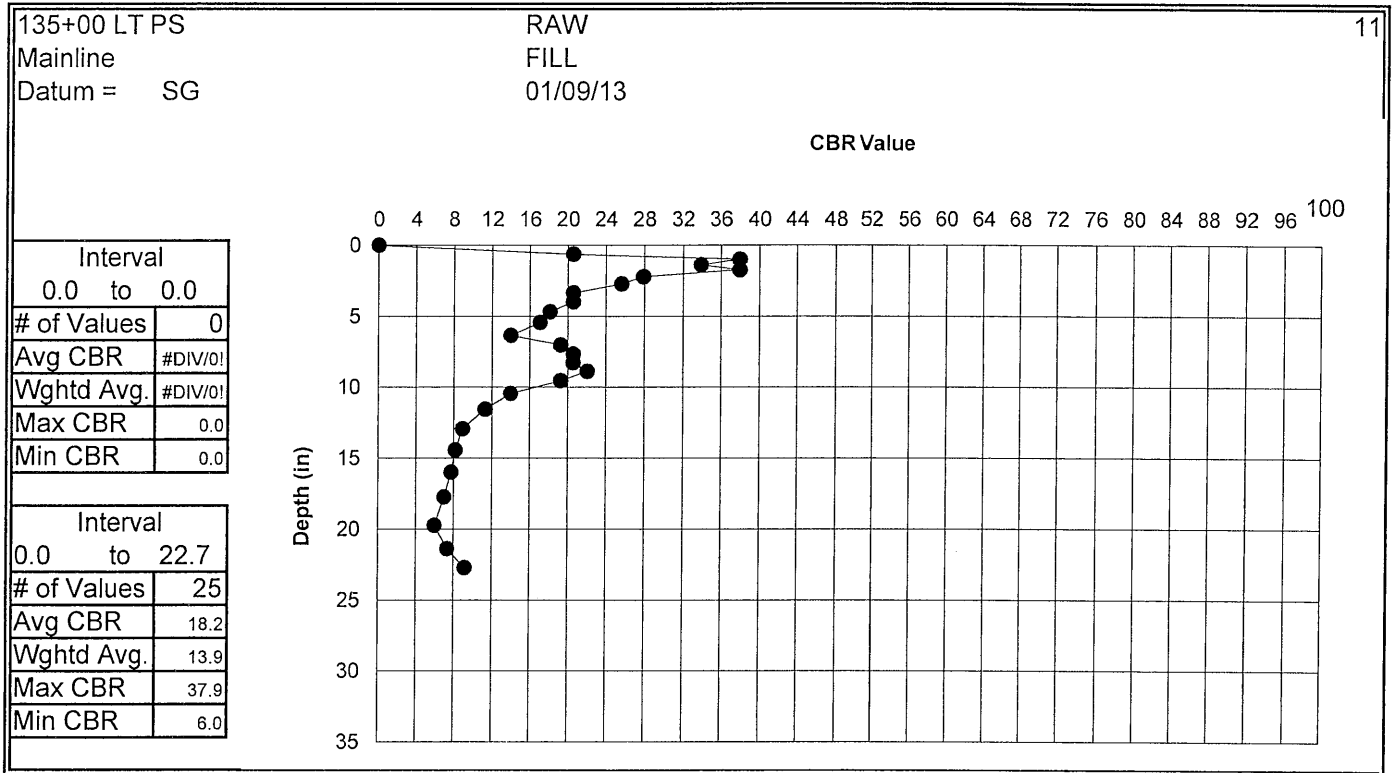


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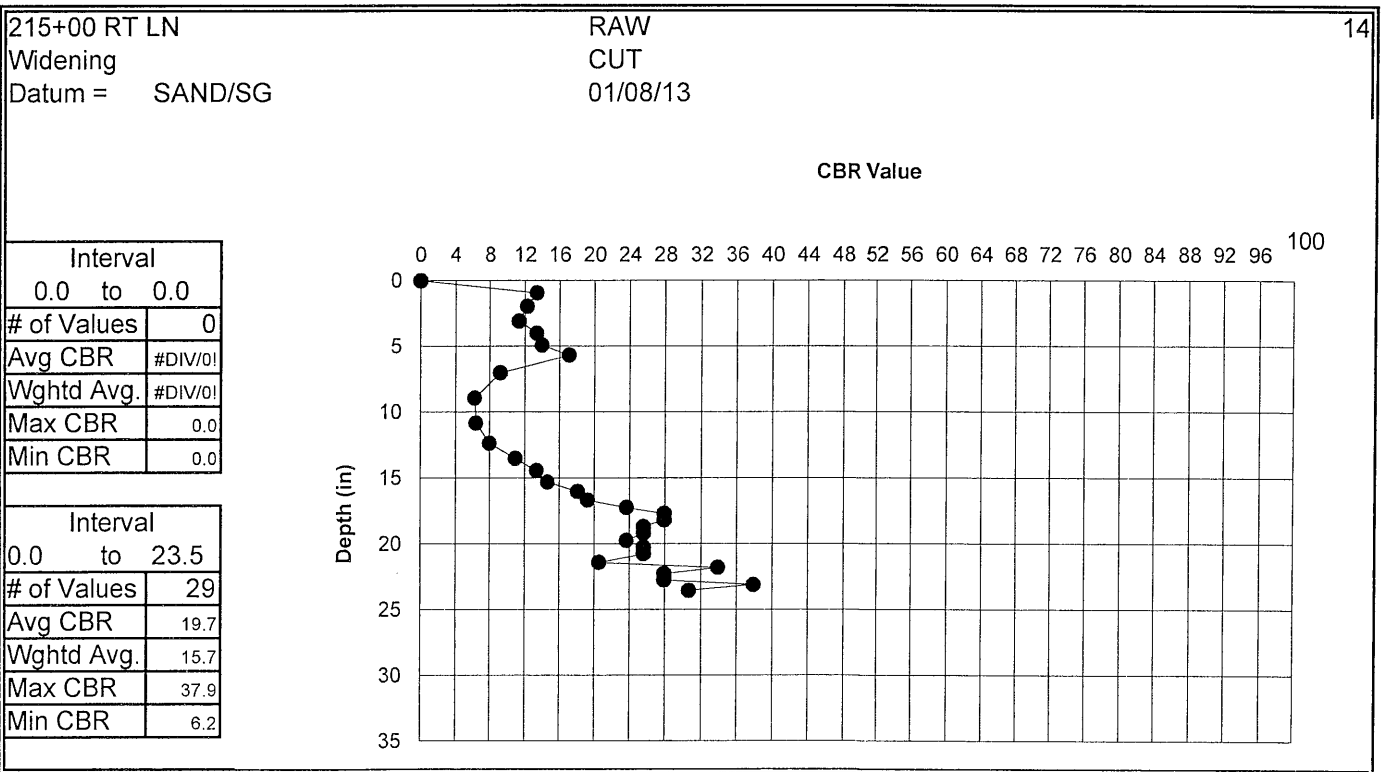
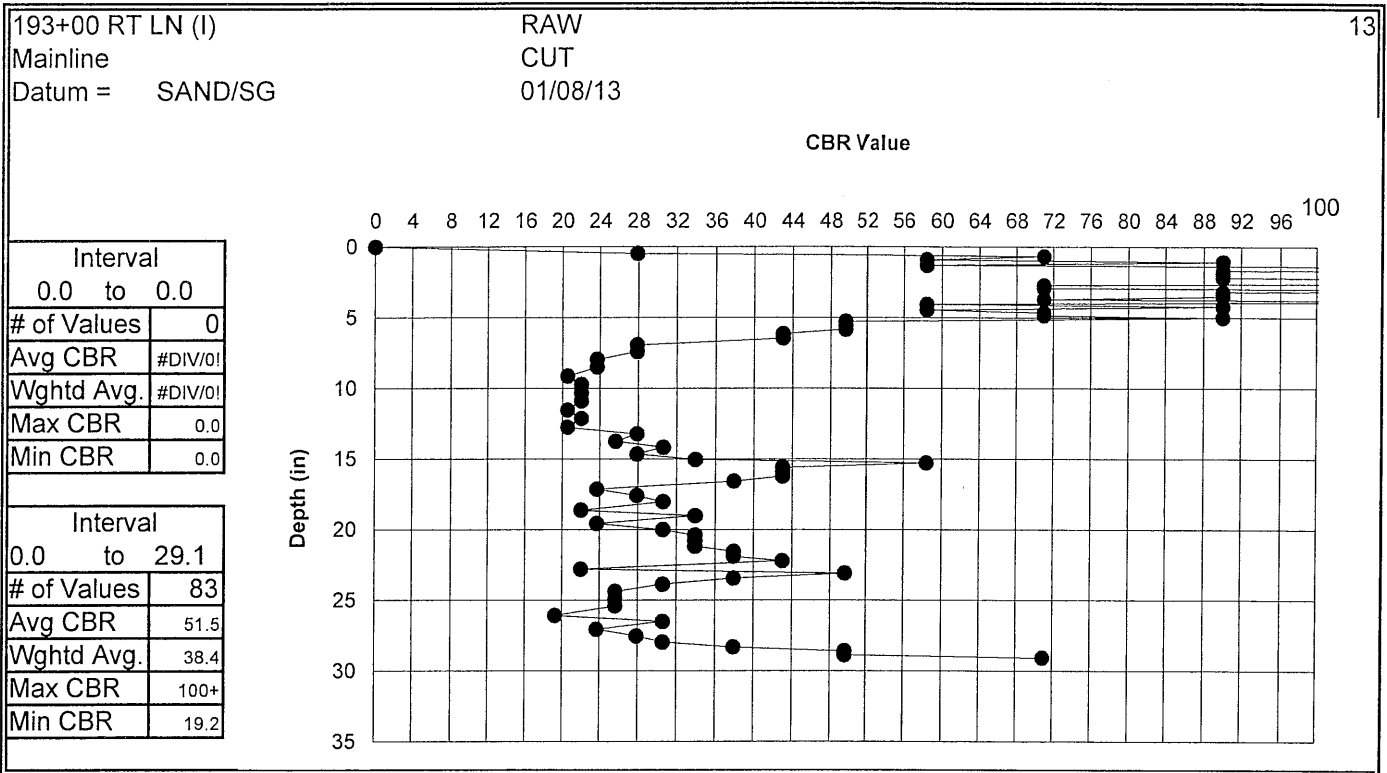


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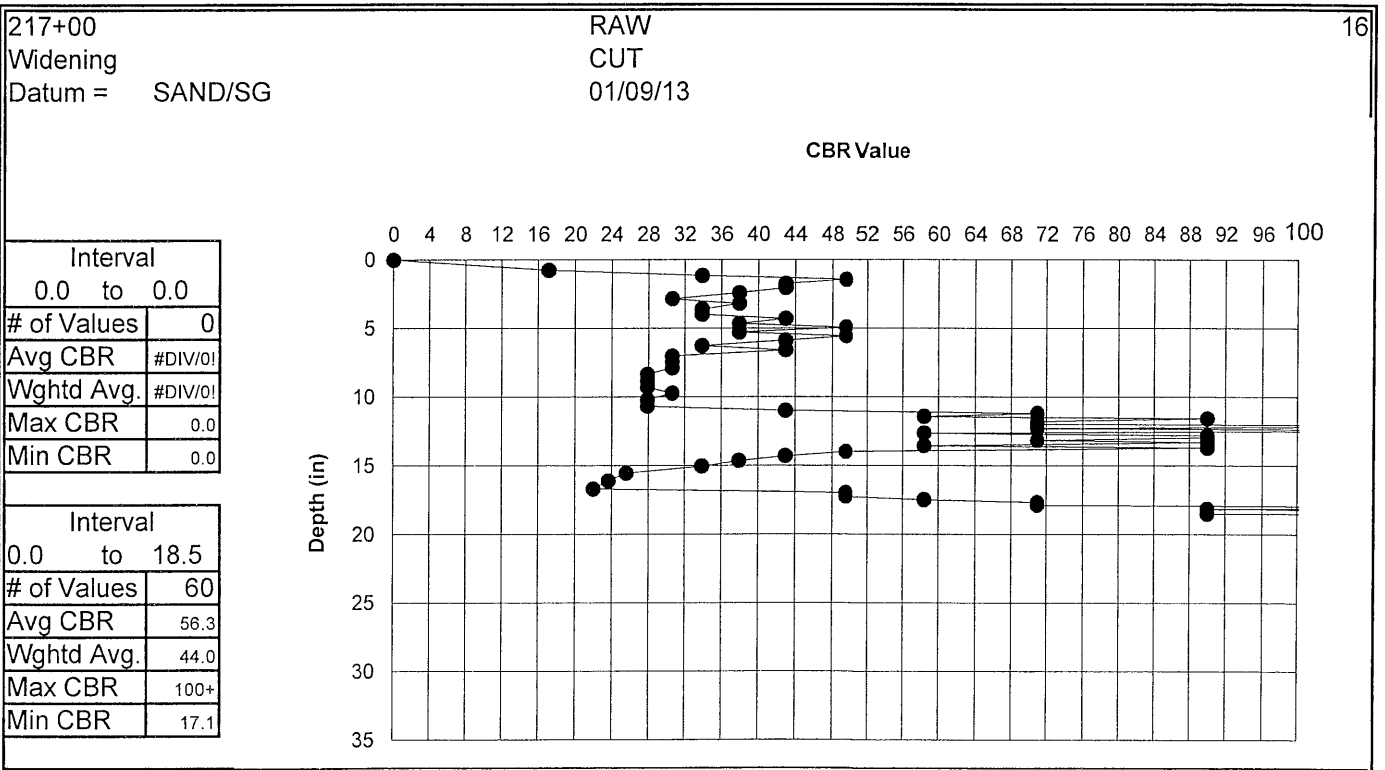
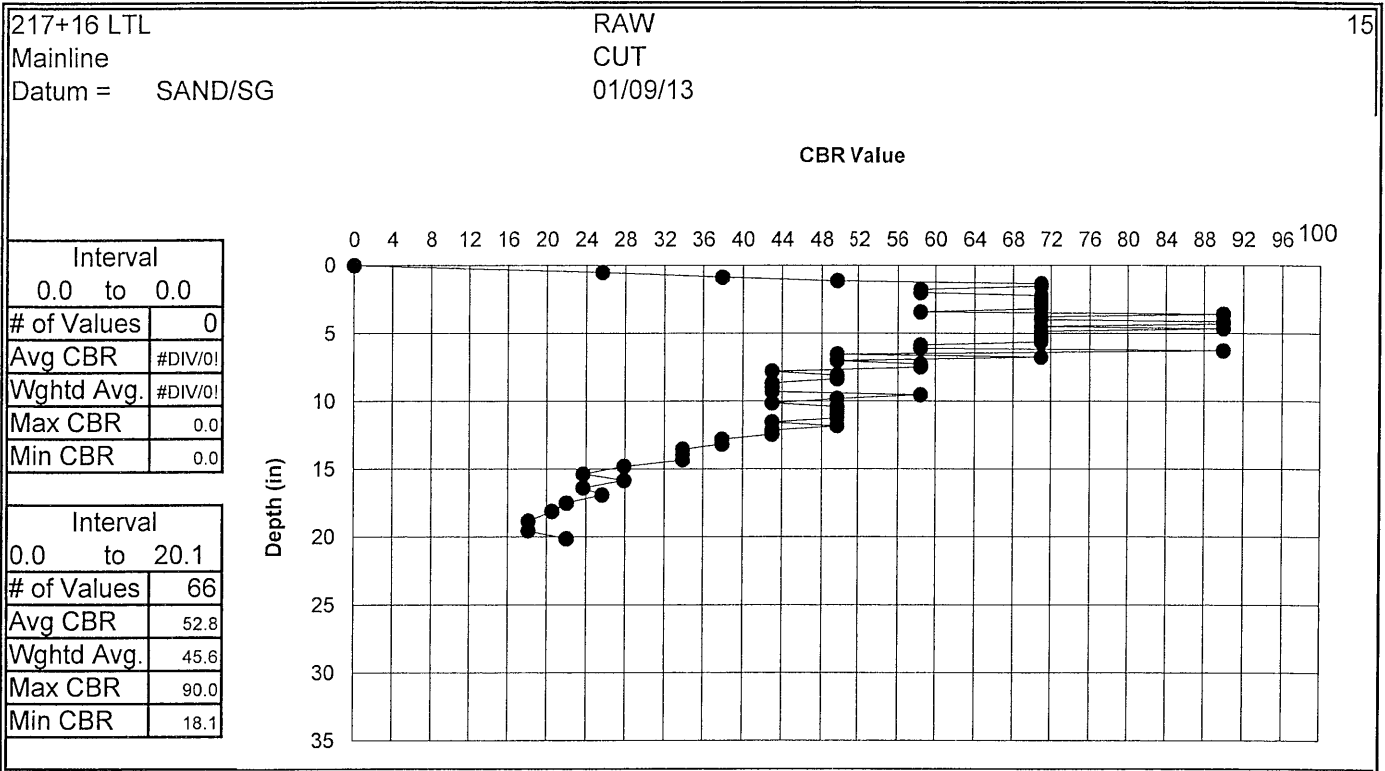


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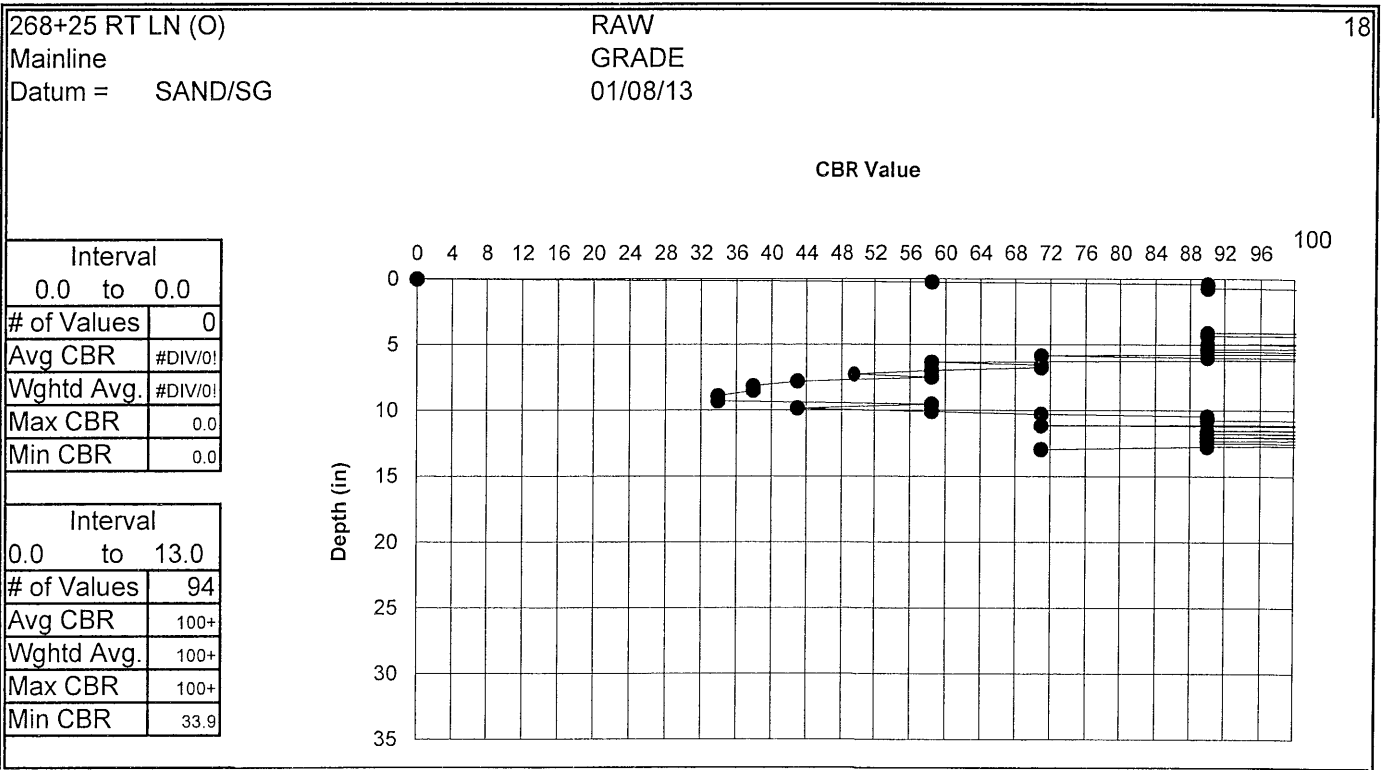
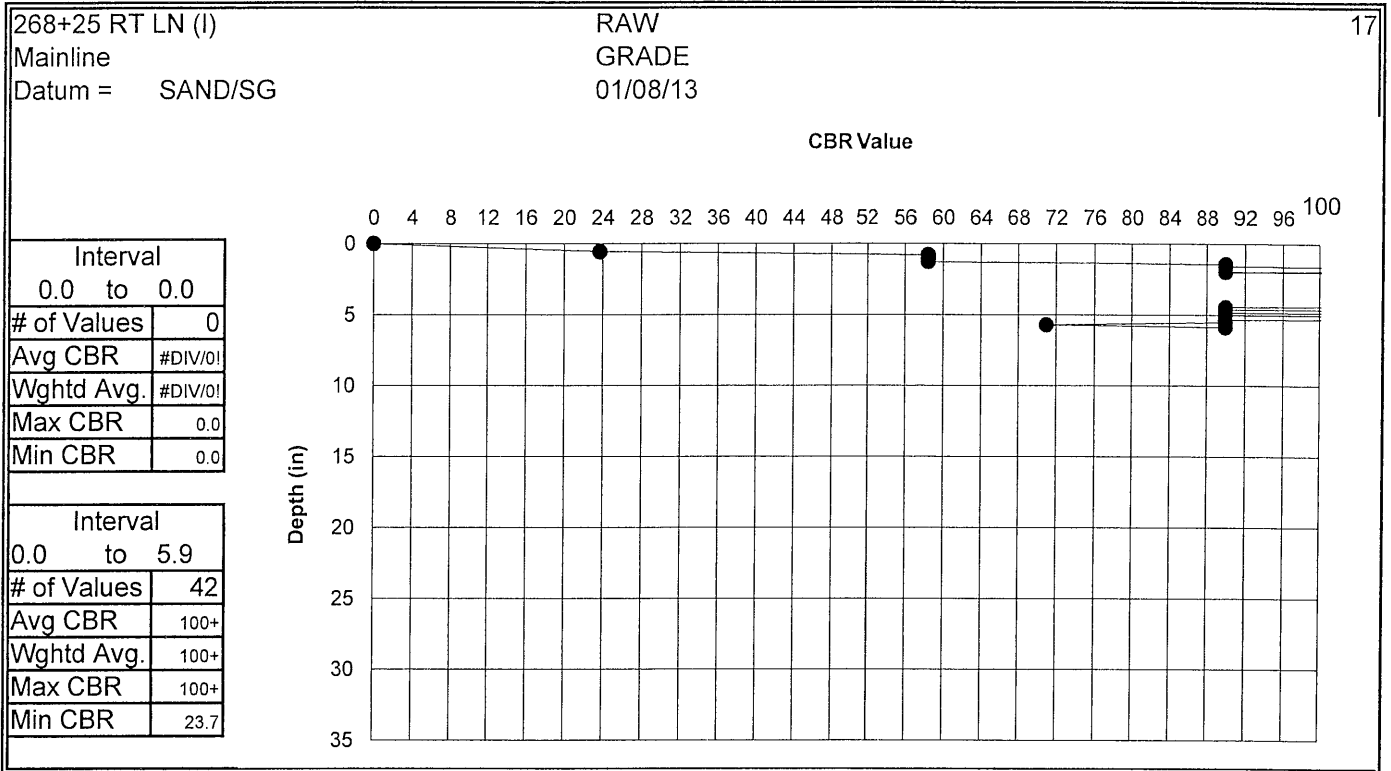


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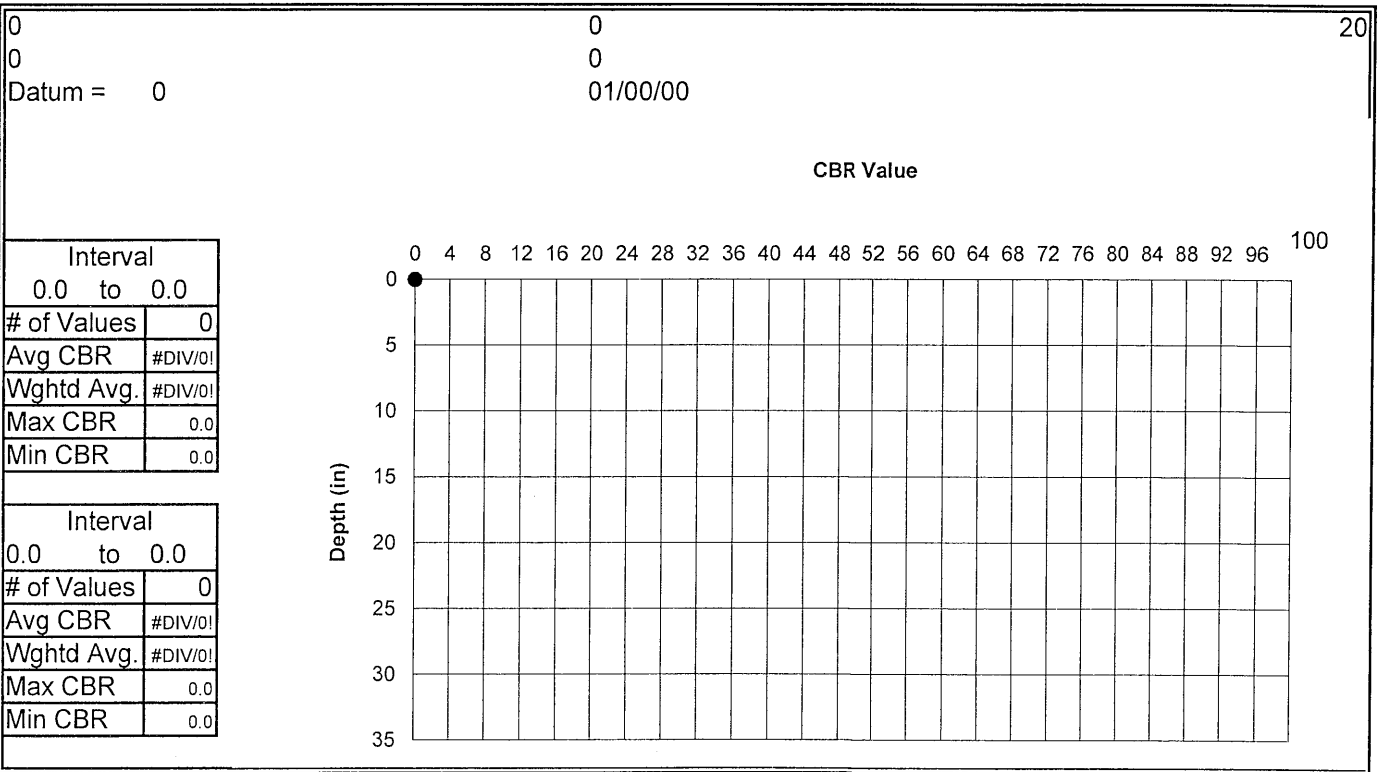
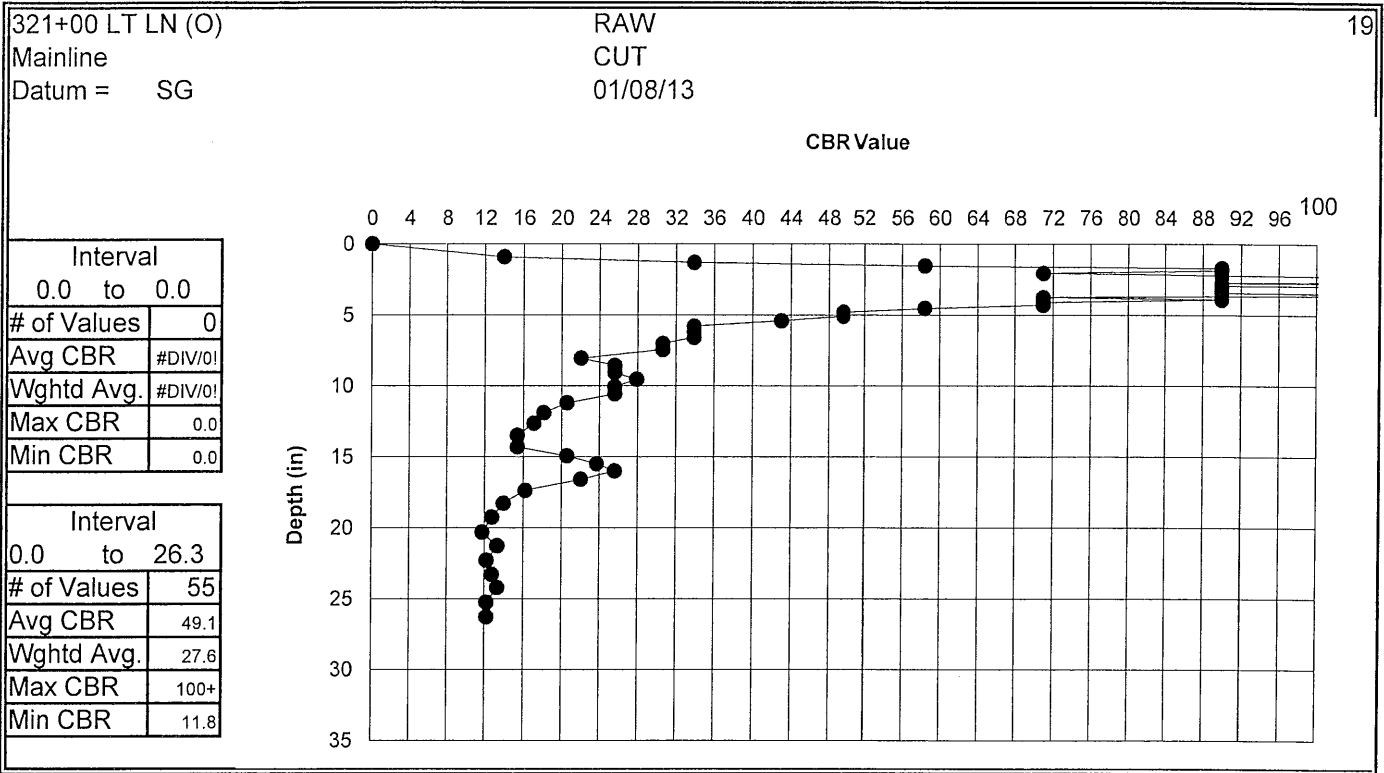


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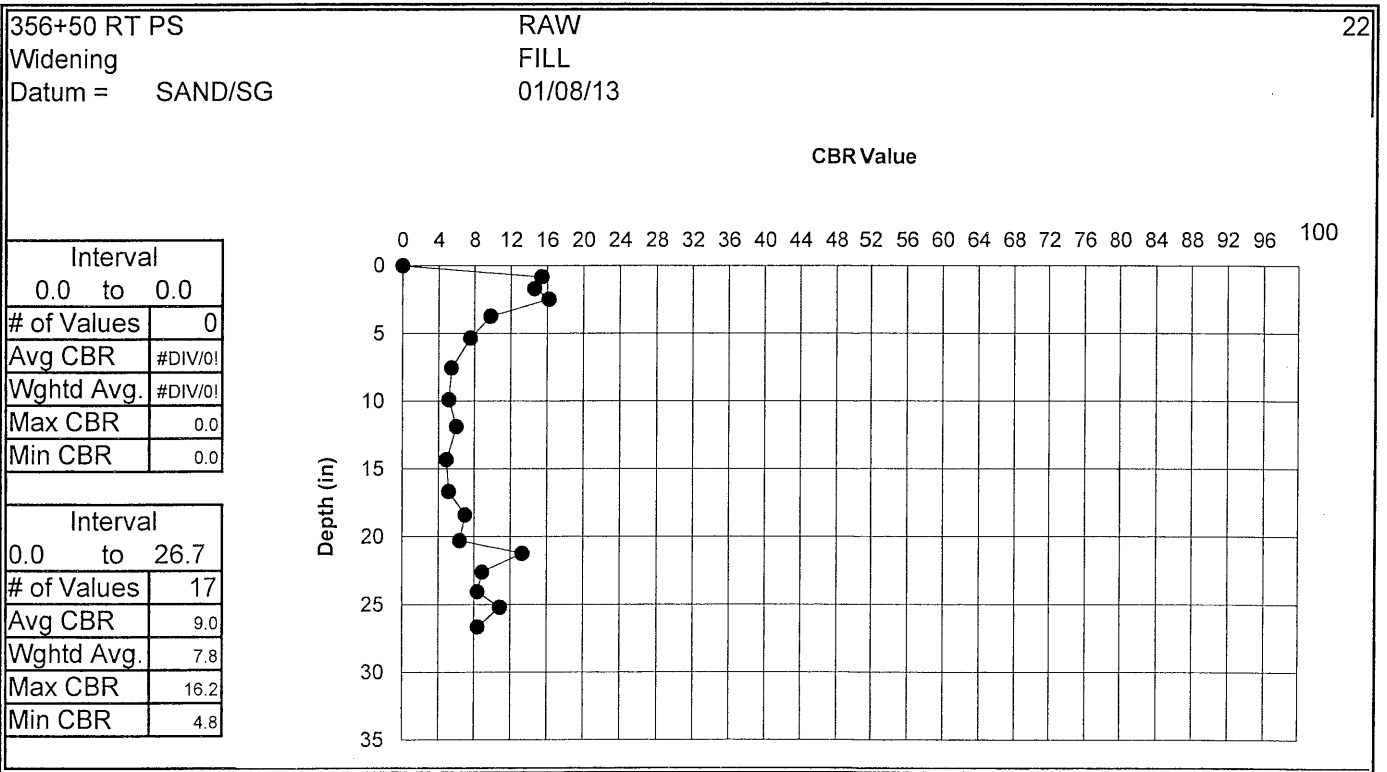
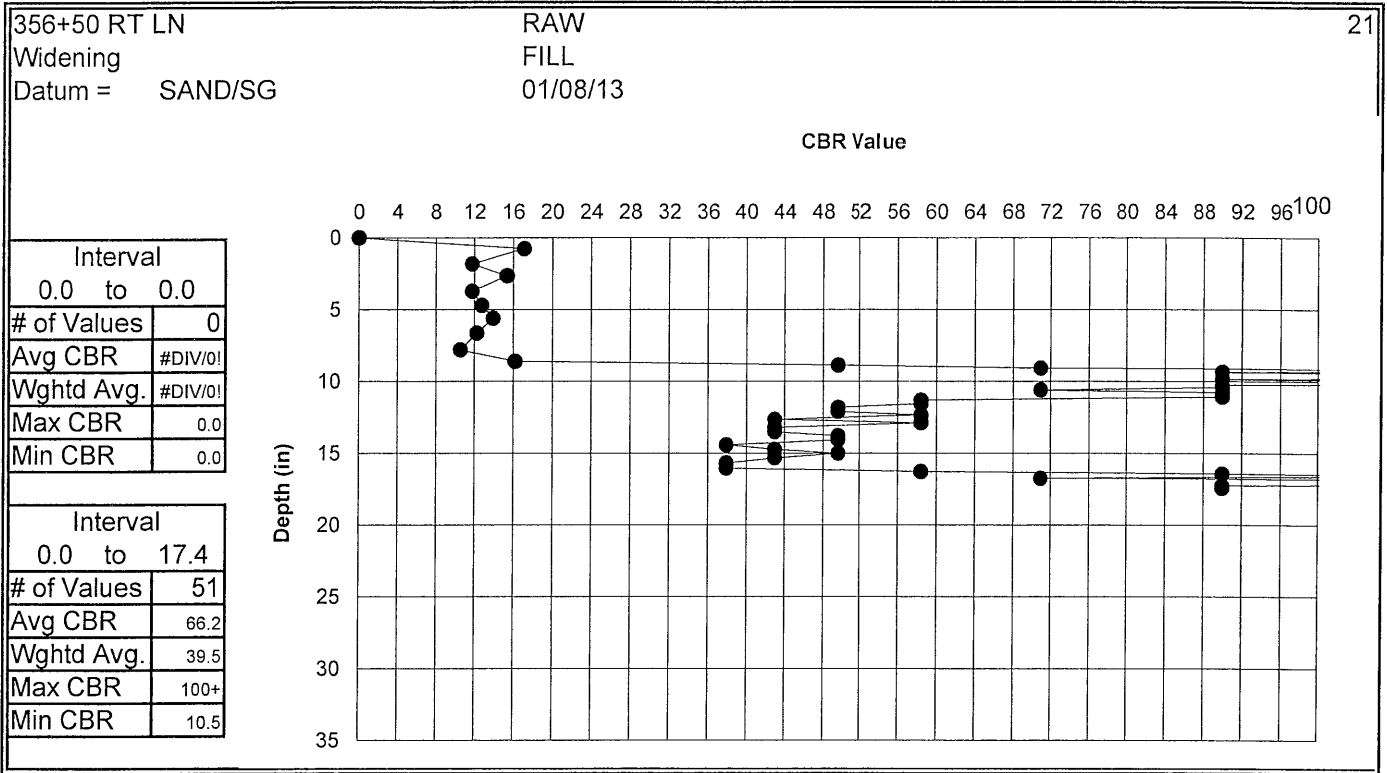


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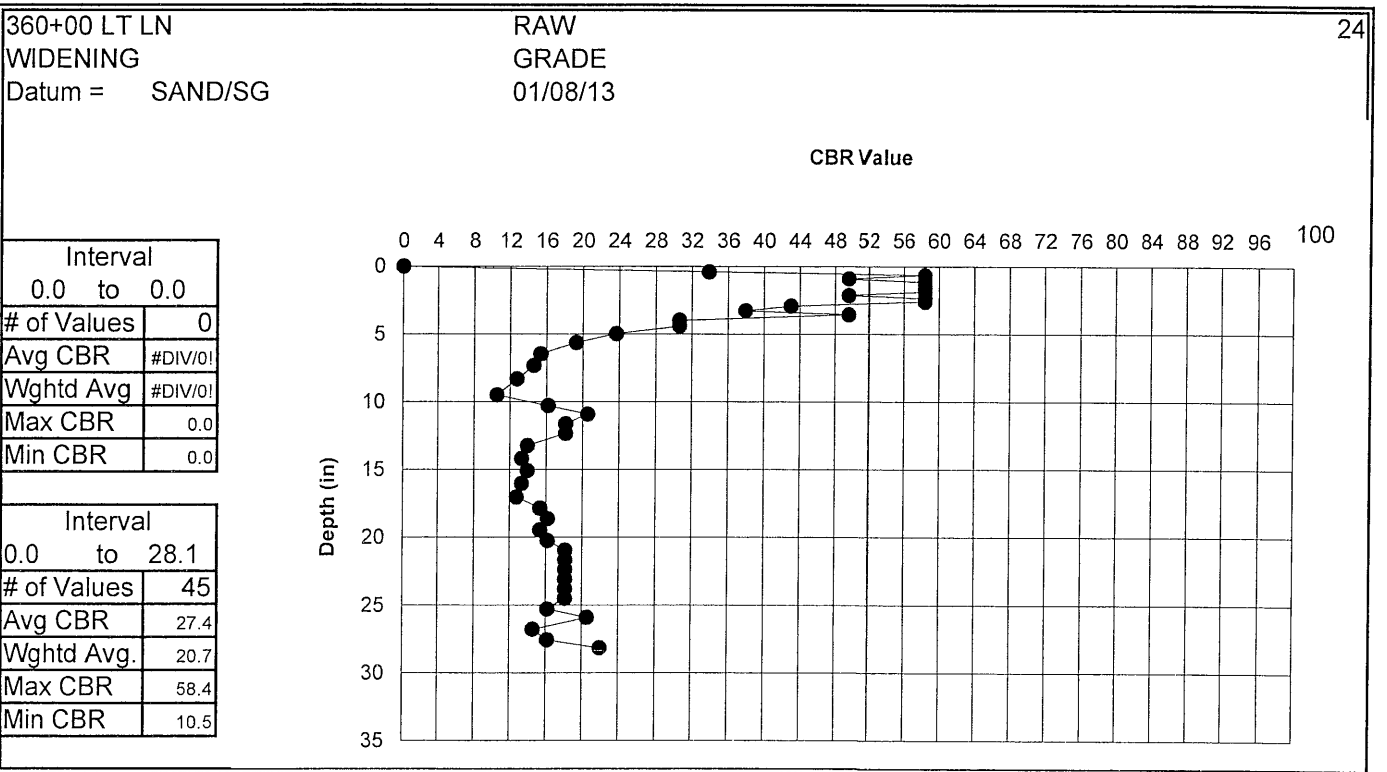
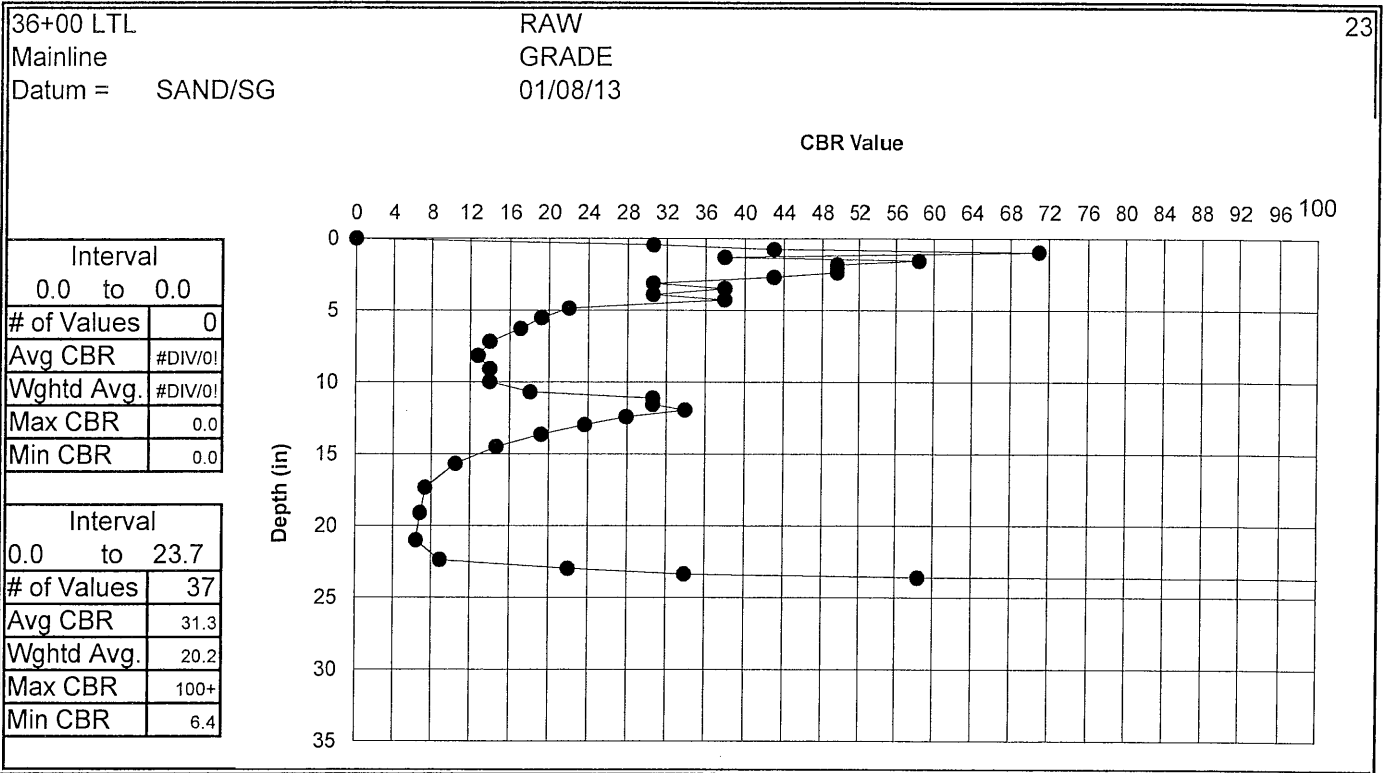


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PAVEMENT CORE PHOTOGRAPHS

Tip No. R-2814C | Project No. 34506.1.1

Wake & Franklin County, NC

43+75 LT OSL, 1' RT

43+75 LTL, 15' RT



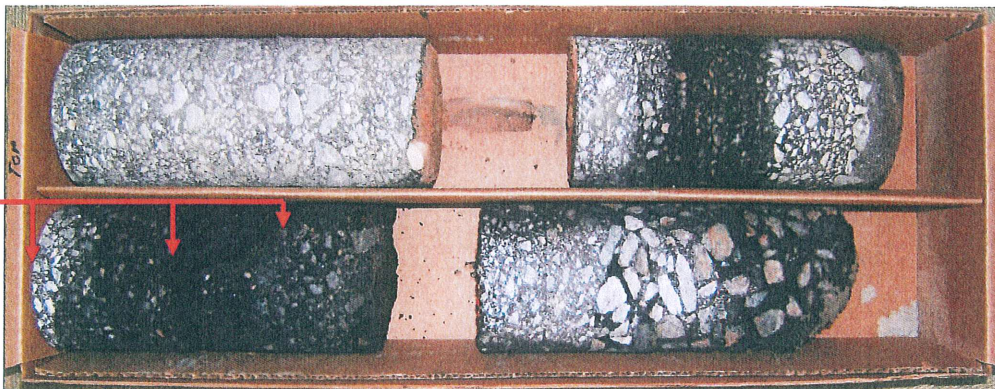
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SCALE IN FEET

122+00 LT LN (WDNG), 1' RT

81+00 LT LN (I), 5' RT

Full depth cracks



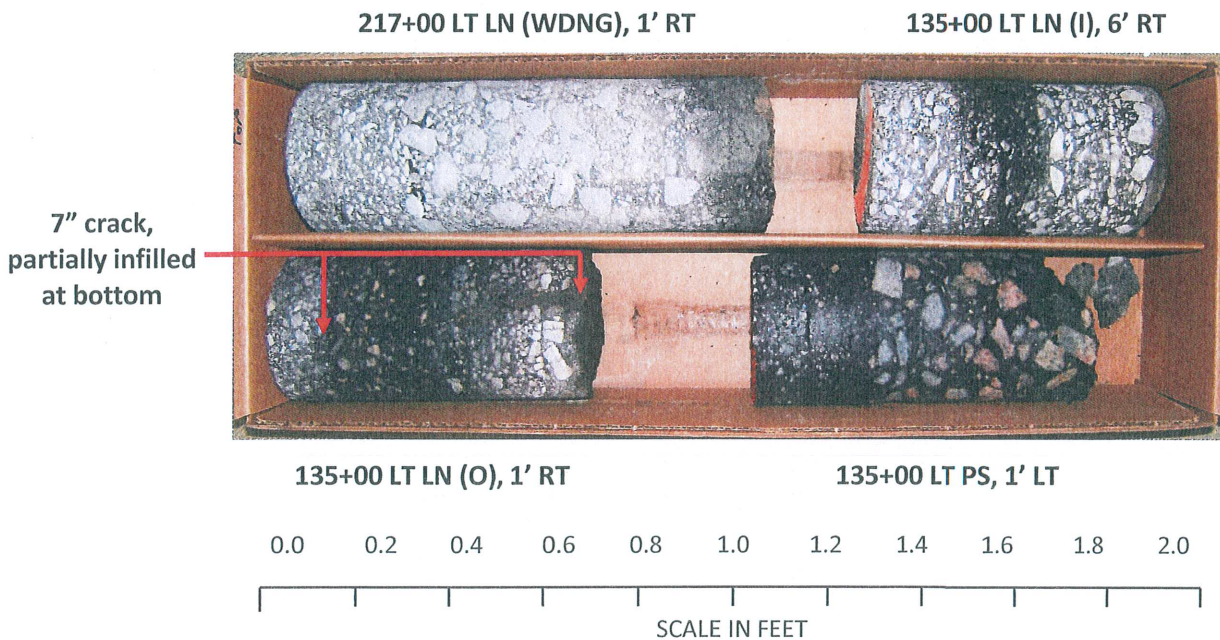
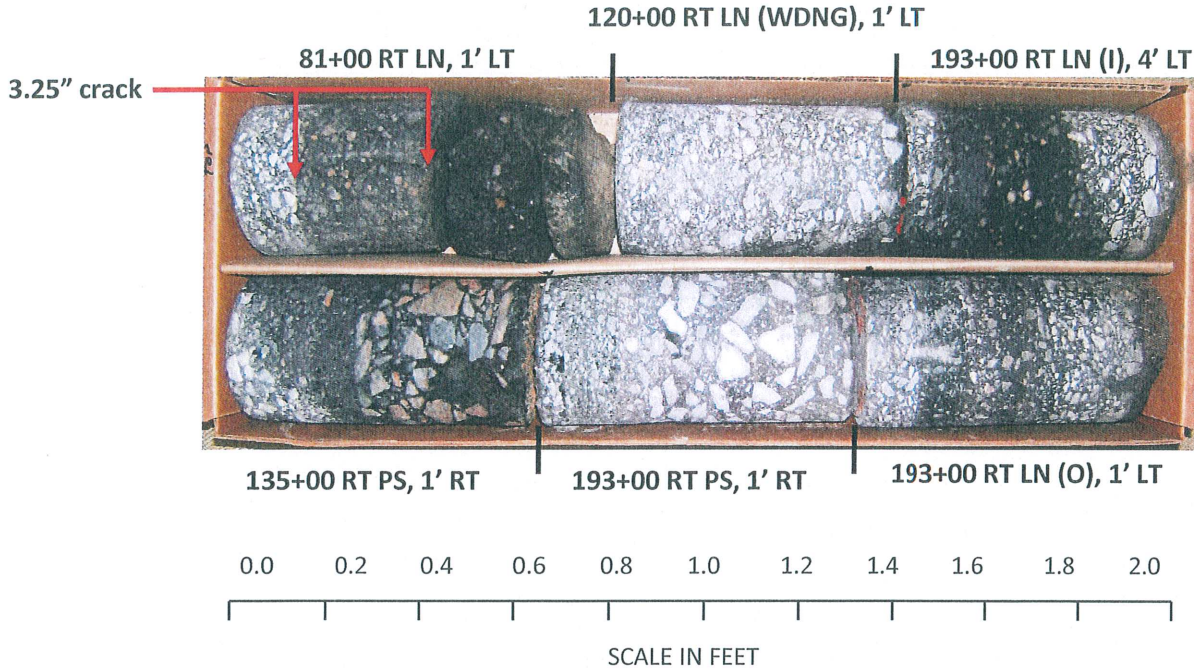
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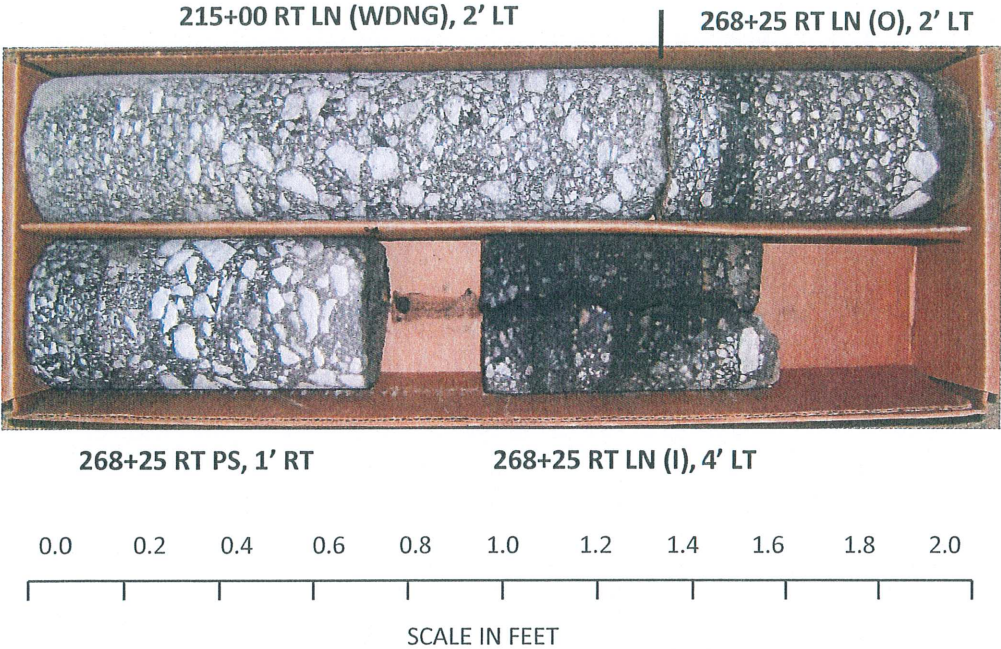
PAVEMENT CORE PHOTOGRAPHS

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Wake & Franklin County, NC

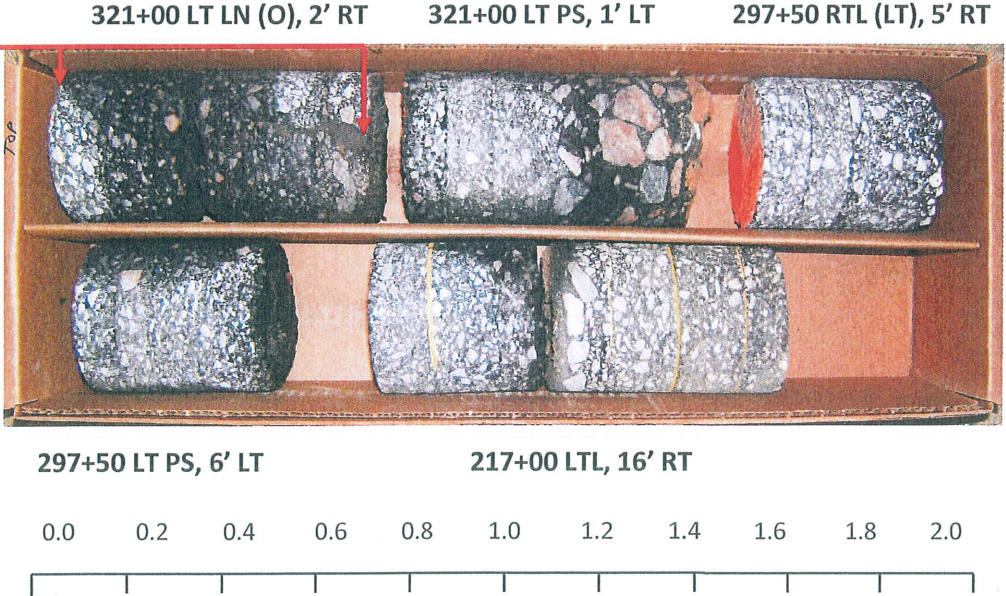




PAVEMENT CORE PHOTOGRAPHS
Tip No. R-2814C | Project No. 34506.1.1
Wake & Franklin County, NC



Full depth crack,
partially infilled
at bottom



SCALE IN FEET



PAVEMENT CORE PHOTOGRAPHS
Tip No. R-2814C | Project No. 34506.1.1
Wake & Franklin County, NC

