

Highway Program

Jeff Adams, Program Manager

Memorandum

DATE: February 8, 2007

TO: Janis Piper

DEPT: Region 4

FROM: Scott A. Hayden

DEPT: Highway Program

SUBJECT: Final Soils Memo 2007-103 – Gouldsboro Rte 186, Pin 12784.00

Site Description

A subsurface investigation has been completed for a 1.5 mile portion of Route 186 in the town of Gouldsboro. The project begins 2.2 miles south of the intersection of Route 186 (South Gouldsboro Rd.) and Route 1 and extends north for 1.5 miles.

The investigation included the use of a drill rig and falling weight deflectometer (FWD). The beginning station is 726+03. A DMI was used to determine the FWD and boring locations based upon this starting point. No survey was provided in the field. **ALL HORIZONTAL OFFSETS PROVIDED IN THE ACCOMPANY ATTACHMENTS ARE GIVING USING THE EXISTING ROADWAY CENTERLINE.**

FWD Results

The entire FWD results are included as a separate attachment to this memo. A summary of the FWD results follows:

% of project found to be deficient	17 %
Range of Recommended Overlay Thickness	0.7 – 4.1 inches
Average Recommended Overlay Thickness	2.5 inches

The subgrade resilient modulus is very high (> 8000psi) throughout 55% of the project area. These high values are anticipated to be due to the presence of shallow bedrock (<10') and not due to firm subgrade soil conditions. When a high subgrade resilient modulus value is encountered, the existing structural number commonly meets or exceeds the future traffic structural number indicating that the existing section is adequate. Unfortunately, due to the shallow bedrock, this is extremely misleading because the roadway is actually at high risk of premature failure. The shallow bedrock traps groundwater and the relatively shallow overlying roadway supporting soil structure becomes wet and weak. Bearing failures commonly result in the relatively thin weak soils and the roadway prematurely fails. In the winter, trapped water becomes a source for ice lens development in the highly frost susceptible soils promoting heaving which also leads to premature pavement failure. The area of greatest concern being affected by shallow bedrock is between stations 750+50 – 796+50. Design considerations should take this into consideration if design expectations are to be met.

A very low subgrade modulus was encountered at stations 758+56 and 798+31. At station 758+56 it is anticipated that the low subgrade modulus is due to wet subgrade soils. At station 798+31 the low subgrade modulus is due to the presence of a 1.5' thick layer of organics at a depth between 2.5'-4.0'. Each of these areas could be soft especially during the spring. Depending on the conditions at the time of construction the use of geosynthetics and/or additional base material may be necessary to support traffic during construction. Construction operations should take this into consideration.

Boring Information

A total of 7 power auger borings, 15 power auger probes, and 15 pavement cores were conducted along the project area (See Boring Logs, Power Auger Probe Summary Sheet, and Pavement Core Summary Sheet). Boring locations were determined based upon FWD deflection results and visual observations during an on-site visit. Soils were described and sampled in the field. Samples of the existing base material and subgrade soils were collected and analyzed in the Bangor lab. Testing results are summarized on the attached Laboratory Testing Summary Sheet.

Pavement Conditions

Pavement conditions vary from poor to fair. Pavement cores encountered a solid pavement layer throughout the project area. However, power auger borings encountered an unbound pavement layer under a solid pavement layer. A pavement thickness summary follows below. For a detail listing of pavement measurements refer to the "Pavement Depth Information" attachment included with this memo.

When NO unbound layer was encountered:

Range of Solid Pavement Thickness:	3.6" – 9.0"
Average Solid Pavement Thickness:	6.0"

When an unbound layer was encountered:

Range of Solid Pavement Thickness:	3.6" – 4.8"
Average Solid Pavement Thickness:	4.5"

Range of Unbound Pavement Thickness:	2.4"
Average Unbound Pavement Thickness:	2.4"

Combined Total Pavement Thicknesses	
Total Pavement Thickness Range	6.0" – 7.2"
Total Averaged Pavement Thickness	7"

Note: Pavement thickness estimates are based upon 20 sample locations. Measurements were taken from boring holes and pavement cores. Boring spacing extended to as much as 1250 feet in areas. Actual pavement thickness may vary.

Base Material

Existing Base Material Type: Silty Gravelly Sand, Gravelly Silty Sand
Percent Passing #200: 4%-23%
Range of Base Material Thickness: 10" – 31"
Average Base Material Thickness: 19"
Quality of Drainage (AASHTO): Poor - Good
Estimated Existing Permeability: 0.5-220 ft/day (AASHTO recommends 1000ft/day)

The existing base material consists of a silty gravelly sand or gravelly silty sand. This material has approximately 4%-23% passing the #200 sieve. Due to the lack of coarse material and the presence of fines, much of the base material encountered should be considered as granular borrow. These poor performance characteristics must be taken into consideration when developing performance expectations related to strength and drainage.

Subgrade Soils

The subgrade soils consist primarily of silty sands (till). It is anticipated that the till soils will be very cobbly in areas. In addition, the soil matrix of till soils can vary considerably from a very sandy matrix to a very silty matrix. These subgrade soils are not well drained.

The silty sands are classified (ASSHTO) as A-2-4 and A-4 soils. The A-2-4 soils may become soft during wet conditions and loose and dusty in dry conditions. The A-4 soils can perform adequately with proper moisture and compaction. However, they will swell and lose much of their stability unless properly compacted and drained. Careful field control of moisture content and pneumatic-tired rollers are normally required for proper compaction.

When these native soils are encountered at subgrade, subgrade should be scarified to a depth of at least 6 inches to remove any cobbles near the surface. If these cobbles are not identified and removed, frost action will eventually push them up into the overlying thin base layer causing the pavement to deform and fail prematurely.

Bedrock

It is anticipated that bedrock is relatively shallow (<10') throughout much of the project area based upon FWD deflections and power auger borings. Bedrock could be encountered at several locations depending on final grade considerations. The following table list potential shallow bedrock areas based upon power auger borings, power auger probes, and FWD deflections.

Possible Shallow Bedrock Areas

Station	Boring / FWD	Refusal Depth
730+50 – 731+50	FWD	< 10'
749+50 – 755+50	Borings/FWD	1.8' / < 5'
766+00 – 773+00	Boring/FWD	3.1' / < 5'
788+00 – 793+00	Boring/FWD	5.0' / < 10'
803+00 – 805+00	FWD	< 10'

Please review the power auger boring logs, power auger probe summary sheet, and the performance data summary sheet for detailed bedrock information.

Differential heaving may occur along shallow bedrock/soil contacts. Twenty to one transition zones should be constructed along soil/bedrock contacts (See profiles of undercut of frost susceptible soils over ledge).

Performance Data Summary

A Performance Data Summary (PDS) sheet has been provided as a separate attachment to this memo. Conditions throughout much of the project area are more challenging than the PDS indicates (number of deficiencies) due to presence of shallow bedrock which creates a very high subgrade resilient modulus value (See FWD Section).

As previously mentioned in the FWD section, the subgrade modulus is very high between stations 750+50 – 796+50. These high values (> 8000 psi) are likely due to presence of shallow bedrock. When a high subgrade resilient modulus value is encountered, the existing structural number commonly meets or exceeds the future traffic structural number indicating that the “Darwin Results” criteria on the PDS is met.. Unfortunately this is extremely misleading because the roadway is actually at high risk of premature failure. Thus between stations 750+50 – 796+50, the number of minimum performance deficiencies would likely be 1 more greater than what is indicated in the deficiency column on the PDS.

The following table lists the areas of greatest concern. Please refer to the Performance Data Summary Sheet for a detailed listing of performance criteria expectations throughout the entire project.

Areas of greatest concern

Area of Concern	Comments
743+00 – 761+00	The presence of relatively shallow bedrock and wet subgrade soils could impact future performance. Additional pavement, base, transition zones, and drainage improvements are required to meet the future structural number and to ease the deleterious affects of the shallow bedrock. Variable depth gravel recommended.
765+00 – 771+00	The presence of relatively shallow bedrock and wet subgrade soils could impact future performance. Aggressive ditching (> 3’) in this area would increase future performance expectations. Without aggressive drainage, this area will be at risk of premature failure.
798+00 – 799+00	Isolated low subgrade modulus area due to moist silty subgrade soils and organics. A 1.5’ thick layer of organics was encountered at a depth of 2.5’ – 4.0’. This area could be problematic during construction if moist to wet conditions exist. Ideally the organic layer should be removed.

Recommendations

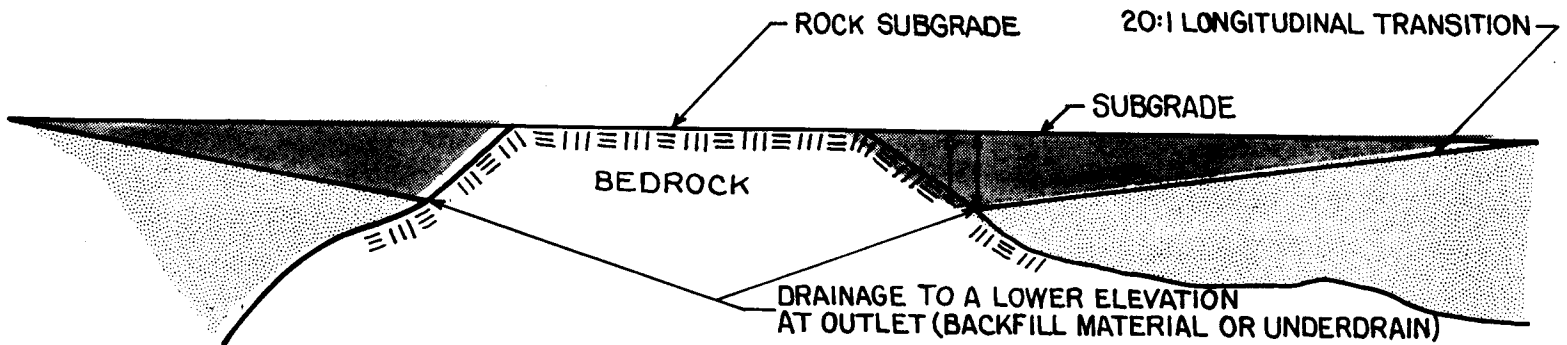
1. It is recommended that the entire project area be drained with aggressive ditching wherever possible. Groundwater is pooling on the shallow bedrock causing the highly frost susceptible subgrade soils to be saturated. Ditching should extend a minimum of 3 feet below finished grade whenever possible.
2. It is recommended that all shallow cross pipes be lowered. Heaving was encountered in February 2007 at the following shallow pipe locations: 743+82, 744+62, and 746+50. All pipes should be lowered to allow for deeper ditching.
3. Variable depth gravel (~ 6") consisting of Type A gravel is recommended between stations 743+00 – 761+00 due to the presence of shallow bedrock, lack of adequate base material, and wet highly frost susceptible subgrade soils. Several transition zones to alleviate differential heaving may be required within this area.
4. It is recommended that the resident engineer conduct a field review in late winter/early spring to determine the existence of any existing differential heaving. It is anticipated that heaving may exist between stations 743+00 – 761+00 and 765+50 – 776+00 due to the presence of shallow bedrock.

If differential heaving is observed transition zones should be constructed in the vicinity of the observed heave. A minimum 2' undercut below subgrade should be utilized along the soil/bedrock contact. See the attached profiles for undercutting frost susceptible soils over ledge.

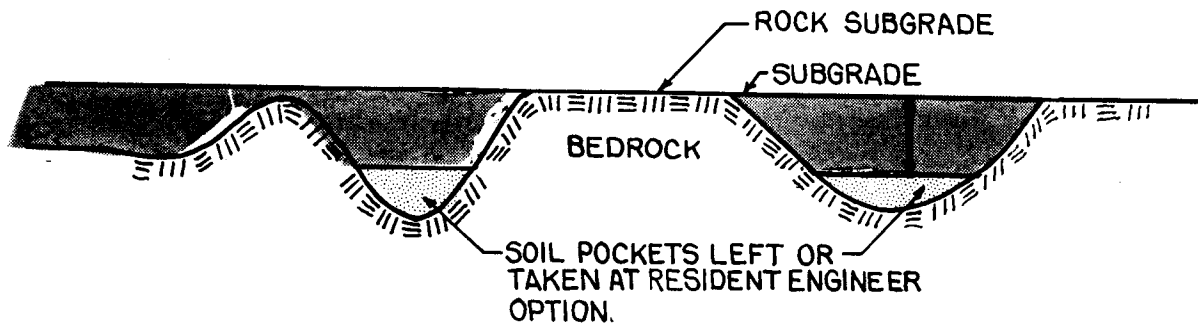
5. It is recommended that the subgrade be raked/scarified to a depth of 6 inches to expose and remove any cobbles present when building upon native till soils.

PROFILE OF UNDERCUT OF FROST SUSCEPTIBLE SOILS OVER LEDGE

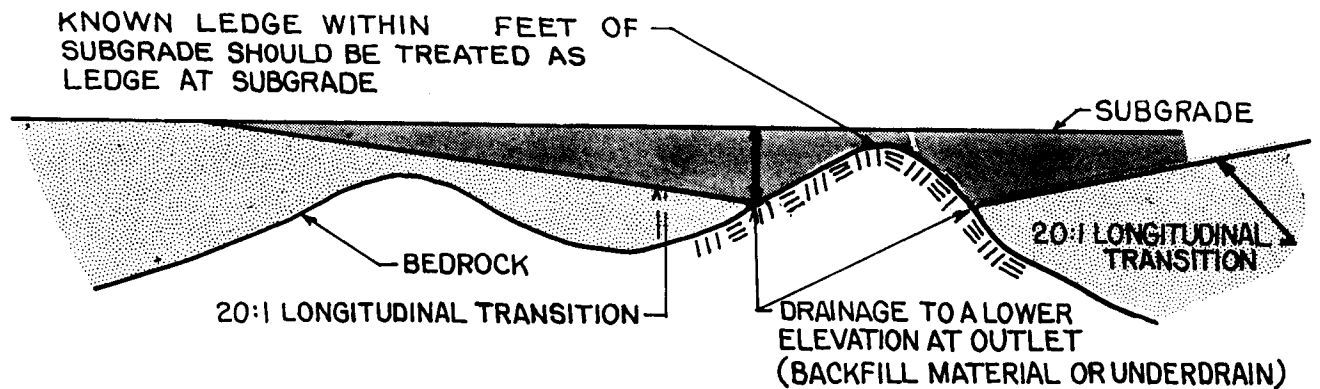
CONDITION 1



CONDITION 2



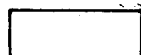
CONDITION 3



IF A SOIL SECTION BETWEEN LEDGE SUBGRADE IS OF SUCH LENGTH THAT THE TRANSITION FROM EACH EDGE WOULD MEET IT SHOULD BE TREATED AS AN EARTH POCKET



FROST SUSCEPTIBLE SOIL TO BE UNDERCUT AND REPLACED WITH NON FROST SUSCEPTIBLE MATERIAL.



FROST SUSCEPTIBLE SOIL

Performance Data Summary Sheet

Gouldsboro Rte. 186
CIP
12784.00

Station (FWD)	D E F	Minimum Performance Data Criteria			Boring Location (Plan View)	Base Material		Subgrade Soils					
						AASHTO Class	% #200	AASHTO Class	% #200				
					KEY								
Station		Red - Fail Green - Met			Solid Pave Thick Unbound Pave - UP Base Thickness (inches)	Soil Type AASHTO Sample #	% 200 Frost Moisture	Soil Type AASHTO Sample #	% 200 Frost Moisture				
					CL								
730+81	0												
733+31	0												
735+81	0				4.8 SP 2.4 UP 31.2	SiGSa A-1-b S11	14 II Damp	SiGSa A-1-b S12	17 II Damp				
738+31	0												
740+81	1				Probe 10.0' NR								
743+31	2	Pavement Thickness (4 inches)	Base Thickness (18 inches)	Subgrade Modulus (3000 psi)	Darwin Results	Heaved Shallow Pipe 743+82							
745+81	2					Heaved Shallow Pipe 744+62							
746+50						Heaved Shallow Pipe 746+50							
748+31	1					4.8 SP 2.4 UP 10.8	SiGSa A-1-b S11	14 II Damp	SiSa/Rock A-2-4 S10	35 II Ref 4.6'			
749+81	2					Probe 4.5' Ref	Frost Heave 748+81						
750+81	1					Probe 1.8' Ref	Outcrop 18' Right						
751+81	1					Probe 3.8' Ref	<i>This area likely to perform as if it had 2 deficiencies rather than 1 due to the shallow bedrock/high subgrade modulus relation. See FWD Section in Soils Memo</i>						
752+81	1					Probe 6.2' Ref							
753+51	1												
755+31	2								4.8 SP 2.4 UP 28.8*	SiGSa A-1-b S12	17 II Damp	SiSa A-2-4 S14	18 Wet 3.0' Ref 4.4'
758+56	3				7.8 SP - 13.8	SiGSa A-1-a S13	4 0 Damp	SiSa A-2-4 S15	21 II Wet 3.5'				
760+81	1												
763+31	1												
765+81	1												
766+31	1				Probe 3.1' Ref								
767+31	1				Probe 4.1' Ref								

- * SP = Solid Pavement Layer
- * UP = Unbound Pavement Layer
- SP+UP = Total Pavement Thickness
- * Base Thickness = Red indicates presence of "treated base"

Performance Data Summary Sheet

Gouldsboro Rte. 186
CIP
12784.00

Station (FWD)	D E F	Minimum Performance Data Criteria			Boring Location (Plan View)	Base Material		Subgrade Soils					
						AASHTO Class	% #200	AASHTO Class	% #200				
					KEY								
Station		Red - Fail Green - Met			Solid Pave Thick Unbound Pave - UP Base Thickness (inches)	Soil Type AASHTO Sample #	% 200 Frost Moisture	Soil Type AASHTO Sample #	% 200 Frost Moistur e				
					CL								
768+31	1				Probe 6.6' Ref	<i>This area likely to perform as if it had 2 deficiencies rather than 1 due to the shallow bedrock/high subgrade modulus relation. See FWD Section in Soils Memo</i>							
769+31	1				Probe 6.4' Ref								
770+31	1				Probe 6.0' Ref								
770+81	1												
773+31	1				Probe 10.0' NR								
775+81	1												
778+31	1												
780+81	2				3.6 SP 2.4 UP 20.4*	GSiSa A-1-b S17	23 II Moist	SiSa A-4 S18	37 III Damp				
783+81	1	Pavement Thickness (4 inches)	Base Thickness (18 inches)	Subgrade Modulus (3000 psi)	Darwin Results								
786+11	0												
788+31	0												
790+81	0								7.2 SP - 20.4	SiSaG A-1-a S19	8 0 Damp	SiSa/Rock A-4 S18	37 III Ref 5.0'
793+31	0												
796+06	1												
798+31	3								5.4 SP - 15.0	SiSaG A-1-a S20	6 0 Damp	SiSa/Peat A-2-4 Wet 3.8'	22 Peat 2.5'-4.0'
800+81	2												
803+31	2												
805+81	2												
806+31	2				Probe 10.0' NR								
807+31	2				Probe 6.4' Ref								

- * SP = Solid Pavement Layer
- * UP = Unbound Pavement Layer
- SP+UP = Total Pavement Thickness
- * Base Thickness = Red indicates presence of "treated base"

Performance Data Summary Sheet

Gouldsboro Rte. 186
 CIP
 12784.00

Station (FWD)	D E F	Minimum Performance Data Criteria				Boring Location (Plan View)	Base Material		Subgrade Soils	
							AASHTO Class	% #200	AASHTO Class	% #200
					KEY					
Station			Red - Fail	Green - Met	Solid Pave Thick Unbound Pave - UP Base Thickness (inches)	Soil Type AASHTO Sample #	% 200 Frost Moisture	Soil Type AASHTO Sample #	% 200 Frost Moisture	
					CL					
807+31	2				Probe 6.4' Ref					
808+31	2				Probe 5.3' Ref					
808+53	2									

* SP = Solid Pavement Layer
 * UP = Unbound Pavement Layer
 SP+UP = Total Pavement Thickness
 * Base Thickness = Red indicates presence of "treated base"

December 8, 2006

Falling Weight Deflectometer (FWD) Summary Sheet

Project #: 12784.00
Town(s): Gouldsboro (2 Sections)
Route(s): #186
Requested By: S. Hayden
Direction of Testing: North

Of FWD tests: 75
Design Life: 12 Yrs
Initial Serviceability: 4.5
Reliability Level: 95%

Of Power Augers/Spoons 23/0
Future 18-kip ESALs (Design Life): 324,120
Terminal Serviceability: 2.5
Overall Standard Deviation: .45

Locations

Distance (Feet)

Description

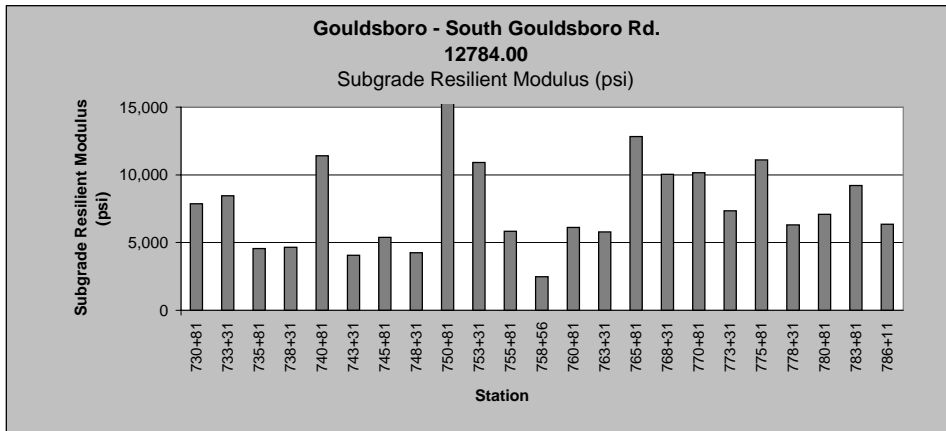
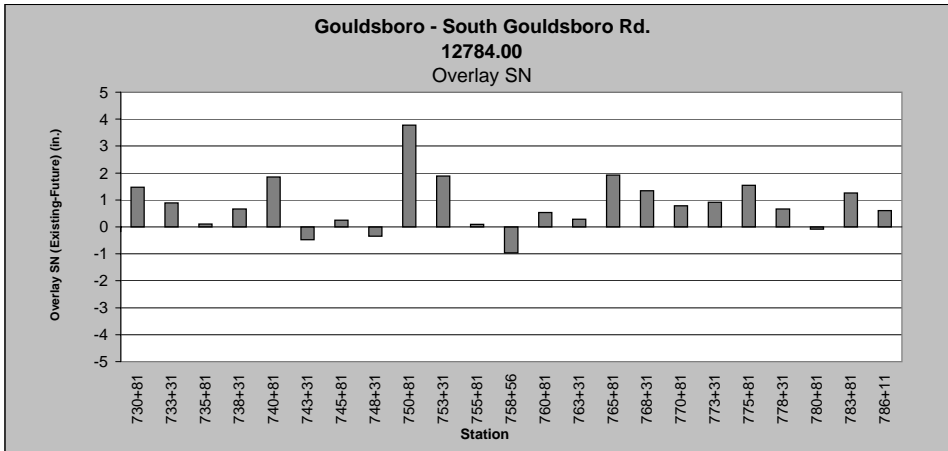
Comments:

Gouldsboro - South Gouldsboro Rd.
12784.00 Rte. 186

December 8, 2006

Station (Feet)	Existing Structural Number (in.)	Future Traffic Structural Number (in.)	Overlay Structural Number (Existing - Future)	Recommended Pavement Thickness (in.)	Pavement Modulus (psi)	Subgrade Resilient Modulus (psi)	Pavement Depth (in)	* Combined Pavement/Gravel Depth Used for Calculation (in)
730+81	4.42	2.95	1.47	-	52,772	7,862	4.8	26.2
733+31	3.76	2.87	0.89	-	32,387	8,462	4.8	26.2
735+81	3.7	3.59	0.11	-	30,888	4,549	4.8	26.2
738+31	4.24	3.57	0.67	-	46,424	4,648	4.8	26.2
740+81	4.42	2.57	1.85	-	52,728	11,417	4.8	26.2
743+31	3.27	3.74	-0.47	1.07	35,989	4,071	4.8	22
745+81	3.63	3.38	0.25	-	49,199	5,397	4.8	22
748+31	3.34	3.68	-0.34	0.77	38,454	4,241	4.8	22
750+81	5.29	1.51	3.78	-	152,386	44,638	4.8	22
753+31	4.51	2.62	1.89	-	47,448	10,925	4.8	27.7
755+81	3.38	3.29	0.09	-	19,949	5,844	4.8	27.7
758+56	3.47	4.43	-0.96	2.18	26,791	2,477	7.8	25.8
760+81	3.76	3.23	0.53	-	47,760	6,128	3.6	23
763+31	3.58	3.3	0.28	-	41,233	5,797	3.6	23
765+81	4.38	2.46	1.92	-	75,773	12,825	3.6	23
768+31	4.04	2.7	1.34	-	59,312	10,039	3.6	23
770+81	3.47	2.69	0.78	-	37,805	10,161	3.6	23
773+31	3.95	3.03	0.92	-	55,579	7,337	3.6	23
775+81	4.14	2.6	1.54	-	63,967	11,109	3.6	23
778+31	3.86	3.2	0.66	-	51,898	6,298	3.6	23
780+81	2.99	3.07	-0.08	0.18	24,219	7,077	3.6	23
783+81	4.05	2.79	1.26	-	34,600	9,212	7.2	27.6
786+11	3.8	3.19	0.61	-	28,552	6,354	7.2	27.6

* For actual Gravel Depths, see logdraft forms

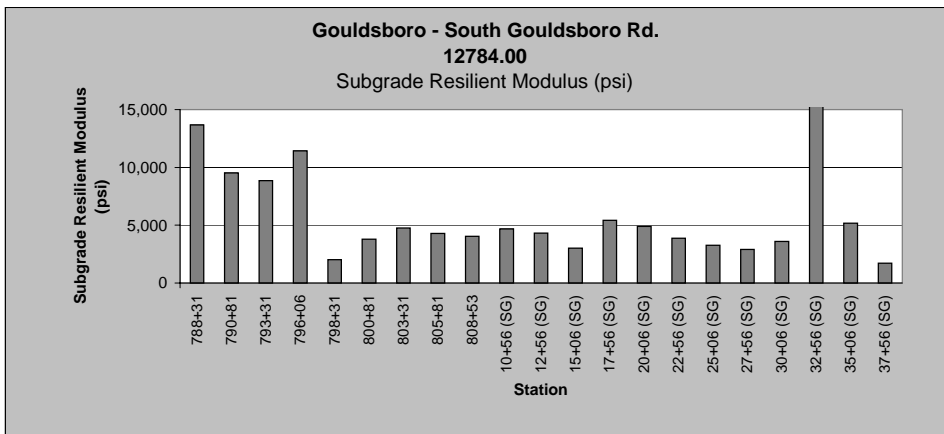
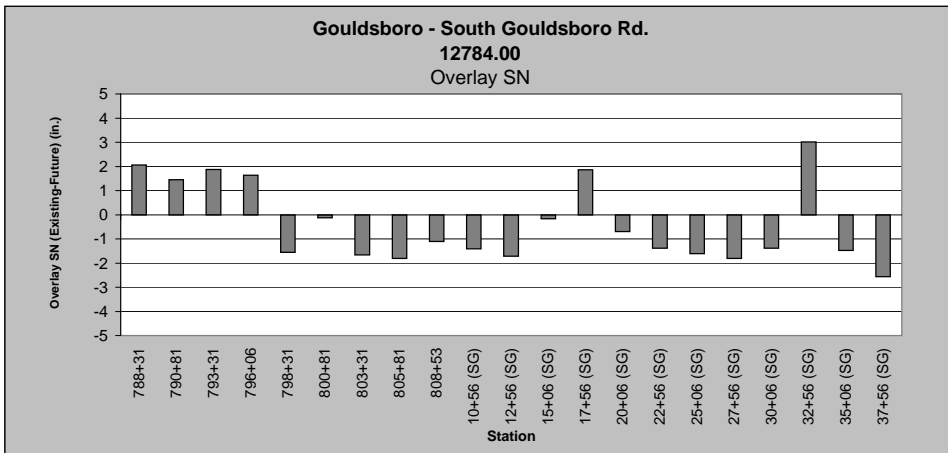


**Gouldsboro - South Gouldsboro Rd.
12784.00 Rte. 186**

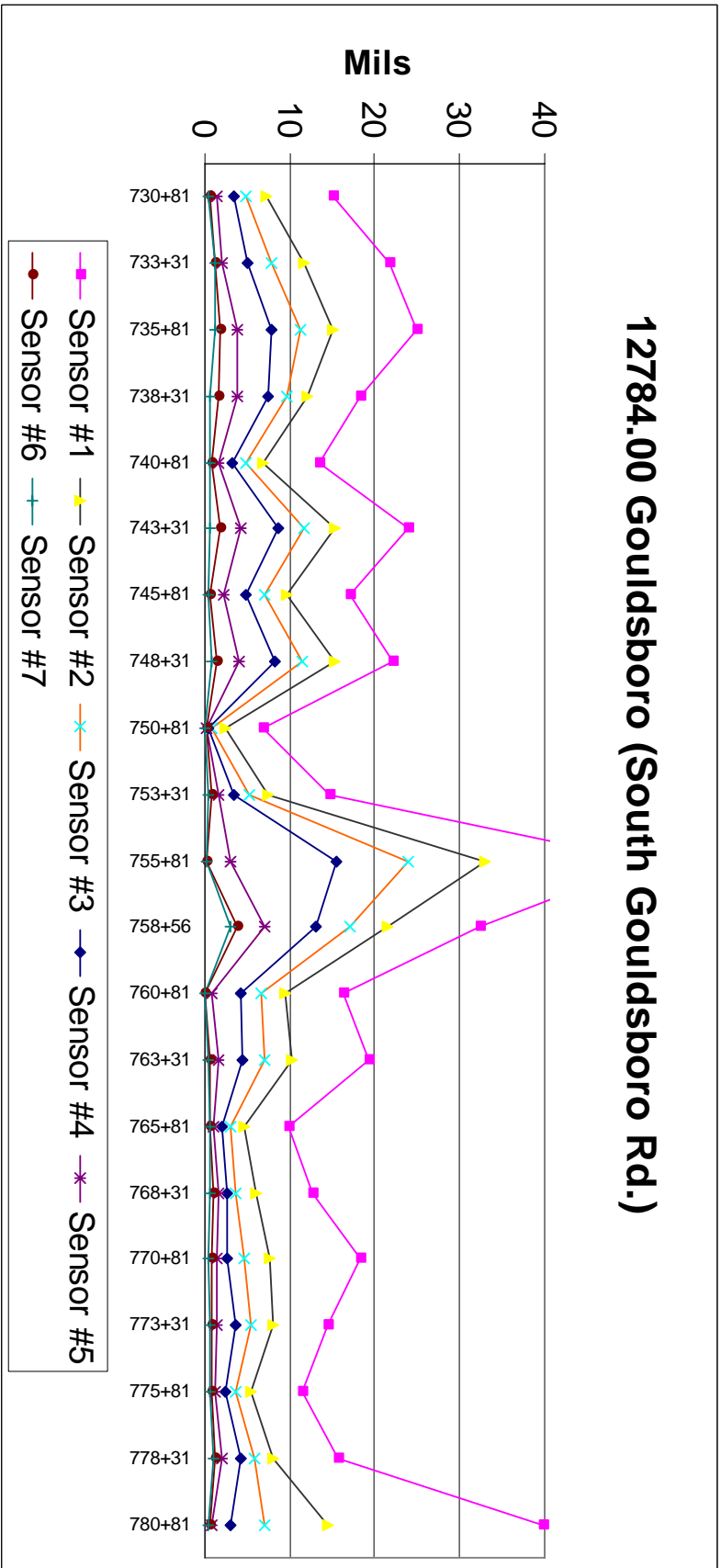
December 8, 2006

Station (Feet)	Existing Structural Number (in.)	Future Traffic Structural Number (in.)	Overlay Structural Number (Existing - Future)	Recommended Pavement Thickness (in.)	Pavement Modulus (psi)	Subgrade Resilient Modulus (psi)	Pavement Depth (in)	* Combined Pavement/Gravel Depth Used for Calculation (in)
788+31	4.47	2.41	2.06	-	46,658	13,667	7.2	27.6
790+81	4.2	2.75	1.45	-	38,610	9,517	7.2	27.6
793+31	4.69	2.82	1.87	-	53,695	8,868	7.2	27.6
796+06	4.21	2.57	1.64	-	39,047	11,438	7.2	27.6
798+31	3.17	4.73	-1.56	3.55	21,882	2,028	5.4	25.2
800+81	3.72	3.84	-0.12	0.27	35,322	3,780	5.4	25.2
803+31	1.88	3.54	-1.66	3.77	57,982	4,754	5.4	10.8
805+81	1.86	3.67	-1.81	4.11	56,337	4,296	5.4	10.8
808+53	2.65	3.75	-1.1	2.5	161,671	4,037	5.4	10.8
10+56 (SG)	2.15	3.56	-1.41	3.2	86,185	4,669	5.4	10.8
12+56 (SG)	1.95	3.66	-1.71	3.89	64,107	4,327	5.4	10.8
15+06 (SG)	3.97	4.14	-0.17	0.39	37,343	3,017	6	26.4
17+56 (SG)	5.24	3.38	1.86	-	85,767	5,423	6	26.4
20+06 (SG)	2.8	3.5	-0.7	1.59	63,414	4,886	9.6	15.6
22+56 (SG)	2.42	3.8	-1.38	3.14	40,959	3,878	9.6	15.6
25+06 (SG)	2.42	4.03	-1.61	3.66	40,756	3,271	9.6	15.6
27+56 (SG)	2.39	4.2	-1.81	4.11	39,364	2,898	9.6	15.6
30+06 (SG)	2.52	3.9	-1.38	3.14	46,529	3,608	9.6	15.6
32+56 (SG)	4.28	1.27	3.01	-	227,062	66,513	9.6	15.6
35+06 (SG)	1.96	3.44	-1.48	3.36	21,710	5,162	9.6	15.6
37+56 (SG)	2.42	4.98	-2.56	5.82	40,721	1,729	9.6	15.6

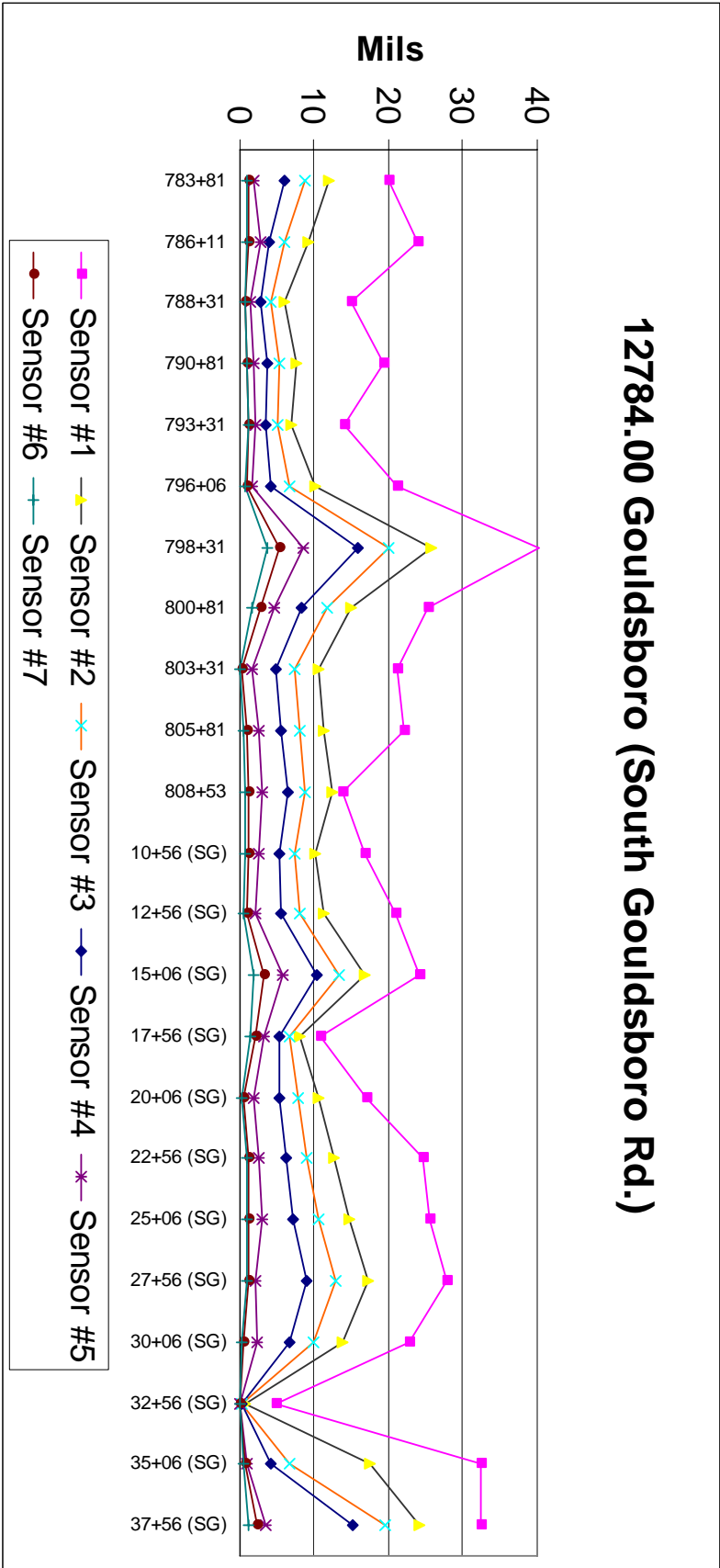
* For actual Gravel Depths, see logdraft forms



12784.00 Gouldsboro (South Gouldsboro Rd.)



12784.00 Gouldsboro (South Gouldsboro Rd.)



PAVEMENT DEPTH INFORMATION

Gouldsboro

Rte. 186

12784.00

STATION	LEFT			CL	RIGHT		
	15'	10'	5'		5'	10'	15'
735+81					(6.5') 4.8 SP 2.4 UP		
748+31		(9.5') 4.8 SP	(4.5') 7.8 SP	8.4 SP	(6.2') 4.8 SP 2.4 UP	(9.0') 9.0 SP	
756+06					(6.2') 4.8 SP 2.4 UP		
758+56					(6.5') 7.8 SP		
768+31		(10.5') 6.4 SP	(4.5') 3.8 SP	6.0 SP	(6.5') 6.0 SP	(8.5') 3.6 SP	
780+96					(6.5') 3.6 SP 2.4 UP		
790+81					(6.7') 7.2 SP		
798+31		(9.5') 6.0 SP	4.6 SP	6.0 SP	(6.5') 5.4 SP	(9.0') 6.0 SP	

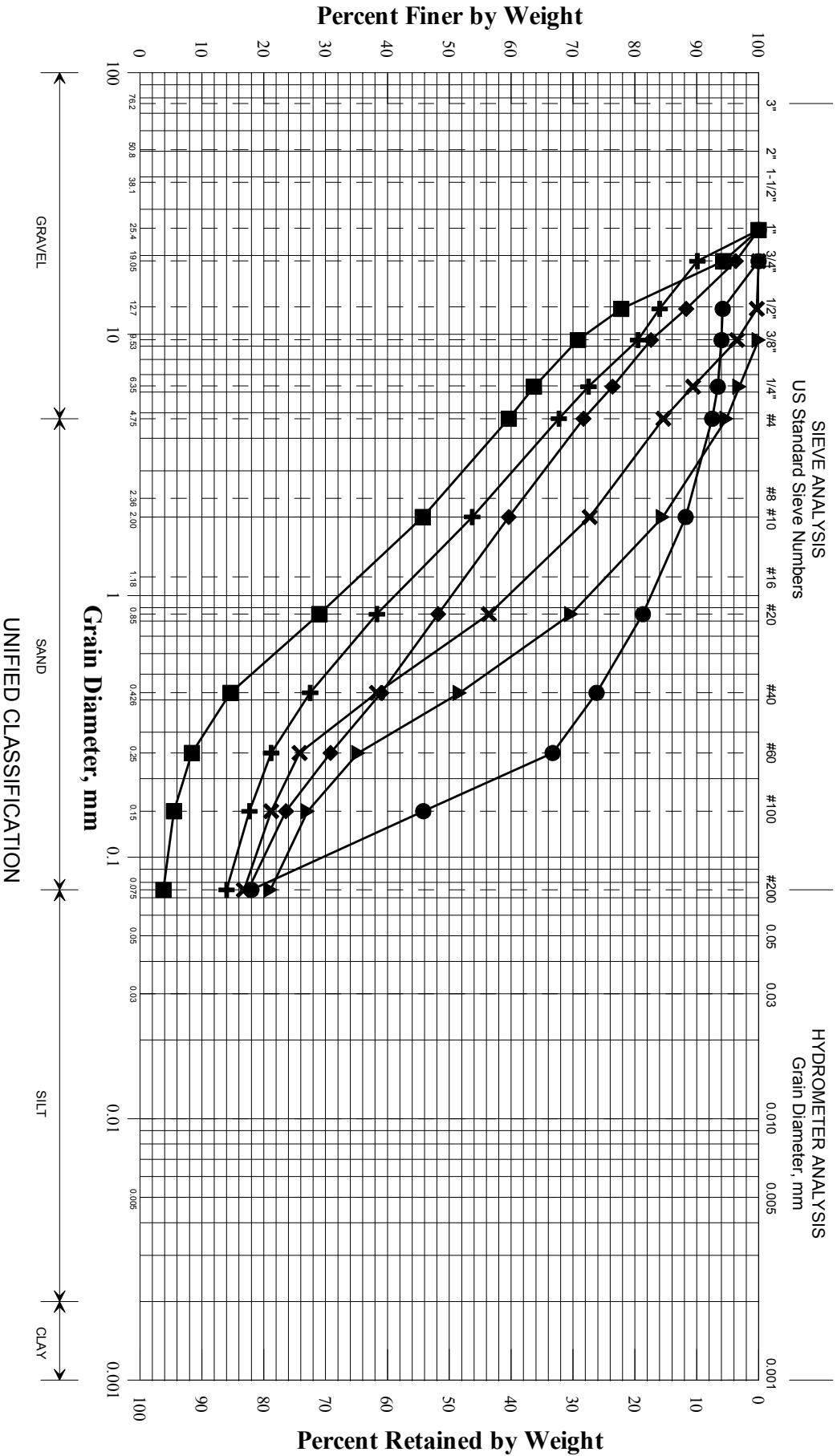
* SP = Solid Pavement Layer, * UP = Unbound Pavement Layer,

Total Pavement = SP+UP, (7.7') = actual offset

Non shaded data obtained from power auger borings, shaded data obtained from coring

The contractor is responsible for determining existing pavement thickness

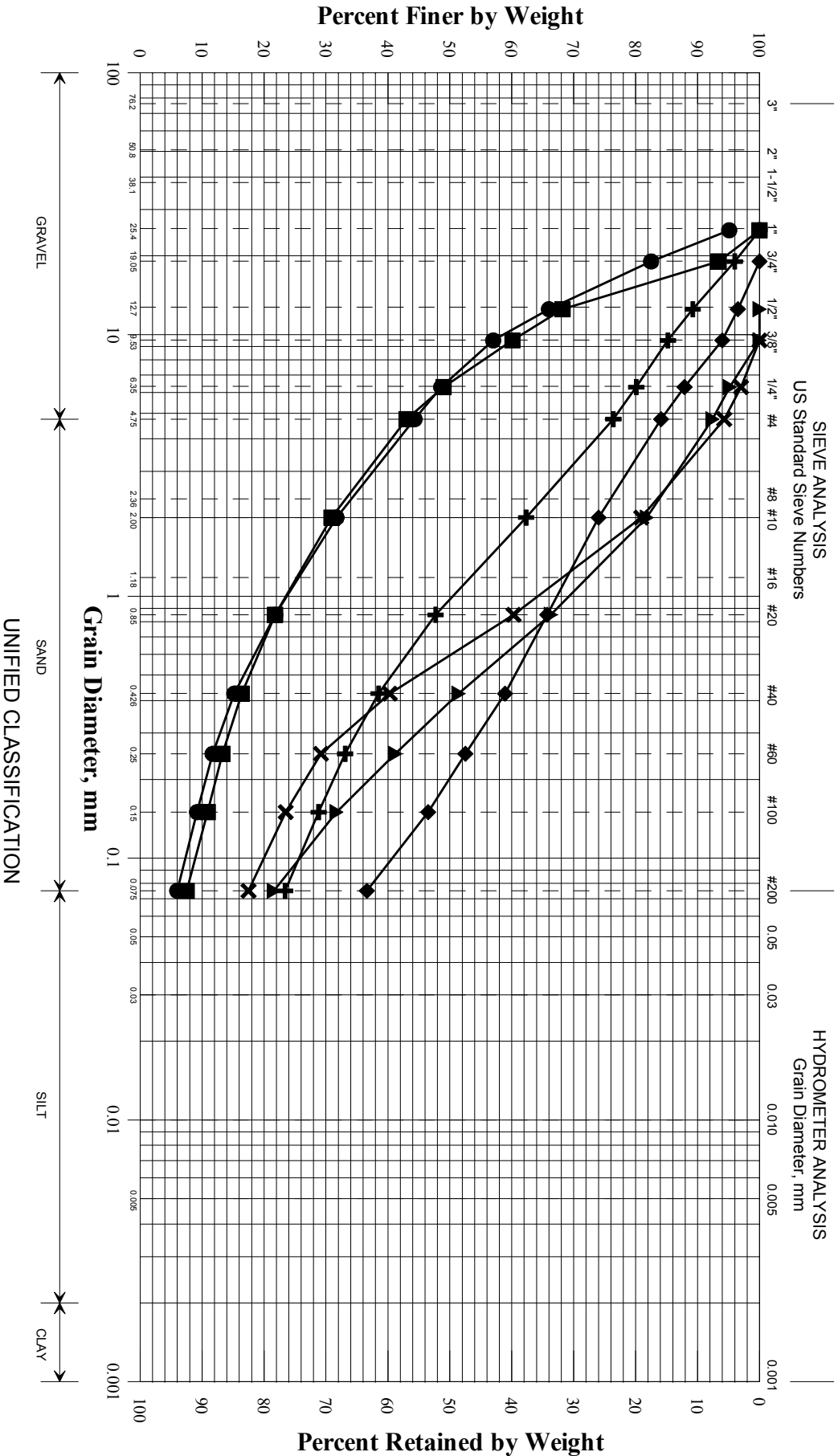
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	HB-GO-107/S11	6.5 RT	0.6-2.6	SAND, some gravel, little silt.	6.8			
◆	HB-GO-107/S12	6.5 RT	3.2-5.0	SAND, some gravel, little silt.	9.3			
■	HB-GO-109/S13	6.2 RT	0.6-1.2	Gravelly SAND, trace silt.	5.0			
●	HB-GO-109/S14	6.2 RT	3.0-4.4	SAND, little silt, trace gravel.	18.5			
▲	HB-GO-110/S15	6.5 RT	1.8-3.5	SAND, some silt, trace gravel.	22.4			
×	HB-GO-110/S16	6.5 RT	3.5-5.0	SAND, little silt, little gravel.	12.7			

PIN
012784.00
Town
Gouldsboro
Reported by/Date
WHITE, TERRY A 2/8/2007

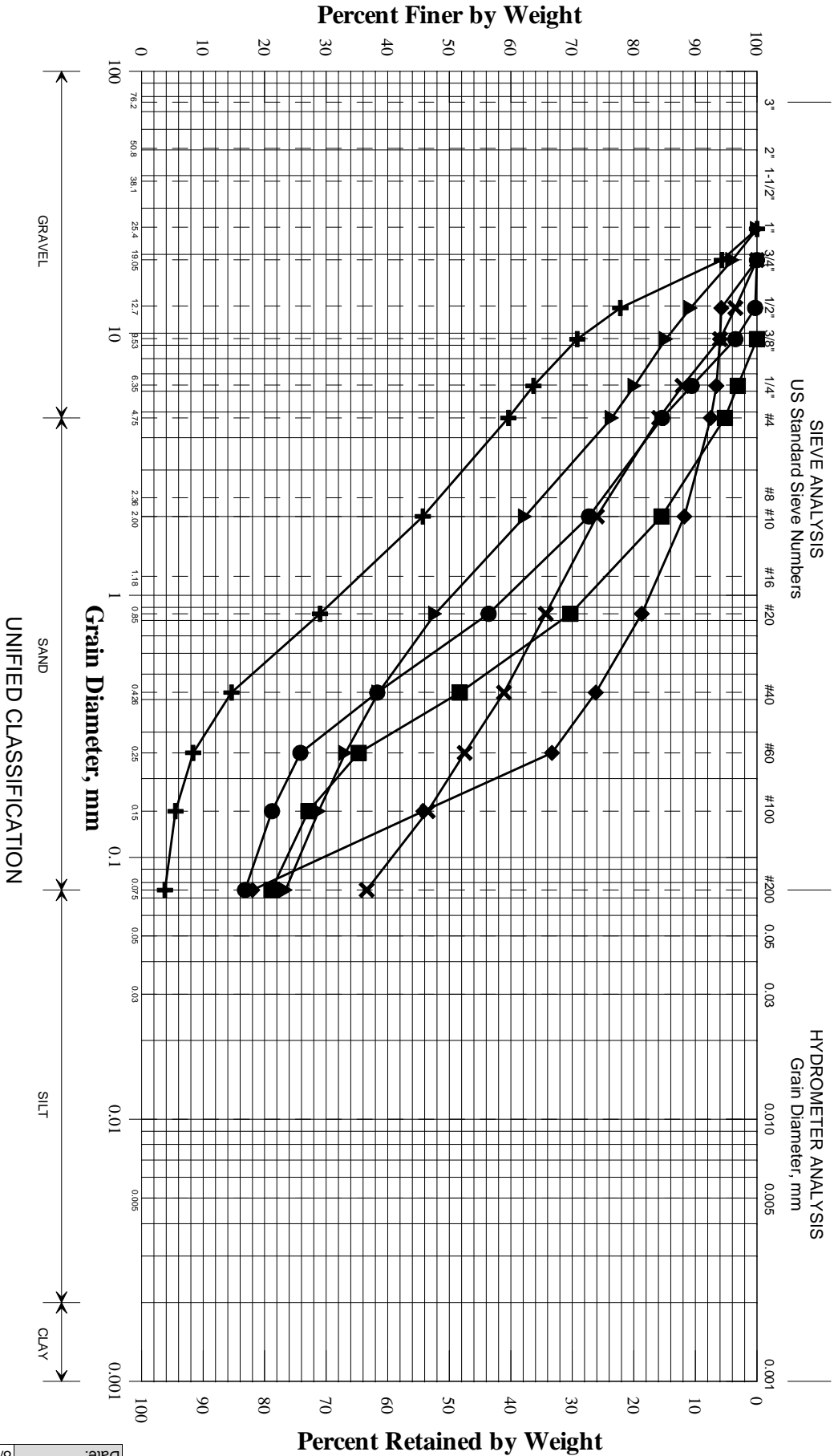
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	HB-GO-111S17	6.5 RT	0.9-2.2	SAND, some gravel, some silt.	13.1			
◆	HB-GO-111S18	6.5 RT	2.2-5.0	Silty SAND, little gravel.	8.0			
■	HB-GO-112S19	6.7 RT	0.6-2.3	GRAVEL, some sand, trace silt.	2.7			
●	HB-GO-113S20	6.5 RT	0.45-1.7	Sandy GRAVEL, trace silt.	3.1			
▲	HB-GO-113S21	6.5 RT	1.7-2.5	SAND, some silt, trace gravel.	13.1			
×	HB-GO-113S22	6.5 RT	2.5-4.0	SAND, little silt, trace gravel.	78.2			

PIN
012784.00
Town
Gouldsboro
Reported by/Date
WHITE, TERRY A 2/8/2007

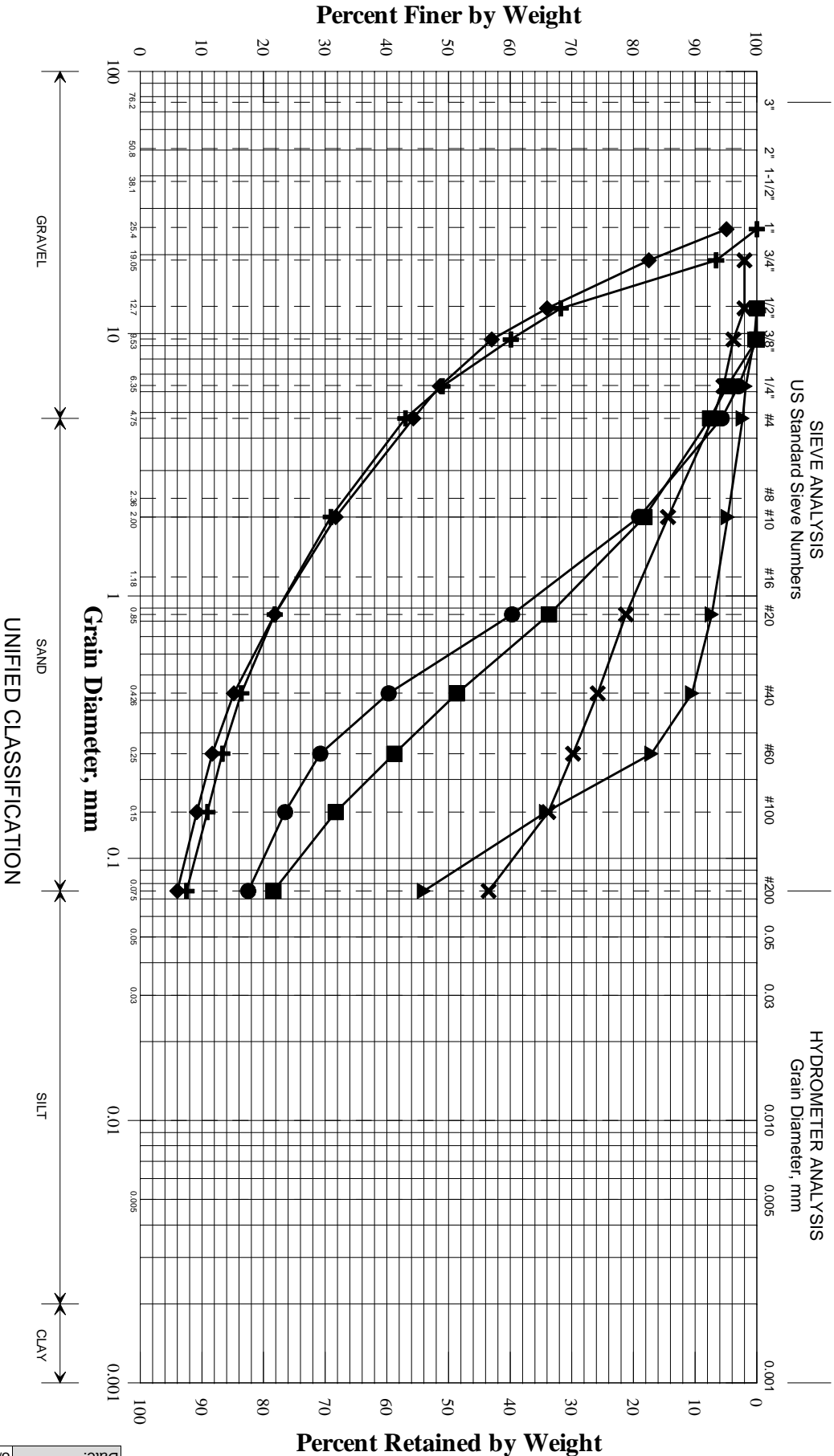
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	HB-GO-109/S13	442+75	6.2 RT	Gravelly SAND, trace silt.	5.0			
◆	HB-GO-109/S14	422+75	6.2 RT	SAND, little silt, trace gravel.	18.5			
■	HB-GO-110/S15	445+25	6.5 RT	SAND, some silt, trace gravel.	22.4			
●	HB-GO-110/S16	445+25	6.5 RT	SAND, little silt, little gravel.	12.7			
▲	HB-GO-111/S17	467+65	6.5 RT	SAND, some gravel, some silt.	13.1			
×	HB-GO-111/S18	467+65	6.5 RT	Silty SAND, little gravel.	8.0			

Reported by:	8/4/2006
Town:	WILSON, TERRY A
Pin:	Gouldsboro
	012784.00

State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
HB-GO-112/S19	477+50	6.7 RT	0.6-2.3	GRAVEL, some sand, trace silt.	2.7			
HB-GO-113/S20	485+00	6.5 RT	0.45-1.7	Sandy GRAVEL, trace silt.	3.1			
HB-GO-113/S21	485+00	6.5 RT	1.7-2.5	SAND, some silt, trace silt.	13.1			
HB-GO-113/S22	485+00	6.5 RT	2.5-4.0	SAND, little silt, trace gravel.	78.2			
HB-GO-114/S23	498+50	5.7 RT	0.9-4.6	Silty SAND, trace gravel.	14.8			
HB-GO-116/S24	512+50	5.4 RT	1.3-4.5	Sandy SILT with clay, trace gravel.	21.9			

Reported by:	8/4/2006
Town:	WILSON, TERRY A
Pin:	Gouldsboro
	012784.00

State of Maine - Department of Transportation
Power Auger Probe Summary Sheet

Town(s): Gouldsboro

Project Number: 12784.01

Station (Feet)	Offset (Feet)	Weathered Rock (Feet)	Refusal (Feet)	No Refusal (Feet)	Water Depth (Ft.)	Comments / Date 12/5/2008
727+00	12.0 Rt.			5.0		
728+00	7.5 Rt.			5.0		Stations with (*)
729+00	11.5 Rt.			5.0		completed 7/10-12/2006
730+00	12.0 Rt.			5.0		
731+00	9.5 Rt.			5.0	1.0	
732+00	11.5 Rt.			5.0	0.6	
733+00	11.5 Rt.			5.0	2.1	
733+50	10.0 Rt.			5.0		
734+00	10.0 Rt.		4.4			
734+00	11.5 Lt.			5.0		
734+50	10.0 Rt.		3.5			
735+00	10.5 Rt.			5.0		
735+00	9.0 Lt.			5.0		
736+00	7.0 Lt.			5.0		
736+00	10.0 Rt.			5.0		
736+50	9.0 Lt.		4.8			with cobbles
736+50	9.0 Rt.		4.7		2.2	
737+00	8.0 Lt.		4.4			
737+00	11.5 Rt.		3.3			
740+50	11.5 Lt.		7.6			
740+50	11.0 Rt.			8.5		
*740+81	6.4 Rt.			10.0	6.5	
741+00	11.5 Lt.		7.5			12/15/2008
741+00	12.0 Rt.			8.5		
741+50	10.5 Lt.		3.0			
741+50	11.0 Rt.		4.1			
748+00	10.0 Lt.		2.1			
748+00	10.5 Rt.		3.5			
748+50	10.0 Lt.		2.4			
748+50	10.5 Rt.			5.0		
749+00	11.5 Lt.		1.6			
749+00	10.5 Rt.		1.0			
749+50	10.0 Lt.		2.2			
749+50	10.0 Rt.		1.8			
*449+81	6.0 Rt.		4.5			
750+00	10.0 Lt.			5.0		
750+00	10.0 Rt.			5.0		
*750+81	6.5 Rt.		1.8			
*750+81	18.0 Rt.					outcrop
*751+81	6.0 Rt.		3.8			
*752+81	6.1 Rt.		6.2		4.3	
760+00	11.5 Lt.		4.2			
760+00	10.5 Rt.			5.0		
760+50	11.0 Lt.		1.7			
760+50	10.0 Rt.		3.0			
761+00	13.5 Lt.		1.4			
761+00	11.0 Rt.		2.1			

State of Maine - Department of Transportation
Power Auger Probe Summary Sheet

Town(s): Gouldsboro

Project Number: 12784.01

Station (Feet)	Offset (Feet)	Weathered Rock (Feet)	Refusal (Feet)	No Refusal (Feet)	Water Depth (Ft.)	Comments / Date 12/15-16/08
761+50	11.0 Lt.		2.5		2.0	
761+50	11.0 Rt.		1.0			Stations with (*)
762+00	10.5 Lt.		3.2			completed 7/10-12/2006
762+00	10.0 Rt.		2.2			
762+50	11.0 Lt.		2.0			
762+50	9.5 Rt.		3.8			
765+00	12.0 Lt.		3.5			
765+00	11.0 Rt.			6.0		
765+50	12.0 Lt.		3.3			
765+50	10.5 Rt.		1.5			
766+00	12.0 Lt.		3.6			
766+00	12.0 Rt.		2.4			
*766+31	6.0 Rt.		3.1			
766+50	11.0 Lt.		3.9			
766+50	12.0 Rt.		2.5			
767+00	10.0 Lt.		4.1			
767+00	11.5 Rt.		3.3			
*767+31	5.5 Rt.		4.1			frequent cobbles
767+50	11.0 Lt.		3.9			
767+50	10.0 Rt.		4.6			
768+00	9.0 Lt.		2.4			
768+00	10.0 Rt.		2.7			
*768+31	6.5 Rt.		6.6			frequent cobbles
768+50	11.0 Lt.		2.3			
768+50	10.0 Rt.		4.1			
769+00	12.0 Lt.		2.5			
769+00	11.0 Rt.		5.2			
*769+31	6.0 Rt.		6.4			frequent cobbles
770+00	13.0 Rt.			5.0		
770+31	6.0 Rt.		6.0			
771+00	13.0 Rt.			5.0		
772+00	13.0 Rt.			5.0		
773+00	13.0 Rt.			5.0		
773+31	7.3 Rt.			10.0		
774+00	13.0 Rt.			5.0		
775+00	11.0 Rt.			5.0		
776+00	8.0 Lt.			5.0		
776+00	11.0 Rt.			5.0		
776+90	11.0 Rt.			5.0		
777+00	12.0 Lt.			5.0		
777+00	12.0 Rt.					overhead wires
778+00	11.0 Lt.			5.0		
778+00	11.0 Rt.			5.0		
779+00	11.0 Lt.			5.0		
779+00	11.0 Rt.			5.0		
780+00	11.0 Lt.			5.0		
780+00	10.0 Rt.			5.0		

State of Maine - Department of Transportation
Power Auger Probe Summary Sheet

Town(s): Gouldsboro

Project Number: 12784.01

Station (Feet)	Offset (Feet)	Weathered Rock (Feet)	Refusal (Feet)	No Refusal (Feet)	Water Depth (Ft.)	Comments / Date 12/15-16/08
781+00	11.0 Lt.			5.0		
781+00	10.0 Rt.			5.0		
782+00	12.0 Lt.			5.0		
782+00	10.0 Rt.			5.0		
783+00	10.5 Lt.			5.0		
784+00	10.5 Lt.			5.0		
785+00	10.0 Lt.			5.0		
786+00	10.0 Lt.			5.0		
787+00	8.5 Lt.			5.0		
788+00	9.0 Lt.			5.0		
789+00	8.0 Lt.			5.0		
790+00	11.5 Lt.			10.0		
790+00	11.5 Rt.			10.5		
791+00	7.5 Lt.			10.0		
791+00	8.5 Lt.		4.2			boulder ?
791+10	8.5 Rt.			10.5		
792+00	9.6 Lt.			10.0		
792+00	8.0 Rt.		8.5			
793+00	11.0 Lt.			10.0		
793+00	6.0 Rt.			10.0		
794+00	10.0 Lt.			10.0		
794+00	7.0 Rt.			10.0		
795+00	11.0 Lt.			5.5		
795+00	8.0 Rt.			4.0		
796+00	10.0 Lt.			4.0		
796+00	8.0 Rt.			4.0		
797+00	10.0 Lt.			4.0		
797+00	8.0 Rt.			4.0		
798+00	11.0 Lt.			5.0	2.0	
798+00	9.0 Rt.			5.0		
799+00	12.0 Lt.			4.0		
799+00	9.5 Rt.			4.0		
800+00	9.5 Lt.			4.0		
800+00	9.5 Rt.			4.0		
*806+31	5.5 Rt.			10.0		
*807+31	5.1 Rt.		6.4			
*808+31	7.9 Rt.		5.3		3.8	
Stations with (*) completed 7/10-12/2006						

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS		Project: Route 186 Location: Gouldsboro, Maine	Boring No.: HB-GO-107 PIN: 12784.00
Driller: MaineDOT	Elevation (ft.):	Auger ID/OD: 5"	
Operator: E. Giguere	Datum: NAVD 88	Sampler: Off Flights	
Logged By: G. Lidstone	Rig Type: CME 45C	Hammer Wt./Fall: N/A	
Date Start/Finish: 7/11/06-7/11/06	Drilling Method: Solid Stem Auger	Core Barrel: N/A	
Boring Location: 735+81, 6.5' Rt.	Casing ID/OD: N/A	Water Level*: None Observed	
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger		Definitions: S _u = Insitu Field Vane Shear Strength (psf) T _v = Pocket Torvane Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) S _{u(lab)} = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods	
		Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test	

Depth (ft.)	Sample Information								Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log		
0	S11		0.60 - 2.60			SSA	-0.40 -0.60		PAVEMENT. Unbound PAVEMENT. Brown, damp, fine to coarse SAND, some gravel, little silt.	G#206870 A-1-b, SM WC=6.8%
2							-2.60		Cobble from 2.6-3.2' bgs.	
4	S12		3.20 - 5.00				-3.20 -5.00		Brown, moist, fine to coarse SAND, some gravel, trace silt.	G#206871 A-1-b, SM WC=9.3%
6									Bottom of Exploration at 5.00 feet below ground surface. NO REFUSAL	
8										
10										
12										

Remarks:
All offsets are from existing Roadway CL.

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS		Project: Route 186 Location: Gouldsboro, Maine	Boring No.: HB-GO-108 PIN: 12784.00
Driller: MaineDOT	Elevation (ft.):	Auger ID/OD: 5"	
Operator: E. Giguere	Datum: NAVD 88	Sampler: Off Flights	
Logged By: G. Lidstone	Rig Type: CME 45C	Hammer Wt./Fall: N/A	
Date Start/Finish: 7/11/06-7/11/06	Drilling Method: Solid Stem Auger	Core Barrel: N/A	
Boring Location: 748+31, 6.2' Rt.	Casing ID/OD: N/A	Water Level*: None Observed	
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger		Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_{u(lab)}$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods	
		Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test	

Depth (ft.)	Sample Information								Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log		
0									PAVEMENT.	
									Unbound PAVEMENT.	
									Brown, damp, fine to coarse SAND, some gravel, little silt. \approx S11	
2									Brown, moist, silty fine to medium SAND, cobbles, trace gravel. \approx S10	
4										
									Bottom of Exploration at 4.60 feet below ground surface.	
									REFUSAL	
6										
8										
10										
12										

Remarks:
All offsets are from existing Roadway CL.

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS		Project: Route 186 Location: Gouldsboro, Maine	Boring No.: HB-GO-109 PIN: 12784.00
Driller: MaineDOT	Elevation (ft.):	Auger ID/OD: 5"	
Operator: E. Giguere	Datum: NAVD 88	Sampler: Off Flights	
Logged By: G. Lidstone	Rig Type: CME 45C	Hammer Wt./Fall: N/A	
Date Start/Finish: 7/11/06-7/11/06	Drilling Method: Solid Stem Auger	Core Barrel: N/A	
Boring Location: 756+06, 6.2' Rt.	Casing ID/OD: N/A	Water Level*: 3.0' bgs.	
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger		Definitions: S _u = Insitu Field Vane Shear Strength (psf) T _v = Pocket Torvane Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) S _{u(lab)} = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods	
		Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test	

Depth (ft.)	Sample Information								Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows						
0	S13		0.60 - 1.20			SSA			-0.40 -0.60 -1.20	PAVEMENT. Unbound PAVEMENT. Dark brown, damp, fine to coarse SAND, some gravel, trace silt. Brown, damp, fine to coarse SAND, some gravel, little silt. ≈ S12	G#206872 A-1-a, SW-SM WC=5.0%	
2												
4	S14		3.00 - 4.40						-3.00 -4.40	Brown, wet, fine SAND, trace medium sand.	G#206873 A-2-4, SM WC=18.5%	
6										Bottom of Exploration at 4.40 feet below ground surface. REFUSAL		
8												
10												
12												

Remarks:
All offsets are from existing Roadway CL.

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS		Project: Route 186 Location: Gouldsboro, Maine	Boring No.: HB-GO-110 PIN: 12784.00
Driller: MaineDOT	Elevation (ft.):	Auger ID/OD: 5"	
Operator: E. Giguere	Datum: NAVD 88	Sampler: Off Flights	
Logged By: G. Lidstone	Rig Type: CME 45C	Hammer Wt./Fall: N/A	
Date Start/Finish: 7/11/06-7/11/06	Drilling Method: Solid Stem Auger	Core Barrel: N/A	
Boring Location: 758+56, 6.5' Rt.	Casing ID/OD: N/A	Water Level*: 3.5' bgs.	
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger		Definitions: S _u = Insitu Field Vane Shear Strength (psf) T _v = Pocket Torvane Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) S _{u(lab)} = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods	
		Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test	

Depth (ft.)	Sample Information								Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows						
0										PAVEMENT.		
						SSA		-0.65		Dark brown, damp, fine to coarse SAND, some gravel, trace silt. ≈S13		
2	S15		1.80 - 3.50					-1.80		Brown, moist, silty fine to medium SAND, trace coarse sand.	G#206874 A-2-4, SM WC=22.4%	
4	S16		3.50 - 5.00					-3.50		Brown, wet, silty fine to coarse SAND, trace gravel.	G#206875 A-1-b, SM WC=12.7%	
								-5.00		Bottom of Exploration at 5.00 feet below ground surface. NO REFUSAL		
6												
8												
10												
12												

Remarks:
All offsets are from existing Roadway CL.

Driller: MaineDOT	Elevation (ft.):	Auger ID/OD: 5"
Operator: E. Giguere	Datum: NAVD 88	Sampler: Off Flights
Logged By: G. Lidstone	Rig Type: CME 45C	Hammer Wt./Fall: N/A
Date Start/Finish: 7/11/06-7/11/06	Drilling Method: Solid Stem Auger	Core Barrel: N/A
Boring Location: 780+96, 6.5' Rt.	Casing ID/OD: N/A	Water Level*: None Observed

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_{u(lab)}$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Depth (ft.)	Sample Information								Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows						
0	S17		0.90 - 2.20			SSA			-0.10 -0.30 -0.50 -0.90	PATCH. PAVEMENT. Unbound PAVEMENT. Dark brown, damp, fine to coarse SAND, some gravel, trace silt. \approx S13 Brown, moist, silty fine to coarse SAND, little gravel.	G#206926 A-1-b, SM WC=13.1%	
2	S18		2.20 - 5.00						-2.20	Brown, damp, dense, silty fine to medium SAND, cobbles, little gravel, (Till).	G#206927 A-4, SM WC=8.0%	
4									-5.00	Bottom of Exploration at 5.00 feet below ground surface. NO REFUSAL		
6												
8												
10												
12												

Remarks:
All offsets are from existing Roadway CL.

Driller: MaineDOT	Elevation (ft.):	Auger ID/OD: 5"
Operator: E. Giguere	Datum: NAVD 88	Sampler: Off Flights
Logged By: G. Lidstone	Rig Type: CME 45C	Hammer Wt./Fall: N/A
Date Start/Finish: 7/11/06-7/11/06	Drilling Method: Solid Stem Auger	Core Barrel: N/A
Boring Location: 790+81, 6.7' Rt.	Casing ID/OD: N/A	Water Level*: None Observed

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_{u(lab)}$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Depth (ft.)	Sample Information								Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows						
0	S19		0.60 - 2.30							PAVEMENT.		
								-0.60		GRAVEL, some brown, damp, fine to coarse sand, trace silt.	G#206928 A-1-a, GP-GM WC=2.7%	
2								-2.30		Brown, damp, dense, silty fine to medium SAND, cobbles, little gravel, (Till) ≈ S18		
4								-4.70		Weathered ROCK.		
								-5.00		Bottom of Exploration at 5.00 feet below ground surface. REFUSAL		
6												
8												
10												
12												

Remarks:
All offsets are from existing Roadway CL.

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS		Project: Route 186 Location: Gouldsboro, Maine	Boring No.: HB-GO-113 PIN: 12784.00
Driller: MaineDOT	Elevation (ft.)		Auger ID/OD: 5"
Operator: E. Giguere	Datum: NAVD 88		Sampler: Off Flights
Logged By: G. Lidstone	Rig Type: CME 45C		Hammer Wt./Fall: N/A
Date Start/Finish: 7/11/06-7/11/06	Drilling Method: Solid Stem Auger		Core Barrel: N/A
Boring Location: 798+31, 6.5' Rt.	Casing ID/OD: N/A		Water Level*: 3.8' bgs.
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger		Definitions: S _u = Insitu Field Vane Shear Strength (psf) T _v = Pocket Torvane Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) S _{u(lab)} = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods	
		Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test	

Depth (ft.)	Sample Information								Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log		
0									PAVEMENT.	
	S20		0.45 - 1.70			SSA	-0.45		GRAVEL, some brown, damp, fine to coarse sand, trace silt, (Fill).	G#206929 A-1-a, GP-GM WC=3.1%
	S21		1.70 - 2.50				-1.70		Brown, moist, fine to coarse SAND, little silt, trace gravel, (Fill).	G#206930 A-2-4, SM WC=13.1%
	S22		2.50 - 4.00				-2.50		PEAT.	G#206931 A-1-b, SM WC=78.2%
4							-4.00		Brown, wet, silty fine to coarse SAND, trace gravel. ≈S16	
							-5.00		Bottom of Exploration at 5.00 feet below ground surface. NO REFUSAL	
6										
8										
10										
12										

Remarks:
All offsets are from existing Roadway CL.