PACIFIC TESTING LABORATORIES

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May 19, 1993
Certificate No. 9304-4055

Mr. John Gow
CITY OF OCEAN SHORES
P.O. Box 909
Ocean Shores, WA 98969

Subject: Geotechnical Investigation to Characterize Subgrade Materials Under Damaged Sections of the Loop Road, City of Ocean Shores, Washington

Dear Mr. Gow:

As requested and agreed, Pacific Testing Laboratories has completed the subject evaluation. Enclosed is our report.

Thank you for using Pacific Testing Laboratories. If you have any questions, please feel free to contact us at (206)485-4244

Approved by: Alastair Lumsden, Senior Engineer

Sincerely,

Matt Miller

Matt Miller, E.I.T.
Geological Engineer

MM/ao

Enclosure

GEOTECHNICAL EVALUATION
of
Ocean Shores Blvd. and Pt. Brown Ave.

INTRODUCTION

This report presents the results of our geotechnical studies on the subgrade for the two main arterials for the City of Ocean Shores. Ocean Shores Blvd. consists of approximately 5.3 miles of divided four lane asphalt roadway and Pt. Brown Avenue consists of approximately 4.5 miles of two lane asphalt roadway. The purpose of our investigation was to evaluate the overall condition of the subgrade for both roads, and to make subsequent recommendations for remediation. Our work included a total of 21 borings to a maximum depth of 15 feet. Twelve borings were completed on Ocean Shores Blvd. and 9 on Pt. Brown Ave.

Our work was performed in general accordance with our proposal No. QOT-L-1807-F, dated April 8, 1993, and was authorized by phone conversation with Mr. John Gow of the City of Ocean Shores on April 27, 1993.

FIELD INVESTIGATION

In a meeting, with Mr. John Gow and Mr. Dave Higgins of the City of Ocean Shores, prior to the start of the project, it was agreed that the investigation would be concentrated on Ocean Shores Blvd. the first day, and Pt. Brown Avenue the second day. It was agreed that on both sections of road, the boreholes would be spread out over the full length of the roads, in an attempt to identify how the roads are built up in their present condition and the different modes of failure.

From the surface, the failures are most often depressions with some alligator cracks and potholes. The depressions are often linear and it was suggested that these failed areas are the result of the decay of old logs which have been buried over the years. It was agreed that the investigation would be concentrated in the failed areas directly over the depressions with the intent of finding the actual cause of failure. On an initial drive through with Mr. Gow, certain areas which were of particular interest were identified. The remainder of the boring locations would be left to the discretion of the Pacific Testing Laboratories field engineer.

On April 27, 1993, Pacific Testing Laboratories mobilized a truck mounted B-75 drill rig to the City of Ocean Shores for the subsurface investigation portion of the evaluation. The actual subsurface investigation did not commence until April 28, 1993. Twelve(12) borings were completed on Ocean Shores Blvd. the first day, with 9 borings completed in the south bound lanes and 3 borings in the north bound lanes. The second day of drilling was concentrated on Pt. Brown Ave. in which 9 borings were completed.

The investigation began with the first borings placed at the north end of Ocean Shores Blvd. near its' intersection with Minard Ave. From this point, the borings were placed approximately every half mile to the end of the subject area at Sportsmen Ave. The first two borings were placed in areas in which the asphalt is in good condition (no visible signs of failure were evident in the immediate vicinity of the borings). We understand that this section is the original asphalt and only minor repairs have been performed. The water table was found to be within 2 feet of the surface, at the time of the boring, in the north end.

As the investigation progressed south, all borings were placed to a minimum depth of 5 feet, with most borings extending to a depth of 10 to 15 feet. The water table ranged from a depth of 2 feet to a depth of 6 feet. The actual road elevations are not known, however, it is assumed that the elevation of the water table is consistent throughout the subject area and that the roadway elevation varies.

At each boring location the sampling procedure was consistent in order to detect any variation in the subgrade. The asphalt was broken through with the hollow stem auger until reaching the baserock. At this point a 3 inch California sampler was driven with a 140 pound hammer with a 30 inch free fall. This enabled the field crew to identify the actual depth of the baserock and its contact with the subgrade. The penetration test also gives an indication of the relative density of the underlying soils for stability purposes. The next sample was taken via the penetration test, at a depth of 2.5 feet using a standard 2 inch sample tube. It was felt that for the purposes of stability beneath the roadway, knowledge of the top two feet is the most critical. Testing at greater depths was performed at five foot intervals for the remainder of the boring, to locate the water table and any logs or organics at depth. It was felt that if organics were the cause of the failures they would have to be located within the zone of the fluctuating water table where they would have a tendency to decay and break down.

SUBSURFACE CONDITIONS

Ocean Shores Boulevard

In general the paving cross section consists of the top asphalt layer which ranges in thickness from 2 inches to 6 inches. We understand that some sections of the roadway have been repaved as well as chip sealed over the years and no apparent accurate records have been kept as to what was actually done in which sections. To the best of our knowledge the section from the northern end of Ocean Shores Blvd. to the intersection of Ensign Ave. is the original asphalt. The failed areas have been patched when needed, but other than that, it is the original section. From Ensign Ave. south to Ocean Lake Way the south bound lanes were chip sealed several years ago, increasing the depth of the top surface. From Ocean Lake Way south to Sportsmen Ave. the paving is again original in the south bound lanes and extensive patching has taken place.

The north bound lanes have been relatively untouched except for patching, with the exception of a section north of Butter Clam Street to an area approximately south of Polaris Blvd. We understand that this section was to have been completely torn out, with the logs removed, and a new section installed several years ago.

Below the asphalt a red silt with cobbles was found, which had been used as the baserock. This is a native import material and is known locally as "Red Rock". The thickness of the red rock varied from non-existent to approximately 10 inches. The condition of the base was loose to medium dense and always moist. The base appears to be very moisture sensitive with a high percentage of fine material. Fine material is defined as that size fraction less than a #200 standard sieve screen. It was also evident that the fine material had leached downward into the sandy subgrade in most cases.

The subgrade consists of a poorly graded brown sand, native to the area. The top three feet of the native sands is loose to medium dense and drains readily. The stability of the sands increases with depth to a fairly dense condition at a depth of 6 feet. This condition was relatively consistent throughout the project.

With the exception of the first two boreholes all the borings were placed in failed sections of the road. Most of the sites were chosen in areas which from the surface appeared to be linear failures. These linear features were suspected to be logs which had been buried over the years as the beach has extended since the jetty from Grays Harbor was built. Boreholes were placed in these locations with the intent of locating the depth to the logs. It was found that if wood debris was present it was in the top two feet, and had decayed substantially. However, wood was not always present.

Boreholes #11 and #12 were located in the area which we understand was rebuilt a number of years ago. When it was rebuilt, we were told, the roadway had been completely removed and the logs dug out. However, the section has had numerous failures since that time. After completing the borings in this area it appeared that the roadway may not have been removed but only overlaid. The borings indicate a top layer of asphalt underlain by red rock then an old roadbed of successive layers of asphalt and red rock on top of the original sand subgrade. This condition was evident in both borings which were approximately 1/4 mile apart.

Point Brown Avenue

The Point Brown Avenue investigation was carried out in the same method as the Ocean Shores Blvd. portion of the work, and sampling procedures were kept consistent. The boreholes were placed at predetermined sites, all in areas of surface failure, except the first boring (#13). The boreholes were placed over areas in which logs were suspected as the cause of failure. To get a good cross section and representative sampling of the street the boreholes were spaced approximately every half mile from south to north.

The first 1 1/2 miles of road were consistent, with approximately 7 inches of asphalt and 4 inches of baserock (red rock), then native sands. From this point the section changed to 4 inches of asphalt underlain by 6 inches of what appeared to be an Asphalt Treated Base. When the asphalt thickness changed type and thickness an absence of base rock was noted, and the asphalt was placed directly upon the brown sands. These conditions were consistent throughout the remainder of the exploration.

In all cases in which logs or organics were suspected to be the cause of failure, they were found to be within the top two feet as before.

CONCLUSIONS

As a result of the field investigation we feel that there are several factors which are influencing the condition of the asphalt surface. These will be discussed below.

Asphalt

Although this investigation was not directed specifically to the asphalt. It (the asphalt) appears to be of low quality, and inadequate for the traffic which it is being subjected to. Upon examination of the asphalt placed on Ocean Shores Blvd. we note that the aggregate used for the mix has a very low fracture count. Most of the coarse aggregate is rounded and therefore does not bond properly to the bitumen in the mix, due to lack of surface area. It also appears that fillers such as sea shells and other organics were used, thus reducing the stability of the mix.

The thickness of the asphalt (in some cases less than 3 inches), is also well below the standard required for the heavy traffic which the area is subject to.

Base Rock

Laboratory testing of the baserock, "red rock", indicates that the material is extremely fine and thus very moisture sensitive. It also appears very gap-graded, with a high percentage of coarse material and a lack of the larger sand sizes. This type of soil tends to lose the finer material when subjected to saturation conditions, due to washout; This process results in increased voids within the coarse matrix.

If the soil is kept above the water table, and not allowed to become saturated, the stability would increase if it were properly compacted, and placed under optimum conditions.

In most cases it was found that the red rock had been placed at an elevation whereat the water table is fluctuating within the baserock layer, thus periodically saturating it and washing out the fine material. This is evident in some areas where the fines have leached downward into the sandy subgrade, resulting in voids near the surface.

Subgrade

The subgrade is composed of the native sands which were found to be in a loose condition directly below the base rock. The sands were also saturated in most conditions very near the surface. Poorly graded, saturated sands, such as those found in the area are very susceptible to consolidation when they are drained and also may densify when subjected to any ground vibrations.

The constant raising and lowering of the water table combined with heavy truck traffic, would be sufficient cause for these processes to take place.

Water Table

The water table plays a significant role in the stability of the subgrade. As mentioned above the base rock is affected by the loss of fines and the subgrade can be affected by consolidation and the potential for densification. In order to increase the stability of the road sections the location of the water table will have to be considered.

Organics

In almost all cases the suspected organics were found at a depth of 3 feet or less. They also appeared to be within the zone of water table fluctuation. Those at greater depths which are kept saturated on a consistent basis are not likely to cause settlement problems. It is the constant wetting and drying of the organics that is causing the decay and subsequent breakdown within the subgrade. In several cases significant voids were found in which it was evident that decay had taken place.

Removing the debris within the zone of fluctuation of the water table would increase the stability of the subgrade, and any further removal at greater depths would not be necessary.

Heavy Loads

The traffic that the roadways are subjected to should be monitored. We understand (and also witnessed) that there is a time during the year in which residents may haul sand off the beach. The absence of load restriction is most likely a major cause of some of the failure of the roadways. The thickness of the paving section in almost all cases examined is well below the standard for heavy truck traffic.

LIMITATIONS

This report has been prepared to aid in the evaluation of the site. Our conclusions and recommendations have been prepared in accordance with generally accepted professional engineering principles and practices. We make no other warranty, either expressed or implied. Our conclusions are based on the results of the field exploration and on our interpretation of surface and sub-surface conditions. If conditions are encountered that appear to be different than those described in this report, we should be notified so that we may review and verify or modify our recommendations.

This report is provided for the information of the client only. The reproduction of this report, except in full, by any method and its transmittal by any means to a third party without the written permission of Pacific Testing Laboratories is prohibited.

END OF REPORT

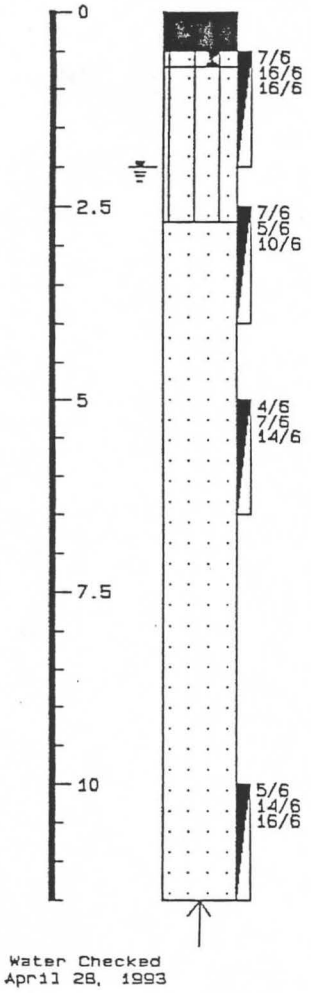
APPENDIX

BORE LOGS

EXPLORATION TEST BORING LOG

BORING NO. 1

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055·
EXCAVATION DATE: Start: April 28, 1993 Finish: April 28, 1993
GROUND WATER DEPTH: 2 feet
ENGINEER: Matt Miller
BORING NO. 1 ELEVATION: na SCALE: 2.5 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving 6 inches thick	
			GP-GM Red silt with cobbles "red rock" 2 inches thick	
		SM	Brown fine sand poorly graded some mottling	
		SM	Grey poorly graded sand	

Borehole is located at the north end of Ocean Shores Blvd.
Approximately 100 feet west of Minard Ave.. Good Section of road.

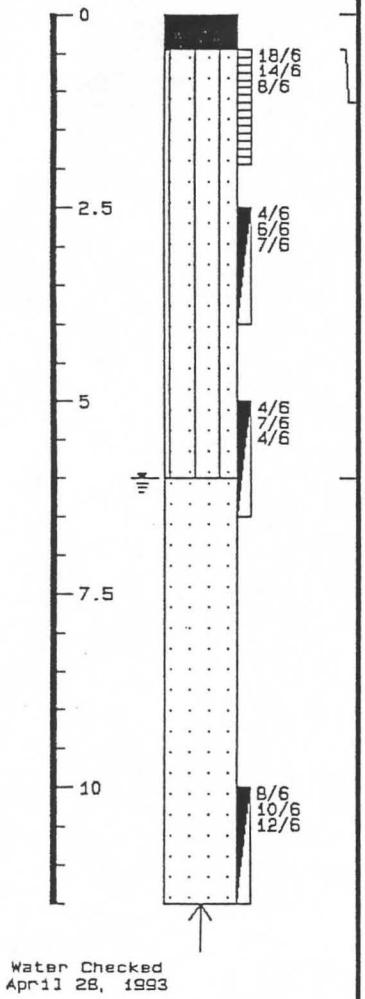
Figure Number 1

PACIFIC TESTING LABORATORIES

EXPLORATION TEST BORING LOG

BORING NO. 2

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055.
EXCAVATION DATE: Start: April 28, 1993 Finish: April 28, 1993
GROUND WATER DEPTH: 6 feet
ENGINEER: Matt Miller
BORING NO. 2 ELEVATION: na SCALE: 2.5 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving good section of asphalt 5.5 inches thick	
		SM	Brown fine sand poorly graded some mottling	
		SM	Grey poorly graded sand	

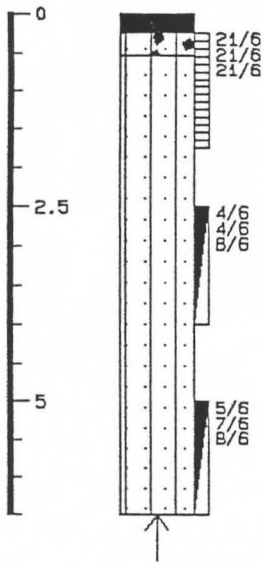
No red rock was found beneath the asphalt as subgrade.
Hole located 100 feet south of Un St.

Figure Number 2

EXPLORATION TEST BORING LOG

BORING NO. 3

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055·
EXCAVATION DATE: Start: April 28, 1993 Finish: April 28, 1993
GROUND WATER DEPTH: .5 feet
ENGINEER: Matt Miller
BORING NO. 3 ELEVATION: na SCALE: 2.5 feet per inch

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
0		Asphalt	Paving Alligatored at the surface 3 inches thick	
		GP-GM	Red silt with cobbles "red rock" 6.5 inches thick	
2.5		SM	Brown fine sand poorly graded some mottling	
5				

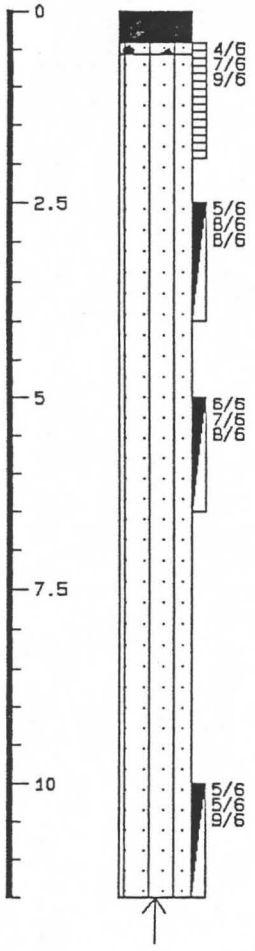
Hole located 100 feet south of Ensign St. south bound lane west side.
Chip sealed area starts at Ensign St. Standing water in the median.

Figure Number 3

EXPLORATION TEST BORING LOG

BORING NO. 4

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055·
EXCAVATION DATE: Start: April 28, 1993 Finish: April 28, 1993
GROUND WATER DEPTH: .5 feet
ENGINEER: Matt Miller
BORING NO. 4 ELEVATION: na SCALE: 2.5 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving Dip in the road looks like a log 5 inches thick	
			GP-GM Red silt with cobbles "red rock" 1.5 inches thick	
		SM	Brown fine sand poorly graded some mottling trace of organics	trace of log wood in cuttings

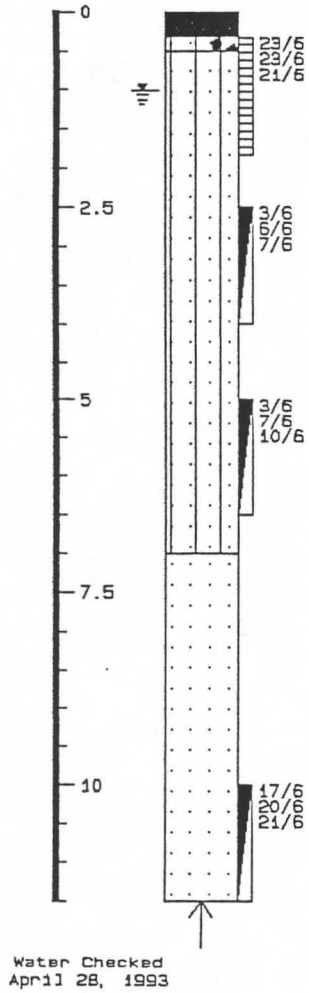
Hole is locate 150 feet south of Sandune, southbound lane, west side.
There is a depression but no patch.

Figure Number 4

EXPLORATION TEST BORING LOG

BORING NO. 5

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055·
EXCAVATION DATE: Start: April 28, 1993 Finish: April 28, 1993
GROUND WATER DEPTH: 1 feet
ENGINEER: Matt Miller
BORING NO. 5 ELEVATION: na SCALE: 2.5 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving Patched area 4 inches thick	
			GP-GM Red silt with cobbles "red rock" 2 inches thick	
		SM	Brown fine sand poorly graded some leaching of red rock trace of organics	
				trace of cobbles
		SM	Grey poorly graded sand	
				3 ft of heave

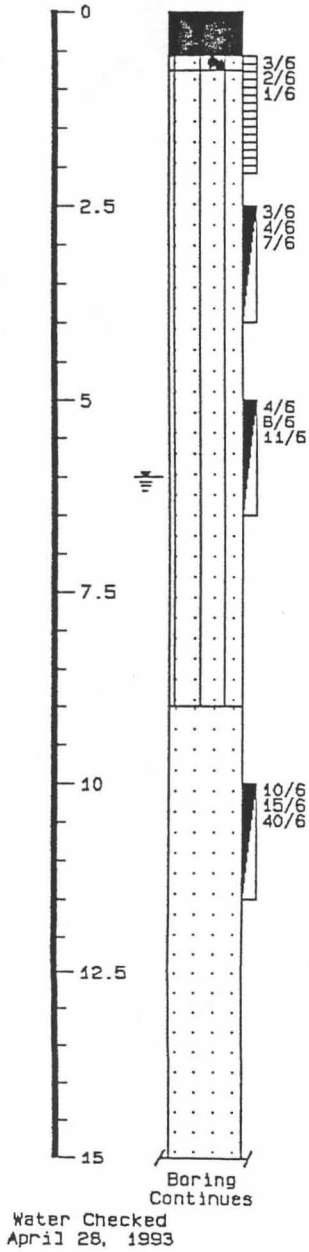
Hole located westside of southbound lanes, by house #181.
Patched area of asphalt.

Figure Number 5

EXPLORATION TEST BORING LOG

BORING NO. 6

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055·
EXCAVATION DATE: Start: April 28, 1993 Finish: April 28, 1993
GROUND WATER DEPTH: 6 feet
ENGINEER: Matt Miller
BORING NO. 6 ELEVATION: na SCALE: 2.5 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving depression areae Ashpalt 7 inches thick	Void directly beneath asphalt
			GP-GM Red silt with cobbles "red rock" 2 inches thick	
		SM	Brown fine sand poorly graded some leaching of red rock trace of organics	
				large wood chunks in cuttings
		SM	Dense grey poorly graded sand	
				only 6" heave

Hole is located 30 feet north of Tauras St. southbound lanes west side.
Void approximately 6 inches deep was found beneath the asphalt.

Figure Number 6

EXPLORATION TEST BORING LOG

BORING NO. 6

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055·
EXCAVATION DATE: Start: April 28, 1993 Finish: April 28, 1993
GROUND WATER DEPTH: 6 feet
ENGINEER: Matt Miller
BORING NO. 6 ELEVATION: na SCALE: 2.5 feet per inch

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
15	15/6 24/6 46/6			

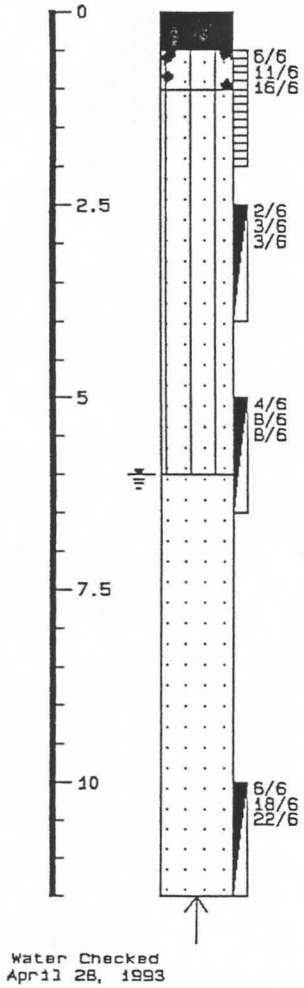
Hole is located 30 feet north of Tauras St. southbound lanes west side.
Void approximately 6 inches deep was found beneath the asphalt.

Figure Number 7

EXPLORATION TEST BORING LOG

BORING NO. 7

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055.
EXCAVATION DATE: Start: April 28, 1993 Finish: April 28, 1993
GROUND WATER DEPTH: 6 feet
ENGINEER: Matt Miller
BORING NO. 7 ELEVATION: na SCALE: 2.5 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving 6 inch depression Ashpalt 6 inches thick	asphalt looks like ATB
			GP-GM Red silt with cobbles "red rock" 6 inches thick	
		SM	Brown fine sand poorly graded some leaching of red rock trace of organics	decomposed wood chunks
		SM	Dense grey poorly graded sand	

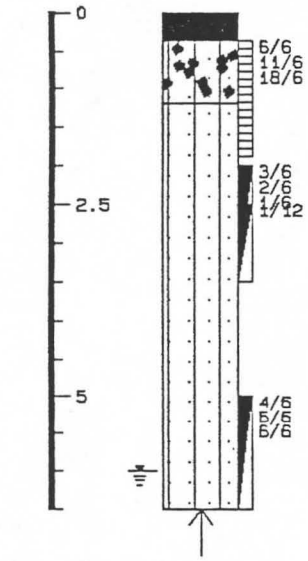
Hole located 60 feet south of Yorkmar, southbound, westside
Standing water in the median. Large void toward the shoulder 1.5 to 2.5

Figure Number 8

EXPLORATION TEST BORING LOG

BORING NO. 8

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055·
EXCAVATION DATE: Start: April 28, 1993 Finish: April 28, 1993
GROUND WATER DEPTH: 6 feet
ENGINEER: Matt Miller
BORING NO. 8 ELEVATION: na SCALE: 2.5 feet per inch



Water Checked
April 28, 1993

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Ramp at 4.5 inches thick	
			GP-GM Red silt with cobbles "red rock" 10 inches thick	
		SM	Brown fine sand poorly graded	hit log with sample tube

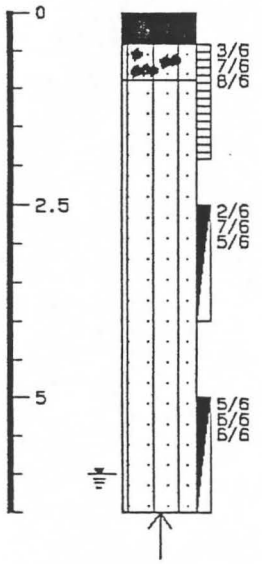
Hole is located south of Inglewood Ct. Appears to be a log depression from the surface all across the road. Hit the log at 2 ft. out at 4 ft

Figure Number 9

EXPLORATION TEST BORING LOG

BORING NO. 9

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055.
EXCAVATION DATE: Start: April 28, 1993 Finish: April 28, 1993
GROUND WATER DEPTH: 6 feet
ENGINEER: Matt Miller
BORING NO. 9 ELEVATION: na SCALE: 2.5 feet per inch



Water Checked
April 28, 1993

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving Patched area slight depression Ashpalt 5 inches thick	
			GP-GM Red silt with cobbles "red rock" 6 inches thick	layers of black sand
		SM	Brown fine sand poorly graded trace of organics	

Hole was located north of Sportsmen St.

Figure Number 10

EXPLORATION TEST BORING LOG

BORING NO. 10

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055·
EXCAVATION DATE: Start: April 28, 1993 Finish: April 28, 1993
GROUND WATER DEPTH: 6 feet
ENGINEER: Matt Miller
BORING NO. 10 ELEVATION: na SCALE: 2.5 feet per inch

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
0	1/6 3/6 2/6	Asphalt	Paving Patched area slight depression Ashpalt 4 inches thick	
			GP-GM Red silt with cobbles "red rock" 5 inches thick	
2.5	2/6 3/6 4/6	SM	Brown fine sand poorly graded trace of organics	
5	2/6 3/6 7/6			

Water Checked
April 28, 1993

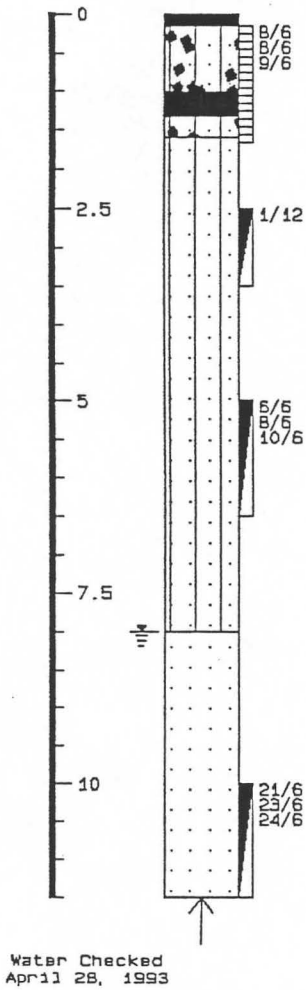
Hole was located north of Maplewood in Northbound lanes west side

Figure Number 11

EXPLORATION TEST BORING LOG

BORING NO. 11

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055.
EXCAVATION DATE: Start: April 28, 1993 Finish: April 28, 1993
GROUND WATER DEPTH: 8 feet
ENGINEER: Matt Miller
BORING NO. 11 ELEVATION: na SCALE: 2.5 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving Patched area slight depression Ashpalt 2 inches thick	
			GP-GM Red silt with cobbles "red rock" 6 inches thick	
		Asphalt	Paving Patched area slight depression Ashpalt 4 inches thick	
			GP-GM Red silt with cobbles "red rock" 3 inches thick	
		SM	Brown fine sand poorly graded trace of organics	
		SM	Dense grey poorly graded sand	

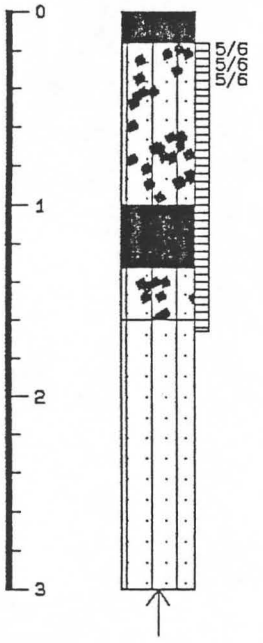
Hole located north of Sandune northbound west side. The area was rebuilt several years ago.

Figure Number 12

EXPLORATION TEST BORING LOG

BORING NO. 12

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055·
EXCAVATION DATE: Start: April 28, 1993 Finish: April 28, 1993
GROUND WATER DEPTH: n feet
ENGINEER: Matt Miller
BORING NO. 12 ELEVATION: na SCALE: 1 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving Patched area slight depression Ashpalt 2 inches thick	picture taken of the sample
			GP-GM Red silt with cobbles "red rock"	
		Asphalt	Paving Patched area slight depression Ashpalt 4 inches thick	
			GP-GM Red silt with cobbles "red rock"	
		SM	Brown fine sand poorly graded trace of organics	

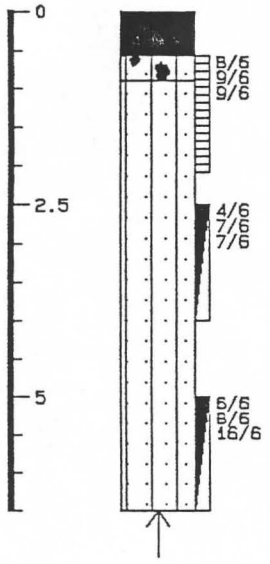
Hole was located 100 ft north of Hoko, Northbound, westside
To verify the condition found in BH 11.

Figure Number 13

EXPLORATION TEST BORING LOG

BORING NO. 13

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055·
EXCAVATION DATE: Start: April 29, 1993 Finish: April 29, 1993
GROUND WATER DEPTH: n feet
ENGINEER: Matt Miller
BORING NO. 13 ELEVATION: na SCALE: 2.5 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving Patched area slight depression Ashpalt 7 inches thick	
			GP-GM Red silt with cobbles "red rock" 4 inches thick	
		SM	Brown fine sand poorly graded	

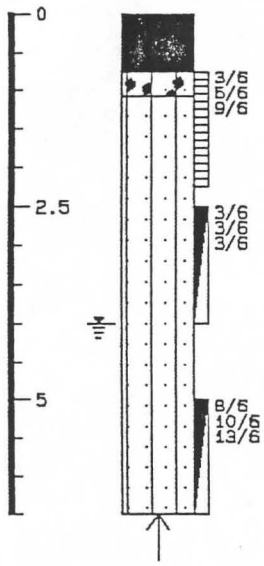
Hole located 300 ft south of Adventurer onb Pt Brown Ave. eastside
Good section of road.

Figure Number 14

EXPLORATION TEST BORING LOG

BORING NO. 14

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055.
EXCAVATION DATE: Start: April 29, 1993 Finish: April 29, 1993
GROUND WATER DEPTH: 4 feet
ENGINEER: Matt Miller
BORING NO. 14 ELEVATION: na SCALE: 2.5 feet per inch



Water Checked
April 29, 1993

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving Patched area slight depression Ashpalt 7 inches thick 2in of patch	Red Rock is 1 inch thick sand & red rok mixed for 3 in
		GP-GM	Red silt with cobbles "red rock"	
		SM	Brown fine sand poorly graded	Traces of wood cedar in the sample tube

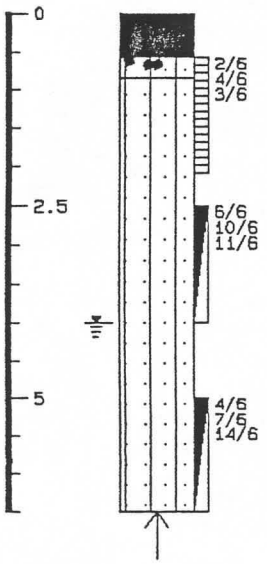
Hole located 100 ft South of Kidder St. on aest side of Pt Brown Ave.

Figure Number 15

EXPLORATION TEST BORING LOG

BORING NO. 15

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055·
EXCAVATION DATE: Start: April 29, 1993 Finish: April 29, 1993
GROUND WATER DEPTH: 4 feet
ENGINEER: Matt Miller
BORING NO. 15 ELEVATION: na SCALE: 2.5 feet per inch



Water Checked
April 29, 1993

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving Patched area slight depression Ashpalt 7 inches thick	mostly cobbles very little silt
			GP-GM Red silt with cobbles "red rock" 3 inches thick	
		SM	Brown fine sand poorly graded	

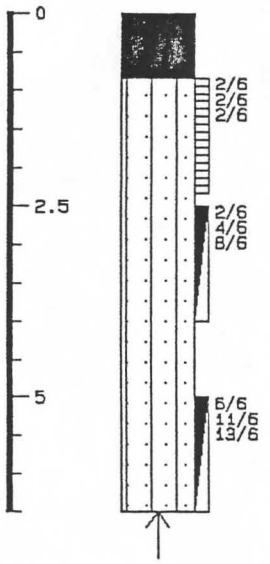
Hole located 500 ft south of Buffalohead St.
No organics found while drilling.

Figure Number 15

EXPLORATION TEST BORING LOG

BORING NO. 16

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055.
EXCAVATION DATE: Start: April 29, 1993 Finish: April 29, 1993
GROUND WATER DEPTH: n feet
ENGINEER: Matt Miller
BORING NO. 16 ELEVATION: na SCALE: 2.5 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving slight depression like a log Ashpalt 10 inches thick	4 in. asphalt 6 in. ATB
		SM	Brown fine sand poorly graded mixed with red rock	No distinct layers dry & soft wood in sample tube

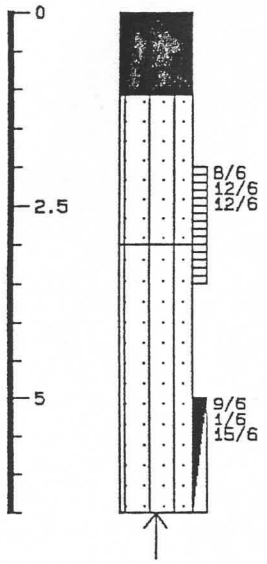
Hole located 400 ft north of Wynoochee, House #564.

Figure Number 17

EXPLORATION TEST BORING LOG

BORING NO. 17

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055.
EXCAVATION DATE: Start: April 29, 1993 Finish: April 29, 1993
GROUND WATER DEPTH: n feet
ENGINEER: Matt Miller
BORING NO. 17 ELEVATION: na SCALE: 2.5 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving slight depression like a log Ashpalt 13 inches thick	7 in. Asphalt 6 in. ATB round rock in the ATB no crushed
		SM	Brown fine sand poorly graded mixed with red rock	wood at 2.5 ft
		SM	Brown fine sand poorly graded	

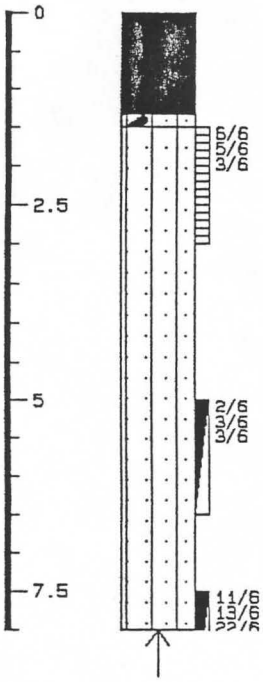
Hole located north of Taurus by House #456

Figure Number 18

EXPLORATION TEST BORING LOG

BORING NO. 18

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055
EXCAVATION DATE: Start: April 29, 1993 Finish: April 29, 1993
GROUND WATER DEPTH: n feet
ENGINEER: Matt Miller
BORING NO. 18 ELEVATION: na SCALE: 2.5 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving slight depression like a log Ashpalt 16 inches thick	bottom 6 in. is ATB
			GP-GM Red silt with cobbles "red rock" 2 inches thick	wood 1.5 to 3 feet
		SM	Brown fine sand poorly graded	

Hole located north of Polaris at house # 217

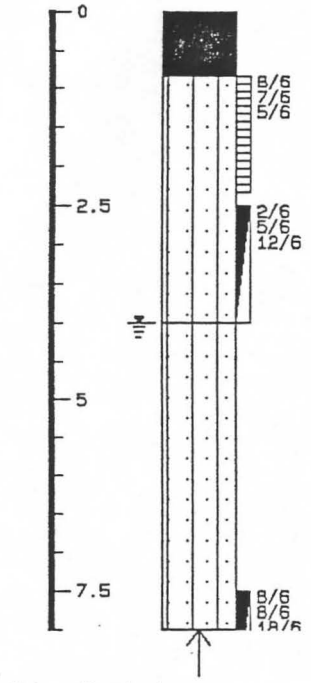
Figure Number 19

PACIFIC TESTING LABORATORIES

EXPLORATION TEST BORING LOG

BORING NO. 19

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055·
EXCAVATION DATE: Start: April 29, 1993 Finish: April 29, 1993
GROUND WATER DEPTH: 4 feet
ENGINEER: Matt Miller
BORING NO. 19 ELEVATION: n SCALE: 2.5 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving slight depression like a log Ashpalt 10 inches thick	7 in asphalt 3 in ATB
		SM	Brown fine sand poorly graded	
				wet rotten wood
		SM	Brown fine sand poorly graded Heavy Mottling	

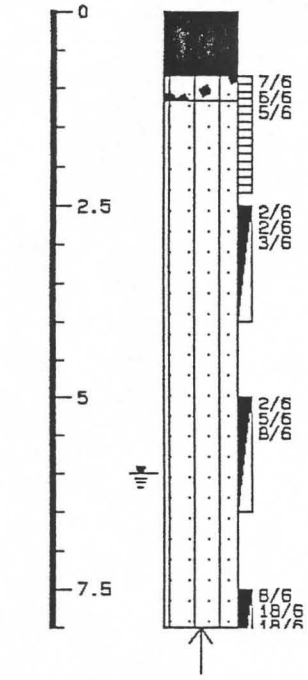
Hole located 300 feet south of Mizzen, west side. Patched section sunk 3 to 4 inches

Figure Number 20

EXPLORATION TEST BORING LOG

BORING NO. 20

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055
EXCAVATION DATE: Start: April 29, 1993 Finish: April 29, 1993
GROUND WATER DEPTH: 6 feet
ENGINEER: Matt Miller
BORING NO. 20 ELEVATION: n SCALE: 2.5 feet per inch



Water Checked
April 29, 1993

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Rampart 10 inches thick	4 in asphalt 6 in ATB
			GP-GM Red silt with cobbles "red rock" 4 inches thick	
		SM	Brown fine sand poorly graded	

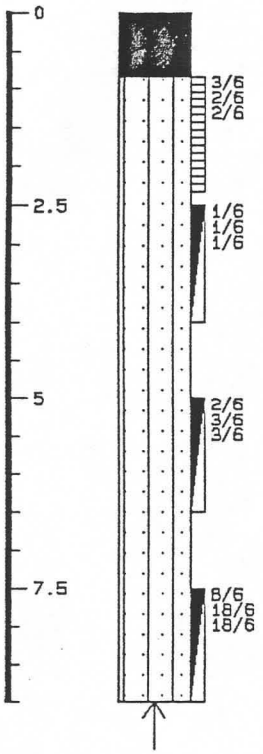
Hole is located north of Pacific across from lot #31
Road is built up approx. 3 feet w/ a ditch on each side

Figure Number 21

EXPLORATION TEST BORING LOG

BORING NO. 21

PROJECT: City of Ocean Shores Road Subgrade Evaluation
CERTIFICATION: 9304-4055·
EXCAVATION DATE: Start: April 29, 1993 Finish: April 29, 1993
GROUND WATER DEPTH: n feet
ENGINEER: Matt Miller
BORING NO. 21 ELEVATION: n SCALE: 2.5 feet per inch



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks
		Asphalt	Paving not patched but dips 3 to 4 inches Ashpalt 10 inches thick	4 in asphalt 6 in ATB
		SM	Brown fine sand poorly graded	

Hole located east side of the road at the 3rd hole of the golf course.
Not patched but dips 3 to 4 inches looks like pushed up on the shoulder

Figure Number 22

Legend:

Symbol:	Description:	Symbol:	Description:
	Paving Ashpalt 10 inches thick		
	GP-GM Red silt with cobbles "red rock" 4 inches thick		
	Brown fine sand poorly graded trace of organics		
	Dense grey poorly graded sand		
7/6 5/6	Standard penetration test. 140 lb. hammer dropped 30"	7/6 5/6	California Sampler
	Water level at time of boring		Bottom of test boring

Notes:

1. Exploratory test pits were made using a wheeled backhoe.
2. A sketch of the test pit locations is included.
3. Boring, sampling, and recording was completed as per ASTM D 420
4. These logs are subject to the limitations, conclusions, and recommendations in this report.

LABORATORY TEST RESULTS

PROCTOR TEST REPORT

Certificate No.: 9304-4055 LR No.: Date: 4-26-1993

Client: Ocean Shores

Location: On Site

Elev/Depth:

Remarks:

Sample#9304-4055-1014

MATERIAL DESCRIPTION

Description: Red Brown Silty Fine Gravel w/ Some C-F Sand

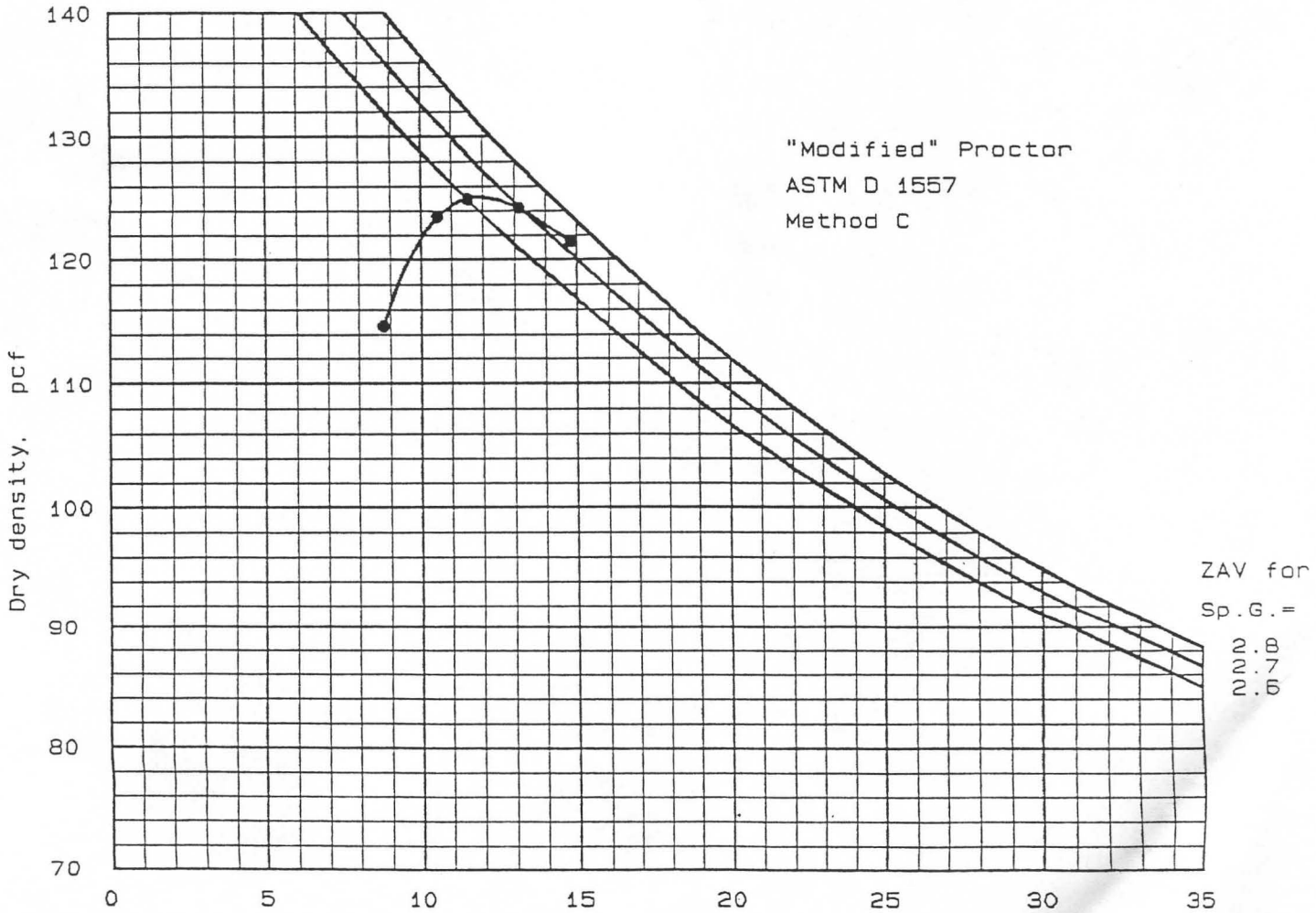
Classifications: USCS: AASHTO:

Nat. Moist. = % Sp.G. =

Liquid Limit = Plasticity Index =

%> No. 4 = 39.1% %< No. 200 = 6.6%

TEST RESULTS
Maximum dry density = 125.1 pcf
Optimum moisture = 11.9 %

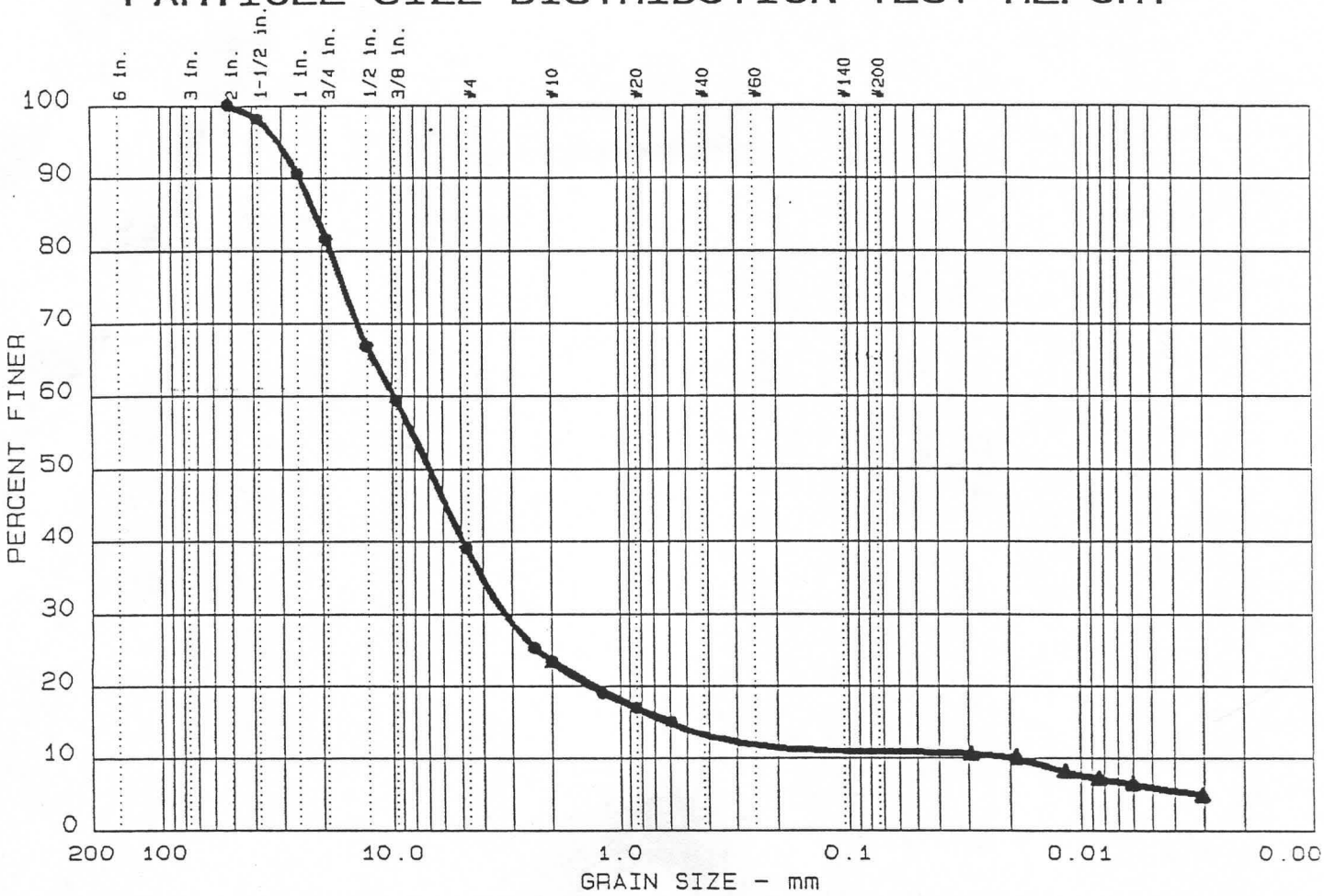


Tested by: M.Bekey
Date: 4-23-1993
Checked by: J.Bekey
Date: 4-26-1993

PACIFIC TESTING LABORATORIES

Figure No. _____

PARTICLE SIZE DISTRIBUTION TEST REPORT



	%+75 mm	% GRAVEL	% SAND	% SILT	% CLAY	USCS
●	0.0	60.9	39.1			GP-GM
▲	0.0	0.0	89.1	10.9		GP-GM

SIEVE inches size	PERCENT FINER ●	▲	
2	100.0		
1.5	98.1		
1	90.6		
0.75	81.6		
0.5	66.8		
0.375	59.4		
	GRAIN SIZE		
D_{60}	9.75	2.00	
D_{30}	3.21	2.00	
D_{10}		0.02	
	COEFFICIENTS		
C_c		101.1	
C_u		101.2	

SIEVE number size	PERCENT FINER ●	▲	
4	39.1		
8	25.3		
10	23.4	23.4	
16	19.1		
20	17.0		
30	15.0		

Sample information:

● Sand Fraction
Red Silty Poorly G Gravel

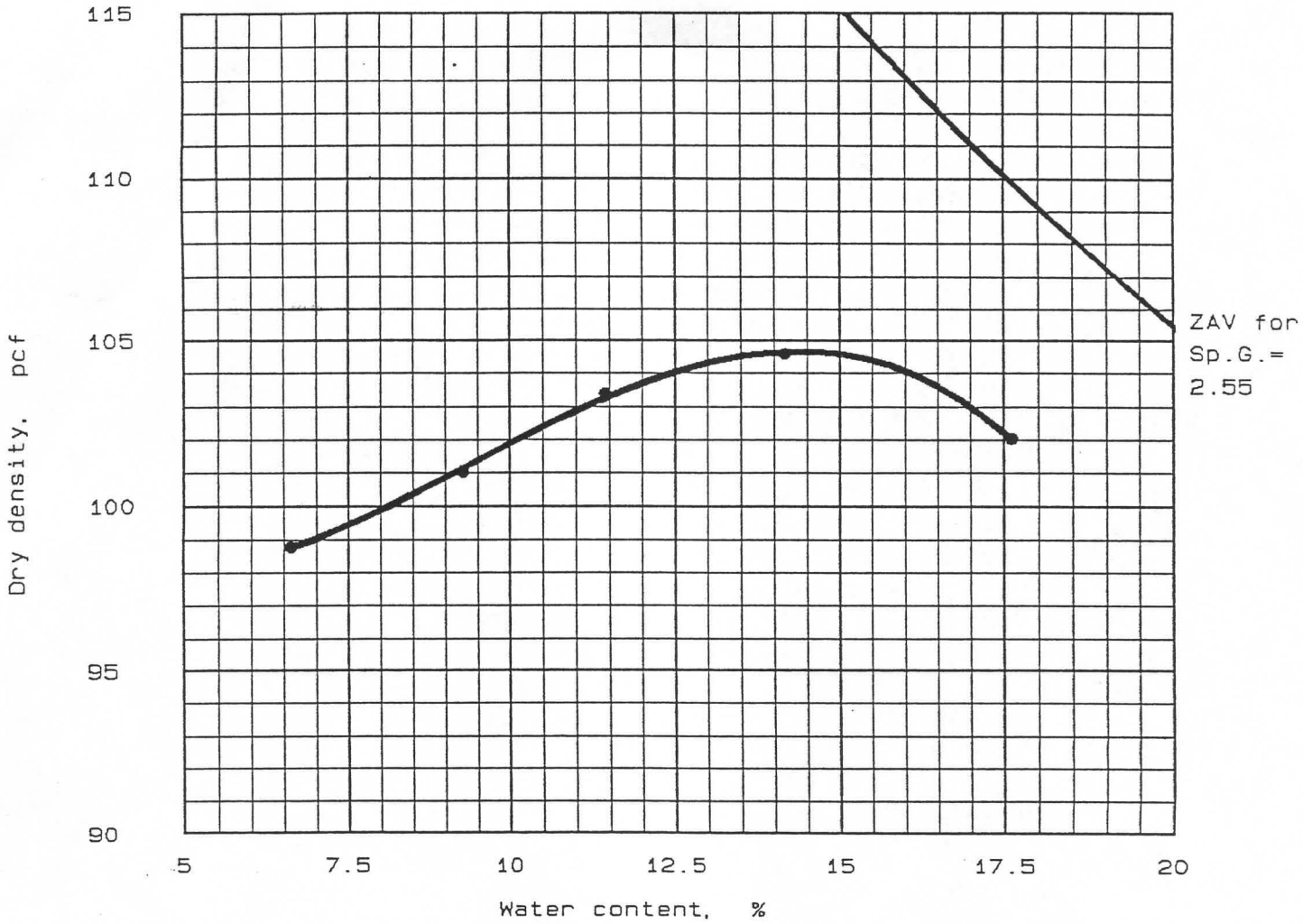
▲ Clay Fraction
Red Silty Poorly G Gravel

Tested by: M. Bekey
Date: 4-22-1993
Checked by: J. Bekey
Date: 4-30-1993
Sample #9304-4055-1014

PACIFIC TESTING LABORATORIES

Certificate No.: 9304-4055 LR No.:
Client: City of Ocean Shores
Local "Red Rock"
Date: 4-30-1993
Fig. No.

PROCTOR TEST REPORT



"Modified" Proctor, ASTM D 1557, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SP		13.6 %		NP	NP	5.3 %	1.1 %

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 14.4 % Maximum dry density = 104.7 pcf	FINE BRWN SND W/ORGANICS

Certificate No.: 9304-4055 LR No.:

Client: CITY OF OCEAN SHORES

Location: BH-21 2-5'BG

Date: 5-14-1993

Remarks:
SAMPLE 4841/02

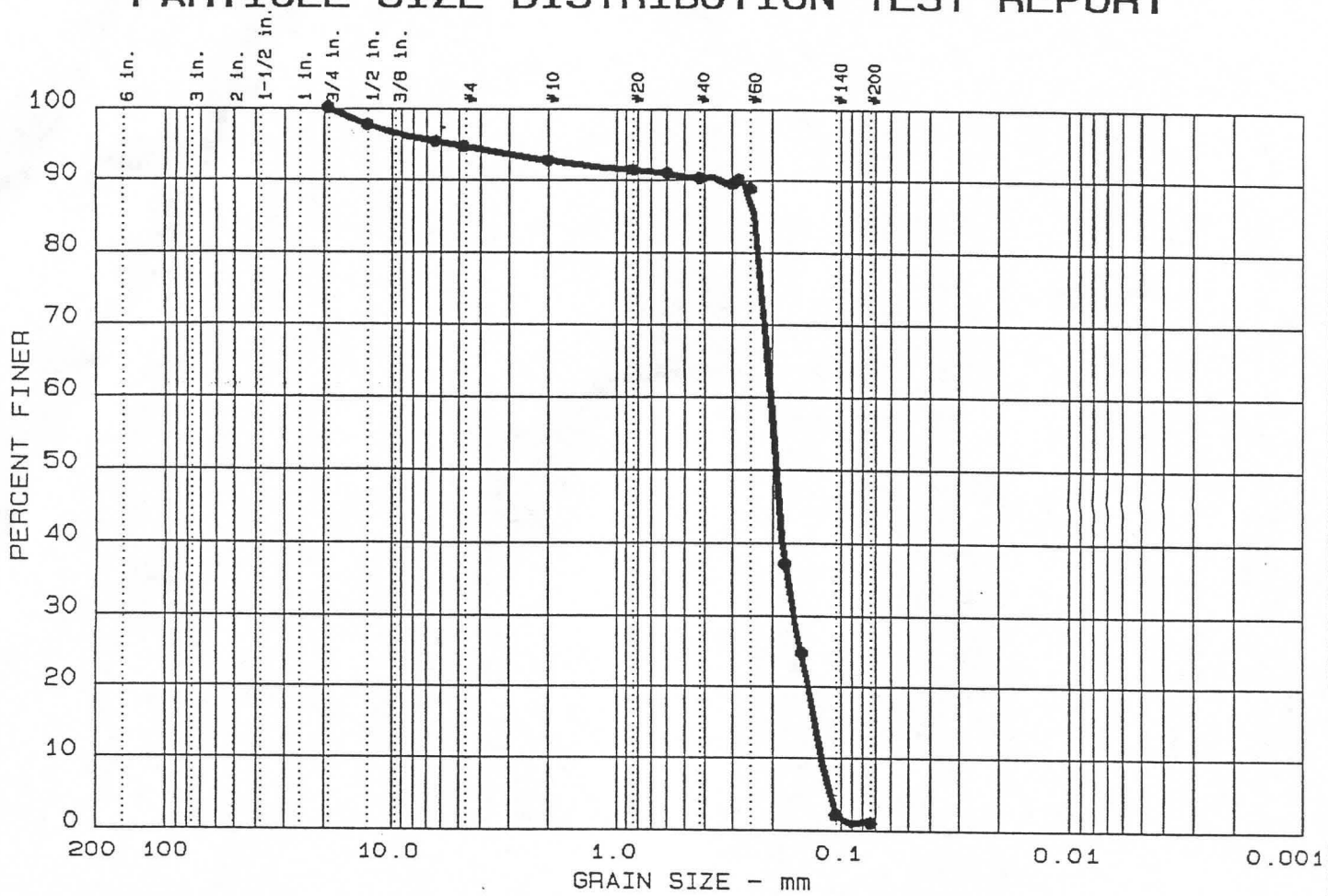
Tested by: ML
Date: 5-14-93
Checked by: JSM
Date: 5-14-93

PROCTOR TEST REPORT

PACIFIC TESTING LABORATORIES

Figure No. 1

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	%+75 mm	% GRAVEL	% SAND	% SILT	% CLAY	USCS
●	17	0.0	5.3	93.6	1.1		SP

SIEVE inches size	PERCENT FINER ●		
0.75	100.0		
0.5	97.7		
0.25	95.4		
	GRAIN SIZE		
D_{60}	0.20		
D_{30}	0.16		
D_{10}	0.12		
	COEFFICIENTS		
C_c	1.07		
C_u	1.7		

SIEVE number size	PERCENT FINER ●		
4	94.7		
10	92.8		
20	91.4		
30	91.0		
40	90.3		
50	89.6		
60	88.9		
80	37.1		
100	24.8		
140	2.1		
200	1.1		

Sample information:
● BH-21 2-5'BG
FINE BRWN SND W/ORGANICS

Tested by: ML
Date: 5-13-93
Checked by: JSM
Date: 5-14-93
SAMPLE 4841/01 M: 13.6%

PACIFIC TESTING LABORATORIES

Certificate No.: 9304-4055 LR No.:
Client: CITY OF OCEAN SHORES
MATERIAL +#60 - ORGANICS
Date: 5-14-93
Fig. No. 1

PROCTOR TEST REPORT

Certificate No.: 9304-4055 LR No.: Date: 4-24-1993

Client: OCEAN SHORES

Location: ONSITE

Elev/Depth:

Remarks:

SAMPLE#9304-4055-1013

MATERIAL DESCRIPTION

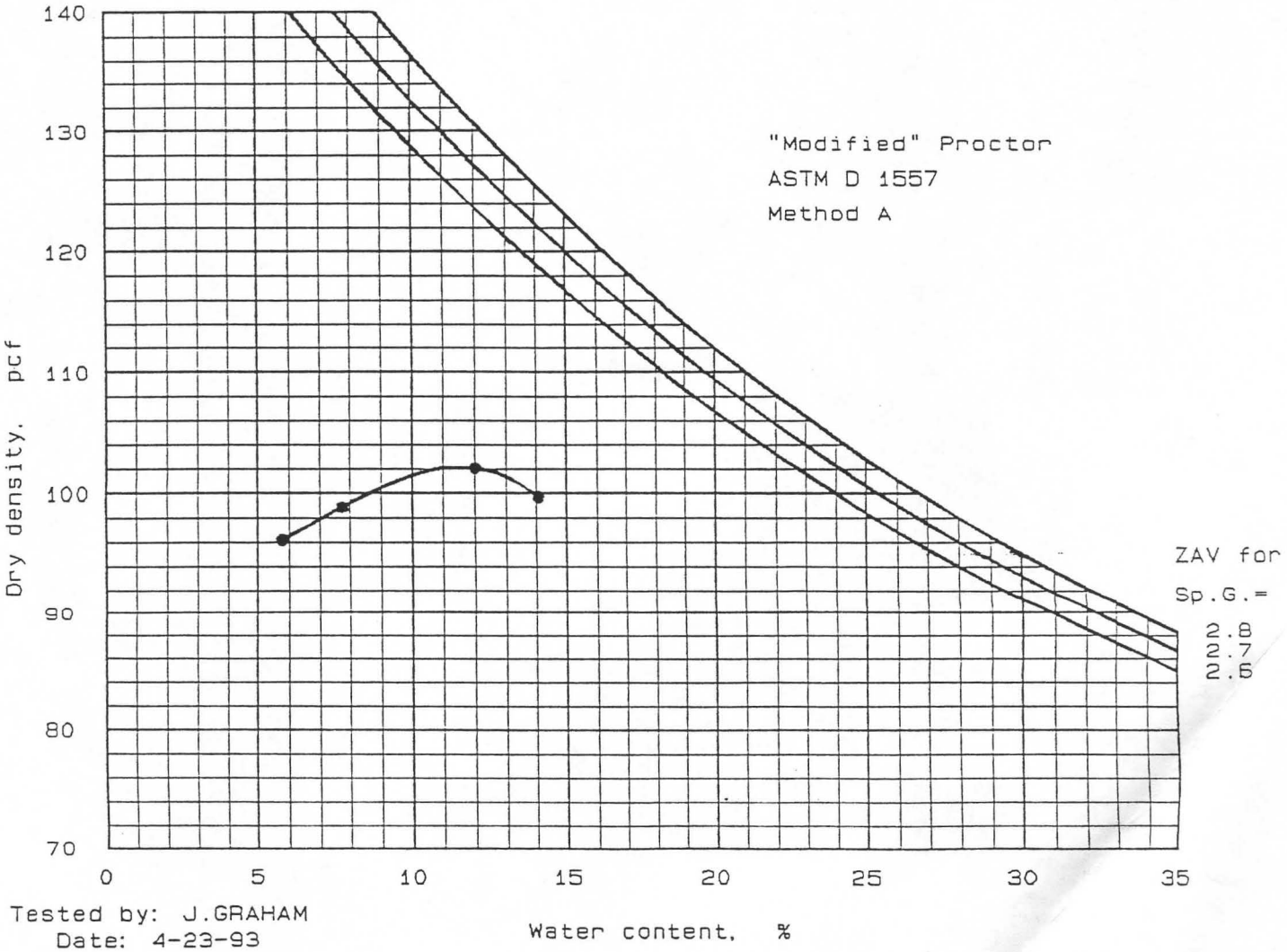
Description: BEACH SAND

Classifications: USCS: AASHTO:

Nat. Moist. = % Sp.G. =

Liquid Limit = Plasticity Index =

TEST RESULTS
Maximum dry density = 102.1 pcf
Optimum moisture = 11.5 %



Tested by: J.GRAHAM
Date: 4-23-93
Checked by: J.BEKEY
Date: 4-23-93

PACIFIC TESTING LABORATORIES

Figure No. _____