APPENDIX B
Geophysical Investigation Report

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November 30, 2011 Our Ref.: 101-1004.000

Washington State Department of Transportation
Materials Laboratory
1655 2nd Avenue SW
Tumwater, WA 98512

Attention: Mr. Andrew Fiske

RE: REPORT ON THE SUSPENSION LOGGING AT SR167 PUYALLUP BRIDGE, PUYALLUP, WA

Dear Mr. Fiske:

Global Geophysics conducted borehole suspension loggings in boreholes H-3P-11 and H-5P-11 in November, 2011. The boring H-3P-11 is 212 ft in depth, and H-5P-11 230 ft in depth. Both of them are PVC cased holes.

The objective of the geophysical investigation is to calculate the s-wave velocities using the suspension logging.

METHODOLOGY AND INSTRUMENTATION

Suspension logging was performed using the suspension PS logging system, manufactured by OYO Corporation, and their subsidiary, Robertson Geologging. This system directly determines the average velocity of a 3.3 feet high segment of the soil column surrounding the boring of interest by measuring the elapsed time between arrivals of a wave propagating upward through the soil column generated by a source, separated with rubber tubes.

The suspension system probe consists of a combined reversible polarity solenoid horizontal shear wave source (SH) and compressional-wave source (P), joined to two biaxial receivers by a flexible isolation cylinder. The separation of the two receivers is 3.28 feet, allowing average wave velocity in the region between the receivers to be determined by inversion of the wave travel time between the two receivers. The total length of the probe as used in these surveys is 21 feet. The probe receives control signals from, and sends the receiver signals to, instrumentation on the surface via an armored 4-conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth data, using a 1.3-foot circumference sheave fitted with a digital rotary encoder. The entire probe is suspended in the boring by the cable, therefore, source motion is not coupled directly to the boring walls; rather, the source motion creates a horizontally

propagating impulsive pressure wave in the fluid filling the boring and surrounding the source. This pressure wave is converted to P and SH-waves in the surrounding soil and rock as it passes through the casing and grout annulus and impinges upon the wall of the boring. These waves propagate through the soil and rock surrounding the boring, in turn causing a pressure wave to be generated in the fluid surrounding the receivers as the soil waves pass their location.

In operation, repeatable pattern of impulses are generated at each depth as follows:
1. The source is fired in one direction producing dominantly horizontal shear with some vertical compression, and the signals from the horizontal receivers situated parallel to the axis of motion of the source are recorded.
2. The source is fired again in the opposite direction and the horizontal receiver signals are recorded.
3. The source is fired again and the vertical receiver signals are recorded. The repeated source pattern facilitates the picking of the P and SH-wave arrivals; reversal of the source changes the polarity of the SH-wave pattern but not the P-wave pattern.

RESULTS

The following paragraphs describe the interpreted results.

Table 1: S-wave and P-wave velocities at borehole H-3P-11

Depth (ft)	S-wave velocity (ft/s)	P-wave velocity (ft/s)	Note
15	353		No p-wave data
18	459		No p-wave data
21	456		No p-wave data
24	592		No p-wave data
27	469	4754	
30	573	4898	
33	618	4970	
36	528	4898	
39	543	5207	
42	620	5207	
45	986	6696	
48	887	6696	
51	656	6076	
54	609	5755	
57	700	6076	
60	620	5965	
63	650	5561	
66	436	5656	
69	666	4898	

72	741	5607	
75	922	5469	
78	953	5423	
81	848	5085	
84	559	5046	
87	646	5423	
90	717	5561	
93	702	5515	
96	771	5561	
99	673	5515	
102	764	5561	
105	805	5515	
108	907	5561	
111	728	5085	
114	801	5292	
117	1060	5377	
120	756	5010	
123	755	5046	
126	817	4859	
129	699	4970	
132	681	5167	
135	636	5292	
138	733	5010	
141	983	5249	
144	750	5167	
147	548	5128	
150	615	5046	
155	791	5249	
160	842	5377	
165	787	5085	
170	659	5249	
175	804	5207	
180	715	5249	
185	771	5335	
190	906	5469	
195	966	5207	
200	925	5207	
205	1037	5377	
210	914	5423	
212.5	758	5335	

Table 2: S-wave and P-wave velocities at borehole H-5P-11

Depth (ft)	S-wave velocity (ft/s)	P-wave velocity (ft/s)	Note
18	413		No p-wave data
21	540		No p-wave data
24	500		No p-wave data
27	509		No p-wave data
30	540		No p-wave data
33	446		No p-wave data
36	618		No p-wave data
39	476	5128	
42	495	5249	
45	489	5860	
48	389	5561	
51	397	5469	
54	446	5656	
57	359	6191	
60	390	5807	
63	520	6191	
66	568	5561	
69	502	5167	
72	382	5249	
75	553	5249	
78	782	5249	
81	746	5249	
84	751	5469	
87	933	5292	
90	820	5292	
93	1068	5377	
96	869	5515	
99	773	4934	
102	640	5010	
105	687	5249	
108	830	5249	
111	709	5085	
114	715	4934	
117	874	5335	
120	691	5249	
123	589	5085	
126	720	4934	

129	843	5046	
132	661	5207	
135	614	5207	
138	764	5292	
141	830	5167	
144	792	5128	
147	738	5249	
150	768	5377	
155	805	5207	
160	737	5207	
165	822	5085	
170	883	5167	
175	687	5010	
180	969	5561	
185	925	5335	
190	1427	6696	
195	1050	5561	
200	1216	6132	
205	996	5207	
210	842	5292	
215	796	5335	
220	1122	5377	
225	1002	5292	
229.2	1094	5515	

LIMITATIONS OF THE GEOPHYSICAL METHODS

Global geophysics services are conducted in a manner consistent with the level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar conditions subject to the time limits and financial and physical constraints applicable to the services. Suspension logging is a remote sensing geophysical method that may not detect all subsurface layer velocity changes.

Sincerely,

Global Geophysics

John Liu, Ph.D., R.G.
Principal Geophysicist

APPENDIX C
Laboratory Test Results

Job No. **XL-4105a** Date **June 12, 2012**

Hole No. **H-1-11** Sheet **1** of **21**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

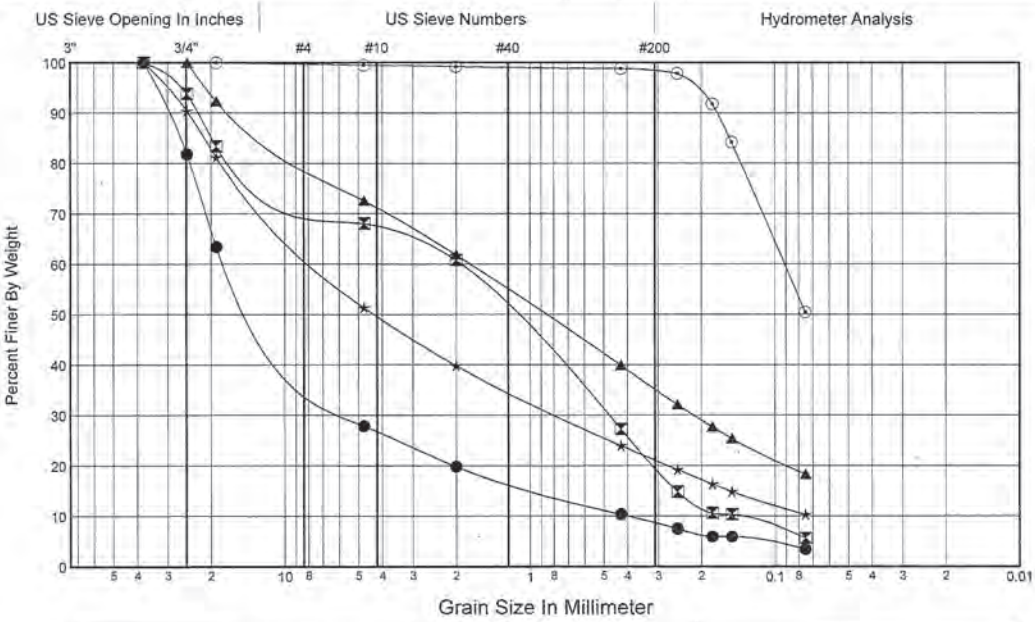
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	5.0	D-1	GP	POORLY GRADED GRAVEL with SAND	2				72.2	24.4	3.4	4.0	41.7
⧗	10.0	D-2	SP-SM	POORLY GRADED SAND with SILT and GRAVEL	13				31.9	62.4	5.7	0.8	13.5
▲	22.0	D-5	SM	SILTY SAND with GRAVEL	14				27.4	54.3	18.3		
★	35.0	D-9	GW-GM	WELL-GRADED GRAVEL with SILT and SAND	8				48.6	41.1	10.3	1.2	99.2
⊙	45.0	D-11	ML	SANDY SILT	28				0.5	49.0	50.5		

GRADATION VALUES

	D95	D90	D85	D80	D70
●	33.550	30.02	26.86	24.34	20.956
⧗	27.112	22.64	19.83	13.99	5.653
▲	20.906	16.13	11.35	7.98	3.845
★	30.354	24.70	21.26	17.94	11.274
⊙	0.214	0.17	0.15	0.14	0.112

GRADATION VALUES

	D60	D50	D30	D20	D10
●	16.608	11.25	5.17	2.04	0.398
⧗	1.925	1.21	0.48	0.31	0.143
▲	1.751	0.86	0.21	0.09	
★	7.086	4.28	0.76	0.27	
⊙	0.091				



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **XL-4105a** Date **June 12, 2012**

Hole No. **H-2-11** Sheet **2** of **21**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

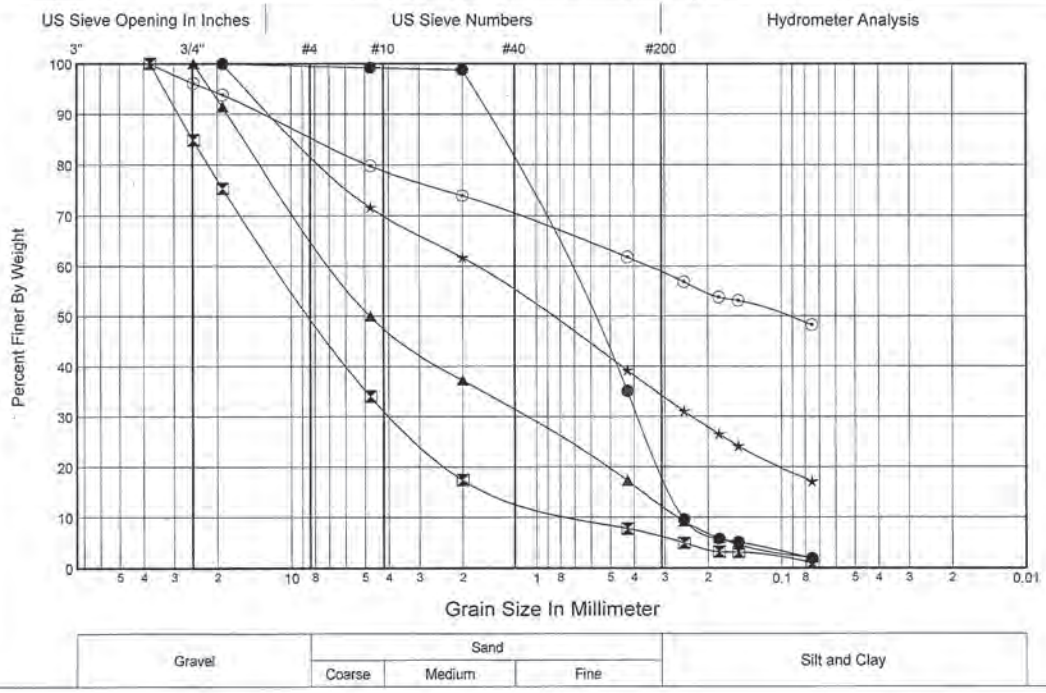
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	50.0	D-12	SP	POORLY GRADED SAND	25				0.8	97.4	1.9	0.7	3.1
⧗	3.0	D-1	GW	WELL-GRADED GRAVEL with SAND	3				66.0	33.0	1.0	2.2	18.7
▲	8.0	D-2	GP	POORLY GRADED GRAVEL with SAND	11				50.0	47.9	2.0	0.7	25.3
★	23.0	D-5	SM	SILTY SAND with GRAVEL	14				28.3	54.6	17.1		
⊙	38.0	D-8	SM	SILTY SAND with GRAVEL	15				20.2	31.5	48.3		

GRADATION VALUES

	D95	D90	D85	D80	D70
●	1.823	1.61	1.43	1.27	0.993
⧗	32.802	28.69	25.10	21.70	15.833
▲	21.309	18.12	15.33	12.97	9.283
★	14.874	11.64	9.11	7.14	4.097
⊙	21.838	13.01	7.93	4.83	1.196

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.779	0.61	0.38	0.31	0.252
⧗	11.332	8.11	3.86	2.29	0.605
▲	6.644	4.75	1.14	0.53	0.263
★	1.768	0.89	0.23	0.10	
⊙	0.349	0.10			



Job No. **XL-4105a** Date **June 12, 2012**

Hole No. **H-3p-11** Sheet **3** of **21**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

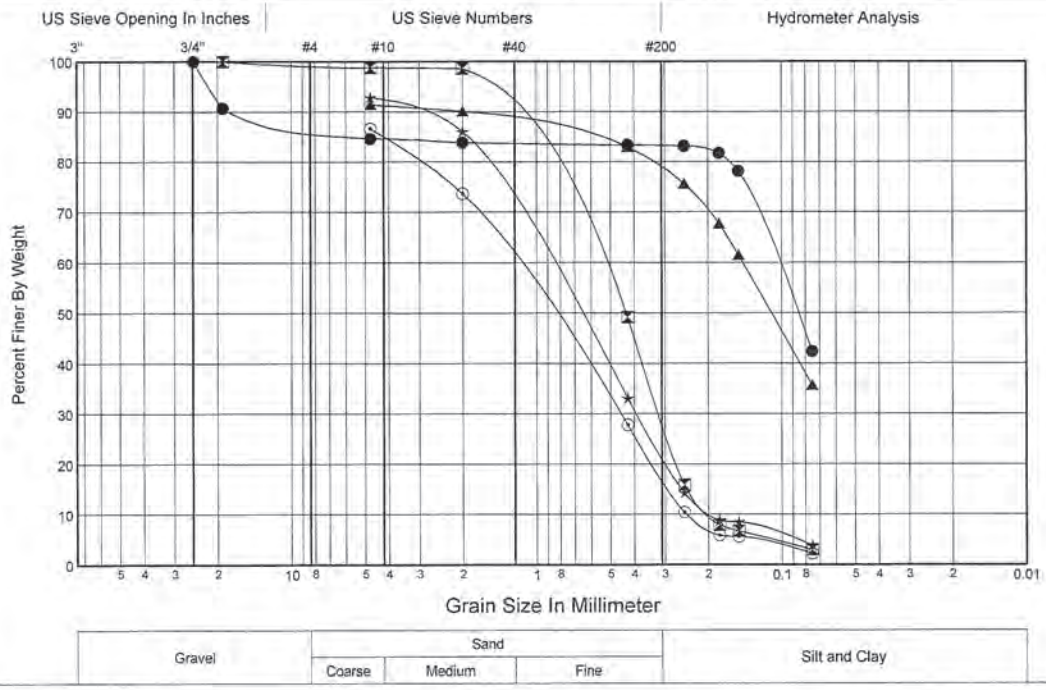
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	43.0	D-9	SM	SILTY SAND with GRAVEL	21				15.4	42.2	42.4		
⧗	53.0	D-11	SP	POORLY GRADED SAND	22				1.2	95.8	3.0	0.8	3.0
▲	5.0	D-1	SM	SILTY SAND	21				0.0	55.7	35.7		
★	10.0	D-3	SP	POORLY GRADED SAND	19				0.0	89.1	3.8	0.8	4.8
⊙	15.0	D-5	SP	POORLY GRADED SAND	16				0.0	84.5	2.2	0.7	5.2

GRADATION VALUES

	D95	D90	D85	D80	D70
●	21.578	16.28	5.20	0.16	0.128
⧗	1.785	1.53	1.31	1.12	0.816
▲		1.93	0.66	0.34	0.198
★		3.29	1.94	1.67	1.249
⊙			4.25	3.04	1.763

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.106	0.09			
⧗	0.596	0.44	0.31	0.27	0.196
▲	0.144	0.11			
★	0.932	0.70	0.39	0.29	0.193
⊙	1.258	0.90	0.46	0.33	0.242



Job No. **XL-4105a** Date **June 12, 2012**

Hole No. **H-3p-11** Sheet **4** of **21**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

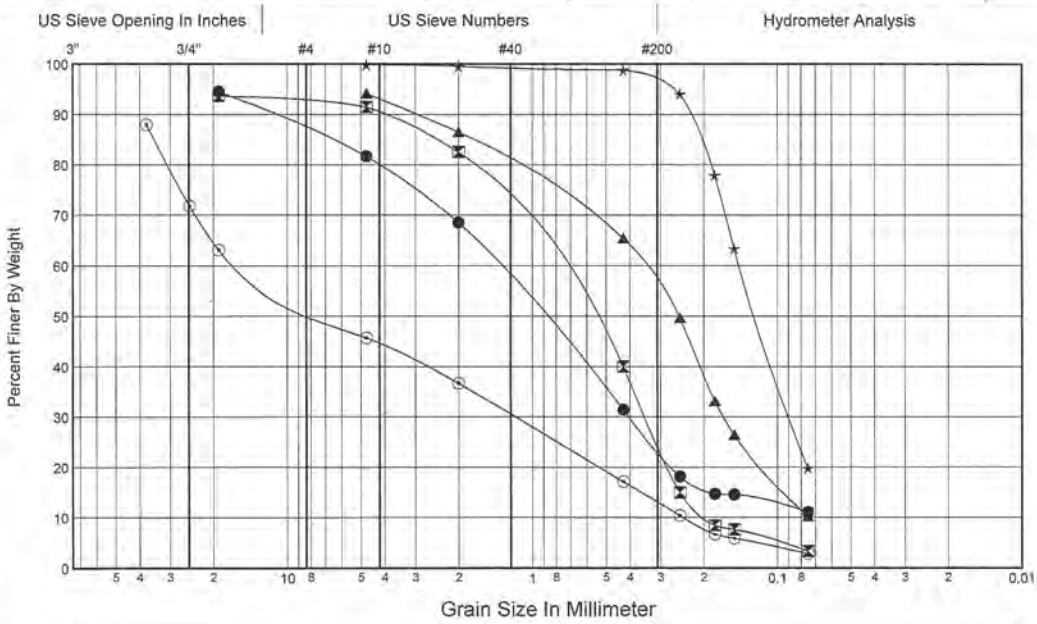
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	18.0	D-6	SW-SM	WELL-GRADED SAND with SILT and GRAVEL	18				12.8	70.6	11.1	1.9	23.1
⧗	23.0	D-8	SP	POORLY GRADED SAND	20				2.2	88.2	3.3	0.7	4.5
▲	30.0	D-11	SP-SM	POORLY GRADED SAND with SILT	21				0.0	84.0	10.2	1.0	4.8
★	35.0	D-13	SM	SILTY SAND	31				0.0	80.1	19.8		
⊙	43.0	D-16	GP	POORLY GRADED GRAVEL with SAND	5				42.2	43.0	2.8	0.4	61.2

GRADATION VALUES

	D95	D90	D85	D80	D70
●		11.65	6.79	4.25	2.196
⧗		4.12	2.54	1.82	1.267
▲		2.96	1.79	1.24	0.594
★	0.277	0.23	0.21	0.19	0.163
⊙			34.81	30.69	23.578

GRADATION VALUES

	D60	D50	D30	D20	D10
●	1.398	0.92	0.40	0.27	
⧗	0.880	0.61	0.34	0.28	0.195
▲	0.354	0.25	0.17	0.11	
★	0.142	0.12	0.09	0.08	
⊙	14.808	6.66	1.17	0.53	0.242



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Hole No. **H-3p-11** Sheet **5** of **21**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

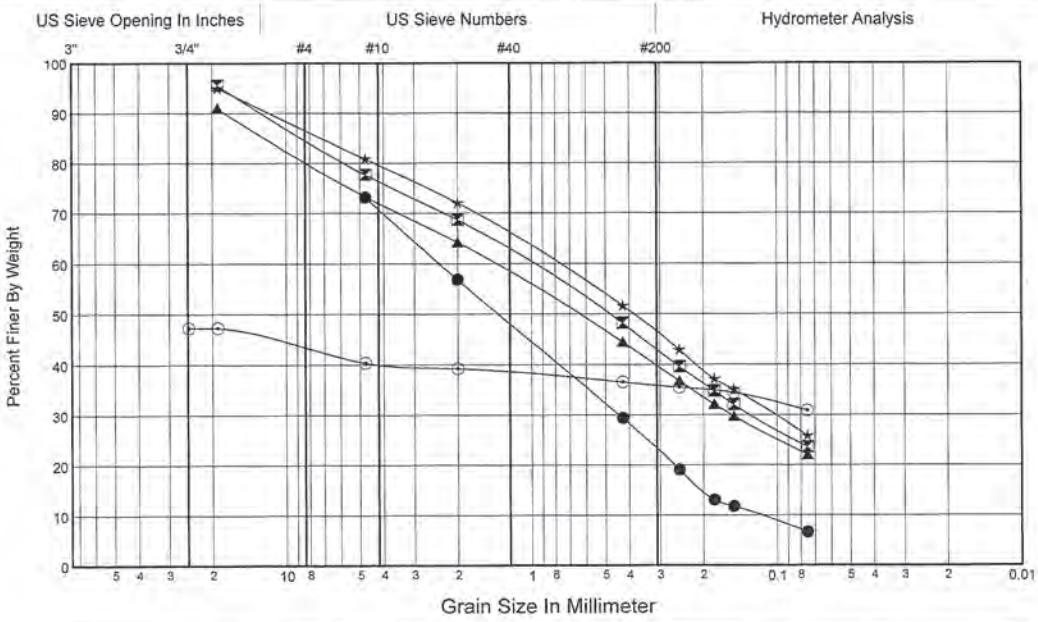
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	45.0	D-17	SP-SM	POORLY GRADED SAND with SILT and GRAVEL	11				0.0	66.5	6.7	0.7	20.1
⧗	48.0	D-18	SM	SILTY SAND with GRAVEL	12				17.9	54.1	23.6		
▲	55.0	D-21	SM	SILTY SAND with GRAVEL	15				17.6	51.3	22.1		
★	60.0	D-23	SM	SILTY SAND with GRAVEL	14				14.2	55.0	25.9		
⊙	65.0	D-25	GM	SILTY GRAVEL	14				6.9	9.5	30.9		

GRADATION VALUES

	D95	D90	D85	D80	D70
●					4.009
⧗	18.106	12.28	8.33	5.65	2.262
▲		17.55	11.85	8.00	3.447
★	18.866	11.56	7.09	4.34	1.704
⊙					

GRADATION VALUES

	D60	D50	D30	D20	D10
●	2.360	1.36	0.44	0.26	0.118
⧗	1.035	0.49	0.13		
▲	1.432	0.65	0.15		
★	0.797	0.38	0.10		
⊙					



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Hole No. **H-3p-11** Sheet **6** of **21**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

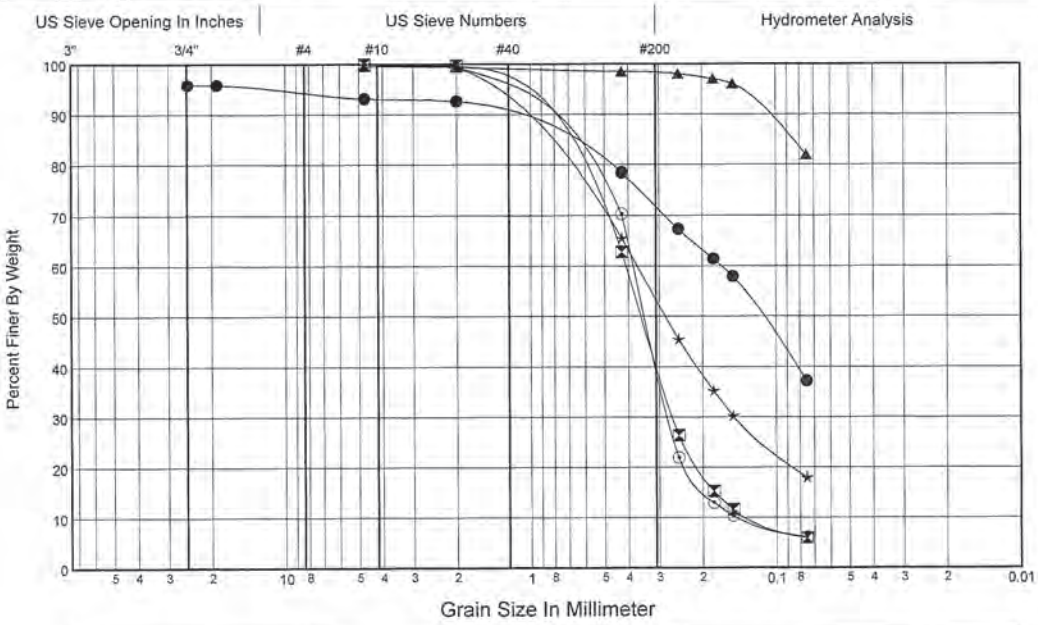
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	68.0	D-26	SM	SILTY SAND	20				2.7	55.9	37.2		
⧗	75.0	D-29	SP-SM	POORLY GRADED SAND with SILT	23				0.0	94.0	6.0	1.4	3.3
▲	85.0	D-31	ML	SILT with SAND	39				0.0	17.6	82.0		
★	90.0	D-32	SM	SILTY SAND	20				0.0	82.0	18.0		
⊙	100.0	D-34	SP-SM	POORLY GRADED SAND with SILT	25				0.0	93.8	6.2	1.4	2.7

GRADATION VALUES

	D95	D90	D85	D80	D70
●	12.223	1.50	0.86	0.50	0.283
⧗	1.640	1.33	1.08	0.87	0.574
▲	0.142	0.11	0.09		
★	1.639	1.30	1.04	0.82	0.521
⊙	1.566	1.20	0.92	0.71	0.423

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.167	0.11			
⧗	0.408	0.35	0.26	0.21	0.124
▲					
★	0.367	0.28	0.15	0.08	
⊙	0.379	0.34	0.27	0.23	0.141



Job No. **XL-4105a** Date **June 12, 2012**

Hole No. **H-3p-11** Sheet **7** of **21**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

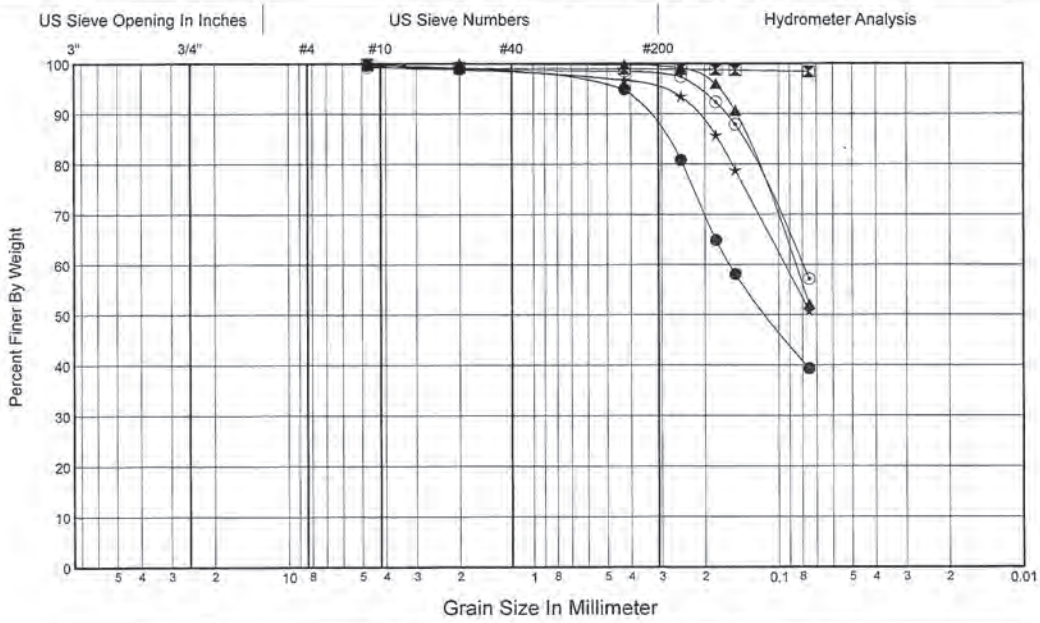
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	115.0	D-37	SM	SILTY SAND	31				0.0	60.3	39.3		
⧗	130.0	D-40	ML	SILT	45				0.0	1.4	98.4		
▲	145.0	D-43	ML	SANDY SILT	34				0.0	47.9	52.1		
★	155.0	D-45	ML	SANDY SILT	24				0.0	49.1	50.8		
⊙	165.0	D-47	ML	SANDY SILT	31				0.0	42.2	57.1		

GRADATION VALUES

	D95	D90	D85	D80	D70
●	0.435	0.35	0.29	0.25	0.200
⧗					
▲	0.174	0.15	0.14	0.12	0.103
★	0.319	0.22	0.18	0.15	0.121
⊙	0.214	0.16	0.14	0.13	0.100

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.158	0.11			
⧗					
▲	0.086				
★	0.094				
⊙	0.080				



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **XL-4105a** Date **June 12, 2012**

Hole No. **H-3p-11** Sheet **8** of **21**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

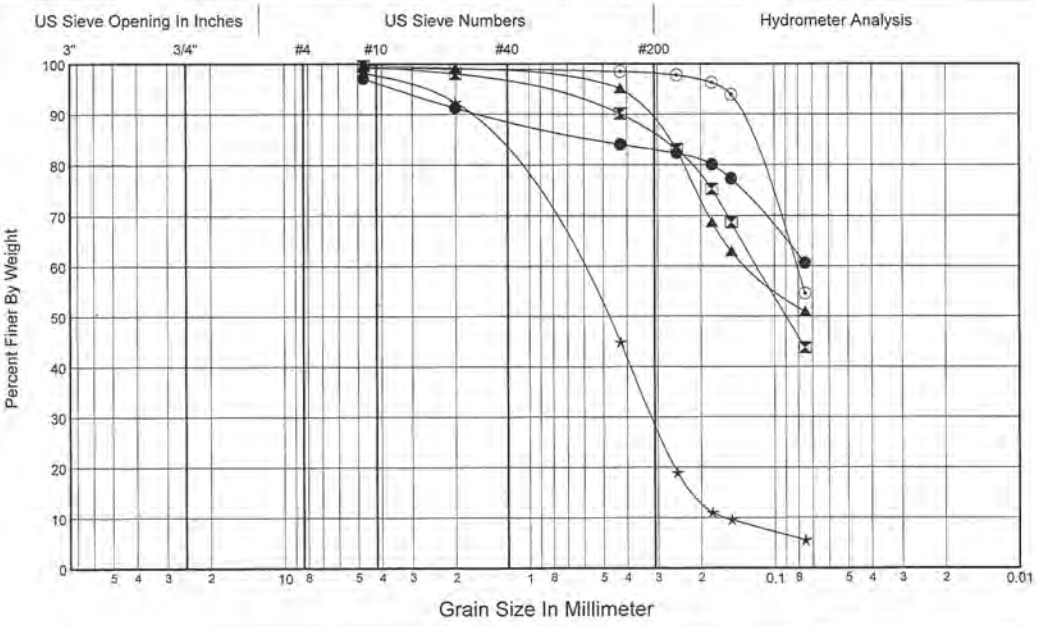
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	170.0	D-48	ML	SANDY SILT	48				0.0	36.5	60.7		
⧗	175.0	D-49	SM	SILTY SAND	17				0.0	55.8	43.8		
▲	195.0	D-53	ML	SANDY SILT	41				0.0	48.9	51.0		
★	205.0	D-55	SP-SM	POORLY GRADED SAND with SILT	18				0.0	92.6	5.6	0.9	4.4
⊙	220.0	D-58	ML	SANDY SILT	33				0.0	44.5	54.6		

GRADATION VALUES

	D95	D90	D85	D80	D70
●	3.462	1.52	0.52	0.18	0.110
⧗	1.095	0.42	0.29	0.22	0.156
▲	0.421	0.34	0.27	0.23	0.185
★	2.929	1.85	1.57	1.33	0.962
⊙	0.163	0.14	0.13	0.12	0.098

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⧗	0.118	0.09			
▲	0.126				
★	0.694	0.50	0.31	0.26	0.157
⊙	0.083				



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Hole No. **H-4p-11** Sheet **9** of **21**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

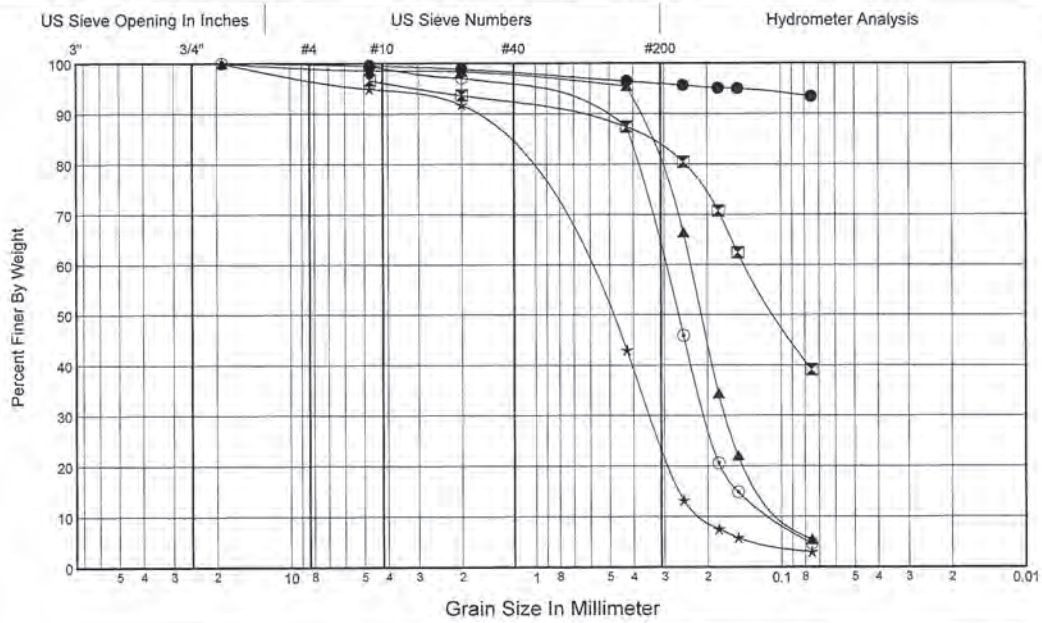
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	225.0	D-59	ML	SILT	49				0.0	6.1	93.5		
⧗	230.0	D-60	SM	SILTY SAND	54				0.0	57.6	39.1		
▲	2.0	D-1	SP-SM	POORLY GRADED SAND with SILT	18				1.4	93.1	5.5	1.3	2.6
★	7.0	D-3	SP	POORLY GRADED SAND	16				5.0	91.9	3.1	0.8	3.5
⊙	12.0	D-5	SP	POORLY GRADED SAND	20				0.5	94.8	4.7	1.3	2.8

GRADATION VALUES

	D95	D90	D85	D80	D70
●	0.147				
⧗	2.927	0.80	0.35	0.25	0.177
▲	0.421	0.38	0.35	0.32	0.267
★	4.788	1.89	1.61	1.37	1.001
⊙	1.414	0.64	0.41	0.39	0.340

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⧗	0.140	0.10			
▲	0.234	0.21	0.17	0.14	0.090
★	0.729	0.53	0.34	0.28	0.207
⊙	0.299	0.26	0.20	0.18	0.108



Job No. **XL-4105a** Date **June 12, 2012**

Hole No. **H-4p-11** Sheet **10** of **21**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

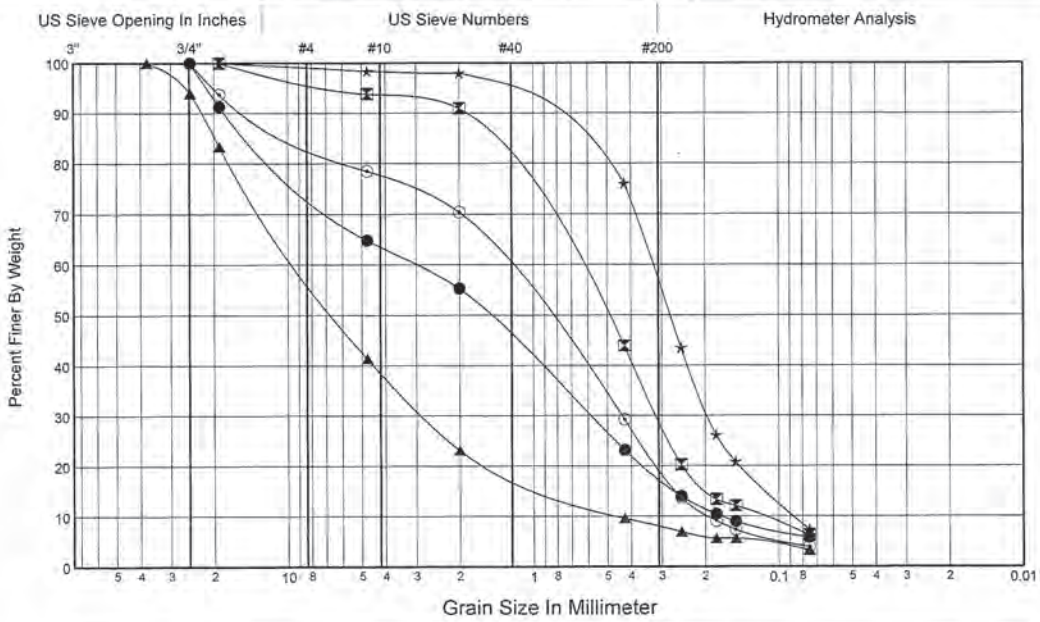
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	19.0	D-8	SP-SM	POORLY GRADED SAND with SILT and GRAVEL	11				35.1	59.0	5.8	0.7	17.9
⧗	24.0	D-10	SW-SM	WELL-GRADED SAND with SILT	13				6.2	87.6	6.2	1.1	6.2
▲	27.0	D-11	GW	WELL-GRADED GRAVEL with SAND	5				58.6	38.1	3.3	2.0	19.7
★	34.0	D-14	SP-SM	POORLY GRADED SAND with SILT	25				1.6	91.0	7.4	1.3	3.8
⊙	37.0	D-15	SP	POORLY GRADED SAND with GRAVEL	14				21.5	74.5	4.0	0.7	7.0

GRADATION VALUES

	D95	D90	D85	D80	D70
●	21.352	17.75	13.65	10.50	6.218
⧗	6.194	1.94	1.64	1.39	1.003
▲	26.883	22.58	19.83	17.00	12.222
★	1.617	1.14	0.80	0.56	0.385
⊙	20.096	13.54	8.59	5.45	1.968

GRADATION VALUES

	D60	D50	D30	D20	D10
●	3.060	1.55	0.59	0.35	0.171
⧗	0.721	0.52	0.31	0.25	0.117
▲	8.785	6.31	2.77	1.39	0.445
★	0.327	0.28	0.19	0.14	0.086
⊙	1.351	0.93	0.44	0.31	0.192



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Hole No. **H-4p-11** Sheet **11** of **21**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

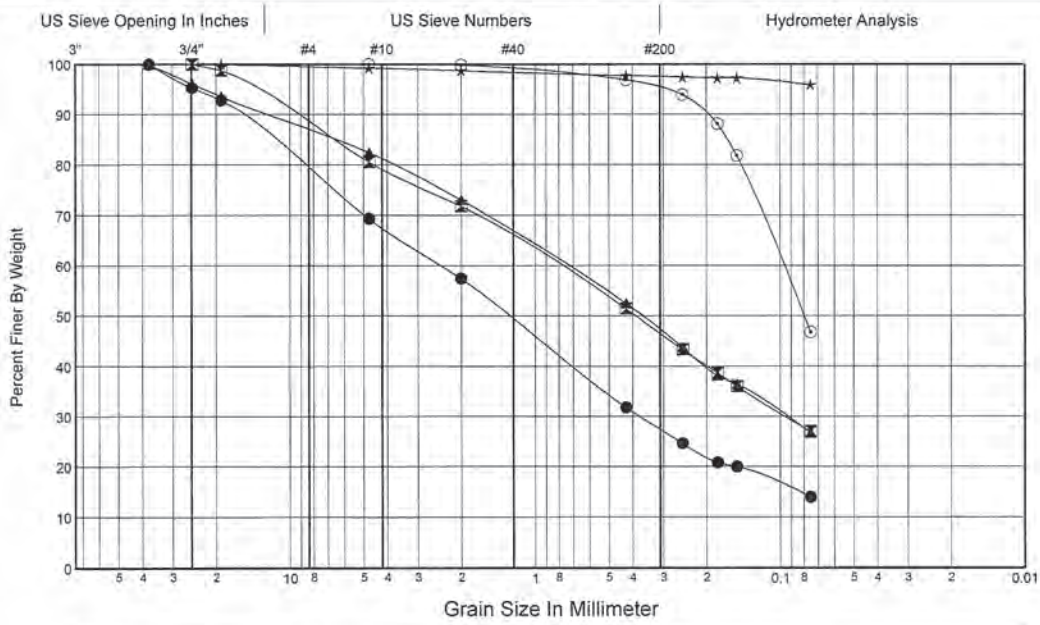
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	42.0	D-17	SM	SILTY SAND with GRAVEL	12				30.6	55.4	14.0		
⧗	44.0	D-18&D-19	SM	SILTY SAND with GRAVEL	13	21		21	19.4	53.5	27.0		
▲	62.0	D-25&D-26	SM	SILTY SAND with GRAVEL	16				17.5	55.7	26.7		
★	67.0	D-27	ML	SILT	41	34		34	0.7	3.3	95.9		
⊙	72.0	D-29	SM	SILTY SAND	24				0.0	53.2	46.8		

GRADATION VALUES

	D95	D90	D85	D80	D70
●	24.167	16.06	11.95	8.90	4.932
⧗	14.268	9.74	6.65	4.48	1.741
▲	22.144	12.15	6.50	3.78	1.587
★					
⊙	0.302	0.20	0.16	0.14	0.119

GRADATION VALUES

	D60	D50	D30	D20	D10
●	2.407	1.28	0.37	0.15	
⧗	0.814	0.39	0.09		
▲	0.747	0.36	0.09		
★					
⊙	0.097	0.08			



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

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Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

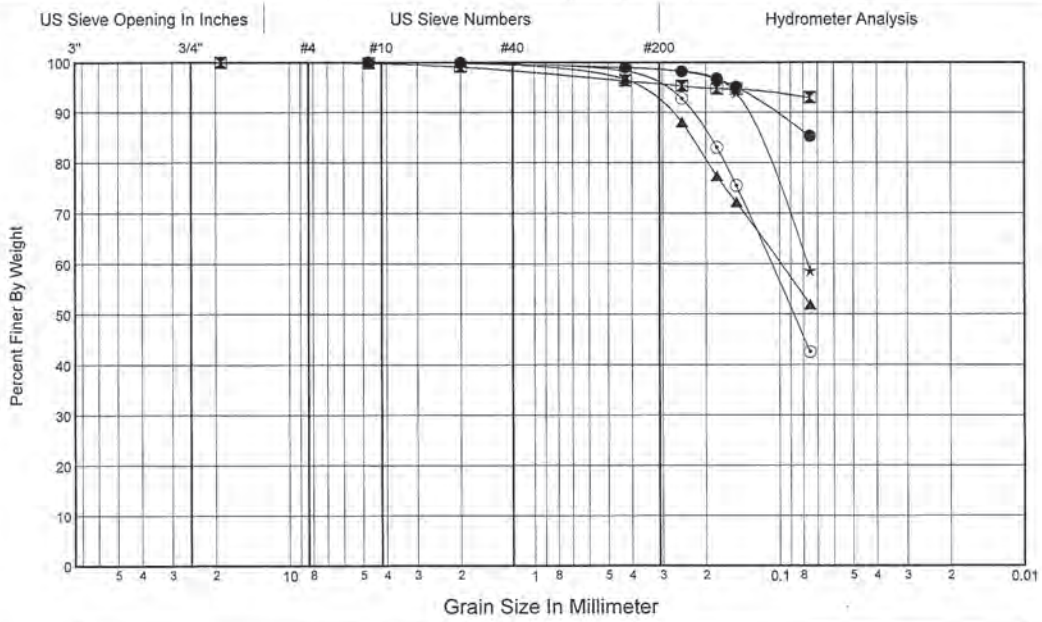
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	79.0	D-31	ML	SILT	42	31		31	0.0	14.7	85.3		
⧗	84.0	D-32	ML	SILT	48				0.1	6.9	93.0		
▲	89.0	D-33	ML	SANDY SILT	30				0.0	48.1	51.9		
★	94.0	D-34	ML	SANDY SILT	28				0.0	41.3	58.7		
⊙	99.0	D-35	SM	SILTY SAND	24				0.0	57.4	42.6		

GRADATION VALUES

	D95	D90	D85	D80	D70
●	0.149	0.10			
⧗	0.210				
▲	0.382	0.28	0.23	0.20	0.139
★	0.160	0.14	0.13	0.11	0.094
⊙	0.308	0.23	0.19	0.17	0.134

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⧗					
▲	0.099				
★	0.077				
⊙	0.108	0.09			



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Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

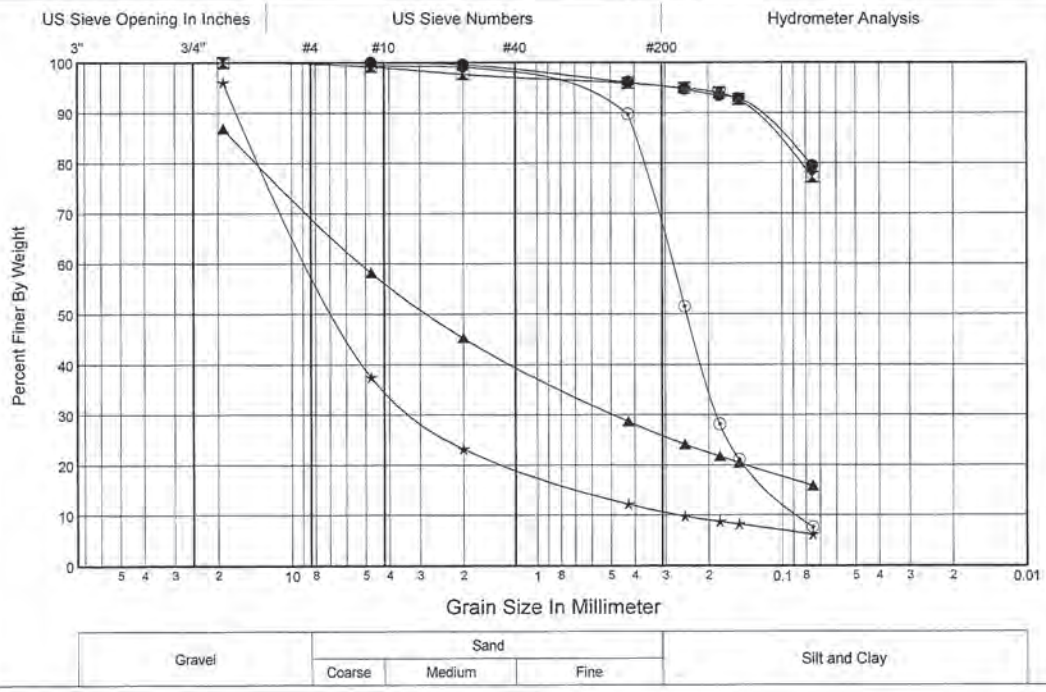
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	114.0	D-38	ML	SILT with SAND	42	33		33	0.0	20.5	79.5		
⧗	124.0	D-40	ML	SILT with SAND	52	29		29	0.8	22.0	77.2		
▲	5.0	D-2	SM	SILTY SAND with GRAVEL	2				28.6	42.4	15.9		
★	10.0	D-4	GP-GM	POORLY GRADED GRAVEL with SILT and SAND	5				58.6	31.3	6.2	4.3	31.0
⊙	13.0	D-5	SP-SM	POORLY GRADED SAND with SILT	28				0.0	91.8	7.7	1.4	3.3

GRADATION VALUES

	D95	D90	D85	D80	D70
●	0.276	0.13	0.10	0.08	
⧗	0.254	0.13	0.11	0.08	
▲			17.36	13.63	8.394
★	18.509	16.44	14.61	12.98	10.245
⊙	0.992	0.44	0.40	0.37	0.323

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⧗					
▲	5.171	2.74	0.48	0.14	
★	8.087	6.38	3.01	1.26	0.261
⊙	0.281	0.24	0.18	0.14	0.085



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Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

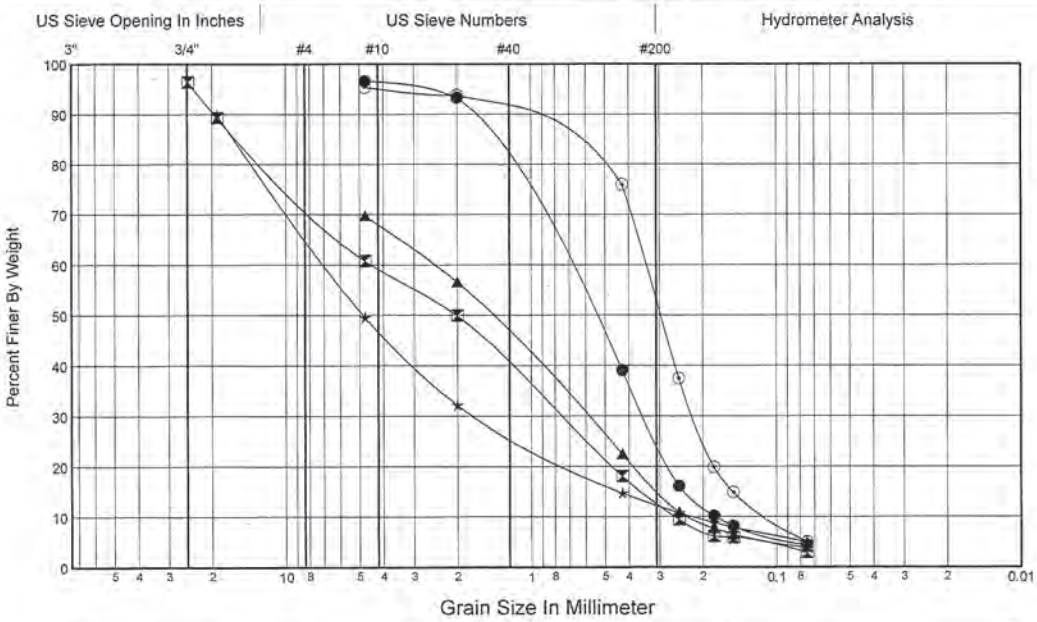
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	18.0	D-7	SP	POORLY GRADED SAND	20				0.0	92.2	4.4	0.9	4.4
⧗	23.0	D-9	SP	POORLY GRADED SAND with GRAVEL	27				35.6	58.0	2.9	0.5	17.2
▲	30.0	D-12	SP	POORLY GRADED SAND with GRAVEL	13				0.0	65.9	3.9	0.6	11.0
★	33.0	D-13	GW-GM	WELL-GRADED GRAVEL with SILT and SAND	8				40.2	44.5	5.1	1.8	31.2
⊙	38.0	D-15	SP-SM	POORLY GRADED SAND with SILT	24				0.0	90.4	5.0	1.3	3.2

GRADATION VALUES

	D95	D90	D85	D80	D70
●	3.083	1.82	1.58	1.37	1.027
⧗	23.671	19.51	15.40	12.08	7.422
▲					
★			16.07	13.53	9.586
⊙	3.738	1.43	0.93	0.60	0.391

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.772	0.58	0.34	0.27	0.176
⧗	4.447	2.01	0.76	0.47	0.258
▲	2.497	1.48	0.60	0.38	0.227
★	6.793	4.81	1.64	0.68	0.218
⊙	0.341	0.30	0.22	0.18	0.106



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Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

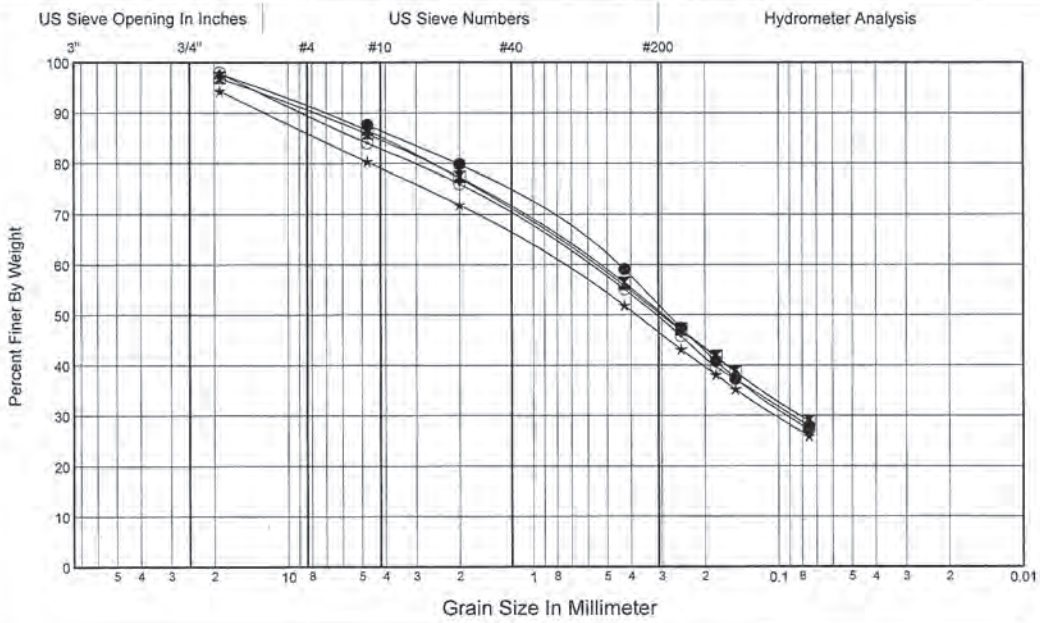
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	40.0	D-16	SM	SILTY SAND	16	22		22	0.0	60.4	27.3		
⧗	45.0	D-18	SM	SILTY SAND	15	22		22	11.0	57.0	28.9		
▲	50.0	D-20	SM	SILTY SAND	16	22		22	11.2	57.7	28.9		
★	55.0	D-22	SM	SILTY SAND with GRAVEL	17	22		22	14.0	54.4	26.0		
⊙	60.0	D-24	SM	SILTY SAND with GRAVEL	18	21		21	13.8	56.2	27.9		

GRADATION VALUES

	D95	D90	D85	D80	D70
●			3.53	2.03	0.957
⧗	14.888	7.94	4.33	2.61	1.158
▲	13.458	7.26	4.11	2.58	1.183
★		12.29	7.50	4.57	1.721
⊙	14.167	8.58	5.20	3.05	1.273

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.454	0.28	0.09		
⧗	0.553	0.29	0.08		
▲	0.573	0.30	0.08		
★	0.795	0.38	0.10		
⊙	0.608	0.32	0.09		



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Hole No. **H-5p-11** Sheet **16** of **21**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

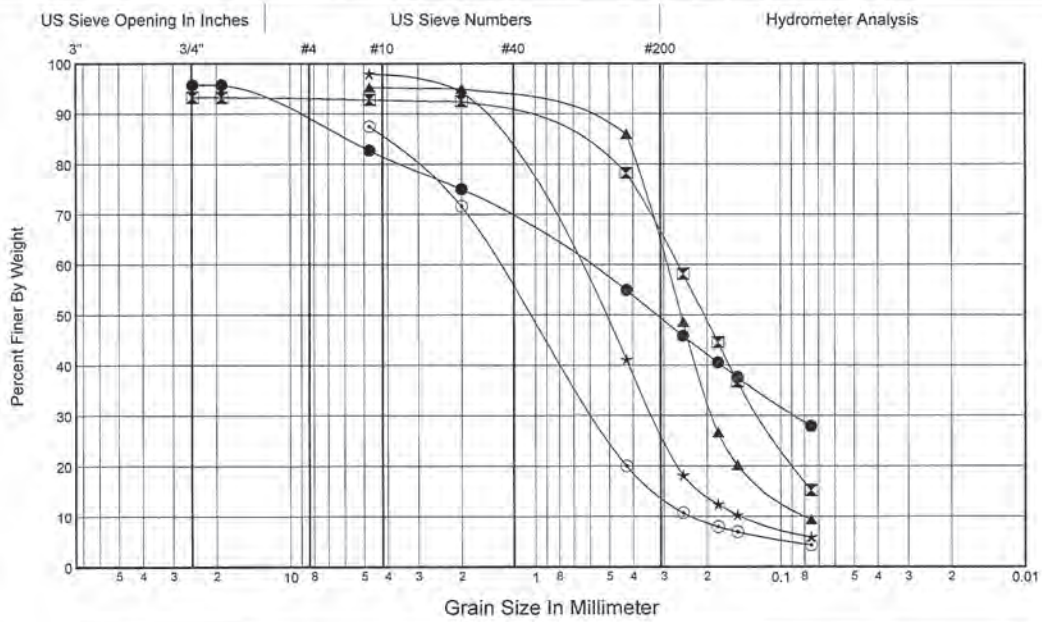
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	68.0	D-27	SM	SILTY SAND with GRAVEL	18	21		21	13.0	54.9	27.9		
⧗	73.0	D-29	SM	SILTY SAND	24				0.4	77.6	15.2		
▲	80.0	D-31	SP-SM	POORLY GRADED SAND with SILT	22				0.0	85.9	9.4	1.6	3.8
★	90.0	D-33	SP-SM	POORLY GRADED SAND with SILT	18				0.0	92.0	6.0	1.0	5.1
⊙	95.0	D-34	SW	WELL-GRADED SAND	16				0.0	83.2	4.4	1.0	6.2

GRADATION VALUES

	D95	D90	D85	D80	D70
●	17.551	10.28	6.02	3.48	1.353
⧗		1.52	0.89	0.52	0.342
▲	1.995	0.84	0.42	0.39	0.339
★	2.267	1.76	1.52	1.31	0.982
⊙			4.14	3.15	1.905

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.626	0.32	0.09		
⧗	0.263	0.21	0.12	0.09	
▲	0.294	0.25	0.19	0.15	0.078
★	0.734	0.55	0.33	0.26	0.143
⊙	1.411	1.05	0.57	0.42	0.229



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Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

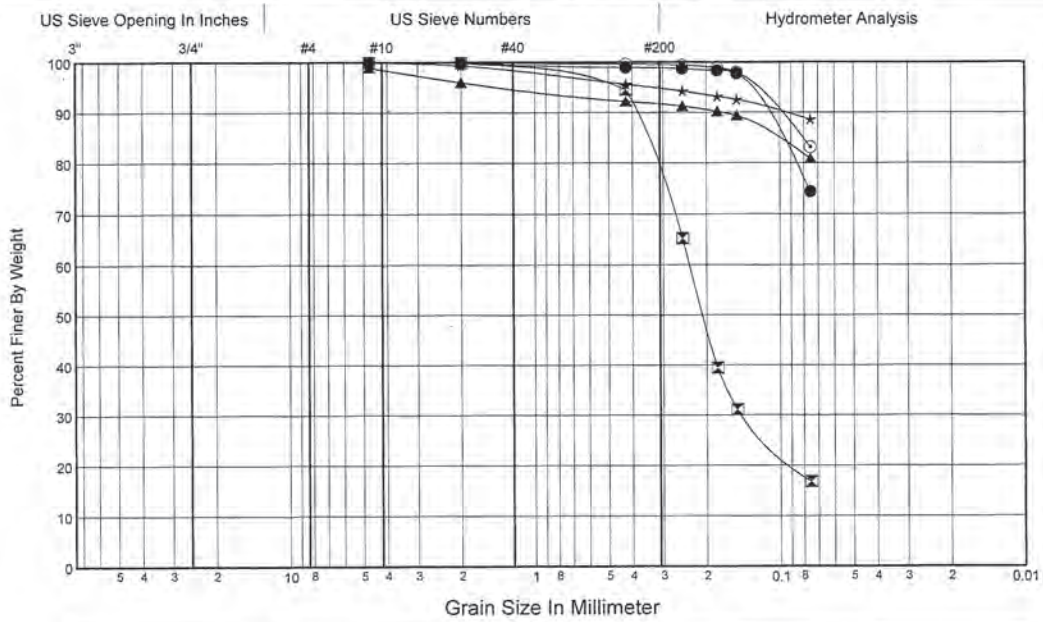
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	100.0	D-35	ML	SILT with SAND	36	1		1	0.0	25.5	74.5		
⧗	110.0	D-37	SM	SILTY SAND	28	1		1	0.0	83.1	16.8		
▲	115.0	D-38	ML	SILT with SAND	55	40	35	5	0.0	18.0	80.9		
★	125.0	D-41	ML	SILT	51	43	39	4	0.0	11.3	88.7		
⊙	130.0	D-42	ML	SILT with SAND	41	1		1	0.0	16.8	83.2		

GRADATION VALUES

	D95	D90	D85	D80	D70
●	0.138	0.12	0.10	0.09	
⧗	0.480	0.39	0.36	0.33	0.272
▲	1.315	0.17	0.10		
★	0.328	0.10			
⊙	0.130	0.10	0.08		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⧗	0.234	0.21	0.14	0.09	
▲					
★					
⊙					



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Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

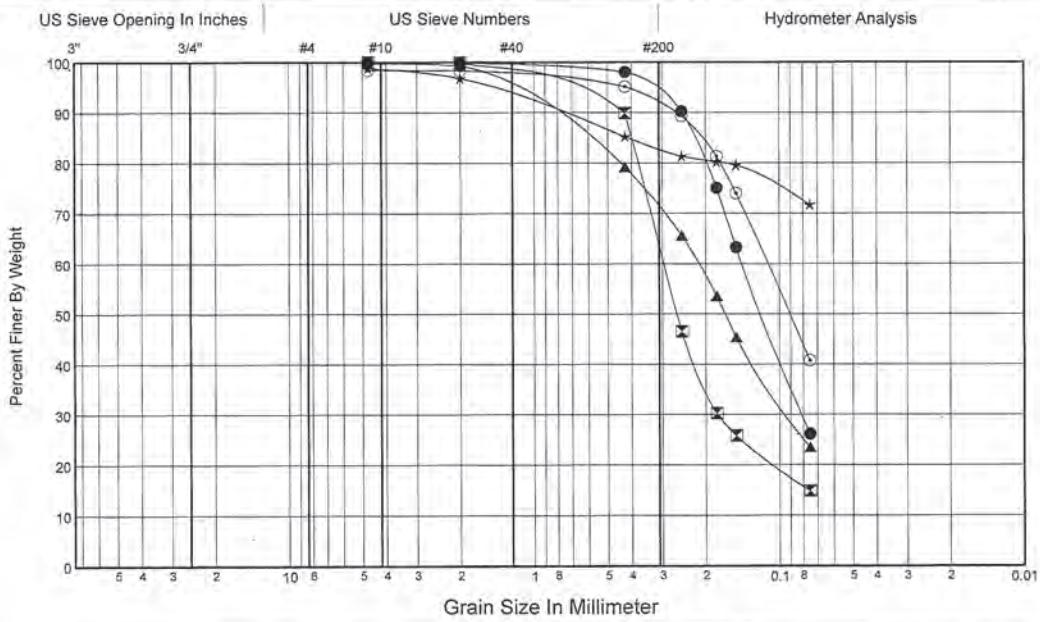
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	135.0	D-43	SM	SILTY SAND	43	1		1	0.0	73.8	26.2		
⧗	140.0	D-44	SM	SILTY SAND	26				0.0	85.2	14.8		
▲	145.0	D-45	SM	SILTY SAND	27				0.0	76.3	23.5		
★	150.0	D-46	ML	SILT with SAND	41	1		1	0.0	27.1	71.8		
⊙	157.0	D-48	SM	SILTY SAND	27	1		1	0.0	57.7	40.8		

GRADATION VALUES

	D95	D90	D85	D80	D70
●	0.344	0.25	0.22	0.20	0.166
⧗	0.935	0.43	0.40	0.38	0.333
▲	1.423	0.97	0.66	0.45	0.297
★	1.555	0.80	0.41	0.17	
⊙	0.418	0.27	0.21	0.17	0.138

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.141	0.12	0.08		
⧗	0.295	0.26	0.18	0.10	
▲	0.215	0.17	0.09		
★					
⊙	0.112	0.09			



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Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

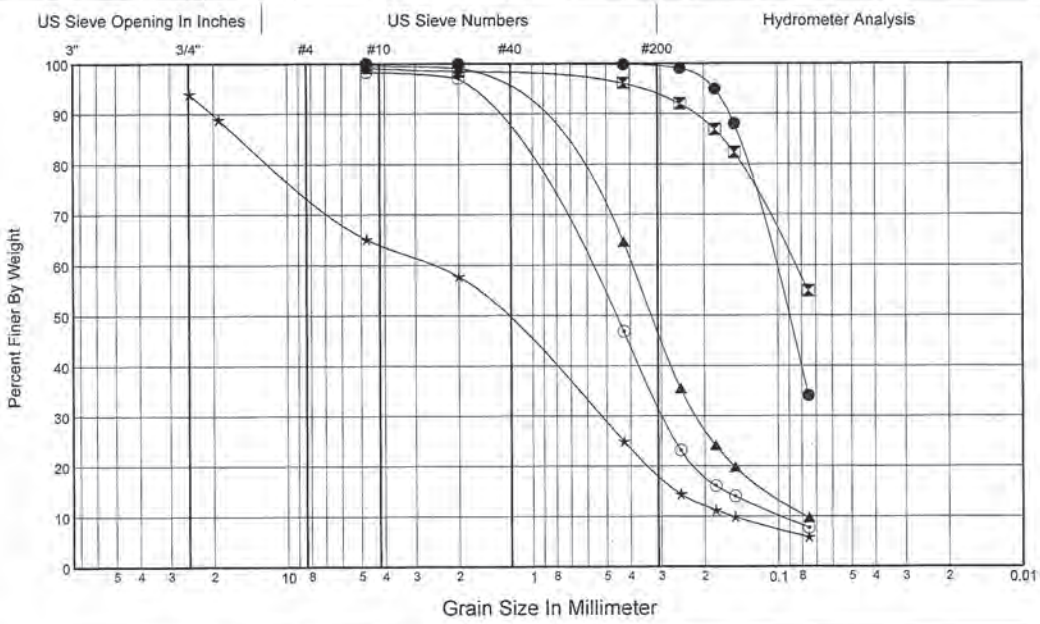
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	165.0	D-50	SM	SILTY SAND	33	1		1	0.0	65.9	34.1		
⧗	175.0	D-52	ML	SANDY SILT	34				0.0	44.3	54.9		
▲	180.0	D-53	SP-SM	POORLY GRADED SAND with SILT	22				0.0	89.8	9.8	1.5	5.1
★	185.0	D-54	SP-SM	POORLY GRADED SAND with SILT and GRAVEL	13				28.9	59.3	5.9	0.7	17.0
⊙	200.0	D-57	SW-SM	WELL-GRADED SAND with SILT	21				0.0	90.6	7.7	1.4	6.6

GRADATION VALUES

	D95	D90	D85	D80	D70
●	0.181	0.16	0.14	0.14	0.119
⧗	0.368	0.22	0.17	0.14	0.110
▲	1.660	1.33	1.06	0.85	0.542
★		20.13	15.11	11.29	6.302
⊙	1.874	1.61	1.38	1.18	0.867

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.105	0.09			
⧗	0.085				
▲	0.391	0.33	0.21	0.15	0.076
★	2.587	1.38	0.54	0.33	0.152
⊙	0.637	0.47	0.29	0.22	0.097



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Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

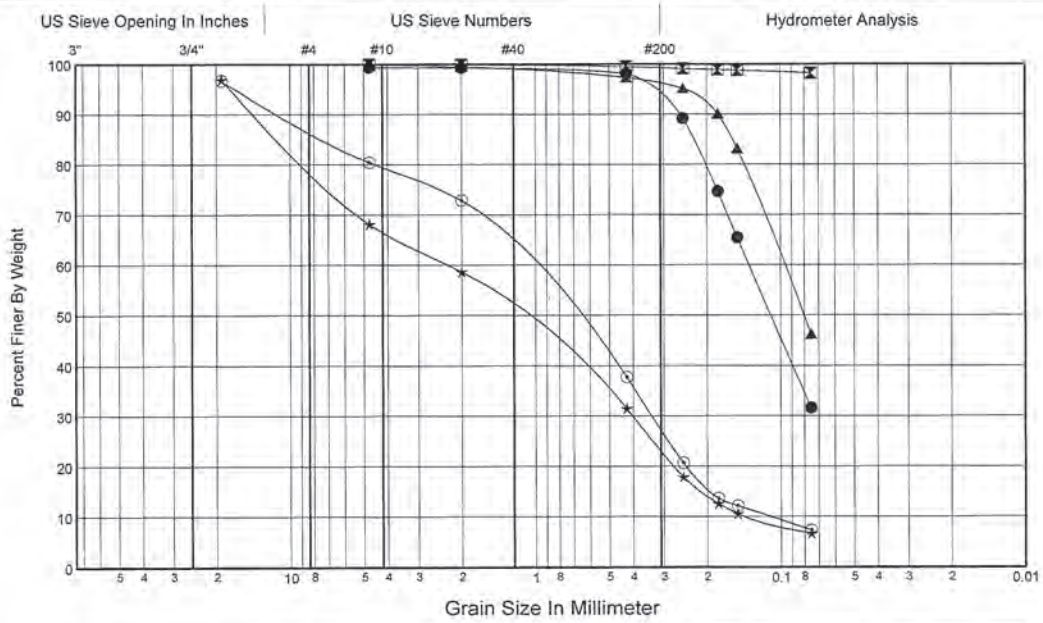
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	205.0	D-58	SM	SILTY SAND	29	1		1	0.0	67.7	31.6		
⧗	210.0	D-59	ML	SILT	44	38	32	6	0.0	1.7	98.2		
▲	215.0	D-60	SM	SILTY SAND	26	1		1	0.0	53.6	46.3		
★	220.0	D-61	SP-SM	POORLY GRADED SAND with SILT and GRAVEL	12				28.8	61.5	6.7	0.5	16.7
⊙	225.0	D-62	SP-SM	POORLY GRADED SAND with SILT and GRAVEL	14				16.3	73.1	7.3	0.9	10.3

GRADATION VALUES

	D95	D90	D85	D80	D70
●	0.352	0.26	0.23	0.20	0.164
⧗					
▲	0.247	0.18	0.16	0.14	0.117
★	17.281	13.58	10.67	8.39	5.181
⊙	16.400	10.71	6.99	4.50	1.759

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.134	0.11			
⧗					
▲	0.097	0.08			
★	2.252	1.22	0.40	0.27	0.135
⊙	1.132	0.73	0.33	0.24	0.110



Job No. **XL-4105a** Date **June 12, 2012**

Hole No. **H-5p-11** Sheet **21** of **21**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

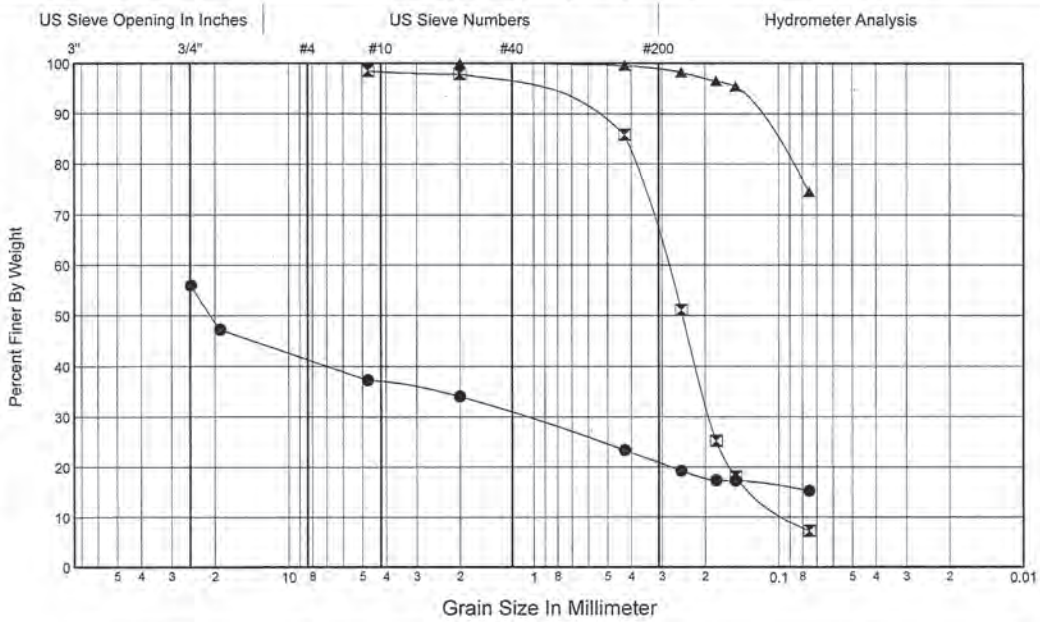
	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	%Gravel	%Sand	%Fines	Cc	Cu
●	235.0	D-64	GM	SILTY GRAVEL with SAND	8				18.7	22.0	15.3		
⧗	240.0	D-65	SP-SM	POORLY GRADED SAND with SILT	19				0.0	91.2	7.3	1.4	3.2
▲	250.0	D-67	ML	SILT with SAND	34	1		1	0.0	25.4	74.6		

GRADATION VALUES

	D95	D90	D85	D80	D70
●					
⧗	1.374	0.72	0.42	0.39	0.334
▲	0.148	0.13	0.11	0.09	

GRADATION VALUES

	D60	D50	D30	D20	D10
●		20.69	1.11	0.27	
⧗	0.286	0.25	0.19	0.16	0.089
▲					



Job No. **XL-4105a** Date **June 21, 2012**

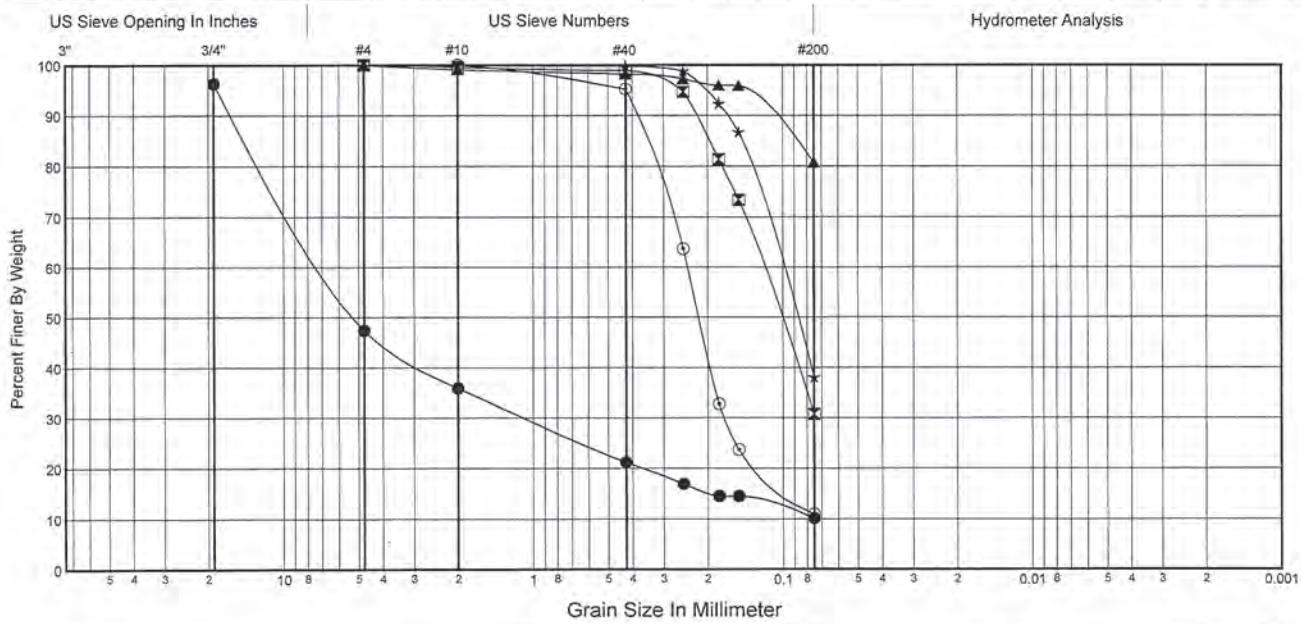
Hole No. **H-6p-11** Sheet **1**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	Moist Density (lbs/ft³)	Specific Gravity	Gravel (%)	Sand (%)	Fines (%)	Cc	Cu	D60	D50	D30	D20	D10
●	6.0	D-2	GW-GM	WELL-GRADED GRAVEL with SILT and SAND	10						48.9	37.4	10.1	2.3	91.3	6.788	5.11	1.08	0.37	
⧗	11.0	D-4	SM	SILTY SAND	17						0.0	69.3	30.7			0.121	0.10			
▲	18.0	D-7	ML	SILT with SAND	30	NA	NP	NA			0.0	19.2	80.7							
★	23.0	D-9	SM	SILTY SAND	29	NA	NP	NA			0.0	62.0	38.0			0.103	0.09			
⊙	28.0	D-11	SP-SM	POORLY GRADED SAND with SILT	23						0.0	89.1	10.9	1.7	3.4	0.241	0.22	0.17	0.12	



Gravel	Sand			Silt			Clay
	Coarse	Medium	Fine	Coarse	Medium	Fine	

Job No. **XL-4105a** Date **June 21, 2012**

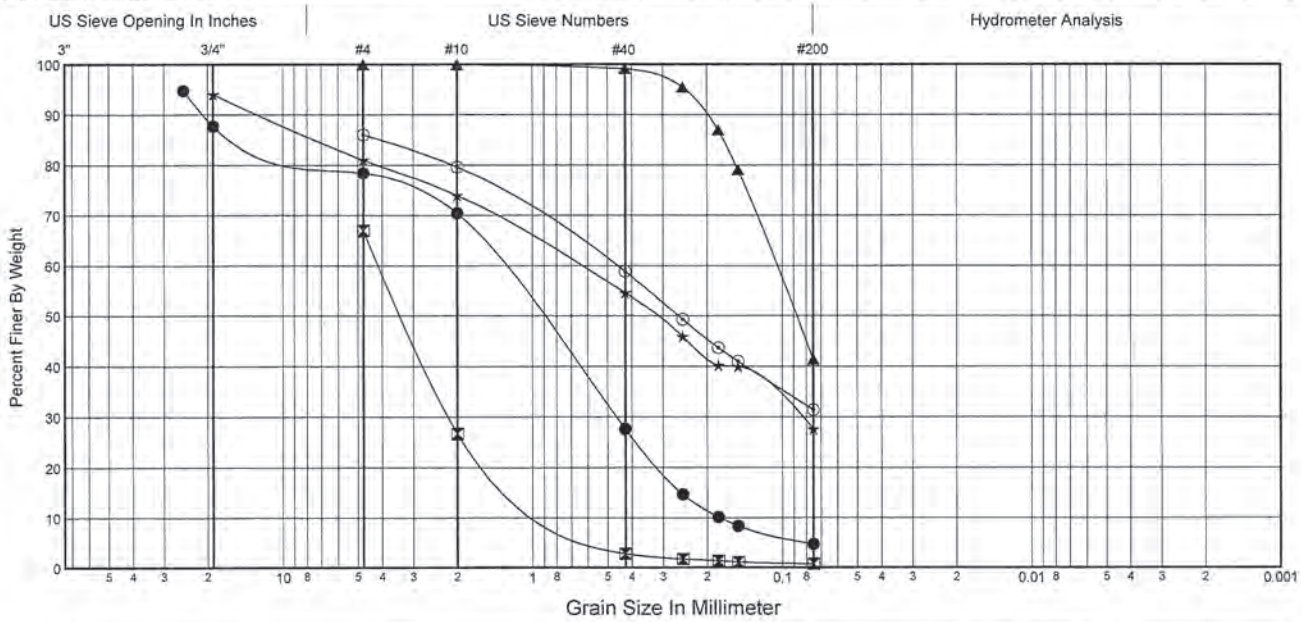
Hole No. **H-6p-11** Sheet **2**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	Moist Density (lbs/ft³)	Specific Gravity	Gravel (%)	Sand (%)	Fines (%)	Cc	Cu	D60	D50	D30	D20	D10
●	33.0	D-13	SP	POORLY GRADED SAND with GRAVEL	13						16.4	73.7	4.7	0.9	7.7	1.373	0.96	0.46	0.31	0.178
⧗	38.0	D-15	SW	WELL-GRADED SAND with GRAVEL	18						0.0	66.2	0.7	1.7	6.0	4.091	3.30	2.15	1.30	0.679
▲	41.0	D-16	SM	SILTY SAND	34	NA	NP	NA			0.0	58.6	41.3			0.106	0.09			
★	48.0	D-19	SM	SILTY SAND with GRAVEL	18	20	NP	NA			13.0	53.4	27.6			0.657	0.32	0.09		
⊙	56.0	D-22	SM	SILTY SAND	17	20	NP	NA			0.0	54.6	31.4			0.463	0.26			



Gravel	Sand			Silt			Clay
	Coarse	Medium	Fine	Coarse	Medium	Fine	

Job No. **XL-4105a** Date **June 21, 2012**

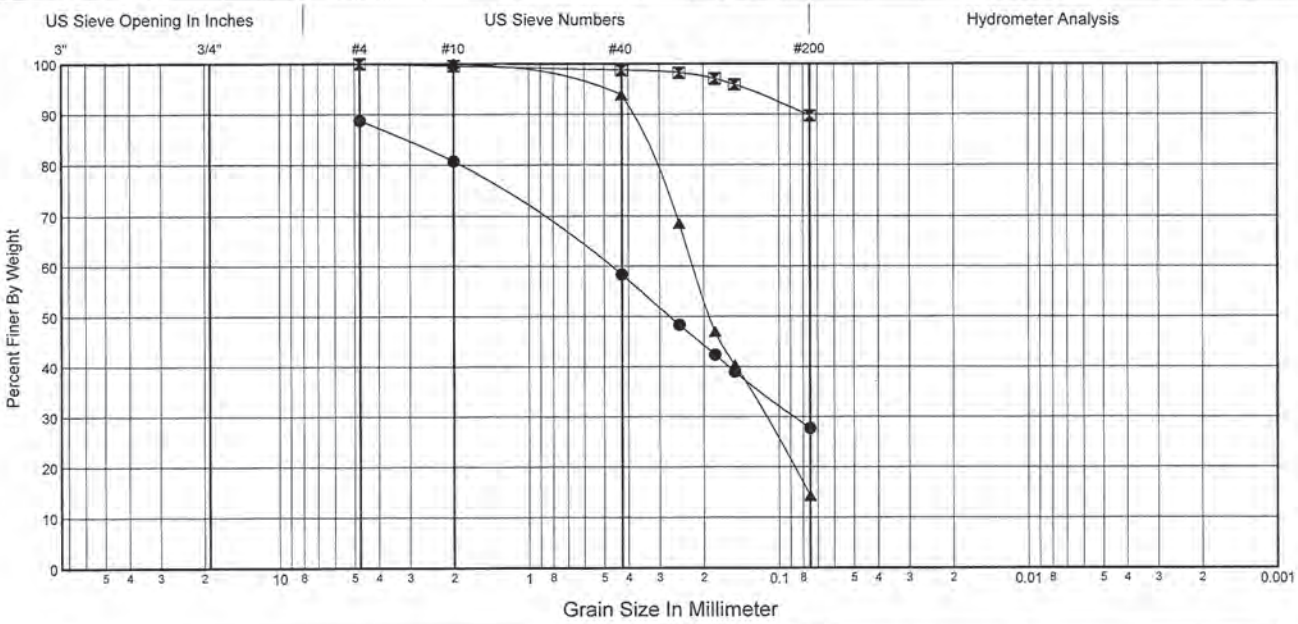
Hole No. **H-6p-11** Sheet **3**

Project **SR 167/Puyallup River Bridge - Bridge Replacement (No. 167/20E)**

Laboratory Summary

Washington State Department of Transportation

	Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	Moist Density (lbs/ft³)	Specific Gravity	Gravel (%)	Sand (%)	Fines (%)	Cc	Cu	D60	D50	D30	D20	D10
●	63.0	D-25	SM	SILTY SAND	14	20	NP	NA			0.0	61.1	27.6			0.477	0.27	0.09		
⧗	71.0	D-28	ML	SILT	39	36	NP	NA			0.0	10.3	89.7							
▲	93.0	D-33	SM	SILTY SAND	24						0.0	85.8	14.2			0.220	0.19	0.11	0.09	



Gravel	Sand			Silt			Clay
	Coarse	Medium	Fine	Coarse	Medium	Fine	