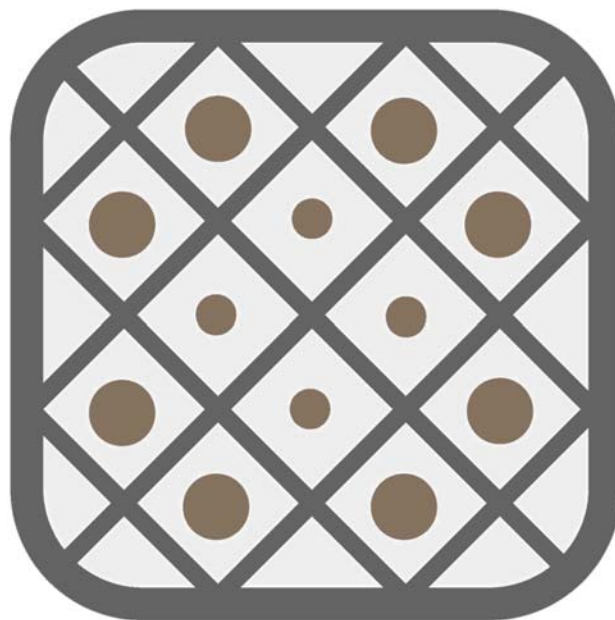


hoil Office



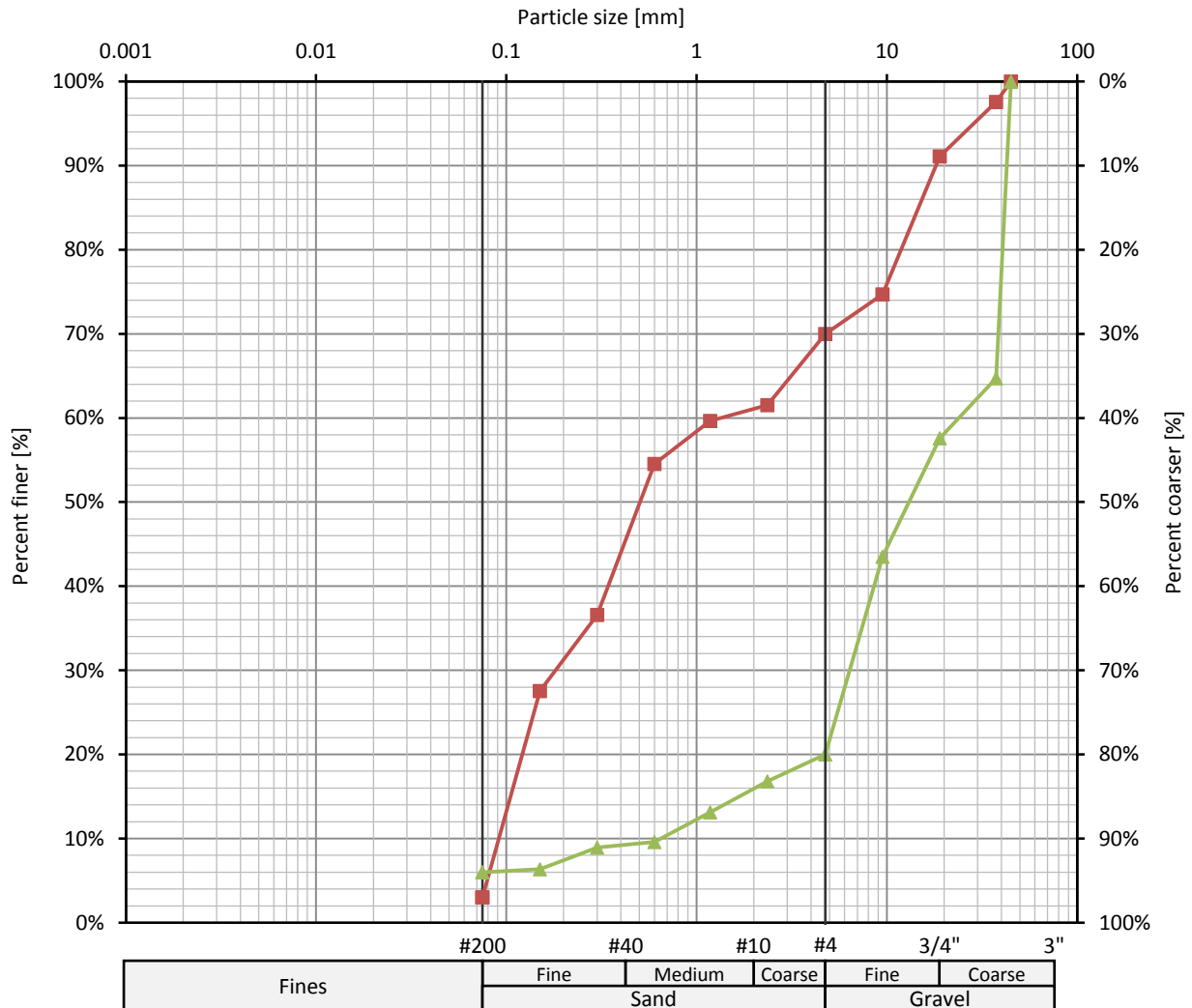
SO-Sieve

# Particle-Size Distribution

## Portrait

# Particle-Size Distribution

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



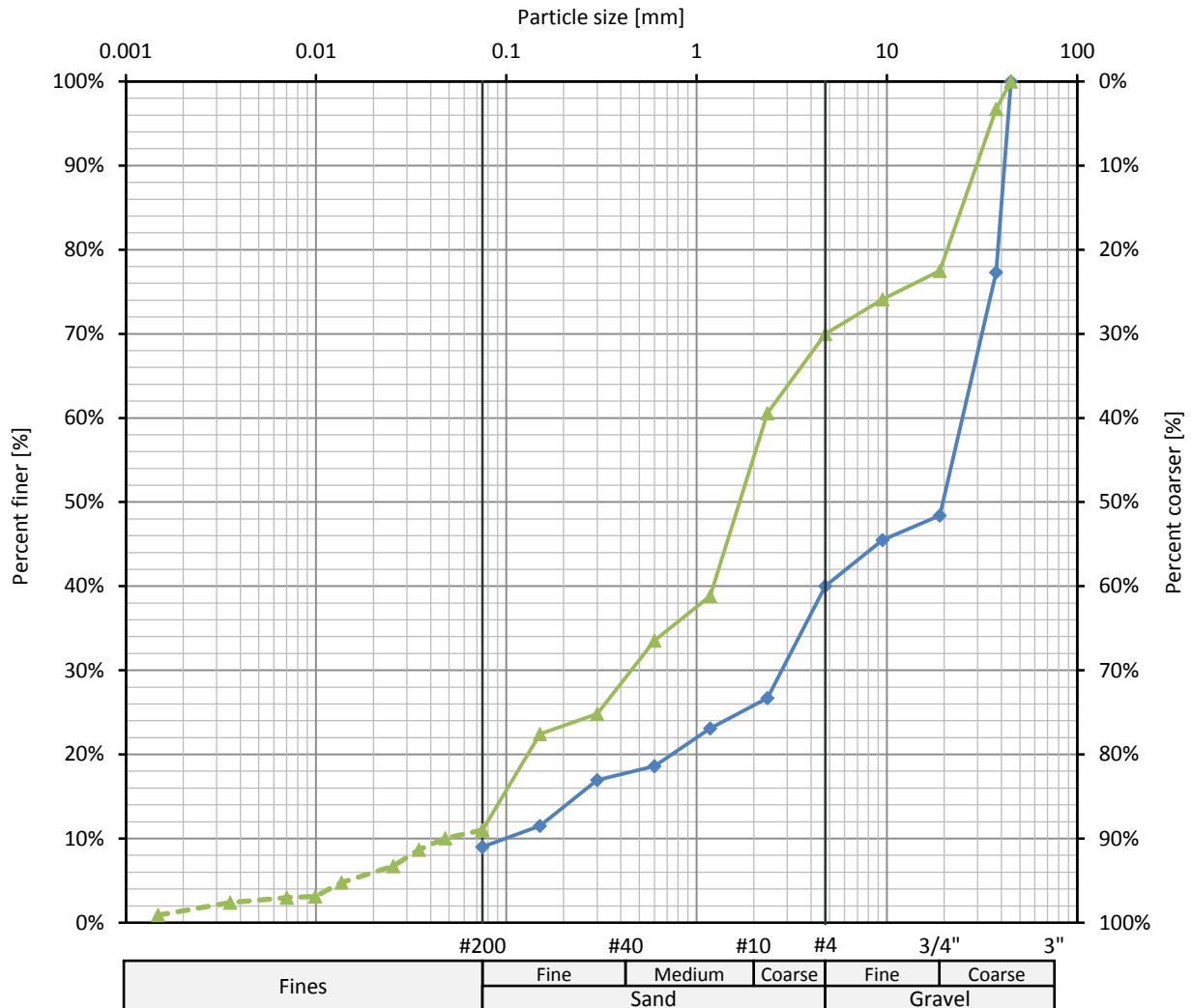
Symbol	Gravel [%]	Sand [%]	Silt [%]	Clay [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
◆							
■	30	67		3	0.0964	0.1906	1.3923
▲	80	14		6	0.6641	6.7696	25.236

Symbol	BH/TP	Depth [m]	C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
◆	TP-01	1			-	-	GW	Well-Graded GRAVEL with Sand
■	TP-01	2	14.44	0.27	-	-	SP	Poorly-Graded SAND with Gravel and Cobbles
▲	TP-01	3	38	2.73			GW-GC	Well-Graded GRAVEL with Clay and Boulders

Tip: Hatched cells are visually examined.

# Particle-Size Distribution

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



Symbol	Gravel [%]	Sand [%]	Silt [%]	Clay [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
◆	60	31	9		0.1051	2.9538	26.4205
■							
▲	30	59	9.7	1.3	-	0.4785	2.3296

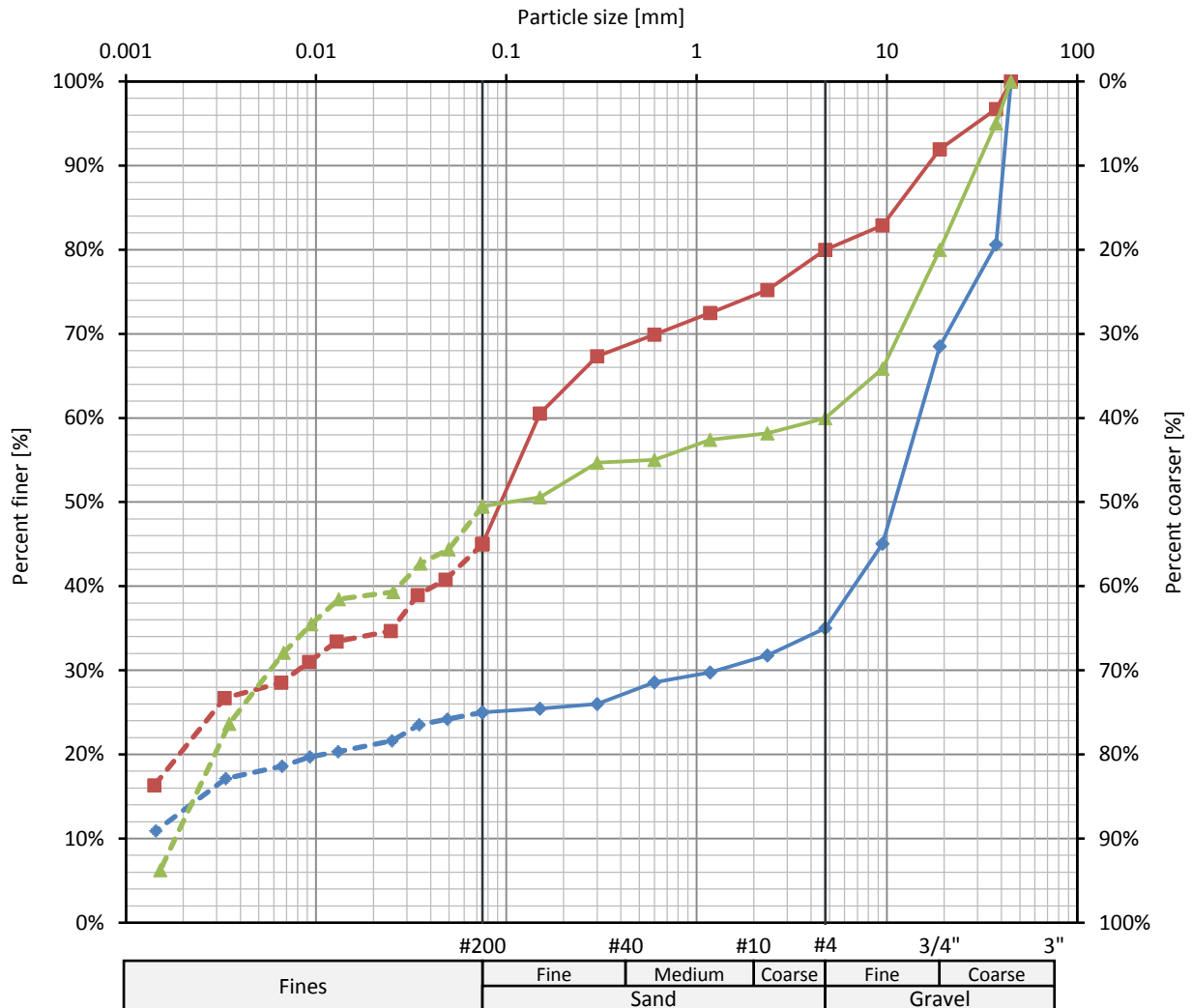
Symbol	BH/TP	Depth [m]	C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
◆	TP-01	4	251.34	3.14	NP	NP	GP-GM	Poorly-Graded GRAVEL with Silt, Sand, Cobbles and Boulders
■	TP-01	5			28	7	SW-SC	Well-Graded SAND with Silty Clay
▲	TP-01	6	-	-			SP-SM	Poorly-Graded SAND with Silt, Gravel and Cobbles

Att.: Particles finer than 0.002 [mm] are considered as Clay.

Tip: Hatched cells are visually examined.

# Particle-Size Distribution

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



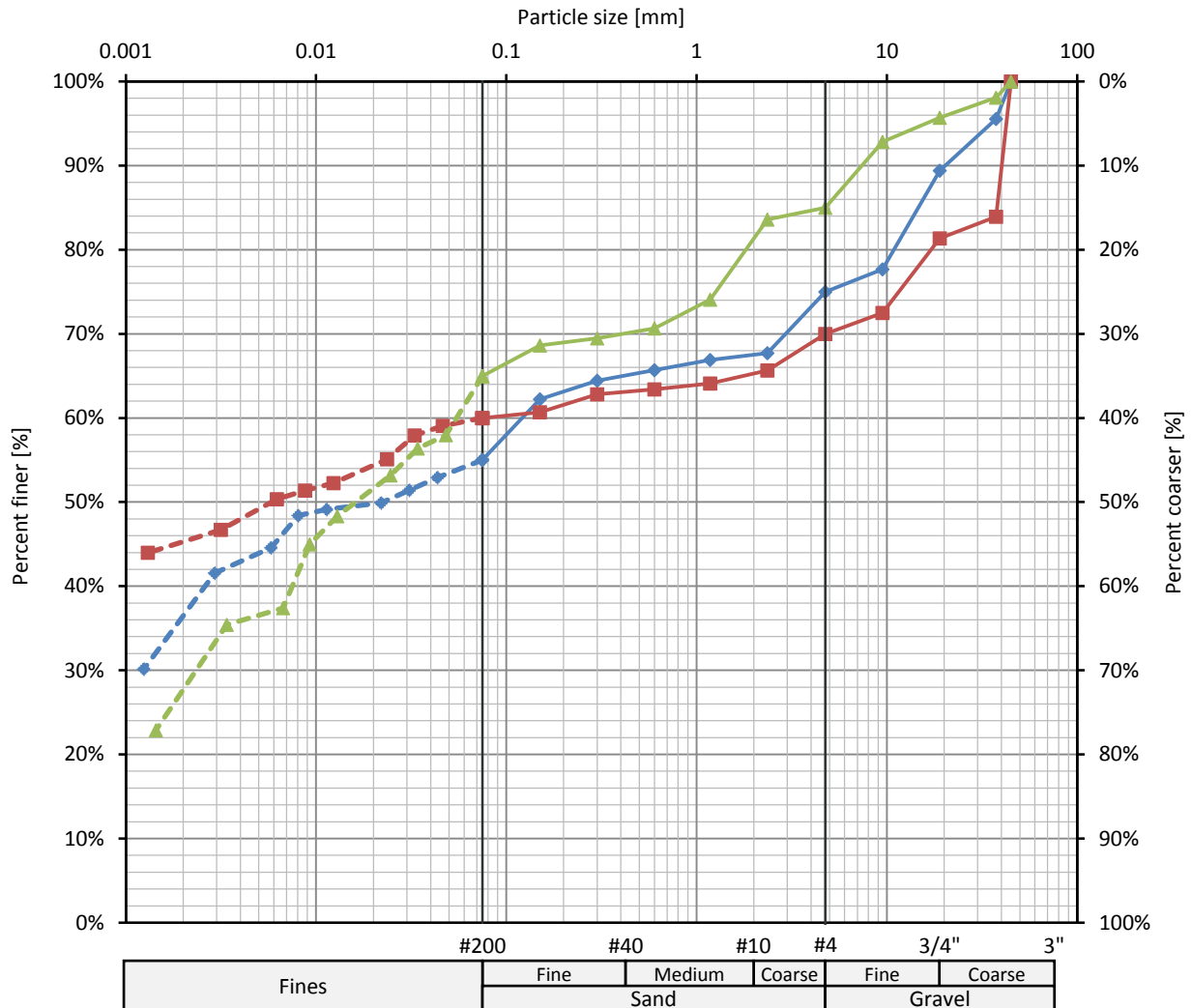
Symbol	Gravel [%]	Sand [%]	Silt [%]	Clay [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
◆	65	10	12.3	12.7	-	1.3285	15.5462
■	20	35	25.5	19.5	-	0.0081	0.1475
▲	40	10.5	39	10.5	0.0019	0.006	4.75

Symbol	BH/TP	Depth [m]	C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
◆	TP-01	7	-	-	61	37	GC	Clayey GRAVEL with Boulders
■	TP-01	8	-	-	23	5	SC-SM	Silty, Clayey SAND with Gravel, Cobbles and Boulders
▲	TP-01	9	2441.87	0	43	14	GM	Silty GRAVEL

Att.: Particles finer than 0.002 [mm] are considered as Clay.

# Particle-Size Distribution

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



Symbol	Gravel [%]	Sand [%]	Silt [%]	Clay [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
◆	25	20	19.7	35.3	-	-	0.1269
■	30	10	15	45	-	-	0.075
▲	15	20	38.5	26.5	-	0.0025	0.0559

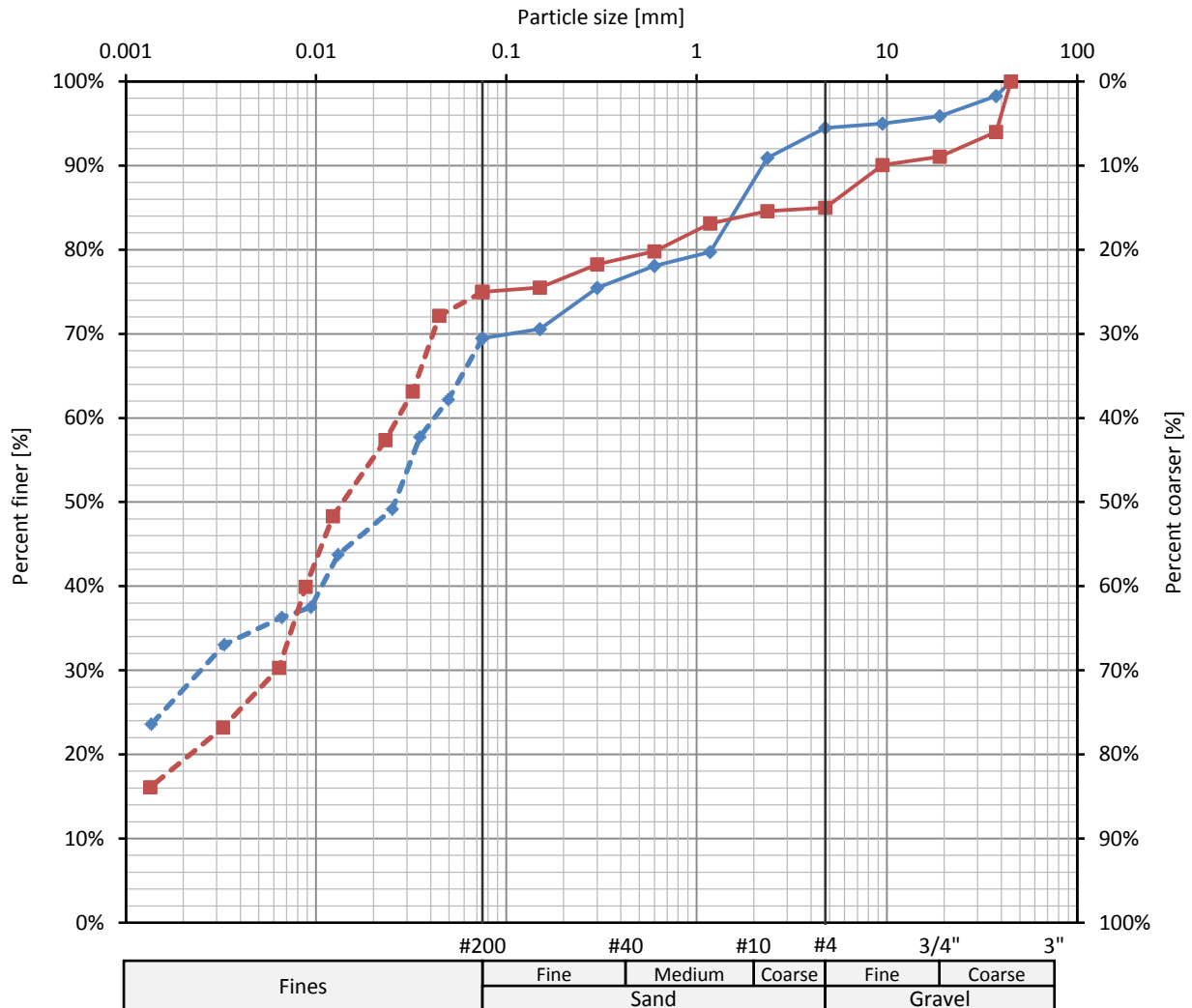
Symbol	BH/TP	Depth [m]	C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
◆	TP-01	10	-	-			CL	Gravelly LEAN CLAY with Sand and Cobbles
■	TP-01	11	-	-	64	38	CH	Gravelly FAT CLAY with Boulders
▲	TP-01	12	-	-			CL-ML	Sandy SILTY CLAY with Gravel, Cobbles and Boulders

Att.: Particles finer than 0.002 [mm] are considered as Clay.

Tip: Hatched cells are visually examined.

# Particle-Size Distribution

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



Symbol	Gravel [%]	Sand [%]	Silt [%]	Clay [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
◆	5.5	25	42.8	26.7	-	0.0027	0.0425
■	15	10	56.4	18.6	-	0.0063	0.0273
▲							

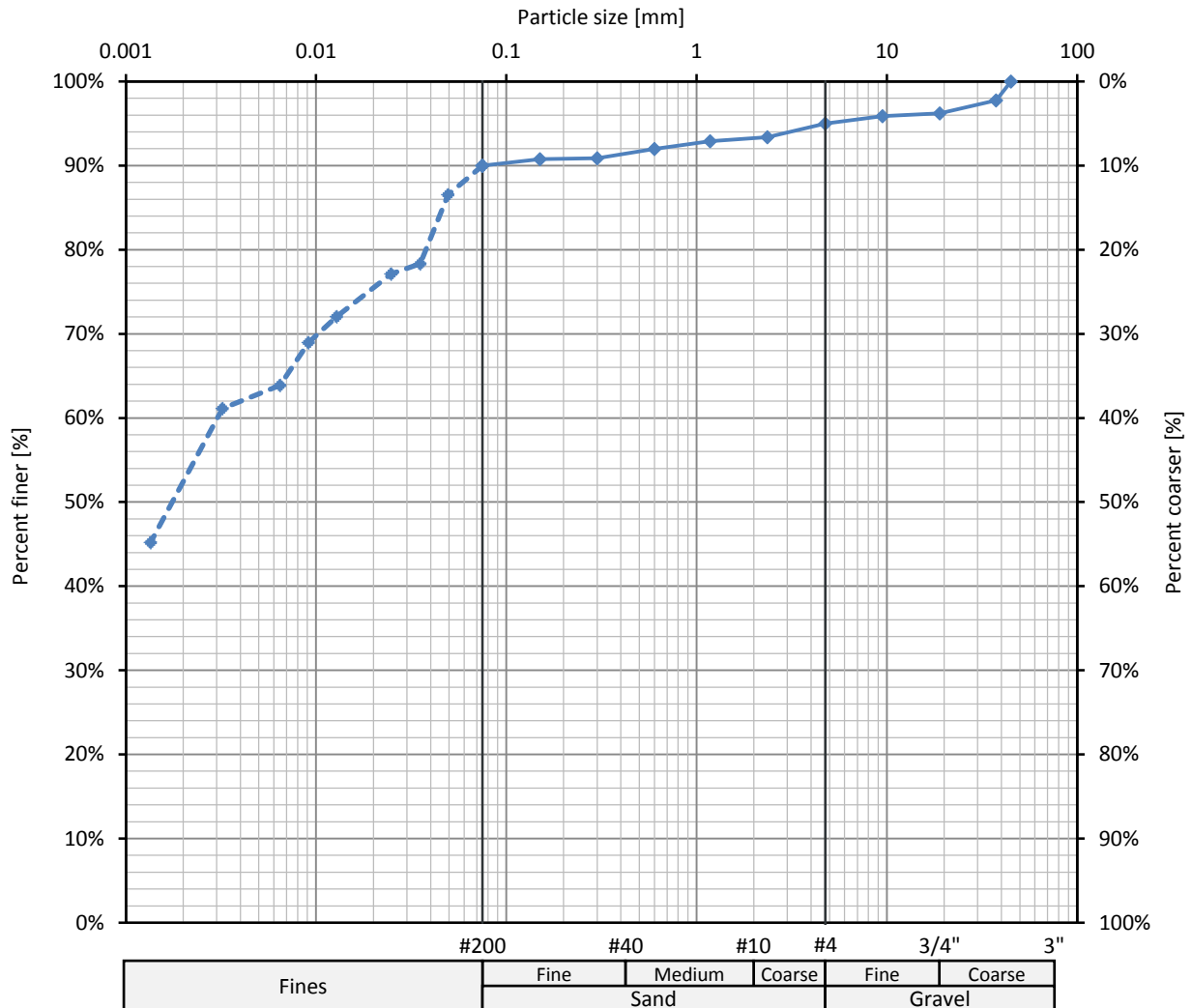
Symbol	BH/TP	Depth [m]	C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
◆	TP-01	13	-	-	NP	NP	ML	Sandy SILT
■	TP-01	14	-	-	74	20	MH	ELASTIC SILT with Gravel and Cobbles
▲	TP-01	15			43	18	OL	ORGANIC CLAY with Sand and Boulders

Att.: Particles finer than 0.002 [mm] are considered as Clay.

Tip: Hatched cells are visually examined.

# Particle-Size Distribution

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



Symbol	Gravel [%]	Sand [%]	Silt [%]	Clay [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
◆	5	5	39.3	50.7	-	-	0.0031

Symbol	BH/TP	Depth [m]	C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
◆	TP-01	16	-	-			OH	ORGANIC CLAY with Cobbles and Boulders

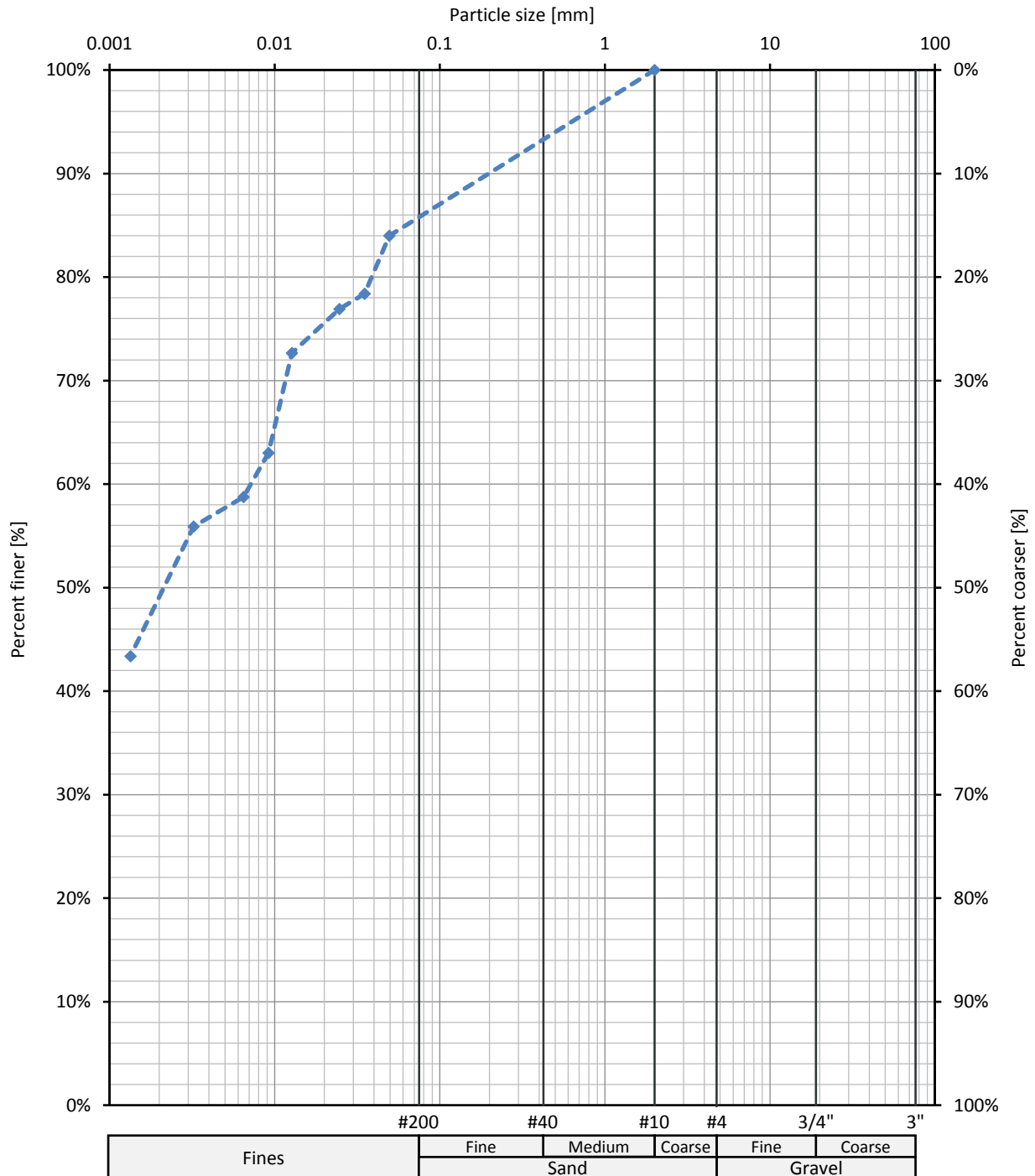
Att.: Particles finer than 0.002 [mm] are considered as Clay.

Tip: Hatched cells are visually examined.



# Hydrometer Test

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



Symbol	BH/TP	Depth [m]	Sand [%]	Silt [%]	Clay [%]
◆	TP-01	15	15.8	36.4	47.8

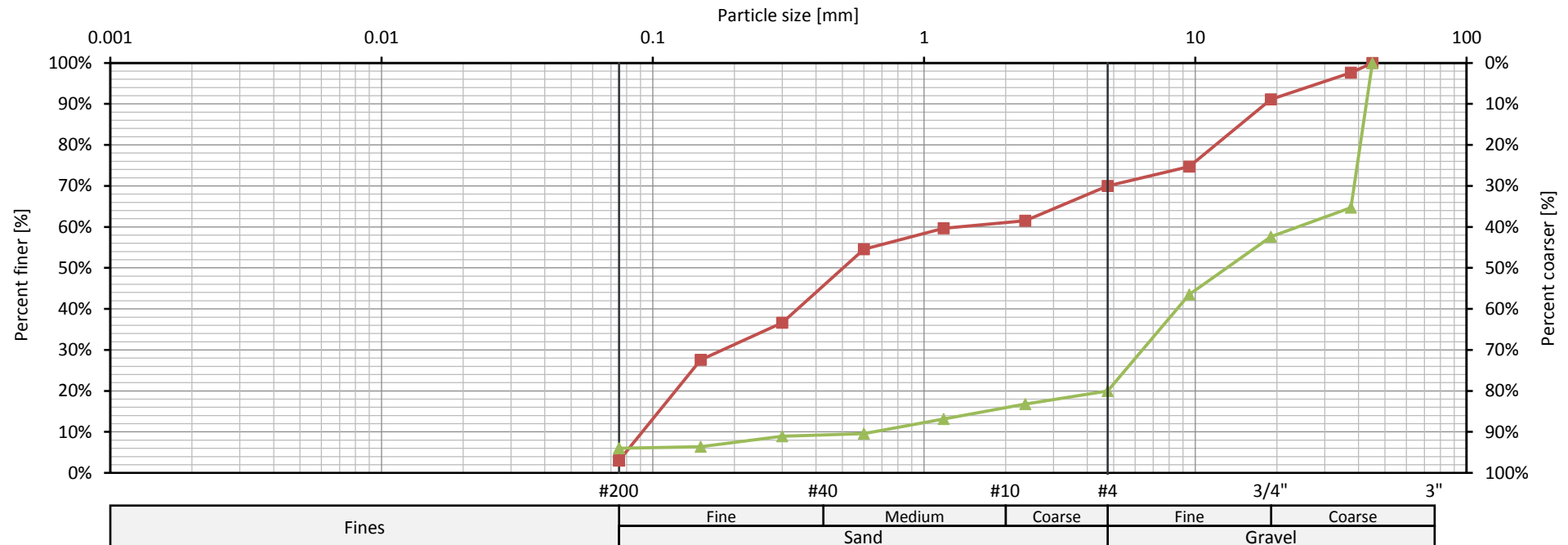
Att.: Particles finer than 0.002 [mm] are considered as Clay.

Particle-Size Distribution

Landscape

# Particle-Size Distribution

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



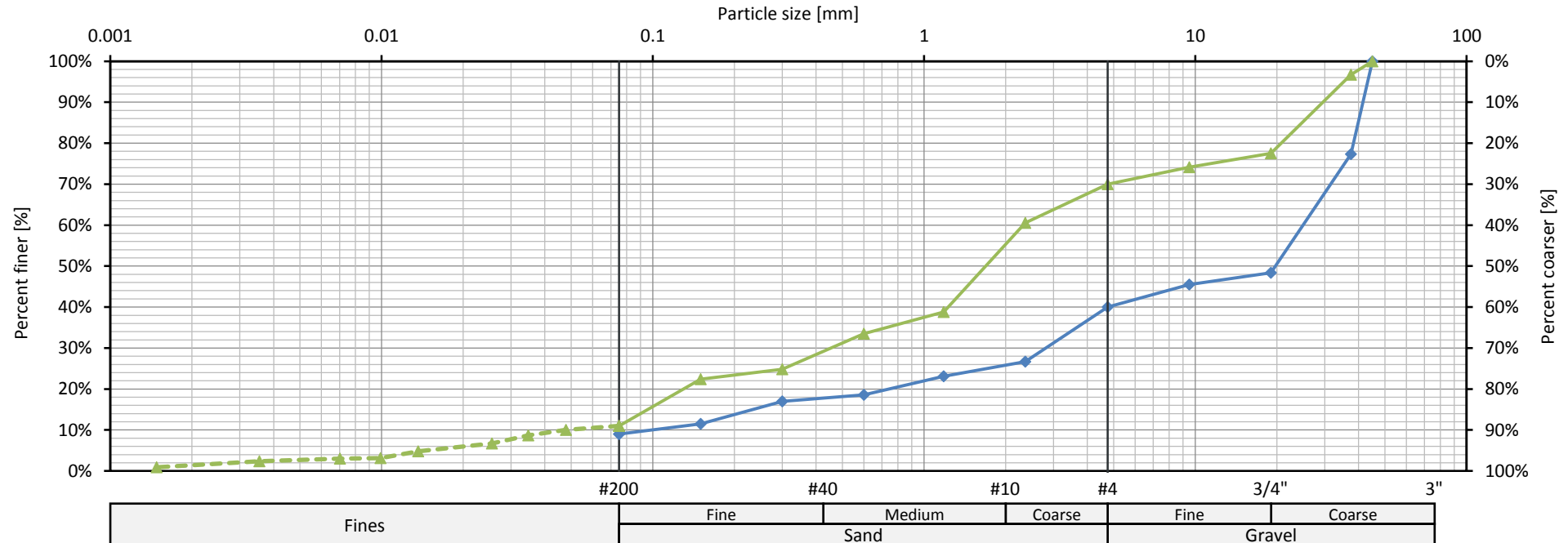
Symbol	Organic	Cobble	Boulder	Gravel [%]	Sand [%]	Silt [%]	Clay [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
◆	-	-	-							
■	-	✓	-	30	67		3	0.0964	0.1906	1.3923
▲	-	-	✓	80	14		6	0.6641	6.7696	25.236

Symbol	BH/TP	Depth [m]	C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
◆	TP-01	1			-	-	GW	Well-Graded GRAVEL with Sand
■	TP-01	2	14.44	0.27	-	-	SP	Poorly-Graded SAND with Gravel and Cobbles
▲	TP-01	3	38	2.73			GW-GC	Well-Graded GRAVEL with Clay and Boulders

Tip: Hatched cells are visually examined.

# Particle-Size Distribution

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



Symbol	Organic	Cobble	Boulder	Gravel [%]	Sand [%]	Silt [%]	Clay [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
◆	-	✓	✓	60	31	9		0.1051	2.9538	26.4205
■	-	-	-							
▲	-	✓	-	30	59	9.7	1.3	-	0.4785	2.3296

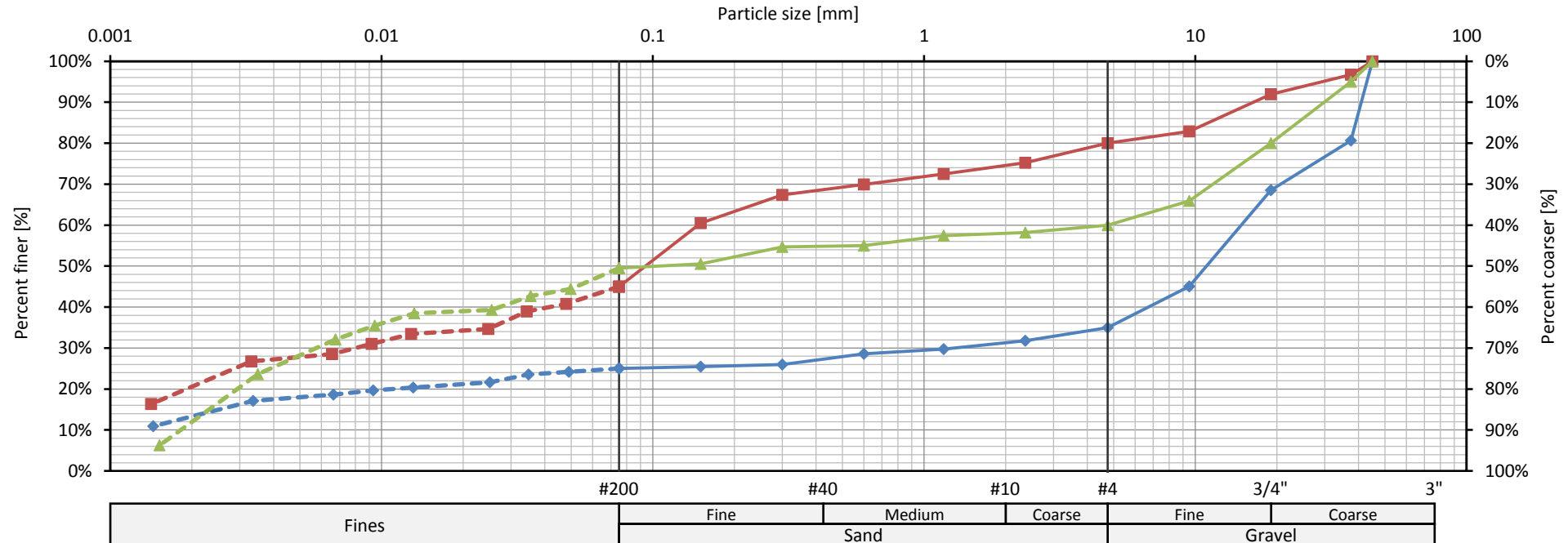
Symbol	BH/TP	Depth [m]	C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
◆	TP-01	4	251.34	3.14	NP	NP	GP-GM	Poorly-Graded GRAVEL with Silt, Sand, Cobbles and Boulders
■	TP-01	5			28	7	SW-SC	Well-Graded SAND with Silty Clay
▲	TP-01	6	-	-			SP-SM	Poorly-Graded SAND with Silt, Gravel and Cobbles

Att.: Particles finer than 0.002 [mm] are considered as Clay.

Tip: Hatched cells are visually examined.

# Particle-Size Distribution

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



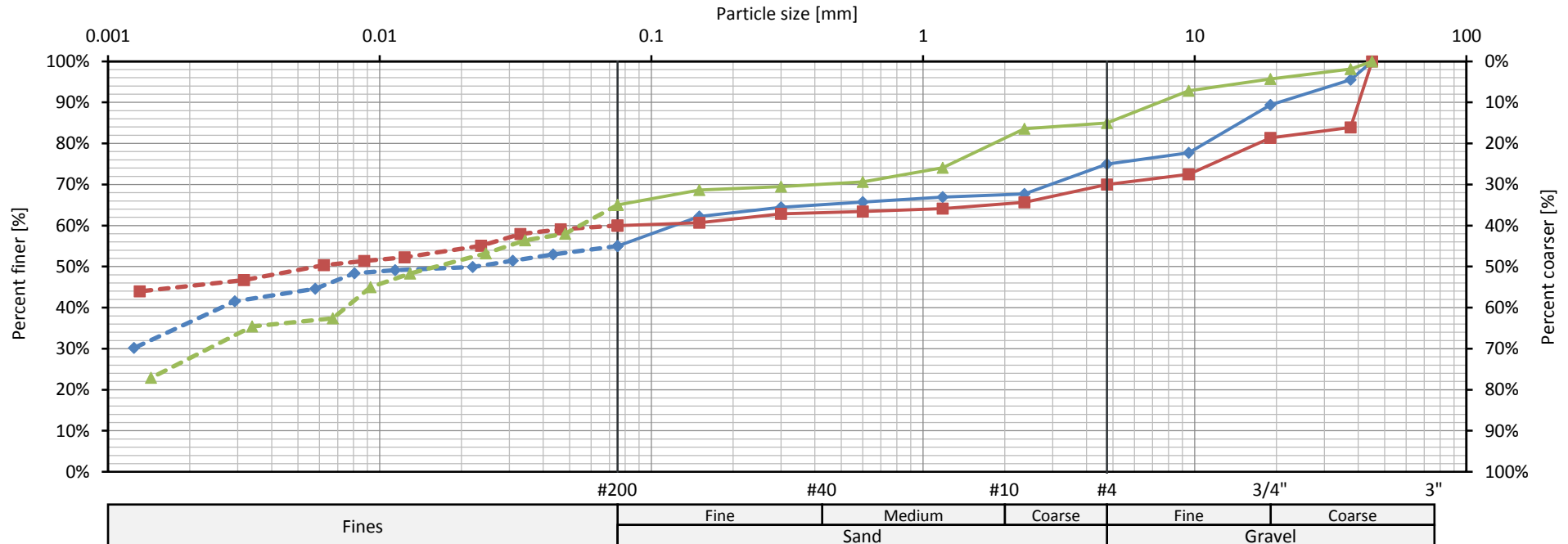
Symbol	Organic	Cobble	Boulder	Gravel [%]	Sand [%]	Silt [%]	Clay [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
◆	-	-	✓	65	10	12.3	12.7	-	1.3285	15.5462
■	-	✓	✓	20	35	25.5	19.5	-	0.0081	0.1475
▲	-	-	-	40	10.5	39	10.5	0.0019	0.006	4.75

Symbol	BH/TP	Depth [m]	C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
◆	TP-01	7	-	-	61	37	GC	Clayey GRAVEL with Boulders
■	TP-01	8	-	-	23	5	SC-SM	Silty, Clayey SAND with Gravel, Cobbles and Boulders
▲	TP-01	9	2441.87	0	43	14	GM	Silty GRAVEL

Att.: Particles finer than 0.002 [mm] are considered as Clay.

# Particle-Size Distribution

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



Symbol	Organic	Cobble	Boulder	Gravel [%]	Sand [%]	Silt [%]	Clay [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
◆	-	✓	-	25	20	19.7	35.3	-	-	0.1269
■	-	-	✓	30	10	15	45	-	-	0.075
▲	-	✓	✓	15	20	38.5	26.5	-	0.0025	0.0559

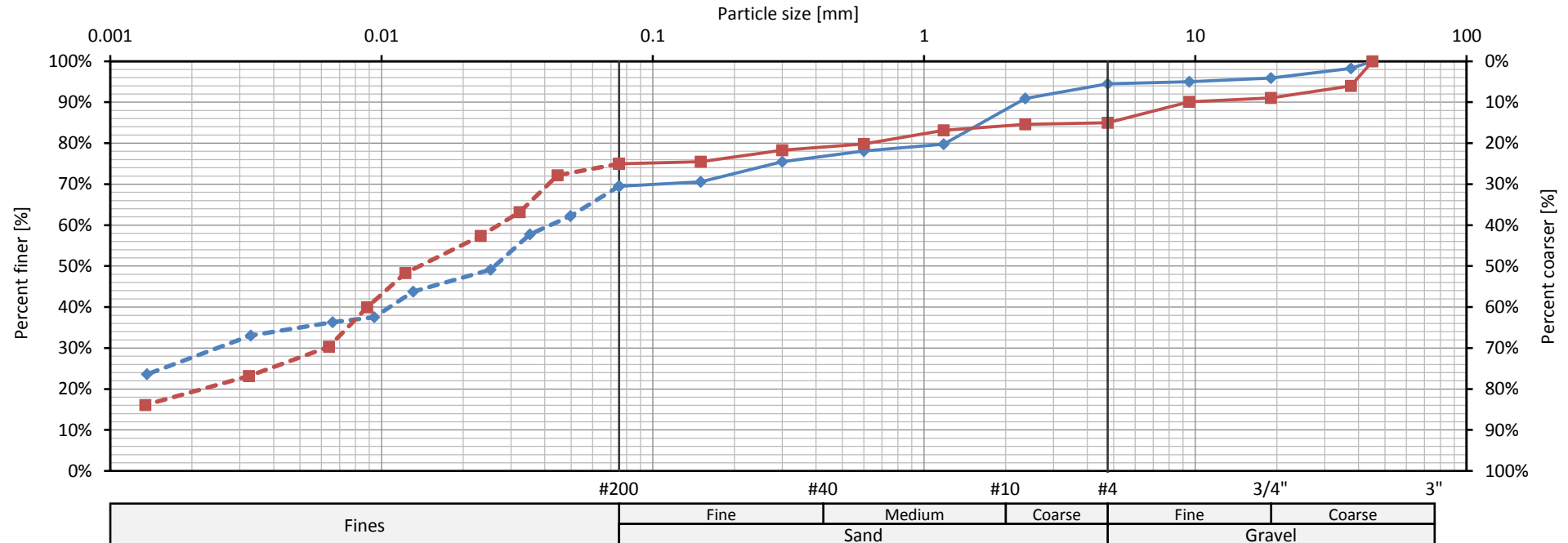
Symbol	BH/TP	Depth [m]	C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
◆	TP-01	10	-	-			CL	Gravelly LEAN CLAY with Sand and Cobbles
■	TP-01	11	-	-	64	38	CH	Gravelly FAT CLAY with Boulders
▲	TP-01	12	-	-			CL-ML	Sandy SILTY CLAY with Gravel, Cobbles and Boulders

Att.: Particles finer than 0.002 [mm] are considered as Clay.

Tip: Hatched cells are visually examined.

# Particle-Size Distribution

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



Symbol	Organic	Cobble	Boulder	Gravel [%]	Sand [%]	Silt [%]	Clay [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
◆	-	-	-	5.5	25	42.8	26.7	-	0.0027	0.0425
■	-	✓	-	15	10	56.4	18.6	-	0.0063	0.0273
▲	✓	-	✓							

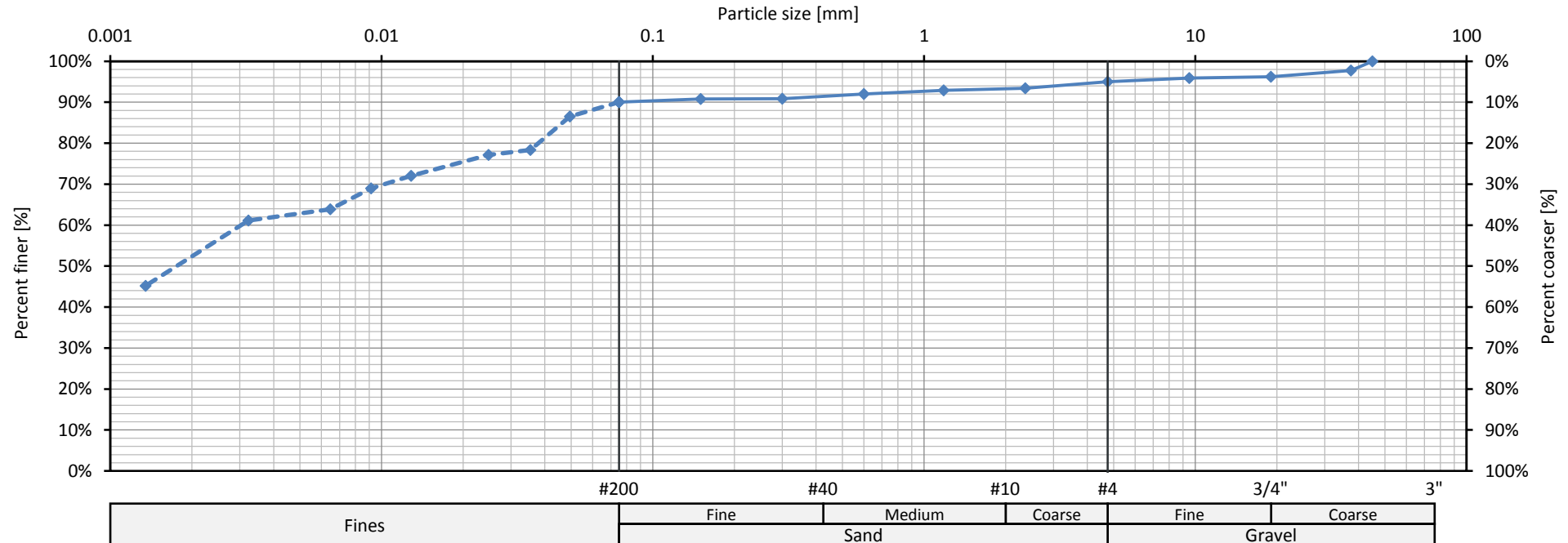
Symbol	BH/TP	Depth [m]	C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
◆	TP-01	13	-	-	NP	NP	ML	Sandy SILT
■	TP-01	14	-	-	74	20	MH	ELASTIC SILT with Gravel and Cobbles
▲	TP-01	15			43	18	OL	ORGANIC CLAY with Sand and Boulders

Att.: Particles finer than 0.002 [mm] are considered as Clay.

Tip: Hatched cells are visually examined.

# Particle-Size Distribution

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



Symbol	Organic	Cobble	Boulder	Gravel [%]	Sand [%]	Silt [%]	Clay [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
◆	✓	✓	✓	5	5	39.3	50.7	-	-	0.0031

Symbol	BH/TP	Depth [m]	C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
◆	TP-01	16	-	-			OH	ORGANIC CLAY with Cobbles and Boulders

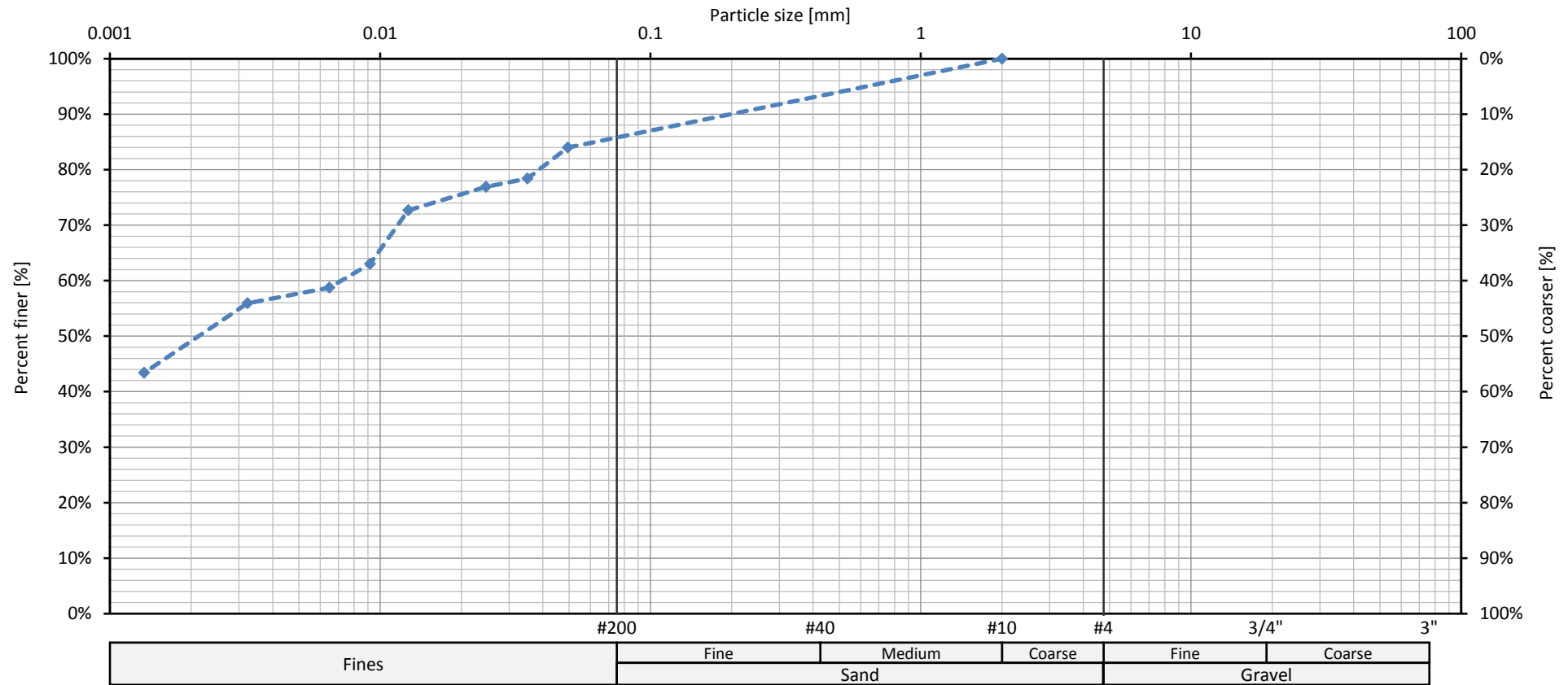
Att.: Particles finer than 0.002 [mm] are considered as Clay.

Tip: Hatched cells are visually examined.



# Hydrometer Test

Project: Project  
Client: Client  
Location: Location  
Code: Project Code



Symbol	BH/TP	Depth [m]	Sand [%]	Silt [%]	Clay [%]
◆	TP-01	15	15.8	36.4	47.8

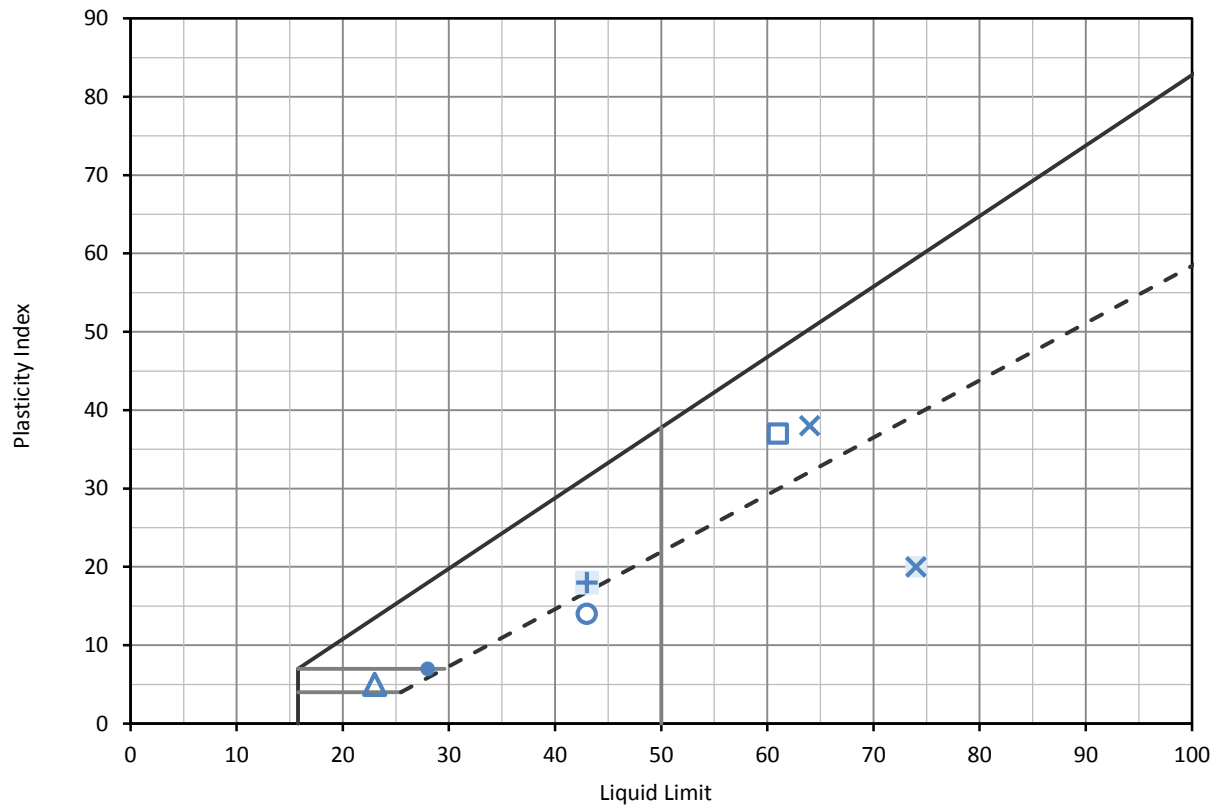
Att.: Particles finer than 0.002 [mm] are considered as Clay.

# Atterberg Limits

# Atterberg Limits Tests

Project: Project  
Client: Client  
Location: Location  
Code: Project Code

Plasticity chart



No.	Symbol	BH/TP	Depth [m]	USCS	LL	PL	PI	Fines as
1	■	TP-01	3	GW-GC				CL
2	▲	TP-01	4	GP-GM	NP	NP	NP	ML
3	●	TP-01	5	SW-SC	28	21	7	CL-ML
4	◆	TP-01	6	SP-SM				ML
5	□	TP-01	7	GC	61	24	37	CH
6	△	TP-01	8	SC-SM	23	18	5	CL-ML
7	○	TP-01	9	GM	43	29	14	ML
8	◇	TP-01	10	CL				CL
9	×	TP-01	11	CH	64	26	38	CH
10	+	TP-01	12	CL-ML				CL-ML
11	✕	TP-01	13	ML	NP	NP	NP	ML
12	⊗	TP-01	14	MH	74	54	20	MH
13	⊕	TP-01	15	OL	43	25	18	CL
14	⊗	TP-01	16	OH				CH

Tip: Hatched cells are visually examined.

# Sieve Analysis

Test data

# Sieve Analysis - Test Data

Project:	Project	BH/TP:	TP-01
Client:	Client	Depth:	2
Location:	Location	USCS:	SP
Code:	Project Code	Sample:	Disturbed

☐ Organic      ☒ Cobble      ☐ Boulder

Dry mass: 5000.0 [g]

[illegible]

Date: 2018-03-14

Time: 08:30

Tested by: -

Notes:

Gravel [%]	Sand [%]	Fines [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
30	67	3	0.0964	0.1906	1.3923

C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
14.44	0.27	-	-	SP	Poorly-Graded SAND with Gravel and Cobbles

# Sieve Analysis - Test Data

Project:	Project	BH/TP:	TP-01
Client:	Client	Depth:	7
Location:	Location	USCS:	GC
Code:	Project Code	Sample:	Undisturbed

☐ Organic    ☐ Cobble    ☒ Boulder

Dry mass: 5000.0 [g]

[illegible]

Date: 2018-03-14

Time: 08:30

Tested by: -

Notes:

Gravel [%]	Sand [%]	Fines [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
65	10	25	-	1.3285	15.5462

C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
-	-	61	37	GC	Clayey GRAVEL with Boulders

# Sieve Analysis - Test Data

Project:	Project	BH/TP:	TP-01
Client:	Client	Depth:	13
Location:	Location	USCS:	ML
Code:	Project Code	Sample:	Undisturbed

☐ Organic      ☐ Cobble      ☐ Boulder

Dry mass: 1000.0 [g]

No.	Sieve	Opening [mm]	Mass retained [g]	Mass retained [%]	Cumulative percent [%]  CoarserFiner	
1	1 (1/2)"	37.5	17.3	1.73	1.73	98.27
2	(3/4)"	19	24	2.4	4.13	95.87
3	(3/8)"	9.5	8.6	0.86	4.99	95.01
4	No. 4	4.75	5.3	0.53	5.52	94.48
5	No. 8	2.36	35.5	3.55	9.07	90.93
6	No. 16	1.18	112	11.2	20.27	79.73
7	No. 30	0.6	16.4	1.64	21.91	78.09
8	No. 50	0.3	26.4	2.64	24.55	75.45
9	No. 100	0.15	48.8	4.88	29.43	70.57
10	No. 200	0.075	11	1.1	30.53	69.47
	Pan [g]		694.7			

Date: 2018-03-14

Time: 16:30

Tested by: -

Notes:

Gravel [%]	Sand [%]	Fines [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
5.5	25	69.5	-	0.0027	0.0425

C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
-	-	NP	NP	ML	Sandy SILT

# Sieve Analysis - Test Data

Project:	Project	BH/TP:	TP-01
Client:	Client	Depth:	16
Location:	Location	USCS:	OH
Code:	Project Code	Sample:	Undisturbed

☒ Organic      ☒ Cobble      ☒ Boulder

Dry mass: 1000.0 [g]

[illegible]

Date: 2018-03-14

Time: 16:30

Tested by: -

Notes:

Gravel [%]	Sand [%]	Fines [%]	D <sub>10</sub> [mm]	D <sub>30</sub> [mm]	D <sub>60</sub> [mm]
5	5	90	-	-	0.0031

C <sub>u</sub>	C <sub>c</sub>	LL	PI	USCS	Description
-	-			OH	ORGANIC CLAY with Cobbles and Boulders

Tip: Hatched cells are visually examined.



Hydrometer

Test data

# Hydrometer (ASTM D7928) - Test Data

Project:	Project	BH/TP:	TP-01
Client:	Client	Depth:	6
Location:	Location	USCS:	SP-SM
Code:	Project Code	Sample:	Disturbed

General	Type: 151H	Dispersant: NaPO3	Separation sieve: No. 200
			Passing: 11.00 [%]

Properties	G <sub>s</sub> : 2.45	Suspension vol., V <sub>sp</sub> : 996.3 [cm3]	Dry soil mass, M <sub>d</sub> : 30.6 [g]
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Correction	Meniscus - C <sub>m</sub> : 0.00050
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Control cylinder

Note: The "Offset" column is filled with companion measurements taken in a control cylinder filled with the reference solution during the test.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
No.	Elapsed time t [min]	Temp. T [°C]	Reading R	Offset R <sub>dt</sub>	Corrected readings		Fall distance H [cm]	Diameter D [mm]	Percent finer [%]	
					R - R <sub>dt</sub>	R <sub>CL</sub>			Partial	Total
1	1	28.7	1.01975	1.003	0.01675	1.02025	10.83	0.04784	91.06	10.02
2	2	28.7	1.0175	1.003	0.0145	1.018	11.43	0.03476	78.83	8.67
3	4	28.7	1.01425	1.003	0.01125	1.01475	12.31	0.0255	61.16	6.73
4	15	28.7	1.011	1.003	0.008	1.0115	13.19	0.01363	43.49	4.79
5	30	28.7	1.00825	1.003	0.00525	1.00875	13.93	0.00991	28.54	3.14
6	60	28.7	1.008	1.003	0.005	1.0085	14	0.00702	27.18	2.99
7	240	28.7	1.007	1.003	0.004	1.0075	14.27	0.00354	21.75	2.39
8	1440	28.7	1.0045	1.003	0.0015	1.005	14.94	0.00148	8.15	0.9

Date: 2018-03-14

Time: 08:30

Tested by: -

Notes:

Sand [%]	Silt [%]	Clay [%]
N/A	88.4	11.6

## Equations

$$(7): R_{CL} = R + C_m$$

$$(9): D = 10 \times \left\{ \left[ \frac{18\mu}{(\rho_w \times g)} \right] / (G_s - 1) \right\} \times (H/t)^{0.5}$$

$$(10): \left[ \frac{G_s}{(G_s - 1)} \right] \times (V_{sp} / M_d) \times \rho_w \times (R - R_{dt}) \times 100$$

$$(11): (10) \times \text{Passing}$$

Att.: Particles finer than 0.002 [mm] are considered as Clay.

## Parameters

Viscosity of water at 20 [°C],

$$\mu: \mu = 0.01 \text{ [g/(cm.s)]}$$

Mass density of water at 20 [°C],

$$\rho_w: \rho_w = 0.99821 \text{ [g/cm}^3\text{]}$$

# Hydrometer (ASTM D7928) - Test Data

Project:	Project	BH/TP:	TP-01
Client:	Client	Depth:	7
Location:	Location	USCS:	GC
Code:	Project Code	Sample:	Undisturbed

General	Type: 152H	Dispersant: NaPO3	Separation sieve: No. 200
			Passing: 25.00 [%]

Properties	G <sub>s</sub> : 2.45	Suspension vol., V <sub>sp</sub> : 996.3 [cm3]	Dry soil mass, M <sub>d</sub> : 30.6 [g]
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Correction	Meniscus - C <sub>m</sub> : 0.50 [g/L]
------------	--

Control cylinder

Note: The "Offset" column is filled with companion measurements taken in a control cylinder filled with the reference solution during the test.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
No.	Elapsed time t [min]	Temp. T [°C]	Reading R [g/L]	Offset [g/L] R <sub>dt</sub>	Corrected readings [g/L] R - R <sub>dt</sub> R <sub>CL</sub>		Fall distance H [cm]	Diameter D [mm]	Percent finer [%] Partial    Total	
1	1	28.7	29.75	1.5	28.25	30.25	11.35	0.04897	96.76	24.19
2	2	28.7	29	1.5	27.5	29.5	11.48	0.03483	94.19	23.55
3	4	28.7	26.75	1.5	25.25	27.25	11.88	0.02506	86.48	21.62
4	15	28.7	25.25	1.5	23.75	25.75	12.15	0.01308	81.35	20.34
5	30	28.7	24.5	1.5	23	25	12.29	0.0093	78.78	19.69
6	60	28.7	23.25	1.5	21.75	23.75	12.51	0.00664	74.5	18.62
7	240	28.7	21.5	1.5	20	22	12.82	0.00336	68.5	17.12
8	1440	28.7	14.25	1.5	12.75	14.75	14.11	0.00144	43.67	10.92

Date: 2018-03-14

Time: 08:30

Tested by: -

Notes:

Sand [%]	Silt [%]	Clay [%]
N/A	49.1	50.9

## Equations

$$(7): R_{CL} = R + C_m$$

$$(9): D = 10 \times \{ [ 18\mu / ( \rho_w \times g ) / ( G_s - 1 ) ] \times ( H / t ) \}^{0.5}$$

$$(10): 0.6226 \times [ G_s / ( G_s - 1 ) ] \times ( V_{sp} / M_d ) \times ( R - R_{dt} ) \times ( 100/1000 )$$

$$(11): (10) \times \text{Passing}$$

Att.: Particles finer than 0.002 [mm] are considered as Clay.

## Parameters

Viscosity of water at 20 [°C],

$$\mu: \mu = 0.01 \text{ [g/(cm.s)]}$$

Mass density of water at 20 [°C],

$$\rho_w: \rho_w = 0.99821 \text{ [g/cm}^3\text{]}$$

# Hydrometer (ASTM D7928) - Test Data

Project:	Project	BH/TP:	TP-01
Client:	Client	Depth:	11
Location:	Location	USCS:	CH
Code:	Project Code	Sample:	Undisturbed

General	Type: 151H	Dispersant: NaPO3	Separation sieve: No. 10
			Passing: 65.17 [%]

Properties	G <sub>s</sub> : 2.45	Suspension vol., V <sub>sp</sub> : 996.3 [cm <sup>3</sup> ]	Dry soil mass, M <sub>d</sub> : 30.6 [g]
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Correction	Meniscus - C <sub>m</sub> : 0.00050
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Calibration relationship

No.	1	2	3	4	5
T <sub>t</sub> [°C]	15	18.5	22	25.5	29
R <sub>151,t</sub>	1.006	1.00525	1.0045	1.00375	1.00275
A <sub>t</sub> *	1.00723	1.00709	1.00707	1.00717	1.00715

A	1.00714	✓
Std. Dev.	6E-05	✓

$$* A_t = R_{151,t} + (7.784 \times 10^{-6} \times T_t) + (4.959 \times 10^{-6} \times T_t^2)$$

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
No.	Elapsed time t [min]	Temp. T [°C]	Reading R	Offset R <sub>dt</sub>	Corrected readings		Fall distance H [cm]	Diameter D [mm]	Percent finer [%]	
					R - R <sub>dt</sub>	R <sub>cl</sub>			Partial	Total
1	1	17	1.02225	1.00558	0.01667	1.02275	10.15	0.04632	90.63	59.06
2	2	18	1.02175	1.0054	0.01635	1.02225	10.29	0.03297	88.89	57.93
3	4	19	1.02075	1.0052	0.01555	1.02125	10.56	0.02362	84.54	55.09
4	15	20	1.01975	1.005	0.01475	1.02025	10.83	0.01235	80.19	52.26
5	30	20	1.0195	1.005	0.0145	1.02	10.89	0.00876	78.83	51.37
6	60	21	1.019	1.00479	0.01421	1.0195	11.03	0.00623	77.25	50.35
7	240	22	1.01775	1.00457	0.01318	1.01825	11.37	0.00316	71.65	46.7
8	1440	23	1.01675	1.00434	0.01241	1.01725	11.64	0.00131	67.47	43.97

Date: 2018-03-14

Time: 16:30

Tested by: -

Notes:

Sand [%]	Silt [%]	Clay [%]
N/A	25	75

## Equations

$$(5): R_{dt} = A - 7.784 \times 10^{-6} \times T - 4.959 \times 10^{-6} \times T^2$$

$$(7): R_{cl} = R + C_m$$

$$(9): D = 10 \times \{ [18\mu / (\rho_w \times g)] / (G_s - 1) \} \times (H/t)^{0.5}$$

$$(10): [G_s / (G_s - 1)] \times (V_{sp} / M_d) \times \rho_w \times (R - R_{dt}) \times 100$$

$$(11): (10) \times \text{Passing}$$

Att.: Particles finer than 0.002 [mm] are considered as Clay.

## Parameters

Viscosity of water at 20 [°C],  
 $\mu$ :  $\mu = 0.01$  [g/(cm.s)]  
 Mass density of water at 20 [°C],  
 $\rho_w$ :  $\rho_w = 0.99821$  [g/cm<sup>3</sup>]

# Hydrometer (ASTM D7928) - Test Data

Project:	Project	BH/TP:	TP-01
Client:	Client	Depth:	12
Location:	Location	USCS:	CL-ML
Code:	Project Code	Sample:	Undisturbed

General	Type: 152H	Dispersant: NaPO3	Separation sieve: No. 200
			Passing: 65.00 [%]

Properties	G <sub>s</sub> : 2.45	Suspension vol., V <sub>sp</sub> : 996.3 [cm <sup>3</sup> ]	Dry soil mass, M <sub>d</sub> : 30.6 [g]
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Correction	Meniscus - C <sub>m</sub> : 0.50 [g/L]
------------	--

Calibration relationship

No.	1	2	3	4	5
T <sub>t</sub> [°C]	15	18.5	22	25.5	29
R <sub>152,t</sub> [g/L]	6.5	5.5	4.25	3	1.5
B <sub>t</sub> * [g/L]	8.48	8.45	8.37	8.49	8.55

B [g/L]	8.47	✓
Std. Dev.	0.06	✓

$$* B_t = R_{152,t} + (1.248 \times 10^{-2} \times T_t) + (7.950 \times 10^{-3} \times T_t^2)$$

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
No.	Elapsed time t [min]	Temp. T [°C]	Reading R [g/L]	Offset [g/L] R <sub>dt</sub>	Corrected readings [g/L] R - R <sub>dt</sub>	R <sub>cl</sub>	Fall distance H [cm]	Diameter D [mm]	Percent finer [%] Partial	Total
1	1	17	32	5.96	26.04	32.5	10.95	0.0481	89.19	57.97
2	2	18	31	5.67	25.33	31.5	11.13	0.03429	86.76	56.39
3	4	19	29.25	5.36	23.89	29.75	11.44	0.02458	81.83	53.19
4	15	20	26.75	5.04	21.71	27.25	11.88	0.01294	74.36	48.33
5	30	20	25.25	5.04	20.21	25.75	12.15	0.00925	69.22	44.99
6	60	21	21.5	4.7	16.8	22	12.82	0.00672	57.54	37.4
7	240	22	20.25	4.34	15.91	20.75	13.04	0.00339	54.49	35.42
8	1440	23	14.25	3.97	10.28	14.75	14.11	0.00144	35.21	22.89

Date: 2018-03-14

Time: 16:30

Tested by: -

Notes:

Sand [%]	Silt [%]	Clay [%]
N/A	59.2	40.8

## Equations

$$(5): R_{dt} = B - 1.248 \times 10^{-2} \times T - 7.950 \times 10^{-3} \times T^2$$

$$(7): R_{cl} = R + C_m$$

$$(9): D = 10 \times \{ [18\mu / (\rho_w \times g)] / (G_s - 1) \} \times (H/t)^{0.5}$$

$$(10): 0.6226 \times [G_s / (G_s - 1)] \times (V_{sp} / M_d) \times (R - R_{dt}) \times (100/1000)$$

$$(11): (10) \times \text{Passing}$$

Att.: Particles finer than 0.002 [mm] are considered as Clay.

## Parameters

Viscosity of water at 20 [°C],  
 $\mu$ :  $\mu = 0.01$  [g/(cm.s)]  
 Mass density of water at 20 [°C],  
 $\rho_w$ :  $\rho_w = 0.99821$  [g/cm<sup>3</sup>]

# Hydrometer (ASTM D422) - Test Data

Project:	Project	BH/TP:	TP-01
Client:	Client	Depth:	13
Location:	Location	USCS:	ML
Code:	Project Code	Sample:	Undisturbed

General	Type: 151H	Dispersant: NaPO3	Separation sieve: No. 50
			Passing: 75.45 [%]

Properties	G <sub>s</sub> : 2.45	Dry soil mass, M <sub>d</sub> : 30.6 [g]
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Correction	Normal	Meniscus - C <sub>m</sub> : 0.00050	Composite	Meniscus - C <sub>m</sub> :		
		Temperature - C <sub>t</sub> : ASTM*		Test No.	1	2
		Dispersant - C <sub>d</sub> : 0.00500		T <sub>t</sub> [°C]		
		* Refer to scientific manual.		C <sub>c,t</sub>		

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
No.	Elapsed time	Temp.	Reading	Corrected readings		Fall distance	Diameter	Percent finer [%]	
	t [min]	T [°C]	R	R <sub>cp</sub>	R <sub>cl</sub>	H [cm]	D [mm]	Partial	Total
1	1	17	1.0205	1.01493	1.021	10.74	0.04962	82.42	62.18
2	2	18	1.01925	1.01386	1.01975	11.07	0.03518	76.52	57.73
3	4	19	1.017	1.0118	1.0175	11.67	0.02522	65.15	49.16
4	15	20	1.0155	1.0105	1.016	12.06	0.01308	57.98	43.74
5	30	20	1.014	1.009	1.0145	12.46	0.0094	49.7	37.5
6	60	21	1.0135	1.00871	1.014	12.59	0.0066	48.1	36.29
7	240	22	1.0125	1.00793	1.013	12.86	0.0033	43.8	33.05
8	1440	23	1.01	1.00566	1.0105	13.52	0.00136	31.27	23.59

Date: 2018-03-14 Time: 16:30 Tested by: -

Notes:

Sand [%]	Silt [%]	Clay [%]
N/A	61.6	38.4

Equations	Parameters
(5): $R_{cp} = R - C_d + C_t$ ; $R_{cp} = R - C_c$	(6): $R_{cl} = R + C_m$
(8): $D = K \times (H / t)^{0.5}$ ; $K = [30n / 980 / (G_s - G_1)]^{0.5}$	G <sub>1</sub> : Specific gravity of the suspending medium (G <sub>1</sub> = 1.000 for all practical purposes).
(9): $\{ (100,000 / M_d) \times [G_s / (G_s - G_1)] \} \times (R_{cp} - G_1)$	n: Viscosity of the suspending medium (in this case water) [g/(cm.s)].
Att.: Particles finer than 0.002 [mm] are considered as Clay.	

# Hydrometer (ASTM D422) - Test Data

Project:	Project	BH/TP:	TP-01
Client:	Client	Depth:	14
Location:	Location	USCS:	MH
Code:	Project Code	Sample:	Undisturbed

General	Type: 152H	Dispersant: NaPO3	Separation sieve: No. 200 Passing: 74.97 [%]
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Properties	G <sub>s</sub> : 2.45	Dry soil mass, M <sub>d</sub> : 30.6 [g]
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Correction	Normal	Meniscus - C <sub>m</sub> : 0.50 [g/L]	Composite	Meniscus - C <sub>m</sub> :		
		Temperature - C <sub>t</sub> : 3.50 [g/L]		Test No.		
		Dispersant - C <sub>d</sub> : 5.00 [g/L]		1                      2		
				T <sub>t</sub> [°C]		
				C <sub>c,t</sub> [g/L]		

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
No.	Elapsed time t [min]	Temp. T [°C]	Reading R [g/L]	Corrected readings [g/L] R <sub>cp</sub> R <sub>cl</sub>		Fall distance H [cm]	Diameter D [mm]	Percent finer [%] Partial Total	
1	1	28.7	29.5	28	30	11.37	0.04456	96.27	72.17
2	2	28.7	26	24.5	26.5	11.95	0.03229	84.23	63.15
3	4	28.7	23.75	22.25	24.25	12.32	0.02318	76.5	57.35
4	15	28.7	20.25	18.75	20.75	12.89	0.01225	64.46	48.33
5	30	28.7	17	15.5	17.5	13.42	0.00884	53.29	39.95
6	60	28.7	13.25	11.75	13.75	14.04	0.00639	40.4	30.29
7	240	28.7	10.5	9	11	14.49	0.00325	30.94	23.2
8	1440	28.7	7.75	6.25	8.25	14.94	0.00135	21.49	16.11

Date: 2018-03-14 Time: 16:30 Tested by: -

Notes:

Sand [%]	Silt [%]	Clay [%]
N/A	75.3	24.7

Equations	Parameters
(5): $R_{cp} = R - C_d + C_t$ ; $R_{cp} = R - C_c$	(6): $R_{cl} = R + C_m$ a: Correction factor
(8): $D = K \times (H / t)^{0.5}$ ; $K = [30n / 980 / (G_s - G_1)]^{0.5}$	G <sub>1</sub> : Specific gravity of the suspending medium (G <sub>1</sub> = 1.000 for all practical purposes).
(9): $[(R_{cp} \times a) / M_d] \times 100$	n: Viscosity of the suspending medium (in this case water) [g/(cm.s)].
(10): (9) x Passing	
Att.: Particles finer than 0.002 [mm] are considered as Clay.	

# Hydrometer (ASTM D422) - Test Data

Project:	Project	BH/TP:	TP-01
Client:	Client	Depth:	15
Location:	Location	USCS:	OL
Code:	Project Code	Sample:	Undisturbed

General	Type: 151H	Dispersant: NaPO3	Separation sieve: No. 10
			Passing: -

Properties	G <sub>s</sub> : 2.45	Dry soil mass, M <sub>d</sub> : 30.6 [g]
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Correction	Normal	Meniscus - C <sub>m</sub> :	Composite	Meniscus - C <sub>m</sub> : 0.00050		
		Temperature - C <sub>t</sub> :		Test No.	1	2
		Dispersant - C <sub>d</sub> :		T <sub>t</sub> [°C]	15	29
				C <sub>c,t</sub>	0.006	0.00275

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
No.	Elapsed time t [min]	Temp. T [°C]	Reading R	Corrected readings		Fall distance H [cm]	Diameter D [mm]	Percent finer [%]	
				R <sub>cp</sub>	R <sub>cl</sub>			Partial	Total
1	1	17	1.02075	1.01521	1.02125	10.67	0.04947	84.01	-
2	2	18	1.0195	1.0142	1.02	11	0.03507	78.39	-
3	4	19	1.019	1.01393	1.0195	11.14	0.02464	76.91	-
4	15	20	1.018	1.01316	1.0185	11.4	0.01272	72.67	-
5	30	20	1.01625	1.01141	1.01675	11.86	0.00917	63.01	-
6	60	21	1.01525	1.01064	1.01575	12.13	0.00648	58.77	-
7	240	22	1.0145	1.01013	1.015	12.33	0.00323	55.91	-
8	1440	23	1.012	1.00786	1.0125	12.99	0.00134	43.39	-

Date: 2018-03-14 Time: 16:30 Tested by: -

Notes:

Sand [%]	Silt [%]	Clay [%]
15.8	36.4	47.8

Equations	Parameters
(5): $R_{cp} = R - C_d + C_t$ ; $R_{cp} = R - C_c$	(6): $R_{cl} = R + C_m$
(8): $D = K \times (H / t)^{0.5}$ ; $K = [30n / 980 / (G_s - G_1)]^{0.5}$	G <sub>1</sub> : Specific gravity of the suspending medium (G <sub>1</sub> = 1.000 for all practical purposes).
(9): $\{ (100,000 / M_d) \times [G_s / (G_s - G_1)] \} \times (R_{cp} - G_1)$	n: Viscosity of the suspending medium (in this case water) [g/(cm.s)].
Att.: Particles finer than 0.002 [mm] are considered as Clay.	



# Hydrometer (ASTM D422) - Test Data

Project:	Project	BH/TP:	TP-01
Client:	Client	Depth:	16
Location:	Location	USCS:	OH
Code:	Project Code	Sample:	Undisturbed

General	Type: 152H	Dispersant: NaPO3	Separation sieve: No. 200
			Passing: 90.00 [%]

Properties	G <sub>s</sub> : 2.45	Dry soil mass, M <sub>d</sub> : 30.6 [g]
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Correction	Normal	Meniscus - C <sub>m</sub> :	Meniscus - C <sub>m</sub> : 0.50 [g/L]
		Temperature - C <sub>t</sub> :	
		Dispersant - C <sub>d</sub> :	
	Composite	Test No.	1 2
		T <sub>t</sub> [°C]	15 29
		C <sub>c,t</sub> [g/L]	6.5 1.5

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
No.	Elapsed time t [min]	Temp. T [°C]	Reading R [g/L]	Corrected readings [g/L]		Fall distance H [cm]	Diameter D [mm]	Percent finer [%]	
				R <sub>cp</sub>	R <sub>cl</sub>			Partial	Total
1	1	17	33.75	27.96	34.25	10.68	0.04948	96.14	86.53
2	2	18	30.75	25.32	31.25	11.17	0.03533	87.06	78.35
3	4	19	30	24.93	30.5	11.29	0.02481	85.71	77.14
4	15	20	28	23.29	28.5	11.62	0.01284	80.06	72.05
5	30	20	27	22.29	27.5	11.78	0.00914	76.62	68.96
6	60	21	25	20.64	25.5	12.11	0.00648	70.97	63.87
7	240	22	23.75	19.75	24.25	12.32	0.00323	67.9	61.11
8	1440	23	18.25	14.61	18.75	13.22	0.00135	50.22	45.2

Date: 2018-03-14 Time: 16:30 Tested by: -

Notes:

Sand [%]	Silt [%]	Clay [%]
N/A	43.6	56.4

Equations	Parameters
(5): $R_{cp} = R - C_d + C_t$ ; $R_{cp} = R - C_c$	(6): $R_{cl} = R + C_m$ a: Correction factor
(8): $D = K \times (H / t)^{0.5}$ ; $K = [30n / 980 / (G_s - G_1)]^{0.5}$	G <sub>1</sub> : Specific gravity of the suspending medium (G <sub>1</sub> = 1.000 for all practical purposes).
(9): $[(R_{cp} \times a) / M_d] \times 100$	n: Viscosity of the suspending medium (in this case water) [g/(cm.s)].
Att.: Particles finer than 0.002 [mm] are considered as Clay.	

Atterberg Limits

Test data

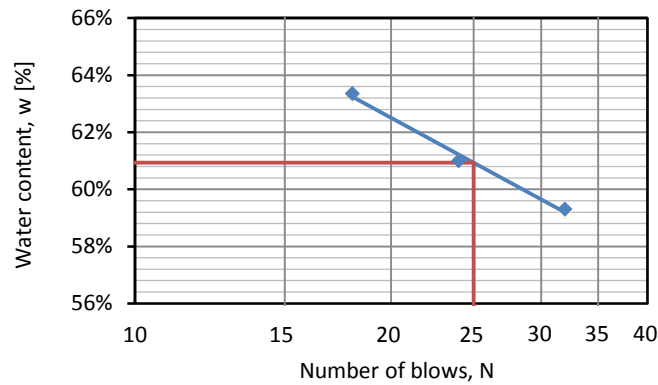
# Atterberg Limits - Test Data

Project: Project	BH/TP: TP-01
Client: Client	Depth: 7
Location: Location	USCS: GC
Code: Project Code	Sample: Undisturbed

## Liquid limit test (LL) Multipoint method One-point method

☐ Liquid limit test could not be performed.

	No.01	No.02	No.03	No.04	No.05	No.01	No.02
Number of blows, N	32	24	18				
Container No.	No. 01	No. 02	No. 03				
Mass of container + moist soil, $M_{cms}$ [g]	35.24	37.79	35.88				
Mass of container + dry soil, $M_{cds}$ [g]	28.52	30.5	28.46				
Mass of container, $M_c$ [g]	17.19	18.55	16.75				
Mass of water, $M_w$ [g]	6.72	7.29	7.42				
Mass of dry soil, $M_{ds}$ [g]	11.33	11.95	11.71				
Water content, $w$ [%]	59.31	61	63.36				



$$LL_n = W_n \cdot (N/25)^{0.121}$$

$$LL = (LL_1 + LL_2) / 2$$

Date: 2018-03-14 Time: 16:30 Tested by: -

Notes:

## Plastic limit test (PL)

☐ Plastic limit test could not be performed.

	No.01	No.02
Container No.	No. 04	No. 05
Mass of container + moist soil, $M_{cms}$ [g]	24.44	23.75
Mass of container + dry soil, $M_{cds}$ [g]	22.96	22.13
Mass of container, $M_c$ [g]	16.76	15.32
Mass of water, $M_w$ [g]	1.48	1.62
Mass of dry soil, $M_{ds}$ [g]	6.2	6.81
Water content, $w$ [%]	23.87	23.79

Date: 2018-03-14

Time: 16:30

Tested by: -

Notes:

$$PL = PL_1 + PL_2$$

$$PL = 23.8$$

## Results

LL	PL	PI	Fines as
61	24	37	CH

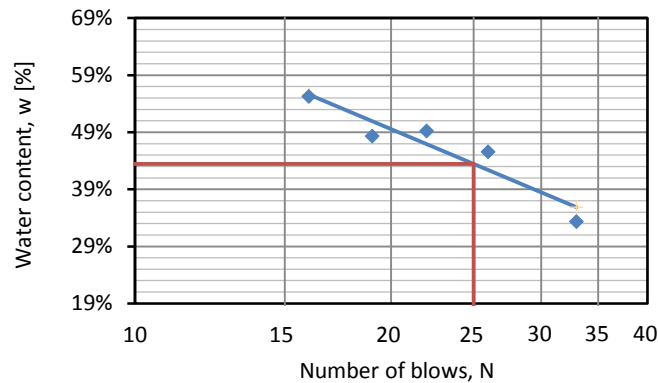
# Atterberg Limits - Test Data

Project: Project	BH/TP: TP-01
Client: Client	Depth: 9
Location: Location	USCS: GM
Code: Project Code	Sample: Undisturbed

## Liquid limit test (LL) Multipoint method One-point method

☐ Liquid limit test could not be performed.

	No.01	No.02	No.03	No.04	No.05	No.01	No.02
Number of blows, N	33	26	22	19	16		
Container No.	No. 06	No. 07	No. 08	No. 09	No. 10		
Mass of container + moist soil, $M_{cms}$ [g]	33.2	32.6	38	36.9	36.8		
Mass of container + dry soil, $M_{cds}$ [g]	28.8	28.5	31.7	31.1	30.5		
Mass of container, $M_c$ [g]	15.6	19.5	18.9	19.1	19.1		
Mass of water, $M_w$ [g]	4.4	4.1	6.3	5.8	6.3		
Mass of dry soil, $M_{ds}$ [g]	13.2	9	12.8	12	11.4		
Water content, $w$ [%]	33.33	45.56	49.22	48.33	55.26		



$$LL_n = W_n \cdot (N/25)^{0.121}$$

$$LL = (LL_1 + LL_2) / 2$$

LL = 43.4

Date: 2018-03-14 Time: 16:30 Tested by: -

Notes:

## Plastic limit test (PL)

☐ Plastic limit test could not be performed.

	No.01	No.02
Container No.	No. 11	No. 12
Mass of container + moist soil, $M_{cms}$ [g]	24.7	28.1
Mass of container + dry soil, $M_{cds}$ [g]	22.4	25.8
Mass of container, $M_c$ [g]	14.9	17.2
Mass of water, $M_w$ [g]	2.3	2.3
Mass of dry soil, $M_{ds}$ [g]	7.5	8.6
Water content, $w$ [%]	30.67	26.74

Date: 2018-03-14

Time: 16:30

Tested by: -

Notes:

$$PL = PL_1 + PL_2$$

PL = 28.7

## Results

LL	PL	PI	Fines as
43	29	14	ML

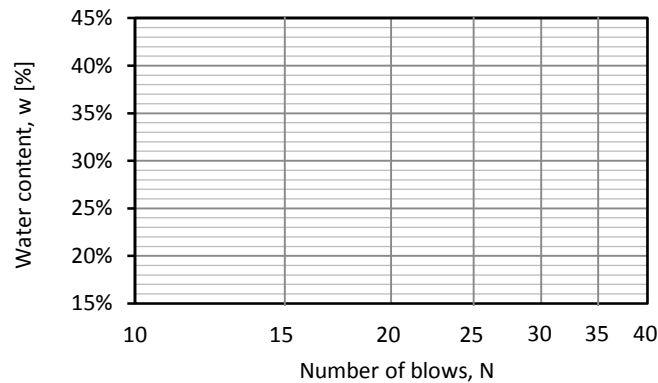
# Atterberg Limits - Test Data

Project: Project	BH/TP: TP-01
Client: Client	Depth: 14
Location: Location	USCS: MH
Code: Project Code	Sample: Undisturbed

## Liquid limit test (LL) Multipoint method One-point method

☐ Liquid limit test could not be performed.

	No.01	No.02	No.03	No.04	No.05	No.01	No.02
Number of blows, N						26	24
Container No.						No. 13	No. 14
Mass of container + moist soil, $M_{cms}$ [g]						36	40.2
Mass of container + dry soil, $M_{cds}$ [g]						28.3	29.5
Mass of container, $M_c$ [g]						17.8	15.1
Mass of water, $M_w$ [g]						7.7	10.7
Mass of dry soil, $M_{ds}$ [g]						10.5	14.4
Water content, $w$ [%]						73.33	74.31



$$LL_n = W_n \cdot (N/25)^{0.121}$$

$$LL = (LL_1 + LL_2) / 2$$

LL = 73.8

Date: 2018-03-14 Time: 16:30 Tested by: -

Notes:

## Plastic limit test (PL)

☐ Plastic limit test could not be performed.

	No.01	No.02
Container No.	No. 15	No. 16
Mass of container + moist soil, $M_{cms}$ [g]	30.4	27.9
Mass of container + dry soil, $M_{cds}$ [g]	25.6	24.8
Mass of container, $M_c$ [g]	16.9	18.9
Mass of water, $M_w$ [g]	4.8	3.1
Mass of dry soil, $M_{ds}$ [g]	8.7	5.9
Water content, $w$ [%]	55.17	52.54

Date: 2018-03-14

Time: 16:30

Tested by: -

Notes:

$$PL = PL_1 + PL_2$$

PL = 53.9

## Results

LL	PL	PI	Fines as
74	54	20	MH