HYDRAULIC CONDUCTIVITY

Project No.	*6163-14-0088.26*	Tested By	*JW*
Project Name	*Z Aera TypeII Concrete Cylinder Hydraulic Conductivity*	Test Date	*8/24/2018*
Boring No.	*180001A (Mix 2A)*	Reviewed By	
Sample No.	*180001A (Mix 2A)*	Review Date	
Sample Depth	*N/A*	Lab No.	*16728*
Sample Description	*Concrete Core, Mix 2A*		

ASTM D5084 - Method F (CVFH)

Sample Type:	*Core*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*#DIV/0!*
Wet Unit Weight, pcf:	*#DIV/0!*
Dry Unit Weight, pcf:	*#DIV/0!*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***1.8E-09***

Remarks: _____

PERMEABILITY TEST
(ASTM D5084 - 10) (Method F, Constant Volume Falling Head)

amec foster wheeler

Project Number	6163-14-0088.26	Tested By	JW
Project Name	Z Aera Typell Concrete Cylinder Hydraulic Conductivity	Test Date	08/24/18
Boring No.	180001A (Mix 2A)	Reviewed By	
Sample No.	180001A (Mix 2A)	Review Date	
Sample Depth	N/A	Lab No.	16728
Sample Description	Concrete Core, Mix 2A		

Initial Sample Data				Final Sample Data	
Length, in		Diameter, in		Pan No.	
Location 1	6.761	Location 1	4.001	Wet Soil+Pan, grams	
Location 2	6.796	Location 2	3.997	Dry Soil + Pan, grams	
Location3	6.759	Location 3	4.005	Pan Weight, grams	
Average	6.772	Average	4.001	Moisture Content, %	#DIV/0!
Volume, in^3	85.14	Wet Soil + Tare, grams	3159.90	Dry Unit Weight, pcf	#DIV/0!
SG Assumed	2.45	Tare Weight, grams	0.00	Saturation, %	#DIV/0!
Soil Sample Wt., g	3159.90	Dry Soil +Tare, grams		Diameter, in.	N/A
Dry UW, pcf	#DIV/0!	Moisture Content, %	#DIV/0!	Length, in.	N/A
Saturation, %	#DIV/0!			Volume, in^3	N/A

Consolidation

Chamber Pressure, psi	70
Back Pressure, psi	60
Confining Pressure, psi	10
Initial Burett Reading	0
Final Burett Reading	0
Volume Change, cc	0

Permeant used water

Elapsed Time (sec)	z_o (cm)	za (cm)	zb (cm)	Δz_p (cm)	Temp (°C)	Intial Hydraulic Gradient	Final Hydraulic Gradient	k cm/sec	k cm/sec at 20 °C
22620	2.50	28.10	25.30	2.80	22.4	18.7	16.6	2.72E-09	2.57E-09
25980	2.50	28.10	25.10	3.00	22.4	18.7	16.4	2.55E-09	2.41E-09
84600	2.50	28.10	22.00	6.10	22.0	18.7	14.1	1.72E-09	1.64E-09
88500	2.50	28.10	21.80	6.30	22.0	18.7	13.9	1.70E-09	1.62E-09
93180	2.50	28.10	21.70	6.40	22.2	18.7	13.8	1.65E-09	1.56E-09
98880	2.50	28.10	21.40	6.70	22.3	18.7	13.6	1.64E-09	1.55E-09
102420	2.50	28.10	21.20	6.90	22.3	18.7	13.5	1.64E-09	1.55E-09

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
7	Core	N/A	N/A	Vertical

Avg. k at 20 °C **1.8E-09** **cm/sec**

a_a = 0.76712 cm^2

A = 81.11 cm^2

L = 17.20 cm

S=L/A= 0.21206 1/cm

a_p= 0.031416 cm^2

M_1= 0.03018

M_2= 1.04095

$C = M_1S/(G_{Hg}-1)$= 0.0005091 for 15° to 25°

Remarks:

HYDRAULIC CONDUCTIVITY

Project No.	*6163-14-0088.26*	Tested By	*JW*
Project Name	*Z Aera TypeII Concrete Cylinder Hydraulic Conductivity*	Test Date	*8/24/2018*
Boring No.	*180001B (Mix 2A) (bottom)*	Reviewed By	
Sample No.	*180001B (Mix 2A) (bottom)*	Review Date	
Sample Depth	*N/A*	Lab No.	*16729B*
Sample Description	*Concrete Core, Mix 2A*		

ASTM D5084 - Method F (CVFH)

Sample Type:	*Core*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*#DIV/0!*
Wet Unit Weight, pcf:	*#DIV/0!*
Dry Unit Weight, pcf:	*#DIV/0!*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***1.7E-09***

Remarks: _____

PERMEABILITY TEST
(ASTM D5084 - 10) (Method F, Constant Volume Falling Head)

amec foster wheeler

Project Number	6163-14-0088.26	Tested By	JW
Project Name	Z Aera Typell Concrete Cylinder Hydraulic Conductivity	Test Date	08/24/18
Boring No.	180001B (Mix 2A) (bottom)	Reviewed By	
Sample No.	180001B (Mix 2A) (bottom)	Review Date	
Sample Depth	N/A	Lab No.	16729B
Sample Description	Concrete Core, Mix 2A		

Initial Sample Data				Final Sample Data	
Length, in		Diameter, in		Pan No.	
Location 1	3.277	Location 1	4.011	Wet Soil+Pan, grams	
Location 2	3.279	Location 2	4.001	Dry Soil + Pan, grams	
Location3	3.322	Location 3	4.013	Pan Weight, grams	
Average	3.293	Average	4.008	Moisture Content, %	#DIV/0!
Volume, in^3	41.55	Wet Soil + Tare, grams	1541.82	Dry Unit Weight, pcf	#DIV/0!
SG Assumed	2.45	Tare Weight, grams	0.00	Saturation, %	#DIV/0!
Soil Sample Wt., g	1541.82	Dry Soil +Tare, grams		Diameter, in.	N/A
Dry UW, pcf	#DIV/0!	Moisture Content, %	#DIV/0!	Length, in.	N/A
Saturation, %	#DIV/0!			Volume, in^3	N/A

Consolidation

Chamber Pressure, psi	70
Back Pressure, psi	60
Confining Pressure, psi	10
Initial Burett Reading	0
Final Burett Reading	0
Volume Change, cc	0

Permeant used: water

Elapsed Time (sec)	z_o (cm)	za (cm)	zb (cm)	Δz_p (cm)	Temp (°C)	Intial Hydraulic Gradient	Final Hydraulic Gradient	k cm/sec	k cm/sec at 20 °C
7320	2.50	27.80	25.70	2.10	22.1	38.0	34.7	3.04E-09	2.90E-09
67260	2.50	27.80	17.50	10.30	21.7	38.0	21.9	2.02E-09	1.94E-09
5100	2.50	27.40	26.50	0.90	21.8	37.4	36.0	1.85E-09	1.78E-09
8880	2.50	27.40	26.00	1.40	21.9	37.4	35.2	1.68E-09	1.60E-09
13140	2.50	27.40	25.60	1.80	22.0	37.4	34.6	1.47E-09	1.40E-09
18480	2.50	27.40	25.20	2.20	22.0	37.4	34.0	1.29E-09	1.23E-09
27300	2.50	27.40	24.70	2.70	22.1	37.4	33.2	1.08E-09	1.03E-09

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
7	Core	N/A	N/A	Vertical

Avg. k at 20 °C **1.7E-09 cm/sec**

a_a =	0.76712	cm^2	a_p=	0.031416	cm^2
A =	81.41	cm^2	M_1=	0.03018	
L =	8.36	cm	M_2=	1.04095	
S=L/A=	0.10273	1/cm	$C = M_1S/(G_{Hg}-1)$=	0.0002466	for 15° to 25°

Remarks:

HYDRAULIC CONDUCTIVITY

Project No.	*6163-14-0088.26*	Tested By	*JW*
Project Name	*Z Aera TypeII Concrete Cylinder Hydraulic Conductivity*	Test Date	*8/24/2018*
Boring No.	*180001B (Mix 2A) (top)*	Reviewed By	
Sample No.	*180001B (Mix 2A) (top)*	Review Date	
Sample Depth	*N/A*	Lab No.	*16729T*
Sample Description	*Concrete Core, Mix 2A*		

ASTM D5084 - Method F (CVFH)

Sample Type:	*Core*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*#DIV/0!*
Wet Unit Weight, pcf:	*#DIV/0!*
Dry Unit Weight, pcf:	*#DIV/0!*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***1.0E-09***

Remarks: _____

PERMEABILITY TEST
(ASTM D5084 - 10) (Method F, Constant Volume Falling Head)

amec foster wheeler

Project Number	6163-14-0088.26	Tested By	JW
Project Name	Z Aera Typell Concrete Cylinder Hydraulic Conductivity	Test Date	08/24/18
Boring No.	180001B (Mix 2A) (top)	Reviewed By	
Sample No.	180001B (Mix 2A) (top)	Review Date	
Sample Depth	N/A	Lab No.	16729T
Sample Description	Concrete Core, Mix 2A		

Initial Sample Data				Final Sample Data	
Length, in		Diameter, in		Pan No.	
Location 1	3.599	Location 1	4.009	Wet Soil+Pan, grams	
Location 2	3.596	Location 2	4.008	Dry Soil + Pan, grams	
Location3	3.699	Location 3	4.008	Pan Weight, grams	
Average	3.631	Average	4.008	Moisture Content, %	#DIV/0!
Volume, in^3	45.82	Wet Soil + Tare, grams	1713.09	Dry Unit Weight, pcf	#DIV/0!
SG Assumed	2.45	Tare Weight, grams	0.00	Saturation, %	#DIV/0!
Soil Sample Wt., g	1713.09	Dry Soil +Tare, grams		Diameter, in.	N/A
Dry UW, pcf	#DIV/0!	Moisture Content, %	#DIV/0!	Length, in.	N/A
Saturation, %	#DIV/0!			Volume, in^3	N/A

Consolidation

Chamber Pressure, psi	70
Back Pressure, psi	60
Confining Pressure, psi	10
Initial Burett Reading	0
Final Burett Reading	0
Volume Change, cc	0

Permeant used: water

Elapsed Time (sec)	z_o (cm)	za (cm)	zb (cm)	Δz_p (cm)	Temp (°C)	Intial Hydraulic Gradient	Final Hydraulic Gradient	k cm/sec	k cm/sec at 20 °C
82620	2.50	27.60	18.70	8.90	21.8	34.2	21.6	1.52E-09	1.45E-09
4260	2.50	27.40	27.00	0.40	22.0	33.9	33.4	1.08E-09	1.03E-09
8580	2.50	27.40	26.60	0.80	22.2	33.9	32.8	1.08E-09	1.02E-09
13860	2.50	27.40	26.20	1.20	22.3	33.9	32.2	1.01E-09	9.56E-10
18000	2.50	27.40	25.90	1.50	22.4	33.9	31.8	9.79E-10	9.24E-10
23700	2.50	27.40	25.60	1.80	22.4	33.9	31.4	8.98E-10	8.48E-10
27600	2.50	27.40	25.30	2.10	22.5	33.9	31.0	9.06E-10	8.53E-10

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
7	Core	N/A	N/A	Vertical

Avg. k at 20 °C **1.0E-09 cm/sec**

a_a = 0.76712 cm^2
A = 81.41 cm^2
L = 9.22 cm
S=L/A= 0.11330 1/cm

a_p= 0.031416 cm^2
M_1= 0.03018
M_2= 1.04095
$C = M_1S/(G_{Hg}-1)$= 0.0002720 for 15° to 25°

Remarks:

HYDRAULIC CONDUCTIVITY

Project No.	*6163-14-0088.26*	Tested By	*JW*
Project Name	*Z Aera TypeII Concrete Cylinder Hydraulic Conductivity*	Test Date	*8/24/2018*
Boring No.	*180018B (Mix 3B) (top)*	Reviewed By	
Sample No.	*180018B (Mix 3B) (top)*	Review Date	
Sample Depth	*N/A*	Lab No.	*16731T*
Sample Description	*Concrete Core, Mix 3B*		

ASTM D5084 - Method F (CVFH)

Sample Type:	*Core*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*#DIV/0!*
Wet Unit Weight, pcf:	*#DIV/0!*
Dry Unit Weight, pcf:	*#DIV/0!*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***9.6E-10***

Remarks: _____

PERMEABILITY TEST
(ASTM D5084 - 10) (Method F, Constant Volume Falling Head)

amec foster wheeler

Project Number 6163-14-0088.26
Project Name Z Aera Typell Concrete Cylinder Hydraulic Conductivity
Boring No. 180018B (Mix 3B) (top)
Sample No. 180018B (Mix 3B) (top)
Sample Depth N/A
Sample Description Concrete Core, Mix 3B

Tested By JW
Test Date 08/24/18
Reviewed By
Review Date
Lab No. 16731T

Initial Sample Data				Final Sample Data	
Length, in		Diameter, in		Pan No.	
Location 1	3.424	Location 1	4.009	Wet Soil+Pan, grams	
Location 2	3.382	Location 2	4.002	Dry Soil + Pan, grams	
Location3	3.453	Location 3	4.008	Pan Weight, grams	
Average	3.420	Average	4.006	Moisture Content, %	#DIV/0!
Volume, in^3	43.11	Wet Soil + Tare, grams	1691.08	Dry Unit Weight, pcf	#DIV/0!
SG Assumed	2.45	Tare Weight, grams	0.00	Saturation, %	#DIV/0!
Soil Sample Wt., g	1691.08	Dry Soil +Tare, grams		Diameter, in.	N/A
Dry UW, pcf	#DIV/0!	Moisture Content, %	#DIV/0!	Length, in.	N/A
Saturation, %	#DIV/0!			Volume, in^3	N/A

Consolidation

Chamber Pressure, psi	70
Back Pressure, psi	60
Confining Pressure, psi	10
Initial Burett Reading	0
Final Burett Reading	0
Volume Change, cc	0

Permeant used water

Elapsed Time (sec)	z_o (cm)	za (cm)	zb (cm)	Δz_p (cm)	Temp (°C)	Intial Hydraulic Gradient	Final Hydraulic Gradient	k cm/sec	k cm/sec at 20 °C
24360	1.80	27.30	23.40	3.90	21.8	36.9	31.0	1.83E-09	1.75E-09
82440	1.80	27.30	20.30	7.00	22.0	36.9	26.4	1.05E-09	9.98E-10
4260	1.80	27.70	27.10	0.60	22.2	37.5	36.6	1.47E-09	1.39E-09
13860	1.80	27.70	26.60	1.10	23.3	37.5	35.8	8.37E-10	7.74E-10
18000	1.80	27.70	26.50	1.20	22.4	37.5	35.7	7.04E-10	6.65E-10
23700	1.80	27.70	26.30	1.40	22.4	37.5	35.4	6.27E-10	5.92E-10
27600	1.80	27.70	26.10	1.60	22.5	37.5	35.1	6.18E-10	5.82E-10

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
7	Core	N/A	N/A	Vertical

Avg. k at 20 °C **9.6E-10 cm/sec**

a_a = 0.76712 cm^2
A = 81.33 cm^2
L = 8.69 cm
S=L/A= 0.10680 1/cm

a_p= 0.031416 cm^2
M_1= 0.03018
M_2= 1.04095
$C = M_1S/(G_{Hg}-1)$= 0.0002564 for 15° to 25°

Remarks:

HYDRAULIC CONDUCTIVITY

Project No.	*6163-14-0088.26*	Tested By	*JW*
Project Name	*Z Aera TypeII Concrete Cylinder Hydraulic Conductivity*	Test Date	*8/24/2018*
Boring No.	*180018B (Mix 3B) (bottom)*	Reviewed By	
Sample No.	*180018B (Mix 3B) (bottom)*	Review Date	
Sample Depth	*N/A*	Lab No.	*16731B*
Sample Description	*Concrete Core, Mix 3B*		

ASTM D5084 - Method F (CVFH)

Sample Type:	*Core*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*#DIV/0!*
Wet Unit Weight, pcf:	*#DIV/0!*
Dry Unit Weight, pcf:	*#DIV/0!*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***9.5E-10***

Remarks: _____

PERMEABILITY TEST
(ASTM D5084 - 10) (Method F, Constant Volume Falling Head)

amec foster wheeler

Project Number 6163-14-0088.26 | Tested By JW
Project Name Z Aera Typell Concrete Cylinder Hydraulic Conductivity | Test Date 08/24/18
Boring No. 180018B (Mix 3B) (bottom) | Reviewed By
Sample No. 180018B (Mix 3B) (bottom) | Review Date
Sample Depth N/A | Lab No. 16731B
Sample Description Concrete Core, Mix 3B

Initial Sample Data				Final Sample Data	
Length, in		Diameter, in		Pan No.	
Location 1	3.381	Location 1	4.008	Wet Soil+Pan, grams	
Location 2	3.471	Location 2	4.024	Dry Soil + Pan, grams	
Location3	3.399	Location 3	4.003	Pan Weight, grams	
Average	3.417	Average	4.012	Moisture Content, %	#DIV/0!
Volume, in^3	43.19	Wet Soil + Tare, grams	1669.98	Dry Unit Weight, pcf	#DIV/0!
SG Assumed	2.45	Tare Weight, grams	0.00	Saturation, %	#DIV/0!
Soil Sample Wt., g	1669.98	Dry Soil +Tare, grams		Diameter, in.	N/A
Dry UW, pcf	#DIV/0!	Moisture Content, %	#DIV/0!	Length, in.	N/A
Saturation, %	#DIV/0!			Volume, in^3	N/A

Consolidation

Chamber Pressure, psi	70
Back Pressure, psi	60
Confining Pressure, psi	10
Initial Burett Reading	0
Final Burett Reading	0
Volume Change, cc	0

Permeant used water

Elapsed Time (sec)	z_o (cm)	za (cm)	zb (cm)	Δz_p (cm)	Temp (°C)	Intial Hydraulic Gradient	Final Hydraulic Gradient	k cm/sec	k cm/sec at 20 °C
15660	1.80	28.00	26.20	1.80	21.9	37.9	35.2	1.21E-09	1.16E-09
22620	1.80	28.00	25.70	2.30	22.0	37.9	34.5	1.08E-09	1.03E-09
25980	1.80	28.00	25.40	2.60	22.1	37.9	34.0	1.07E-09	1.02E-09
29640	1.80	28.00	25.20	2.80	22.1	37.9	33.7	1.02E-09	9.67E-10
88620	1.80	28.00	20.50	7.50	21.8	37.9	26.6	1.02E-09	9.77E-10
9360	1.80	28.00	27.30	0.70	21.9	37.9	36.9	7.70E-10	7.36E-10
13380	1.80	28.00	27.00	1.00	21.9	37.9	36.4	7.74E-10	7.40E-10

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
7	Core	N/A	N/A	Vertical

Avg. k at 20 °C **9.5E-10** **cm/sec**

a_a = 0.76712 cm^2
A = 81.55 cm^2
L = 8.68 cm
S=L/A= 0.10643 1/cm

a_p= 0.031416 cm^2
M_1= 0.03018
M_2= 1.04095
$C = M_1S/(G_{Hg}-1)$= 0.0002555 for 15° to 25°

Remarks:

HYDRAULIC CONDUCTIVITY

Project No.	*6163-14-0088.26*	Tested By	*JW*
Project Name	*Z Aera TypeII Concrete Cylinder Hydraulic Conductivity*	Test Date	*8/24/2018*
Boring No.	*180018A (Mix 3B)*	Reviewed By	
Sample No.	*180018A (Mix 3B)*	Review Date	
Sample Depth	*N/A*	Lab No.	*16730*
Sample Description	*Concrete Core, Mix 3B*		

ASTM D5084 - Method F (CVFH)

Sample Type:	*Core*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*#DIV/0!*
Wet Unit Weight, pcf:	*#DIV/0!*
Dry Unit Weight, pcf:	*#DIV/0!*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***9.5E-10***

Remarks: _____

PERMEABILITY TEST
(ASTM D5084 - 10) (Method F, Constant Volume Falling Head)

amec foster wheeler

Project Number	6163-14-0088.26	Tested By	JW
Project Name	Z Aera Typell Concrete Cylinder Hydraulic Conductivity	Test Date	08/24/18
Boring No.	180018A (Mix 3B)	Reviewed By	
Sample No.	180018A (Mix 3B)	Review Date	
Sample Depth	N/A	Lab No.	16730
Sample Description	Concrete Core, Mix 3B		

Initial Sample Data				Final Sample Data	
Length, in		Diameter, in		Pan No.	
Location 1	6.696	Location 1	4.019	Wet Soil+Pan, grams	
Location 2	6.762	Location 2	4.018	Dry Soil + Pan, grams	
Location3	6.916	Location 3	4.010	Pan Weight, grams	
Average	6.791	Average	4.016	Moisture Content, %	#DIV/0!
Volume, in^3	86.01	Wet Soil + Tare, grams	3359.40	Dry Unit Weight, pcf	#DIV/0!
SG Assumed	2.45	Tare Weight, grams	0.00	Saturation, %	#DIV/0!
Soil Sample Wt., g	3359.40	Dry Soil +Tare, grams		Diameter, in.	N/A
Dry UW, pcf	#DIV/0!	Moisture Content, %	#DIV/0!	Length, in.	N/A
Saturation, %	#DIV/0!			Volume, in^3	N/A

Consolidation

Chamber Pressure, psi	70
Back Pressure, psi	60
Confining Pressure, psi	10
Initial Burett Reading	0
Final Burett Reading	0
Volume Change, cc	0

Permeant used: water

Elapsed Time (sec)	z_o (cm)	za (cm)	zb (cm)	Δz_p (cm)	Temp (°C)	Intial Hydraulic Gradient	Final Hydraulic Gradient	k cm/sec	k cm/sec at 20 °C
22980	1.80	29.30	27.70	1.60	22.4	20.0	18.8	1.38E-09	1.30E-09
26340	1.80	29.30	27.60	1.70	22.4	20.0	18.7	1.28E-09	1.21E-09
85020	1.80	29.30	25.70	3.60	21.7	20.0	17.3	8.73E-10	8.39E-10
88860	1.80	29.30	25.60	3.70	22.0	20.0	17.2	8.61E-10	8.20E-10
93540	1.80	29.30	25.40	3.90	22.2	20.0	17.1	8.66E-10	8.21E-10
99240	1.80	29.30	25.10	4.20	22.3	20.0	16.9	8.84E-10	8.37E-10
102780	1.80	29.30	25.10	4.20	22.3	20.0	16.9	8.54E-10	8.08E-10

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
7	Core	N/A	N/A	Vertical

Avg. k at 20 °C **9.5E-10 cm/sec**

a_a = 0.76712 cm^2
A = 81.71 cm^2
L = 17.25 cm
S=L/A= 0.21111 1/cm

a_p= 0.031416 cm^2
M_1= 0.03018
M_2= 1.04095
$C = M_1S/(G_{Hg}-1)$= 0.0005069 for 15° to 25°

Remarks: