



October 18, 2018

Mr. Frank Hofer
Keystone Patio
PO Box 7, Road #6
Warren, MB R0C 3E0

Subject: Concrete Paving Stone Test Results – Holland Pavers
Reference: ACM # 051418-3929

Dear Frank,

Attached are the independent laboratory test results for the three sets of Holland paving units manufactured April 30, 2018 at your facility. All tests were conducted in accordance with ASTM C140-17b, *Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units, Annex A4 Test Procedures for Concrete Interlocking Paving Units*.

The results demonstrate that all three sets performed very well and easily meet the compressive strength and absorption requirements of ASTM C936-16, *Standard Specification for Solid Concrete Interlocking Paving Units*.

ASTM C936-16 requires the average compressive strength of three units be not less than 8,000 psi [55 MPa], with no individual unit less than 7,200 psi [50 MPa]. The standard also requires the average water absorption of three units not be greater than 5%, with no individual unit greater than 7%.

If you have any questions regarding this report, please contact Dennis Hayes or me.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Craig Walloch', is written over a large, faint yellow hexagonal graphic in the background.

Craig Walloch
Vice President Technical Development
Attachments: S&ME Paving Units Test Results



Summary of Results
 Keystone Patio - Warren, MB
 Holland Pavers - Mix Design Trial
 Manufactured April 30, 2018
 ACM # 051418-3929

Set #	1	2	3
Mix Design	Holland #1	Holland #2	Holland #3
<u>Mix Design (lbs/batch)</u>			
Sand	1050	1050	1372
Rock	40	61	---
Total Agg.	1090	1111	1372
Cement	238	242	378
Total Cem.	238	242	378
Total Batch	1328	1353	1750
<u>Admixture</u>			
Admixture Type	CS 340	CS 340	CS 340
Dosage, oz/cwt (oz/batch)	5 (12)	5 (12)	2.6 (10)
<u>Production Parameters</u>			
Batch Water, lbs.	50.5	52	55
<u>Mix Design (% of Total Agg)</u>			
Sand	96.3%	94.5%	100.0%
Rock	3.7%	5.5%	---
Total Agg.	100.0%	100.0%	100.0%
Cement	21.8%	21.8%	27.6%
Total Cem.	21.8%	21.8%	27.6%
<u>Physical Properties (inch-lbs)</u>			
Compressive Strength, psi	15,100	14,490	11,410
Absorption, %	2.7	3.0	3.8
Density, pcf	142.1	140.0	133.6
<u>Physical Properties (SI)</u>			
Compressive Strength, MPa	104.1	99.9	78.7
Absorption, %	2.7	3.0	3.8
Density, kg/m ³	2,277	2,244	2,142



Plant: <u>Keystone Patio – Warren, Manitoba, Canada</u>	Job No: <u>1803-10-111</u>
Client: <u>ACM Chemistries, Inc. – Mr. Craig Walloch / Lance Tuttle</u>	Report No: <u>001778</u>
Lab No: <u>051418-3929</u>	Report Date: <u>6/5/18</u>
Unit ID: <u>Holland pavers, manufactured: 4/30/18</u>	Received Date: <u>6/21/18</u>
<u>Compressive Strength Test Date: 6/5/18</u>	

SUMMARY OF AVERAGE TEST RESULTS

	ASTM C936 Required	Result			
		Set 1	Set 2	Set 3	
Net Area Compressive Strength	8,000 (55) min.	15,100 (104.1)	14,490 (99.9)	11,410 (78.7)	Psi (MPa)
Absorption	5 max.	2.7	3.0	3.8	%
Oven Dry Density	-	142.1 (2,277)	140.0 (2,244)	133.6 (2,142)	lb/ft ³ (kg/m ³)
	ASTM C140 Required				
Length / Width	2.1 max.	2.02	2.02	2.02	
Minimum Aspect Ratio	0.60 min.	0.616	0.621	0.601	
Maximum Aspect Ratio	1.20 max.	0.630	0.638	0.617	
Average Cap Thickness	0.060 (1.5) max.	0.021 (0.5)	0.029 (0.7)	0.037 (0.9)	in. (mm)
Thickness Variation Across Cut	0.08 (2.0) max.	Not Cut	Not Cut	Not Cut	in.(mm)

Please see the accompanying page for detailed results.
 Tests were performed in accordance with ASTM C140-17b.



Plant: Keystone Patio – Warren, Manitoba, Canada
Client: ACM Chemistries, Inc. – Mr. Craig Walloch / Lance Tuttle
Lab No: 051418-3929
Unit ID: Holland pavers, manufactured: 4/30/18
Set No. 1

Job No: 1803-10-111
Report No: 001778
Report Date: 6/5/18
Received Date: 6/21/18

TESTING OF SOLID CONCRETE PAVING UNITS

Compressive Strength – test date: 6/5/18

Specimen No.	1A	1B	1C	Average
Received weight, lbs	6.134	6.088	5.844	6.022
Width, inches	3.917	3.870	3.863	3.883
Thickness, inches	2.424	2.439	2.381	2.415
Length, inches	7.816	7.801	7.827	7.815
Aspect Ratio	0.619	0.630	0.616	0.622
Height after capping, inches	2.453	2.471	2.447	2.457
Average cap thickness, inches	0.015	0.016	0.033	0.021
Net Area, in ²	30.62	30.19	30.24	30.35
Maximum load, lbs	467,450	457,090	437,520	454,020
Aspect Ratio Factor	1.007	1.018	1.004	1.009
Compressive Strength, psi	15,370	15,410	14,530	15,100

Absorption and Density

Specimen No.	1D	1E	1F	Average
Received weight, lbs	6.094	6.028	5.936	6.019
Immersed weight, lbs	3.544	3.470	3.400	3.471
Saturated weight (SSD), lbs	6.144	6.064	5.984	6.064
Oven dry weight, lbs	5.988	5.912	5.812	5.904
Absorption, %	2.6	2.6	3.0	2.7
Absorption, pcf	3.7	3.7	4.2	3.9
Density, pcf	143.7	142.2	140.4	142.1

These results meet the compressive strength and absorption requirements of ASTM C936-16.
 Tests were performed in accordance with ASTM C140-17b.

Respectfully submitted,

Brian O'Dell
 Brian O'Dell
 Jun 5 2018 10:34 AM
 CSgn

Brian O'Dell
 Masonry Laboratory Manager



Plant: Keystone Patio – Warren, Manitoba, Canada
Client: ACM Chemistries, Inc. – Mr. Craig Walloch / Lance Tuttle
Lab No: 051418-3929
Unit ID: Holland pavers, manufactured: 4/30/18
Set No. 2

Job No: 1803-10-111
Report No: 001778
Report Date: 6/5/18
Received Date: 6/21/18

TESTING OF SOLID CONCRETE PAVING UNITS

Compressive Strength – test date: 6/5/18

Specimen No.	2A	2B	2C	Average
Received weight, lbs	6.194	6.034	5.690	5.973
Width, inches	3.871	3.866	3.852	3.863
Thickness, inches	2.462	2.426	2.392	2.427
Length, inches	7.804	7.793	7.791	7.796
Aspect Ratio	0.636	0.628	0.621	0.628
Height after capping, inches	2.499	2.477	2.477	2.484
Average cap thickness, inches	0.019	0.026	0.043	0.029
Net Area, in ²	30.21	30.13	30.01	30.12
Maximum load, lbs	464,700	439,050	384,900	429,550
Aspect Ratio Factor	1.023	1.015	1.009	1.016
Compressive Strength, psi	15,740	14,790	12,940	14,490

Absorption and Density

Specimen No.	2D	2E	2F	Average
Received weight, lbs	6.088	5.986	5.938	6.004
Immersed weight, lbs	3.514	3.336	3.376	3.409
Saturated weight (SSD), lbs	6.132	5.922	5.980	6.011
Oven dry weight, lbs	5.972	5.740	5.808	5.840
Absorption, %	2.7	3.2	3.0	3.0
Absorption, pcf	3.8	4.4	4.1	4.1
Density, pcf	142.3	138.5	139.2	140.0

These results meet the compressive strength and absorption requirements of ASTM C936-16.
 Tests were performed in accordance with ASTM C140-17b.

Respectfully submitted,

Brian O'Dell Brian O'Dell
Jun 5 2018 10:34 AM
eSign

Brian O'Dell
Masonry Laboratory Manager



Plant: Keystone Patio – Warren, Manitoba, Canada
Client: ACM Chemistries, Inc. – Mr. Craig Walloch / Lance Tuttle
Lab No: 051418-3929
Unit ID: Holland pavers, manufactured: 4/30/18
Set No. 3

Job No: 1803-10-111
Report No: 001778
Report Date: 6/5/18
Received Date: 6/21/18

TESTING OF SOLID CONCRETE PAVING UNITS

Compressive Strength – test date: 6/5/18

Specimen No.	3A	3B	3C	Average
Received weight, lbs	5.646	5.434	5.340	5.473
Width, inches	3.849	3.845	3.846	3.847
Thickness, inches	2.367	2.391	2.310	2.356
Length, inches	7.794	7.777	7.767	7.779
Aspect Ratio	0.615	0.622	0.601	0.612
Height after capping, inches	2.447	2.450	2.395	2.431
Average cap thickness, inches	0.040	0.030	0.043	0.037
Net Area, in ²	30.00	29.90	29.87	29.92
Maximum load, lbs	333,470	417,380	271,660	340,840
Aspect Ratio Factor	1.003	1.010	0.988	1.000
Compressive Strength, psi	11,150	14,090	8,990	11,410

Absorption and Density

Specimen No.	3D	3E	3F	Average
Received weight, lbs	5.582	5.436	5.388	5.469
Immersed weight, lbs	3.156	3.038	3.006	3.067
Saturated weight (SSD), lbs	5.672	5.552	5.500	5.575
Oven dry weight, lbs	5.484	5.336	5.294	5.371
Absorption, %	3.4	4.0	3.9	3.8
Absorption, pcf	4.7	5.4	5.2	5.1
Density, pcf	136.0	132.4	132.5	133.6

These results meet the compressive strength and absorption requirements of ASTM C936-16. Tests were performed in accordance with ASTM C140-17b.

Respectfully submitted,

Brian O'Dell
 Brian O'Dell
 Jun 5 2018 10:34 AM
 CS&S

Brian O'Dell
 Masonry Laboratory Manager



Plant: Keystone Patio – Warren, Manitoba, Canada
Client: ACM Chemistries, Inc. – Mr. Craig Walloch / Lance Tuttle
Lab No: 051418-3929
Unit ID: Holland pavers, manufactured: 4/30/18
Set No. 1

Job No: 1803-10-111
Report No: 001778
Report Date: 6/5/18
Received Date: 6/21/18

TESTING OF SOLID CONCRETE PAVING UNITS

Compressive Strength – test date: 6/5/18

Specimen No.	1A	1B	1C	Average
Received weight, kg	2.782	2.761	2.651	2.732
Width, mm	99.5	98.3	98.1	98.6
Thickness, mm	61.6	62.0	60.5	61.3
Length, mm	198.5	198.1	198.8	198.5
Aspect Ratio	0.619	0.630	0.616	0.622
Height after capping, mm	62.3	62.8	62.2	62.4
Average cap thickness, mm	0.4	0.4	0.8	0.5
Net Area, mm ²	19,752	19,477	19,507	19,579
Maximum load, kN	2,079.4	2,033.3	1,946.3	2,019.7
Aspect Ratio Factor	1.007	1.018	1.004	1.009
Compressive Strength, MPa	106.0	106.2	100.2	104.1

Absorption and Density

Specimen No.	1D	1E	1F	Average
Received weight, kg	2.764	2.734	2.693	2.730
Immersed weight, kg	1.608	1.574	1.542	1.575
Saturated weight (SSD), kg	2.787	2.751	2.714	2.751
Oven dry weight, kg	2.716	2.682	2.636	2.678
Absorption, %	2.6	2.6	3.0	2.7
Absorption, kg/m ³	60.0	58.6	66.6	61.7
Density, kg/m ³	2,303	2,279	2,249	2,277

These results meet the compressive strength and absorption requirements of ASTM C936-16.

Tests were performed in accordance with ASTM C140-17b.

Note: The data on this page was converted from US Customary measurements and is submitted for informational purposes.

Respectfully submitted,


 Brian O'Dell
Jun 5 2018 10:34 AM


Brian O'Dell
 Masonry Laboratory Manager



Plant: Keystone Patio – Warren, Manitoba, Canada
Client: ACM Chemistries, Inc. – Mr. Craig Walloch / Lance Tuttle
Lab No: 051418-3929
Unit ID: Holland pavers, manufactured: 4/30/18
Set No. 2

Job No: 1803-10-111
Report No: 001778
Report Date: 6/5/18
Received Date: 6/21/18

TESTING OF SOLID CONCRETE PAVING UNITS

Compressive Strength – test date: 6/5/18

Specimen No.	2A	2B	2C	Average
Received weight, kg	2.810	2.737	2.581	2.709
Width, mm	98.3	98.2	97.8	98.1
Thickness, mm	62.5	61.6	60.8	61.6
Length, mm	198.2	197.9	197.9	198.0
Aspect Ratio	0.636	0.628	0.621	0.628
Height after capping, mm	63.5	62.9	62.9	63.1
Average cap thickness, mm	0.5	0.6	1.1	0.7
Net Area, mm ²	19,490	19,437	19,362	19,430
Maximum load, kN	2,067.2	1,953.1	1,712.2	1,910.8
Aspect Ratio Factor	1.023	1.015	1.009	1.016
Compressive Strength, MPa	108.5	102.0	89.2	99.9

Absorption and Density

Specimen No.	2D	2E	2F	Average
Received weight, kg	2.761	2.715	2.693	2.723
Immersed weight, kg	1.594	1.513	1.531	1.546
Saturated weight (SSD), kg	2.781	2.686	2.712	2.727
Oven dry weight, kg	2.709	2.604	2.634	2.649
Absorption, %	2.7	3.2	3.0	3.0
Absorption, kg/m ³	61.1	70.4	66.1	65.9
Density, kg/m ³	2,281	2,220	2,230	2,244

These results meet the compressive strength and absorption requirements of ASTM C936-16.

Tests were performed in accordance with ASTM C140-17b.

Note: The data on this page was converted from US Customary measurements and is submitted for informational purposes.

Respectfully submitted,


Brian O'Dell
Jun 5 2018 10:34 AM
CSign

Brian O'Dell
Masonry Laboratory Manager



Plant: Keystone Patio – Warren, Manitoba, Canada
Client: ACM Chemistries, Inc. – Mr. Craig Walloch / Lance Tuttle
Lab No: 051418-3929
Unit ID: Holland pavers, manufactured: 4/30/18
Set No. 3

Job No: 1803-10-111
Report No: 001778
Report Date: 6/5/18
Received Date: 6/21/18

TESTING OF SOLID CONCRETE PAVING UNITS

Compressive Strength – test date: 6/5/18

Specimen No.	3A	3B	3C	Average
Received weight, kg	2.561	2.465	2.422	2.483
Width, mm	97.8	97.7	97.7	97.7
Thickness, mm	60.1	60.7	58.7	59.8
Length, mm	198.0	197.5	197.3	197.6
Aspect Ratio	0.615	0.622	0.601	0.612
Height after capping, mm	62.2	62.2	60.8	61.7
Average cap thickness, mm	1.0	0.7	1.1	0.9
Net Area, mm ²	19,354	19,292	19,272	19,306
Maximum load, kN	1,483.4	1,856.7	1,208.5	1,516.2
Aspect Ratio Factor	1.003	1.010	0.988	1.000
Compressive Strength, MPa	76.9	97.2	62.0	78.7

Absorption and Density


Specimen No.	3D	3E	3F	Average
Received weight, kg	2.532	2.466	2.444	2.481
Immersed weight, kg	1.432	1.378	1.363	1.391
Saturated weight (SSD), kg	2.573	2.518	2.495	2.529
Oven dry weight, kg	2.487	2.420	2.401	2.436
Absorption, %	3.4	4.0	3.9	3.8
Absorption, kg/m ³	74.7	85.9	82.6	81.1
Density, kg/m ³	2,180	2,123	2,123	2,142

These results meet the compressive strength and absorption requirements of ASTM C936-16.

Tests were performed in accordance with ASTM C140-17b.

Note: The data on this page was converted from US Customary measurements and is submitted for informational purposes.

Respectfully submitted,


Brian O'Dell
Jun 5 2018 10:35 AM
CSign

Brian O'Dell
Masonry Laboratory Manager