



REPORT OF

**REPORT OF PAVEMENT EVALUATION
MALVERN OF MADISON PAVEMENT
CHARLOTTESVILLE, VIRGINIA**

ECS PROJECT NO. 28:2124

FOR:

**MALVERN OF MADISON HOA
2811 HYDRAULIC RD
CHARLOTTESVILLE, VIRGINIA 22901**

ATTN: TJ WRIGHT

July 13, 2017



July 13, 2017

Via email to: tjwright@relee.build

Malvern of Madison HOA
c/o Mr. T.J. Wright
2811 Hydraulic Rd
Charlottesville, Virginia 22901

ECS Project No. 28:2124

Reference: Report of Pavement Evaluation
Malvern of Madison Subdivision
Madison, Virginia

Dear Mr. Wright:

ECS MID-ATLANTIC, LLC (ECS) is pleased to submit this report regarding the pavement evaluation for the Malvern of Madison subdivision. Our services have been provided in general accordance with ECS Proposal No. 28:1641-GP, dated April 19, 2017. This report includes the results of the pavement coring, soils laboratory testing, and evaluation of the pavement section for the project.

SCOPE OF SERVICES

Our field exploration consisted of a site visit by an Engineering Geologist, 60 widely spaced asphalt cores within the roadways, measuring of the subbase stone, and the collection of representative subgrade soil from five (5) locations. Laboratory testing consisted of Atterberg Limits, Grain Size Analysis, Standard Proctor and California Bearing Ratio testing. ECS also evaluated a heavy duty and light duty pavement section based on the CBR values and assumed traffic loading.

The coring locations were located in the field by an ECS representative by measuring angles and distances from existing structures. The test locations shown on the plan provided in the Appendix should be considered approximate.

PROJECT CHARACTERISTICS

From the reviewed documents and several conversations, we understand that there is approximately 8.5 miles of paved roadway in the subdivision. Based on a visible observation of the roadways prior to coring, areas were noted to show wear and distress.

FIELD EXPLORATION

In order to characterize the general roadway and stone subbase conditions, 60 test cores (C-1 through C-60) were performed. The cores were performed with truck-mounted coring equipment utilizing diamond core barrels and hand augers to advance the exploration through the stone subbase. Water

was used in this asphalt coring process. Therefore, testing the subgrade soils for natural moisture content would not provide accurate results.

The following table shows the results of the on-site coring and subbase measurements.

LOCATION	CORE ID NUMBER	ASPHALT THICKNESS	GRAVEL THICKNESS	LOCATION	CORE ID NUMBER	ASPHALT THICKNESS	GRAVEL THICKNESS
Malvern Drive	C-1	5.5"	7"	Windmill Lane 1	C-31	2"	2.5"
Ashlawn Drive 1	C-2	2"	7"	Windmill Lane 2	C-32	2"	4.5"
Ashlawn Drive 2	C-3	1.25"	3"	Windmill Lane 3	C-33	1.75"	3"
Ashlawn Drive 3	C-4	2"	2"	Bee Gum Way 1	C-34	2"	4"
Ashlawn Drive 4	C-5	2"	5"	Bee Gum Way 2	C-35	2"	4"
Ashlawn Drive 5	C-6	2"	5"	Sleigh Bell Lane 1	C-36	2"	3"
Ashlawn Drive 6	C-7	1.75"	15"	Sleigh Bell Lane 2	C-37	2.5"	4.5"
Ashlawn Drive 7	C-8	2.25"	9"	Half Penny Lane 1	C-38	2"	5.5"
Ashlawn Drive 8	C-9	2"	12"	Half Penny Lane 2	C-39	2.25"	4.5"
Ashlawn Drive 9	C-10	2.25"	8"	Carriage Lane 1	C-40	2.5"	6"
Ashlawn Drive 10	C-11	3"	8"	Carriage Lane 2	C-41	2.5"	4.5"
Sylvan Lane 1	C-12	2.25"	8"	Carriage Lane 3	C-42	1.75"	2"
Sylvan Lane 2	C-13	1.5"	3.5"	Powderhorn Lane 1	C-43	1.75"	5.75"
Sylvan Lane 3	C-14	1.75"	3.5"	Powderhorn Lane 2	C-44	1.75"	4"
Sylvan Lane 4	C-15	2"	3"	Powderhorn Lane 3	C-45	1.5"	2"
Sylvan Lane 5	C-16	3"	2.5"	Aroda Road 1	C-46	3.5"	3"
Thumbblatch Ln 1	C-17	1.75"	6.5"	Aroda Road 2	C-47	2"	5"
Thumbblatch Ln 2	C-18	2"	6"	Old Forge Way 1	C-48	2"	8"
Chestnut Trl Ln 1	C-19	2.25"	8"	Old Forge Way 2	C-49	2.5"	7.5"
Chestnut Trl Ln 2	C-20	2"	4"	Old Forge Way 3	C-50	2.5"	6.25"
Chestnut Trl Ln 3	C-21	1.75"	4"	Old Forge Way 4	C-51	4.5"	6"
Pine Court 1	C-22	1.5"	4.5"	Old Forge Way 5	C-52	3.25"	4"
Pine Court 2	C-23	1.25"	3.75"	Old Forge Way 6	C-53	2.25"	2"
Butter Churn Wy 1	C-24	1.5"	4"	Anvil Court	C-54	1.75"	6"
Butter Churn Wy 2	C-25	1.25"	3"	Turkey Trot Lane 1	C-55	1.75"	3"
Malvern Drive	C-26	2.25"	8"	Turkey Trot Lane 2	C-56	2"	3"
Pine Torch Lane 1	C-27	2"	4"	Surrey Court 1	C-57	2.25"	1.5"
Pine Torch Lane 2	C-28	3.25"	4.5"	Surrey Court 2	C-58	2.75"	2.5"
Pine Torch Lane 3	C-29	4.5"	5.5"	Covered Bridge 2	C-59	3.5"	4.25"
Covered Bridge 1	C-30	5"	3"	Liberty Lane	C-60	2.25"	9.5"

Based on the laboratory testing that was performed on select samples of the subgrade soils, the soils generally consist of Sandy SILT (ML) and Sandy CLAY (CL). There are some sections that contain Silty SAND (SM). The following table provides a summary of the laboratory testing that was performed.

Roadway Soil Sample Summary

Coring Location	CBR	Soil Type	% Fines	CBR Value
C-16 – Sylvan Lane	1	CL	66.1	4.3
C-21 – Chestnut Trail Ln	2	CL	71.0	6.7
C-29 – Pine Torch Lane	3	CL	59.2	1.3
C-39 – Half Penny Lane	4	ML	51.1	12.5

ROADWAY PAVEMENT

Laboratory testing demonstrated CBR values ranging from 1.3 to 12.5. For design purposes in order to compare to existing conditions, a design CBR value of 4.0 has been selected.

Pavement sections were evaluated using the VDOT “Pavement Design Guide for Subdivision and Secondary Roads”. These sections can be compared to the results of the field observations. The following pavement designs are based on the CBR value of 4.0, five heavy trucks per day, and an estimated average daily traffic (ADT) of 920 vehicles (230 houses x 4 trips per house per day) for the heavy duty drive lanes (Malvern Drive and Covered Bridge Drive) and a maximum ADT of 220 vehicles (55 houses average x 4 trips per house per day) for the remainder of the roads within the subdivision. These traffic volumes are expected to be conservative. The sections are noted below.

Flexible Pavement Section

Pavement Section	Drive Lanes	Side Roads
	Thickness (in.)	Thickness (in.)
Surface Coarse (SMA-9.5)	2.0	1.5
Base Coarse (BM-25.0)	3.0	
Aggregate Subbase Coarse (VDOT No. 21A/B)	6.0	8.0

It appears that many of the road sections cored did not meet or come close to the pavement sections noted above. ECS also observed that some of the lots were still undeveloped, indicating that traffic will increase in the future from current loading.

CLOSING

The information contained herein was developed from the data obtained from the pavement cores which indicate conditions at specific locations at the time of exploration. Asphalt and stone thicknesses and soil conditions may vary between the coring locations.

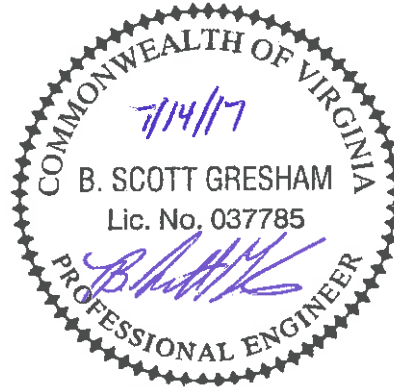
We have appreciated the opportunity to be of service to you. If you have any questions with regard to the information and recommendations contained in this report, or if we can be of further assistance to you during construction, please do not hesitate to contact us.

Respectfully,

ECS MID-ATLANTIC, LLC



Steven Crouch, C.P.G.
Environmental Geologist

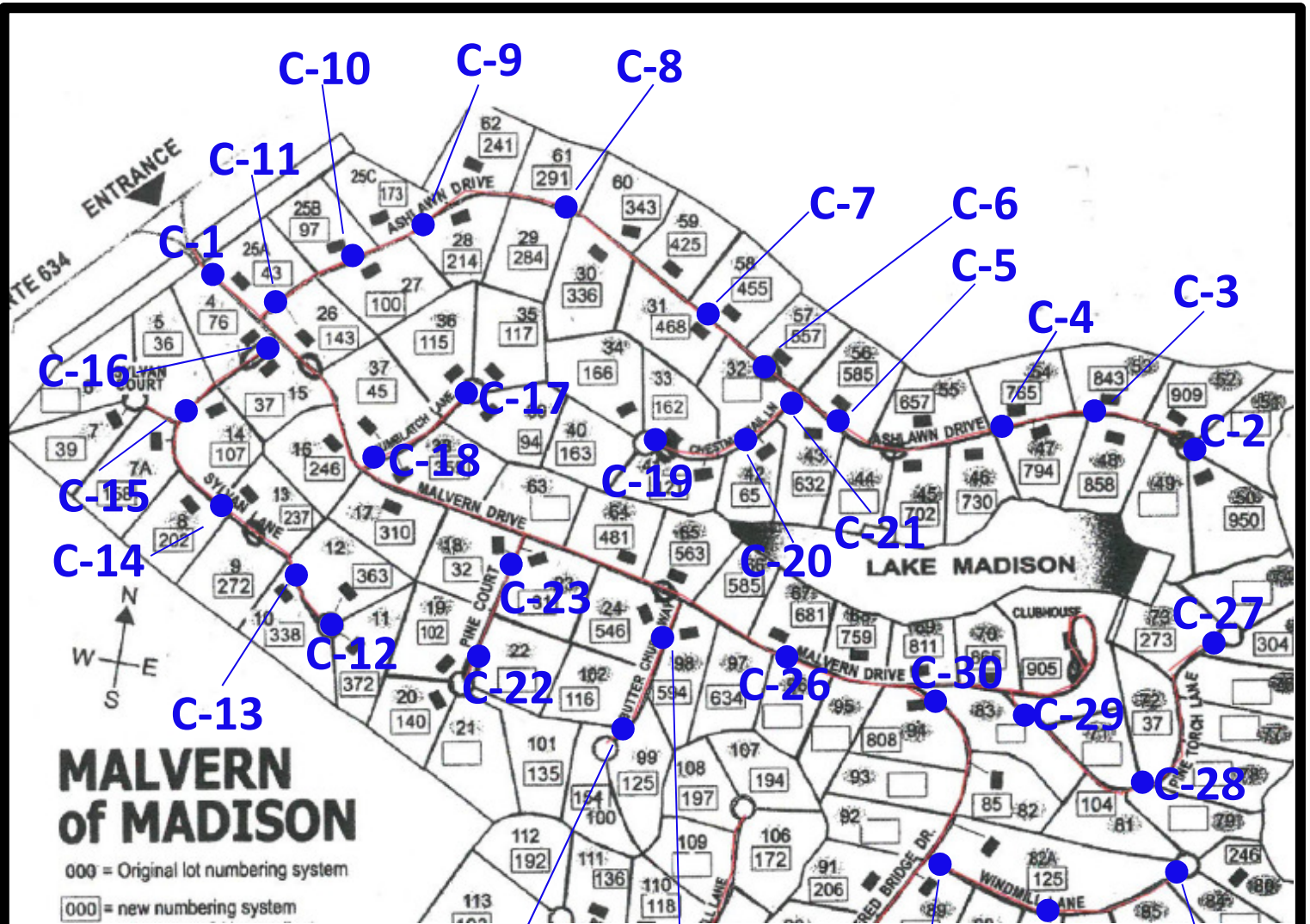


B. Scott Gresham, P.E.
VP/Charlottesville Branch Manager

APPENDIX

Coring Location Diagram

Laboratory Testing Summary



LEGEND

- APPROXIMATE CORING LOCATION

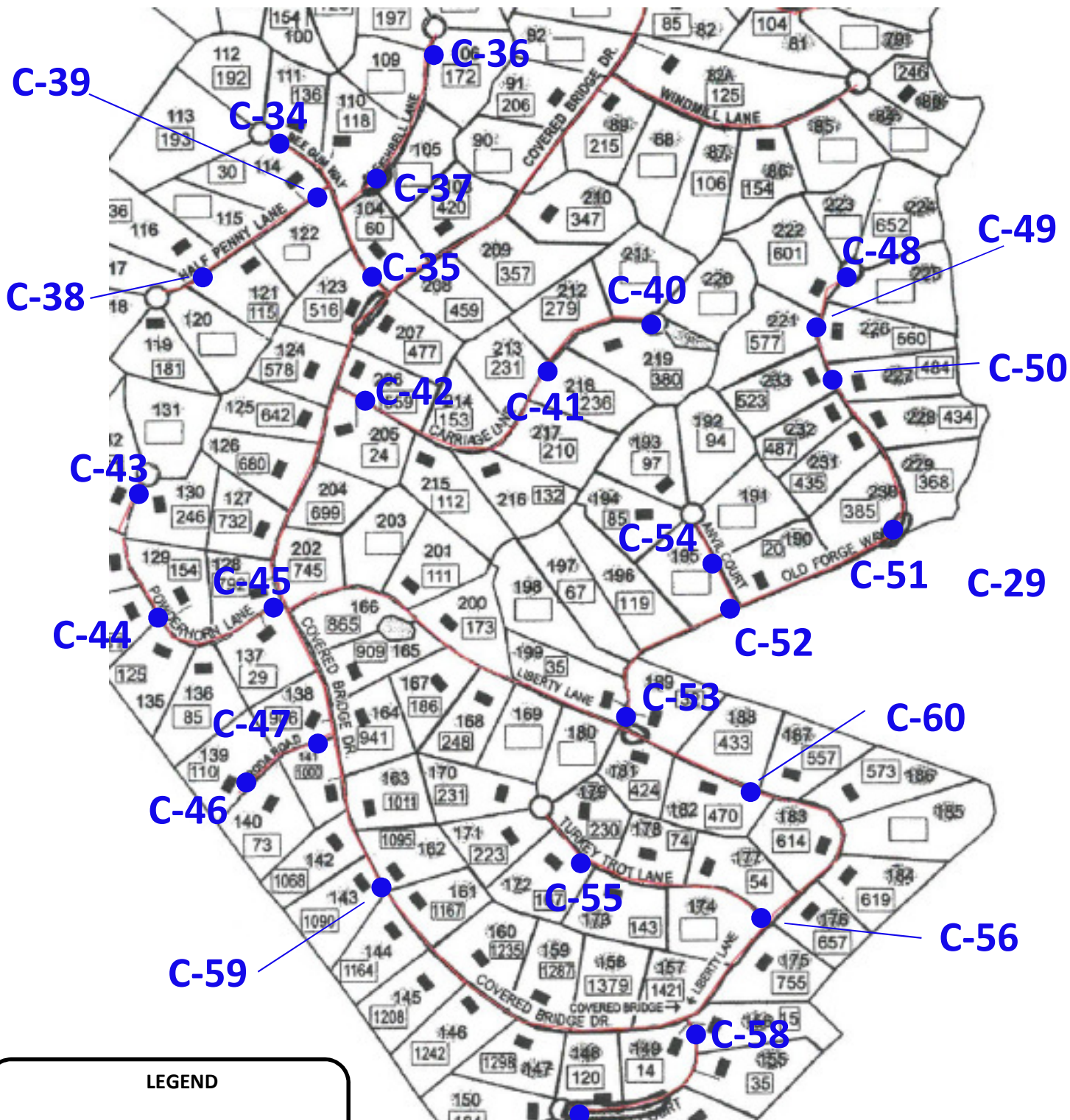
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**CORING LOCATION DIAGRAM
 MALVERN OF MADISON**

MADISON, VA

ENGINEER	SJC
SOURCE	Malvern 2015 Repair Map
PROJECT NO.	28:2124
SHEET	1 OF 2
DATE	07/3/2017



LEGEND

- APPROXIMATE CORING LOCATION

Not To Scale



**CORING LOCATION DIAGRAM
MALVERN OF MADISON**

MADISON, VA

ENGINEER	SJC
SOURCE	Malvern 2015 Repair Map
PROJECT NO.	28:2124
SHEET	2 OF 2
DATE	07/3/2017

Laboratory Testing Summary

Sample Source	Sample Number	Depth (feet)	MC ¹ (%)	Soil Type ²	Atterberg Limits ³			Percent Passing No. 200 Sieve ⁴	Moisture - Density (Corr.) ⁵		CBR Value ⁶	Other
					LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
Pine Torch Lane 3 C-29												
	CBR-3	0.50 - 0.50		CL	38	23	15	59.2	104.9	19.0	1.5	
Half Penny Lane 2 C-39												
	CBR-4	0.50 - 0.50		ML	38	35	3	51.1	110.9	16.6	13.8	
Chestnut Trail Lane C-21												
	CBR-2	0.50 - 0.50		CL	45	26	19	71.0	105.1	19.9	7.6	
Sylvan Lane C-16												
	CBR-1	0.50 - 0.50		CL	43	24	19	66.1	105.2	19.9	4.6	

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method
Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No.
Project Name: Malvern Of Madison Pavement
PM: Steven J. Crouch
PE: Scott Gresham
Printed On: Friday, July 14, 2017



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