



LIMITED ASBESTOS AND LEAD-BASED PAINT SURVEY REPORT

S-45 Over the Little Pee Dee Swamp Bridge Replacements

Lester Road (S-45)

Dillon County, South Carolina 29536



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Yes, Asbestos was found

No, Asbestos was not found

Yes, Lead-Based Paint was found

No, Lead-Based Paint was not found

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1.0 INTRODUCTION

Froehling & Robertson, Inc. (F&R) conducted limited asbestos containing materials and lead-based paint consulting services on February 22, 2018 for Bridge Structure No.'s 1770004500200 and 1770004500300 located over the Little Pee Dee Swamp along Lester Road (S-45), approximately one (1) mile northeast of the intersection with Lockemy Highway (SC 57) in Dillon County, South Carolina. It is F&R's understanding that the structures are the subject of planned demolition which will impact building materials. The following sections document the survey procedures and results. Refer to Appendix A for Personnel Accreditation documentation of F&R personnel associated with this survey.

1.1. Purpose

The purpose of the Pre-Demolition Asbestos and Lead-Based paint Survey is to identify Asbestos-Containing Materials (ACMs) and Lead-Based Paint (LBP) coatings that may require appropriate removal, handling, and disposal procedures prior to scheduled demolition activities at the subject property.

1.2. Site Description

The project site consists of two short-span bridges which extend over the Little Pee Dee Swamp. The bridges are located along Lester Road approximately 6.5 miles southeast of Dillon, South Carolina. Bridge 2, identified as Structure Number 177004500200, is located over the middle portion of the Little Pee Dee Swamp and Bridge 3, identified as Structure Number 1770004500300, is located over the northern portion of the Little Pee Dee Swamp. F&R notes that the bridge structure numbers and locations were verified by the structure numbers embossed on placards located on the southwest corners of the bridge abutments. Bridge 2 is approximately 2700 square feet in size (90' X 30') and Bridge 3 is approximately 4,500 SF in size (150' X 30'). Both structures are constructed with cast-in-place reinforced concrete bridge decks that are finished with an asphalt paved roadway. The bridge decks are supported by a series of concrete beams that extend across a series of wood bents which extend into the subsurface below the water to an unknown depth. Concrete abutments are located at the ends of the bridges and provide support for the approach embankments. Low reinforced concrete barrier rails are located along the edges of both structures. A metal rail extends along the top of the concrete barrier rails on the east and west sides of the bridges. Refer to Appendix B for site sketches of the bridge structures, including asbestos sample locations.

2.0 SCOPE OF SERVICES

As outlined in F&R proposal number 1865-00401, the survey included the following services with respect to the proposed demolition activities:



- Identification and sampling, as necessary, of suspect ACMs.
- Determination of the presence, location, and estimated quantity of identified ACMs.
- Testing, as necessary, of surface coatings for the presence of Lead.

Based on information provided by the client, it is F&R's understanding that the Bridge 2, Structure No. 1770004500200 and Bridge 3, Structure No. 1770004500300 will be replaced and will be the subject of demolition which will impact all structure components. As such, this survey as performed constitutes a comprehensive structure survey and this report shall not be utilized for the determination of presence or absence of Regulated Materials outside of the demolition areas should the scope of work be altered or expanded beyond that of the currently scheduled demolition activities.

3.0 LIMITED ASBESTOS-CONTAINING MATERIALS SURVEY

F&R's South Carolina Licensed Asbestos Building Inspector, Andréa LeCroy (South Carolina Asbestos Building Inspector #BI-01080), conducted the Asbestos Survey of Bridge Structure No. 1770004500200 and Bridge Structure No. 1770004500300 located over the Little Pee Dee Swamp along Lester Road (S-45), approximately one (1) mile northeast of the intersection with Lockemy Highway (SC 47), in Dillon County, South Carolina on February 22, 2018. The noted Inspector was assisted by Terron Edwards.

Federal Regulations (40 CFR Part 61, Subpart M – National Emission Standard for Asbestos (NESHAP)), as well as South Carolina State Regulations (61-86.1 Standards of Performance for Asbestos Projects) require a thorough asbestos inspection of the structure to be conducted prior to the commencement of renovation and/or demolition activities. An ACM is defined by the Occupational Safety & Health Administration (OSHA) and the Environmental Protection Agency (EPA) as material containing greater than one percent (1%) asbestos.

3.1. Asbestos-Containing Materials (ACM) Methodology

This survey was conducted in general accordance with the Federal NESHAP and applicable State regulations for the presence of ACMs. The survey was characterized by a visual inspection and sampling of suspect structure components at the subject property to be impacted by the proposed demolition activities.

Guidelines utilized in the asbestos survey were established by the EPA, ASTM International (ASTM), and The Environmental Information Association, Inc. (EIA). Utilized guidelines included: the Asbestos Hazard Emergency Response Act (40 CFR Part 763, Subpart E – Asbestos-Containing Materials in Schools (cited as AHERA)), ASTM Standard E2356-14 *Standard Practice for Comprehensive Building Asbestos Surveys*, and the EIA publication *Managing Asbestos in Buildings: A Guide for Owners and Managers – A Revision to the United States Environmental*



Protection Agency's 1985 document *Guidance for Controlling Asbestos-Containing Materials in Buildings (EPA 560/5-85-024)* Known as the Purple Book.

F&R's aforementioned South Carolina licensed asbestos inspector collected and submitted forty-six (46) samples to the laboratory, of which, a total of thirty-four (34) suspect asbestos-containing bulk samples were analyzed by Polarized Light Microscopy following positive stop direction to the Laboratory; and twelve (12) samples of non-friable organically bound materials were analyzed by Transmission Electron Microscopy (TEM) in accordance with South Carolina State Regulations (61-86.1 Standards of Performance for Asbestos Projects).

Samples of suspect ACMs were organized as per the AHERA concept of Homogeneous Area (HA), collected, and transported to the Scientific Analytical Institute (SAI), an NVLAP accredited lab (NVLAP Lab Code: 200664-0) and South Carolina licensed asbestos laboratory in Greensboro, North Carolina for analysis by Polarized Light Microscopy (PLM) following EPA Method 600/R-93/116. Additionally, as required by South Carolina DHEC, for non-friable organically bound (NOB) materials such as mastics and gaskets were verified with Transmission Electron Microscopy (TEM) analysis. Refer to Appendix A for Laboratory Certificates of Accreditations. Refer to Appendix C for Laboratory Certificates of Analysis and Bulk Sample Chain of Custody Forms for further description of sampled materials and analytical results.

3.2. Asbestos-Containing Materials Findings

The following material types were identified, sampled, and accordingly homogenized based upon similar construction discovered during bulk sampling:

- Asphalt
- Concrete
- Bearing Pad
- Felt Paper
- Mastics – Various Applications
- Pipe Gasket

The following table presents a summary of survey results from sampling events performed on February 22, 2018. Refer to Appendix B for illustration of the locations of collected bulk samples.

**SUSPECT ASBESTOS-CONTAINING MATERIALS SAMPLE INFORMATION
BRIDGE 2 – STRUCTURE NO. 1770004500200**

HA #	Sample #	Situation ¹	Sample Location(s)	Material Description	Result (Percent ACM)
1	M-1	R	Reflector on Roadway (One Reflector at East End of Bridge)	Reflector Black Mastic	NAD ²
1	M-2	R	Reflector on Roadway (One Reflector at East End of Bridge)	Reflector Black Mastic	NAD



HA #	Sample #	Situation ¹	Sample Location(s)	Material Description	Result (Percent ACM)
1	M-3	R	Reflector on Roadway (One Reflector at East End of Bridge)	Reflector Black Mastic	NAD ³
2	AS-4	R	Pavement South End of Roadway	Asphalt	NAD
2	AS-5	R	Pavement Sampled at Center of Roadway	Asphalt	NAD
2	AS-6	R	Pavement Northwest End of Roadway, Adjacent to White Stripe	Asphalt	NAD ³
3	CON-7	BR	Barrier Rail Top of Deck Near Center on East Side of Bridge	Concrete	NAD
3	CON-8	BR	Bottom of Deck, Approximately Center Near Northeast End	Concrete	NAD
3	CON-9	BR	Barrier Rail Top of Deck Near Center on West Side of Bridge	Concrete	NAD
3	CON-10	D	Top of Deck Near the Northeast Corner of Deck	Concrete	NAD
3	CON-11	B	Concrete Beam Beneath Bridge Deck, East End	Concrete	NAD
4	M-12	B	Interface of Concrete Beam and Deck on the Underside of the Northeast End of the Bridge Near Second Wood Bent	Black Mastic (Between Bearing Pad and Concrete Decking, Beams, and Abutments)	NAD
4	M-13	A	Interface of Concrete Abutment and Bearing Pad Near the Center of the Abutment on the South End of the Bridge	Black Mastic (Between Bearing Pad and Concrete Decking, Beams, and Abutments)	NAD
4	M-14	B	Interface of Concrete Beam and Bridge Deck on the Underside of the South End of Bridge Near First Wood Bent, West Side	Black Mastic (Between Bearing Pad and Concrete Decking, Beams and Abutments)	NAD ³



HA #	Sample #	Situation ¹	Sample Location(s)	Material Description	Result (Percent ACM)
5	BM-15	A	Interface of Abutment and Deck, South End of Bridge, West Side	Black Mat (Bridge Bearing Pad)	NAD
5	BM-16	A	Interface of Abutment and Deck, North End of Bridge, East Side	Black Mat (Bridge Bearing Pad)	NAD
5	BM-17	B	Between Concrete Deck and Beam on the South end of the Bridge, Near Center of 1 st Beam	Black Mat (Bridge Bearing Pad)	NAD ³
6	FP-18	WB	Between Beam and Wood Bent, North End of Bridge, West Side, 1 st Bent	Felt Paper	NAD
6	FP-19	WB	Between Beam and Wood Bent, South End of Bridge, East Side, 2 nd Bent	Felt Paper	NAD
6	FP-20	WB	Between Beam and Wood Bent, South End of Bridge, East Side, 2 nd Bent	Felt Paper	NAD ³
7	G-21	P	Water Pipe Parallel to West Side of Bridge, Sampled Gasket at Northwest End	Black Gasket	NAD
7	G-22	P	Water Pipe Parallel to West Side of Bridge, Sampled Gasket at Southwest End	Black Gasket	NAD
7	G-23	P	Water Pipe Parallel to West Side of Bridge, Sampled Gasket at Northwest End	Black Gasket	NAD ³

¹Situation: R – Roadway; BR – Barrier Rail; D – Deck; B – Beam; A – Abutment; WB – Wood Bent; P – Pipe

²NAD: No Asbestos Detected; ³NAD: No Asbestos Detected by TEM

**SUSPECT ASBESTOS-CONTAINING MATERIALS SAMPLE INFORMATION
BRIDGE 3 – STRUCTURE NO. 1770004500300**

HA #	Sample #	Situation ¹	Sample Location(s)	Material Description	Result (Percent ACM)
1	CON-1	BR	Barrier Rail South End of Bridge, West Side	Concrete	NAD ²



HA #	Sample #	Situation ₁	Sample Location(s)	Material Description	Result (Percent ACM)
1	CON-2	D	Concrete Deck, Top of Bridge Adjacent to Rail, North End of Bridge, East Side	Concrete	NAD
1	CON-3	D	Concrete Deck Top of Bridge Adjacent to Rail Near South End of Bridge, East Side	Concrete	NAD
2	CON-4	B	Concrete Beam Beneath Bridge Deck Along the Northeast Perimeter of the Bridge	Concrete	NAD
2	CON-5	D	Bottom of the Bridge Deck, Near Center of the South End of Deck	Concrete	NAD
2	AS-6	R	Pavement South End of Bridge, Near Center	Asphalt	NAD
3	AS-7	R	Pavement West Side, Near Barrier Rail, Approximately Center	Asphalt	NAD
3	AS-8	R	Pavement, East Side, Near Center of Road, Approximately Three Feet from Rail	Asphalt	NAD ³
3	M-9	R	Reflector on Roadway, South End of Bridge, Center Line	Reflector Black Mastic	NAD
3	M-10	R	Reflector on Roadway, North End of Bridge, Center Line	Reflector Black Mastic	NAD
3	M-11	R	Reflector on Roadway, North End of Bridge, Center Line	Reflector Black Mastic	NAD ³
4	BM-12	B	Between Concrete Deck and Beam on the South end of the Bridge, Near Center	Black Mat (Bridge Bearing Pad)	NAD
4	BM-13	B	Between Concrete Deck and Beam on the North End of Bridge, East Side	Black Mat (Bridge Bearing Pad)	NAD
4	BM-14	A	Between Concrete Deck and Abutment, North End of Bridge, East Side	Black Mat (Bridge Bearing Pad)	NAD ³



HA #	Sample #	Situation ¹	Sample Location(s)	Material Description	Result (Percent ACM)
5	M-15	A	Interface of Bridge Deck and Abutment on the South End, East Side	Black Mastic (Between Bearing Pad and Concrete Decking, Beams, and Abutments)	NAD
5	M-16	B	Interface of Bridge Deck and 1 st Beam on the South End of Bridge, West Side	Black Mastic (Between Bearing Pad and Concrete Decking, Beams, and Abutments)	NAD
5	M-17	B	Interface of Bridge Deck and 1 st Beam on the North End of Bridge, Near Center	Black Mastic (Between Bearing Pad and Concrete Decking, Beams, and Abutments)	NAD ³
6	F-18	WB	Between Beam and Wood Bent, North End of Bridge, West Side, 2 nd Bent	Felt Paper	NAD
6	F-19	WB	Between Beam and Wood Bent, South End of Bridge, East Side, 1 st Bent	Felt Paper	NAD
6	F-20	WB	Between Beam and Wood Bent, South End of Bridge, West Side, 1 st Bent	Felt Paper	NAD ³
7	G-21	P	Water Pipe Parallel to Concrete Railing on the West Side of the Bridge, Gasket at North End	Black Gasket	NAD
7	G-22	P	Water Pipe Parallel to Concrete Railing on the West Side of the Bridge, Gasket at North End	Black Gasket	NAD
7	G-23	P	Water Pipe Parallel to Concrete Railing on the West Side of the Bridge, Gasket at South End	Black Gasket	NAD ³

¹Situation: BR – Barrier Rail; D – Deck; R – Roadway; B – Beam; A – Abutment; WB – Wood Bent; P – Pipe

²NAD: No Asbestos Detected; ³NAD: No Asbestos Detected by TEM

3.3. Asbestos-Containing Materials Inventory

Asbestos Containing Materials (ACMs) were not identified during this survey. Photographic documentation of site conditions and select sampled suspect ACMs is provided as Appendix D.



3.3.1. Presumed Asbestos-Containing Materials

During the conduct of this survey, sampling was limited to those materials which were within the areas designated by the client, which were safely accessible, and which were able to be sampled without damaging systems or structures. As such, some materials should be presumed to be positive, unless sampling is conducted and shown to be negative. Such presumed asbestos containing materials (PACMS) include, but are not limited to:

- Items concealed within cavities or beneath inaccessible finish surfaces

Note that asbestos was used in over 3,000 known products and was used extensively in construction materials including in insulation and finish materials such as drywall-based systems, acoustical tiles, caulks and mastics, vinyl-based materials, and specialty products. Asbestos also continues to be used in new construction because, as stated by the EPA, "the manufacture, importation, processing, and distribution in commerce of [various] products [...] are not banned."

3.4. Asbestos-Containing Materials Recommendations

Laboratory analysis of the collected, submitted, and analyzed samples indicated an analytical result of "None Detected" with regard to asbestos content. Photographic Documentation of site conditions and sampled materials is provided as Appendix D.

Should additional suspect ACMs be discovered during demolition activities that have not been sampled and will be disturbed, F&R recommends work be temporarily halted. Samples of suspect materials should be collected, analyzed, and handled accordingly prior to the resumption of demolition activities.

F&R further recommends that an Asbestos Abatement Contractor, utilizing appropriately accredited personnel, be engaged to properly remove newly discovered ACMs prior to demolition activities. If asbestos abatement activities are performed at the structures, the work should be performed by an appropriately licensed asbestos abatement contractor.

3.5. Applicable Regulations

3.5.1. EPA/NESHAP Regulations for Asbestos-Containing Materials

The U.S. Environmental Protection Agency promulgated the National Emission Standards for Hazardous Air Pollutants (NESHAP) [40 CFR Part 61], which addresses the application, removal, and disposal of asbestos-containing materials (ACM). Under NESHAP the following categories are defined for asbestos-containing materials:

Friable - When dry, can be crumbled, pulverized, or reduced to powder by hand pressure.



Non-friable - When dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Category I Non-friable ACM - Packings, gaskets, resilient floor coverings, and asphalt roofing products containing more than 1% asbestos.

Category II Non-friable ACM – Material, excluding Category I Non-friable ACM, which contains more than 1% asbestos.

Regulated Asbestos Containing Material (RACM) – One of the following:

1. Friable ACM
2. Category I Non-friable ACM that has become friable.
3. Category I Non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading.
4. Category II Non-friable ACM that has a high probability of becoming, or has become, friable by the forces expected to act on the material in the course of demolition or renovation operations.

Under NESHAP, the following actions are required:

1. Prior to the commencement of demolition or renovation activities, the building owner must inspect the affected facility or part of the facility where the demolition or renovation activities will occur for the presence of asbestos.
2. Remove RACM from the facility before activities begin that would break up, dislodge, or similarly disturb the material or preclude access for subsequent removal.
3. RACM need not be removed if:
 - a) It is Category I non-friable ACM that is not in poor condition.
 - b) It is on a facility component that is encased in concrete or other similar material and is adequately wet whenever exposed.
 - c) It was not accessible for testing and was therefore not discovered until after demolition began and because of the demolition the material cannot be safely removed.
 - d) It is Category II non-friable ACM and the probability is low that the material will become crumbled, pulverized, or reduced to powder during demolition.



3.5.2. South Carolina Asbestos Hazard Management Program

The South Carolina Department of Health and Environmental Control (DHEC) Department of Air Quality administers the Asbestos Hazard Management Program (AHMP) which accredits individuals and issues permits for asbestos removal projects on behalf of the Federal NESHAP program which has been delegated to the State of South Carolina.

For more information, visit the SC DHEC website at:
<https://www.scdhec.gov/Environment/AirQuality/Asbestos/>.

3.5.3. OSHA Asbestos Regulations

The Occupational Safety and Health Administration (OSHA) regulates employee exposure to asbestos under 29 CFR 1926.1101 and 29 CFR 1910.1001. Work associated with known or suspect ACMs must be conducted according to these regulations in addition to the noted EPA regulations.

4.0 LIMITED LEAD-BASED PAINT SURVEY

F&R's Terron J. Edwards EPA Certified Lead-Based Paint Inspector (EPA Certification # LBP-I-1164100-1), performed the testing of surface coatings for lead on February 22, 2018. Refer to Appendix A for F&R Personnel Accreditation Documentation.

For definitions of terms used in this document with regard to Lead-Based Paint, please reference the Glossary of the [U.S. Department of Housing and Urban Development \(HUD\) Guidelines for the Evaluation and Control of Lead-Based paint Hazards in Housing \(Second Edition, July 2012\)](#).

Based on the nature of this survey, when one component tests positive for the presence of lead similar painted/coated components shall be assumed to be lead-containing, unless additional testing is performed.

4.1. Lead-Based Paint Survey Methodology

The survey was conducted in general accordance with EPA's work practice standards for conducting LBP activities (40 CFR 745.227), and the HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (Second Edition, July 2012). This survey constitutes a relatively comprehensive surface-by-surface investigation for LBP.

4.1.1. XRF Testing

Sampling of surface coatings was conducted utilizing an Innov-X Systems LBP-4000 PCS X-Ray Fluorescence (XRF) Spectrometer Lead Paint Analyzer (ID # 22816). Only accessible painted,



coated, and/or varnished surfaces were tested using the XRF. Collected readings represent components types; therefore if there is a positive result of a component, similar components in the structure should be assumed to be lead-based paint, or sampled for confirmation.

The XRF contains a X-Ray tube and operates on the principle of x-ray fluorescence, whereby lead atoms in a surface coating are stimulated to emit characteristic x-rays, which are then detected by the instrument. Levels of lead are reported in units of milligrams per square centimeter (mg/cm^2). The XRF can measure surface or non-surface concentrations of lead with 95% accuracy at the HUD action level of $1.0 \text{ mg}/\text{cm}^2$. The XRF is able to accurately detect a concentration as low as $0.1 \text{ mg}/\text{cm}^2$ of lead. The XRF classifies coated surfaces as “positive”, “negative”, or “null” for lead content based on the action level ($1.0 \text{ mg}/\text{cm}^2$) and the performance characteristics of the XRF. The XRF was checked for calibration before and after the survey. The calibration was checked against a standard reference material ($1.04 \text{ mg}/\text{cm}^2$ NIST Standard) supplied by the XRF manufacturer. A copy of the XRF Performance Characteristic sheet is included as an attachment to this report.

- Positive: Lead is present at or above the action level of $1.0 \text{ mg}/\text{cm}^2$ on *one or more* of the components tested.
- Negative: Lead is not present at or above the action level of $1.0 \text{ mg}/\text{cm}^2$ on any of the components tested.
- Null: Insufficient data was collected by the XRF during the sample time to determine if the surface is positive or negative (i.e. – premature removal or instrument slippage, terminating the test).

4.2. Lead-Based Paint Survey Findings

4.2.1. XRF Survey Results

A total of seventeen (17) XRF readings, including internal standardization, calibration, and three test readings were collected from the bridge structures. None of the readings, collected from coated and electroplated structure materials tested at the subject Property, were positive for LBP when compared to the action level of $1.0 \text{ mg}/\text{m}^2$. Refer to Appendix E, XRF Data Table for a listing of the readings and respective information as well as an explanation of the table and the Performance Characteristic Sheet.

4.3. Lead-Based Paint Conclusions & Recommendations

This survey concludes that components associated with Bridge 2, Structure No. 1770004500300 and Bridge 3, Structure No. 1770004500300 do not contain lead-based paint/coatings.



4.4. Applicable Regulations

4.4.1. OSHA Regulations for Lead-Based Paint

While the materials tested at the site were negative for lead based paint and/or surface coatings, other painted and/or coated surfaces or materials containing lead may contain sufficient concentrations of lead, which when disturbed, may generate lead dust greater than the “Action Level” concentration of 30 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) or greater than the “Permissible Exposure Limit” of 50 micrograms per cubic meter established by the OSHA “Lead Exposure in Construction Rule” (29 CFR 1926.62). The OSHA standard does not define acceptable levels of lead in paint at which no exposure to airborne lead (above the action level) would be expected; however, guidance is available for work practices which present the highest risk for lead exposure to workers. Rather, OSHA defines airborne concentrations and references specific types of work practices and operations from which a lead hazard may be generated (reference 29 CFR 1926.62, section d). Environmental and personnel monitoring should be conducted during removal or demolition processes (as applicable) to determine actual personal exposure. This monitoring information can be used to determine the levels of personnel protection and environmental controls required for work involving specific removal/demolition processes on specific structures. Under OSHA requirements, the Contractor performing the work will be required to conduct this monitoring. It is important to note that environmental controls will vary dependent upon the content of lead in paint, the process used to remove it, duration of the work, and the amount of paint to be removed.

F&R recommends that workers disturbing painted (or coated) surfaces as part of this project receive OSHA Lead in Construction Awareness training and that engineering controls and hygiene practices described in 29 CFR 1926.62 be followed during the disturbance of painted (or coated) surfaces.

4.4.2. EPA Regulations for Lead-Based Paint

For disposal of construction/demolition debris that has LBP, testing may be required as specified by the Environmental Protection Agency (EPA) for lead content to determine proper disposal. EPA regulations require that a generator of waste determine if that waste is hazardous by performing testing in accordance with the requirements of 40 CFR 261.11 or for wastes that may be RCRA hazardous (such as items with high lead content), the generator may assume that the waste is hazardous and comply with the hazardous waste regulation. The need for determination of disposal may be additionally subject to the disposal and/or recycling facility utilized.

5.0 LIMITATIONS

This report has been prepared for the exclusive use the South Carolina Department of Transportation (SC DOT) and/or their agents. This service was performed in accordance with



generally accepted environmental practices. No other warranty, expressed or implied, is made. Conclusions and recommendations are based, in part, upon information provided to us by others and site observations. We have not verified the completeness or accuracy of the information provided by others, unless otherwise noted. Observations and recommendations are based upon conditions readily visible at the site at the time of the site visit, and upon current industry standards.

During this study, suspect asbestos were submitted for analysis at a NVLAP-accredited laboratory via polarized light microscopy and transmission light microscopy; suspect LBP was field characterized using industry standard methods and practices. Inaccessible areas, such as behind solid ceilings or behind solid walls were not surveyed; therefore, some target materials may not have been identified. As with similar surveys of this nature, actual conditions exist only at the precise locations from which samples were collected or tested. Areas inspected were limited to those designated by the scope of services by the Client. Certain inferences are based on the results of this sampling and related testing to form a professional opinion of conditions in areas beyond those from which the samples were collected. Visual evaluation of other materials of concern conducted comprised a cursory visual review of the building materials and, to a limited extent, contents of the facility. It is also understood that this is a non-invasive survey so that it is possible that concealed materials may be present that were not accessible during the original survey. No other warranty, expressed or implied, is made. Reasonable effort was made by inspection personnel to locate and sample suspect materials within the structure with regard to the scope of services. However, for a facility, the existence of unique or concealed ACMs or LBP and debris is a possibility. F&R does not warrant, guarantee or profess to have the ability to locate or identify all ACMs, LBP, or other chemicals of concern in a facility.

Under this scope of services, F&R assumes no responsibility regarding response actions (e.g. O&M Plans, Encapsulation, Abatement, Removal, Tenant Notification, etc.) initiated as a result of these findings. F&R assumes no liability for the duties and responsibilities of the Client with respect to compliance with appropriate regulations. Compliance with regulations and response actions are the sole responsibility of the Client and should be conducted in accordance with local, state, and/or federal requirements and should be performed by appropriately qualified and licensed/accredited personnel, as warranted.

Froehling & Robertson, Inc. by virtue of providing the services described in this report, does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to local, state, or federal public agencies conditions at the site that may present a potential danger to public health, safety, or the environment. The Client agrees to notify the appropriate local, state, or federal public agencies as required by law, or otherwise to disclose, in a timely manner, information that may be necessary to prevent danger to public health, safety, or the environment. The contents of the report should not be construed in any way as a recommendation to purchase, sell, or develop the project site. F&R retains the right to



revise this report if new information is later discovered or made available. The report must be presented in its entirety.

Appendix A

F&R Personnel and Laboratory Accreditations

ANDRÉA LeCROY

Environmental Scientist

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Education

B.S., Environmental Studies
University of North Carolina
Asheville, 2001

Years of Experience

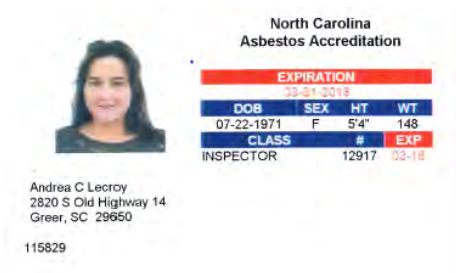
1 Year with F&R
5 Years Total

Undergraduate Coursework
Geology, University of South
Carolina (1991-1993)

Asbestos

Federal / North Carolina / South Carolina

- Building Inspector



Erosion Control & Sediment Control

- SC Certified Erosion Prevention and Sediment Control Inspector (CEPSCI)



OSHA Training

- 40-Hour HAZWOPER

United States Environmental Protection Agency

This is to certify that



Terron J Edwards

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402, and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226 as:

Inspector

In the Jurisdiction of:

All EPA Administered Lead-based Paint Activities Program States, Tribes and Territories

This certification is valid from the date of issuance and expires

April 27, 2019

A handwritten signature in black ink, appearing to read "Adrienne Priselac". The signature is fluid and cursive.

Adrienne Priselac, Manager, Toxics Office

Land Division

LBP-1164100-1

Certification #

April 13, 2016

Issued On



Greenville Technical College

Buck Mickel Center, 216 S. Pleasantburg Drive, Greenville, South Carolina 29606 (864) 250-8800

TERRON EDWARDS

18 Woods Lake Rd, Greenville, SC 29607
7974

has met the requirement and passed the examination and hands-on skills assessment for

Lead Inspector Refresher Training Course

Greenville, SC

172 - EVT533 - 013

Certificate Number

April 6, 2017

Course Date(s)

April 6, 2017

Examination Date



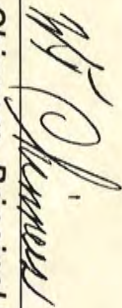
Not Applicable

EPA Interim Certification Expiration Date

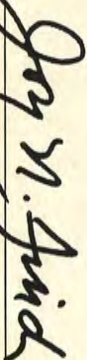
April 6, 2019

NC Expiration Date

W.T. Chinnery, Principal Instructor



Joy N. Finch, Training Manager



United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200664-0

Scientific Analytical Institute
Greensboro, NC

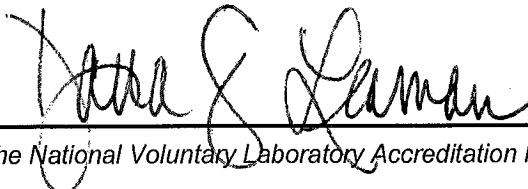
*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:*

Asbestos Fiber Analysis

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2018-01-01 through 2018-12-31

Effective Dates



For the National Voluntary Laboratory Accreditation Program



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Scientific Analytical Institute
4604 Dundas Drive
Greensboro, NC 27407
Mr. Nathaniel Durham
Phone: 336-292-3888 Fax: 336-292-3313
Email: ndurham@sailab.com
<http://www.sailab.com>

ASBESTOS FIBER ANALYSIS

NVLAP LAB CODE 200664-0

Bulk Asbestos Analysis

<u>Code</u>	<u>Description</u>
18/A01	EPA -- 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples
18/A03	EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials

Airborne Asbestos Analysis

<u>Code</u>	<u>Description</u>
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

A handwritten signature in black ink, appearing to read "Nathaniel Durham".

For the National Voluntary Laboratory Accreditation Program

Appendix B

Facility Sketch:

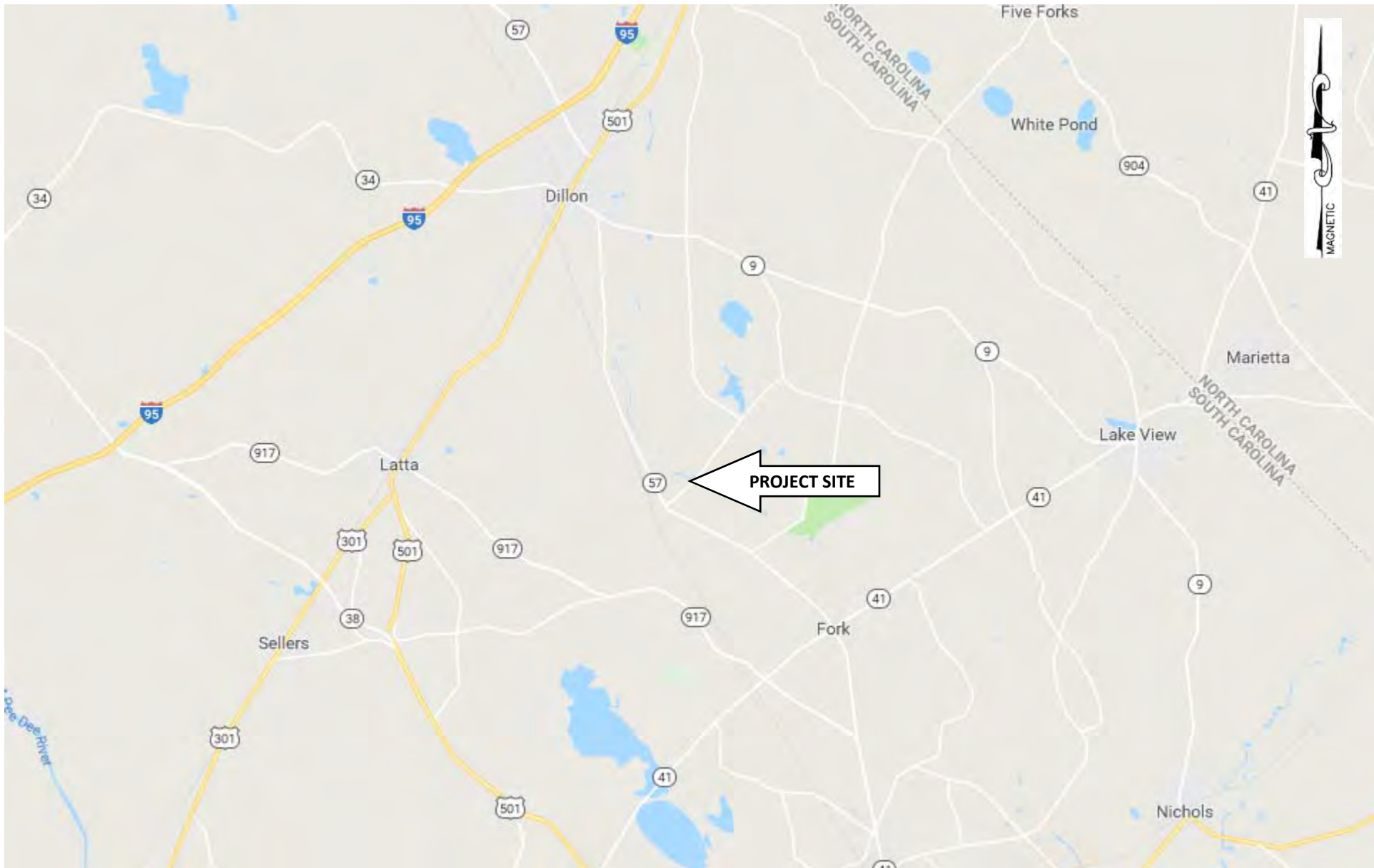
Site Vicinity Map (Figure 1)

Site Location Map (Figure 2)

Sample Location Plans:

Bridge 2 – Structure No. 1770004500200 (Figures 3 & 4)

Bridge 3 – Structure No. 1770004500300 (Figures 5 & 6)



SITE VICINITY MAP



FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881
 18 Woods Lake Road
 Greenville, South Carolina 29607 | USA
 T 864.271.2840 | F 864.271.8124

Project:	Lester Road (S-45) Bridge Replacements ACM & LBP Survey	
Location:	Lester Road (S-45), Dillon County, SC 29536	
Source:	Bing Maps	
Date:	March 19, 2018	
Job Number:	65V-0174	
Drawn By: AL	Not to Scale	Figure 1



SITE LOCATION MAP



FROEHLING & ROBERTSON, INC.
Engineering Stability Since 1881
 18 Woods Lake Road
 Greenville, South Carolina 29607 | USA
 T 864.271.2840 | F 864.271.8124

Project:	Lester Road (S-45) Bridge Replacements ACM & LBP Survey
Location:	Lester Road (S-45), Dillon County, SC 29536
Source:	Bing Maps
Date:	March 19, 2018
Job Number:	65V-0174
Drawn By: AL	Not to Scale

Figure 2



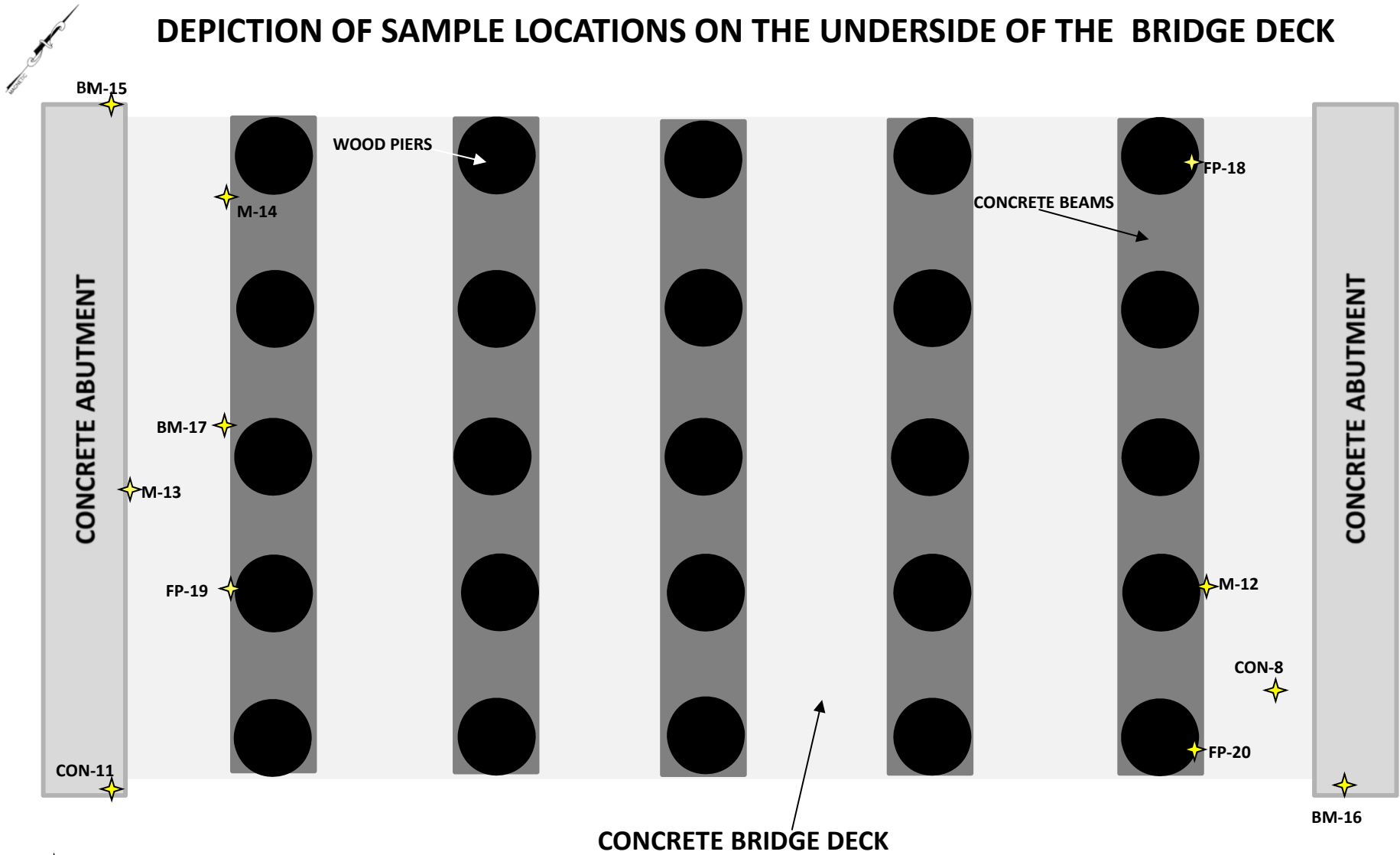
BRIDGE 2 STRUCTURE NO. 1770004500200 SAMPLE LOCATION PLAN




FROEHLING & ROBERTSON, INC.
Engineering Stability Since 1881
 18 Woods Lake Road
 Greenville, South Carolina 29607 | USA
 T 864.271.2840 | F 864.271.8124

Project:	Lester Road (S-45) Bridge Replacements ACM & LBP Survey
Location:	Lester Road (S-45), Dillon County, SC 29536
Source:	Google Earth / F&R
Date:	March 19, 2018
Job Number:	65V-0174
Drawn By: AL	Not to Scale

DEPICTION OF SAMPLE LOCATIONS ON THE UNDERSIDE OF THE BRIDGE DECK



 No Asbestos Detected

BRIDGE 2 - STRUCTURE NO. 1770004500200 SAMPLE LOCATION PLAN			
	FROEHLING & ROBERTSON, INC. <i>Engineering Stability Since 1881</i> 18 Woods Lake Road Greenville, South Carolina 29607 USA T 864.271.2840 F 864.271.8124	Project:	Lester Road (S-45) Bridge Replacements ACM & LBP Survey
		Location:	Lester Road (S-45), Dillon County, SC 29536
		Source:	F&R
		Date:	March 19, 2018
		Job Number:	65V-0174
		Drawn By: AL	Not to Scale
		Figure 4	



BRIDGE 3 - STRUCTURE NO. 1770004500300 SAMPLE LOCATION PLAN

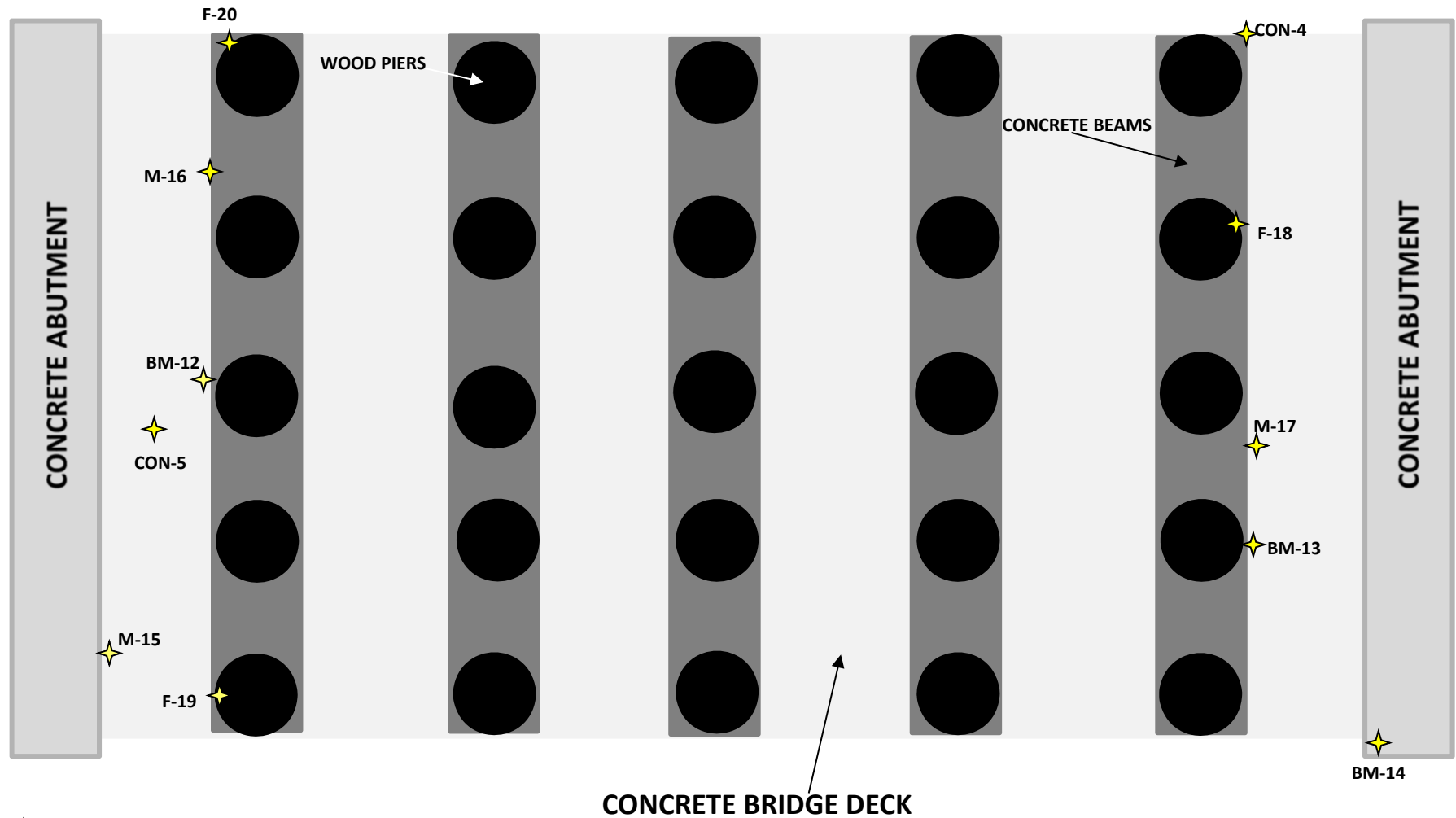


FROEHLING & ROBERTSON, INC.
Engineering Stability Since 1881
 18 Woods Lake Road
 Greenville, South Carolina 29607 | USA
 T 864.271.2840 | F 864.271.8124


Project:	Lester Road (S-45) Bridge Replacements ACM & LBP Survey
Location:	Lester Road (S-45), Dillon County, SC 29536
Source:	Google Earth / F&R
Date:	March 19, 2018
Job Number:	65V-0174
Drawn By: AL	Not to Scale



DEPICTION OF SAMPLE LOCATIONS ON THE UNDERSIDE OF THE BRIDGE DECK



 No Asbestos Detected

BRIDGE 3 - STRUCTURE NO. 1770004500300 SAMPLE LOCATION PLAN			
	FROEHLING & ROBERTSON, INC. <i>Engineering Stability Since 1881</i> 18 Woods Lake Road Greenville, South Carolina 29607 USA T 864.271.2840 F 864.271.8124	Project:	Lester Road (S-45) Bridge Replacements ACM & LBP Survey
		Location:	Lester Road (S-45), Dillon County, SC 29536
		Source:	F&R
		Date:	March 19, 2018
		Job Number:	65V-0174
		Drawn By: AL	Not to Scale
			Figure 6

Appendix C

Laboratory Certificates of Analysis
Bulk Sample Chain of Custody Forms



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



Customer: Froehling & Robertson
18 Woods Lake Rd
Greenville, SC 29607

Attn: Andrea LeCroy

Lab Order ID: 11804745
Analysis ID: 11804745_PLM
Date Received: 2/26/2018
Date Reported: 3/2/2018

Project: Lester Road S-45 Bridge Na 1770004500200

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
M-1	Reflector black mastic	None Detected		100% Other	Black Non Fibrous Heterogeneous
11804745PLM_1					Dissolved
M-2	Reflector black mastic	None Detected		100% Other	Black Non Fibrous Heterogeneous
11804745PLM_2					Dissolved
M-3	Reflector black mastic	Not Analyzed			
11804745PLM_3	TEM				
AS-4	Asphalt	None Detected		100% Other	Black, Brown Non Fibrous Heterogeneous
11804745PLM_4					Ashed
AS-5	Asphalt	None Detected		100% Other	Black, Brown Non Fibrous Heterogeneous
11804745PLM_5					Ashed
AS-6	Asphalt	Not Analyzed			
11804745PLM_6	TEM				
CON-7	Concrete	None Detected		100% Other	Gray Non Fibrous Heterogeneous
11804745PLM_7					Crushed
CON-8	Concrete	None Detected		100% Other	Gray Non Fibrous Heterogeneous
11804745PLM_8					Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAL. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Byron Stroble (23)

Analyst

Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



Customer: Froehling & Robertson
18 Woods Lake Rd
Greenville, SC 29607

Attn: Andrea LeCroy

Lab Order ID: 11804745
Analysis ID: 11804745_PLM
Date Received: 2/26/2018
Date Reported: 3/2/2018

Project: Lester Road S-45 Bridge Na 1770004500200

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
CON-9	Concrete	None Detected		100% Other	Gray Non Fibrous Heterogeneous
11804745PLM_9					Crushed
CON-10	Concrete	None Detected		100% Other	Gray Non Fibrous Heterogeneous
11804745PLM_10					Crushed
CON-11	Concrete	None Detected		100% Other	Gray Non Fibrous Heterogeneous
11804745PLM_11					Crushed
M-12	Black mastic	None Detected		100% Other	Black Non Fibrous Heterogeneous
11804745PLM_12					Dissolved
M-13	Black mastic	None Detected		100% Other	Black Non Fibrous Heterogeneous
11804745PLM_13					Dissolved
M-14	Black mastic	Not Analyzed			
11804745PLM_14	TEM				
BM-15	Black mat	None Detected		100% Other	Black Non Fibrous Homogeneous
11804745PLM_15					Ashed
BM-16	Black mat	None Detected		100% Other	Black Non Fibrous Homogeneous
11804745PLM_16					Ashed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAL. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Byron Stroble (23)

Analyst

Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



Customer: Froehling & Robertson
18 Woods Lake Rd
Greenville, SC 29607

Attn: Andrea LeCroy

Lab Order ID: 11804745
Analysis ID: 11804745_PLM
Date Received: 2/26/2018
Date Reported: 3/2/2018

Project: Lester Road S-45 Bridge Na 1770004500200

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
BM-17	Black mat	Not Analyzed			
11804745PLM_17	TEM				
FP-18	Felt paper	None Detected	70% Cellulose	30% Other	Black Fibrous Heterogeneous
11804745PLM_18					Teased, Dissolved
FP-19	Felt paper	None Detected	70% Cellulose	30% Other	Black Fibrous Heterogeneous
11804745PLM_19					Teased, Dissolved
FP-20	Felt paper	Not Analyzed			
11804745PLM_20	TEM				
G-21	Gasket	None Detected		100% Other	Black Non Fibrous Homogeneous
11804745PLM_21					Ashed
G-22	Gasket	None Detected		100% Other	Black Non Fibrous Homogeneous
11804745PLM_22					Ashed
G-23	Gasket	Not Analyzed			
11804745PLM_23	TEM				

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAL. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Byron Stroble (23)

Analyst

Approved Signatory



Scientific Analytical Institute
 4604 Dundas Dr. Greensboro, NC 27407
 Phone: 336.292.3888 Fax: 336.292.3313
 www.sailab.com lab@sailab.com

Lab Use Only
 Lab Order ID: 11804145
 Client Code: _____

Company Contact Information	
Company: FROEHLING & ROBERTSON	Contact: ANDREA LEROY
Address: 18 WOODS LAKE RD. GREENVILLE, SC 29607	Phone: 864-704-1210 Fax: _____ Email: ALECRON@FMR.COM

Asbestos Test Types	
PLM EPA 600/R-93/116 (PLM)	<input checked="" type="checkbox"/>
Positive stop	<input checked="" type="checkbox"/>
PLM Point Count 400 (PT4)	<input type="checkbox"/>
PLM Point Count 1000 (PTM)	<input type="checkbox"/>
PCM NIOSH 7400-A Rules (PCM)	<input type="checkbox"/>
B Rules (PCB) <input type="checkbox"/> TWA (PTA) <input type="checkbox"/>	
TEM AHERA (AHE)	<input type="checkbox"/>
TEM Level II (LII)	<input type="checkbox"/>
TEM NIOSH 7402 (TNI)	<input type="checkbox"/>
TEM Bulk Qualitative (TBL)	<input type="checkbox"/>
TEM Bulk Chatfield (TBS)	<input checked="" type="checkbox"/>
TEM Bulk Quantitative (TBQ)	<input type="checkbox"/>
TEM Wipe ASTM D6480-05	<input type="checkbox"/>
TEM Microvac ASTM D5755-02	<input type="checkbox"/>
TEM Water EPA 100.2 (TW1)	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>

Billing/Invoice Information	Turn Around Times	
Company: FROEHLING & ROBERTSON	90 Min. <input type="checkbox"/>	48 Hours <input type="checkbox"/>
Contact: ANDREA LEROY	3 Hours <input type="checkbox"/>	72 Hours <input type="checkbox"/>
Address: 18 WOODS LAKE RD. GREENVILLE, SC 29607	6 Hours <input type="checkbox"/>	96 Hours <input type="checkbox"/>
	12 Hours <input type="checkbox"/>	120 Hours <input checked="" type="checkbox"/>
	24 Hours <input type="checkbox"/>	144+ Hours <input type="checkbox"/>

PO Number: 65V-0174
 Project Name/Number: LESTER ROAD S-45
 BRIDGE No 1770004500200

PERFORM PLM & TEM AT THE SAME TIME

Sample ID #	Volume/Area	Comments
M-1	REFLECTOR BLACK MASTIC	1 REFLECTOR
M-2		ON BRIDGE
M-3		
AS-4	ASPHALT	ROADWAY
AS-5		ABOVE CONCRETE DECK
CON-7	CONCRETE	BRIDGE DECK (TOP)
CON-8		(BOTTOM)
CON-9		RAIL
CON-10		BRIDGE DECK (TOP)
CON-11		SUPPORT BEAM (BOTTOM)

Accepted
 Rejected

Total # of Samples _____

Relinquished by	Date/Time	Received by	Date/Time
ANDREA LEROY	2/24/18 12:00pm	B. Hulley	2/26 1030A



Scientific Analytical Institute
4604 Dundas Dr, Greensboro, NC 27407
Phone: 336.292.3888 Fax: 336.292.3313
www.sailab.com lab@sailab.com

Lab Use Only
Lab Order ID:
Client Code:

11804145

Sample ID #	Description/Location	Volume/Area	Comments
M-12	BLACK MASTIC		BOTTOM OF
M-13	↓		BRIDGE DECK
TEM M-14	↓		UNDER BLACK
			MATT
BM-15	BLACK MAT		BTWN- BLACK
TEM BM-16	↓		MASTIC &
BM-17	↓		DECK / BEAMS
FP-18	FELT PAPER		ISOLATED TO
FP-19	↓		TOP OF OLD
TEM FP-20	↓		WOOD PIERS
G-21	GASKET		WATER LINE
G-22	↓		PARALLEL TO
TEM G-23	↓		BRIDGE



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



Customer: Froehling & Robertson
18 Woods Lake Rd
Greenville, SC 29607

Attn: Andrea LeCroy

Lab Order ID: 11804748
Analysis ID: 11804748_PLM
Date Received: 2/26/2018
Date Reported: 3/2/2018

Project: Beridge No. 1770004500300 Lester Road S-45

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
CON-1	Concrete	None Detected		100% Other	Gray Non Fibrous Heterogeneous
11804748PLM_1					Crushed
CON-2	Concrete	None Detected		100% Other	Gray Non Fibrous Heterogeneous
11804748PLM_2					Crushed
CON-3	Concrete	None Detected		100% Other	Gray Non Fibrous Heterogeneous
11804748PLM_3					Crushed
CON-4	Concrete	None Detected		100% Other	Gray Non Fibrous Heterogeneous
11804748PLM_4					Crushed
CON-5	Concrete	None Detected		100% Other	Gray Non Fibrous Heterogeneous
11804748PLM_5					Crushed
AS-6	Asphalt	None Detected		100% Other	Black, Brown Non Fibrous Heterogeneous
11804748PLM_6					Ashed
AS-7	Asphalt	None Detected		100% Other	Brown, Black Non Fibrous Heterogeneous
11804748PLM_7					Ashed
AS-8	Asphalt	Not Analyzed			
11804748PLM_8	TEM				

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAL. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Byron Stroble (23)

Analyst

Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



Customer: Froehling & Robertson
18 Woods Lake Rd
Greenville, SC 29607

Attn: Andrea LeCroy

Lab Order ID: 11804748
Analysis ID: 11804748_PLM
Date Received: 2/26/2018
Date Reported: 3/2/2018

Project: Beridge No. 1770004500300 Lester Road S-45

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
M-9	Reflector black mastic	None Detected		100% Other	Gray, Black Non Fibrous Heterogeneous
11804748PLM_9					Dissolved
M-10	Reflector black mastic	None Detected		100% Other	Gray, Black Non Fibrous Heterogeneous
11804748PLM_10					Dissolved
M-11	Reflector black mastic	Not Analyzed			
11804748PLM_11	TEM				
BM-12	Black mat	None Detected		100% Other	Black Non Fibrous Homogeneous
11804748PLM_12					Ashed
BM-13	Black mat	None Detected		100% Other	Black Non Fibrous Homogeneous
11804748PLM_13					Ashed
BM-14	Black mat	Not Analyzed			
11804748PLM_14	TEM				
M-15	Black mastic	None Detected		100% Other	Black Non Fibrous Heterogeneous
11804748PLM_15					Dissolved
M-16	Black mastic	None Detected		100% Other	Black Non Fibrous Heterogeneous
11804748PLM_16					Dissolved

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAL. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Byron Stroble (23)

Analyst

Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



Customer: Froehling & Robertson
18 Woods Lake Rd
Greenville, SC 29607

Attn: Andrea LeCroy

Lab Order ID: 11804748
Analysis ID: 11804748_PLM
Date Received: 2/26/2018
Date Reported: 3/2/2018

Project: Beridge No. 1770004500300 Lester Road S-45

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
M-17	Black mastic	Not Analyzed			
11804748PLM_17	TEM				
F-18	Felt paper	None Detected	70% Cellulose	30% Other	Black Fibrous Heterogeneous
11804748PLM_18					Teased, Dissolved
F-19	Felt paper	None Detected	70% Cellulose	30% Other	Black Fibrous Heterogeneous
11804748PLM_19					Teased, Dissolved
F-20	Felt paper	Not Analyzed			
11804748PLM_20	TEM				
G-21	Gasket	None Detected		100% Other	Black Non Fibrous Homogeneous
11804748PLM_21					Ashed
G-22	Gasket	None Detected		100% Other	Black Non Fibrous Homogeneous
11804748PLM_22					Ashed
G-23	Gasket	Not Analyzed			
11804748PLM_23	TEM				

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAL. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Byron Stroble (23)

Analyst

Approved Signatory



Scientific Analytical Institute
 4604 Dundas Dr. Greensboro, NC 27407
 Phone: 336.292.3888 Fax: 336.292.3313
 www.sailab.com lab@sailab.com

Lab Use Only
 Lab Order ID: 11804748
 Client Code: _____

Company Contact Information	
Company: FROELING AND ROBERTSON	Contact: ANDREW LEROY
Address: 18 WOODS LAKE RD. GREENVILLE, SC 29607	Phone <input checked="" type="checkbox"/> : 864 704 1210 Fax <input type="checkbox"/> : Email <input checked="" type="checkbox"/> : alecroyle@andr.com

Asbestos Test Types	
PLM EPA 600/R-93/116 (PLM)	<input checked="" type="checkbox"/>
Positive stop	<input checked="" type="checkbox"/>
PLM Point Count 400 (PT4)	<input type="checkbox"/>
PLM Point Count 1000 (PTM)	<input type="checkbox"/>
PCM NIOSH 7400-A Rules (PCM)	<input type="checkbox"/>
B Rules (PCB) <input type="checkbox"/> TWA (PTA) <input type="checkbox"/>	
TEM AHERA (AHE)	<input type="checkbox"/>
TEM Level II (LII)	<input type="checkbox"/>
TEM NIOSH 7402 (TNI)	<input type="checkbox"/>
TEM Bulk Qualitative (TBL)	<input type="checkbox"/>
TEM Bulk Chatfield (TBS)	<input checked="" type="checkbox"/>
TEM Bulk Quantitative (TBQ)	<input type="checkbox"/>
TEM Wipe ASTM D6480-05	<input type="checkbox"/>
TEM Microvac ASTM D5755-02	<input type="checkbox"/>
TEM Water EPA 100.2 (TW1)	<input type="checkbox"/>
Other:	<input type="checkbox"/>

Billing/Invoice Information	Turn Around Times	
Company: FROELING AND ROBERTSON	90 Min. <input type="checkbox"/>	48 Hours <input type="checkbox"/>
Contact:	3 Hours <input type="checkbox"/>	72 Hours <input type="checkbox"/>
Address:	6 Hours <input type="checkbox"/>	96 Hours <input type="checkbox"/>
	12 Hours <input type="checkbox"/>	120 Hours <input checked="" type="checkbox"/>
	24 Hours <input type="checkbox"/>	144+ Hours <input type="checkbox"/>

PO Number: 65V-0174
 Project Name/Number: BRIDGE NO. 1770004500300
 LESTER ROAD S-45

PERFORM PLM & TEM AT THE SAME TIME

Sample ID #	Volume/Area	Comments
CON-1	CONCRETE	RAIL
CON-2		BRIDGE DECK (TOP)
CON-3		BRIDGE DECK (TOP)
CON-4		COLUMN (BOTTOM)
CON-5		BRIDGE DECK (BOTTOM)
AS-6	ASPHALT	ROADWAY
AS-7		
TEM AS-8	REFLECTOR BLACK MASTIC	
M-9		2 REFLECTORS
M-10		
TEM M-11		

Total # of Samples _____

Relinquished by	Date/Time	Received by	Date/Time
ANDREW LEROY	2/24/18 12:00pm	PAUL M... (signature)	2/26/18 10:30 AM

Page 1 of 2
 A-F-017 EXP: 12-1-13
 Accepted
 Rejected

11804748



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4604 Dundas Dr. Greensboro, NC 27407
Phone: 336.292.3888 Fax: 336.292.3313
www.sailab.com lab@sailab.com

Lab Use Only
Lab Order ID: _____
Client Code: _____

Sample ID #	Description/Location	Volume/Area	Comments
EM BM-12	BLACK MAT		UNDER BRIDGE
EM BM-13	↓		DECK & BEAMS
EM BM-14	↓		↓
M-15	BLACK MASTIC		BENEATH
EM M-16	↓		BLACK MAT
EM M-17	↓		↓
F-18	FELT PAPER		WOOD PIERS
EM F-19	↓		↓
EM F-20	↓		↓
G-21	BASKET		WATER LINE
EM G-22	↓		TO PARALLEL
EM G-23	↓		TO BRIDGE



Bulk Asbestos Analysis by Transmission Electron Microscopy

Semi-Quantitative
Chatfield SOP 1988-02 Rev. 1

Customer: Froehling & Robertson
18 Woods Lake Rd
Greenville, SC 29607

Attn: Andrea LeCroy

Lab Order ID: 11804746

Analysis ID: 11804746_TB

Date Received: 2/26/2018

Date Reported: 3/2/2018

Project: Lester Road S-45 Bridge Na 1770004500200

Sample ID	Description	Organic	Acid Sol.	Asbestos	LCL-UCL
<i>Lab Sample ID</i>	<i>Lab Notes</i>	<i>(Wt. %)</i>	<i>(Wt. %)</i>	<i>(Wt. %)</i>	<i>(Wt. %)</i>
M-3	Reflector black mastic	27%	-	None Detected	
11804746TBS_1					
AS-6	Asphalt	5.6%	-	None Detected	
11804746TBS_2					
M-14	Black mastic	66%	-	None Detected	
11804746TBS_3					
BM-17	Black mat	66%	-	None Detected	
11804746TBS_4					
FP-20	Felt paper	96%	-	None Detected	
11804746TBS_5					
G-23	Gasket	99%	-	None Detected	
11804746TBS_6					

Disclaimer: This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government.

Ired Gulley (6)

Analyst

Scientific Analytical Institute, Inc.

Approved Signatory

(336) 292-3888



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 Phone: 336.292.3888 Fax: 336.292.3313
 www.sailab.com lab@sailab.com

Lab Use Only
 Lab Order ID: 11804746
 Client Code:

Company Contact Information	
Company: FROEHLING & ROBERTSON	Contact: ANDREA LECROY
Address: 18 WOODS LAKE RD. GREENVILLE, SC 29607	Phone: 864-704-1210 Fax: Email: ALECROY@FMR.COM

Asbestos Test Types	
PLM EPA 600/R-93/116 (PLM)	<input checked="" type="checkbox"/>
Positive stop	<input checked="" type="checkbox"/>
PLM Point Count 400 (PT4)	<input type="checkbox"/>
PLM Point Count 1000 (PTM)	<input type="checkbox"/>
PCM NIOSH 7400-A Rules (PCM)	<input type="checkbox"/>
B Rules (PCB) <input type="checkbox"/>	TWA (PTA) <input type="checkbox"/>
TEM AHERA (AHE)	<input type="checkbox"/>
TEM Level II (LII)	<input type="checkbox"/>
TEM NIOSH 7402 (TNI)	<input type="checkbox"/>
TEM Bulk Qualitative (TBL)	<input type="checkbox"/>
TEM Bulk Charfield (TBS)	<input checked="" type="checkbox"/>
TEM Bulk Quantitative (TBQ)	<input type="checkbox"/>
TEM Wipe ASTM D6480-05	<input type="checkbox"/>
TEM Microvac ASTM D5755-02	<input type="checkbox"/>
TEM Water EPA 100.2 (TW1)	<input type="checkbox"/>
Other:	<input type="checkbox"/>

Billing/Invoice Information	Turn Around Times
Company: FROEHLING & ROBERTSON	90 Min. <input type="checkbox"/> 48 Hours <input type="checkbox"/>
Contact: ANDREA LECROY	3 Hours <input type="checkbox"/> 72 Hours <input type="checkbox"/>
Address: 18 WOODS LAKE RD. GREENVILLE, SC 29607	6 Hours <input type="checkbox"/> 96 Hours <input type="checkbox"/>
	12 Hours <input type="checkbox"/> 120 Hours <input checked="" type="checkbox"/>
	24 Hours <input type="checkbox"/> 144 Hours <input type="checkbox"/>

PO Number: 65V-0174
 Project Name/Number: LESTER ROAD S-45
 BRIDGE No 1770004500200

PERFORM PLM & TEM AT THE SAME TIME

Sample ID #	Volume/Area	Comments
M-1	REFLECTOR	BLACK MASTIC
M-2		↓
TEM M-3		REFLECTOR ON BRIDGE
AS-4		↓
AS-5		ASPHALT ROADWAY
TEM AS-6		↓
CON-7		CONCRETE
CON-8		↓
CON-9		CONCRETE
CON-10		↓
CON-11		CONCRETE

Accepted BRIDGE DECK (TOP)
 Rejected RAIL BRIDGE DECK (TOP)
 Support BEAM (Bottom)
 Total # of Samples _____

Relinquished by	Date/Time	Received by	Date/Time
ANDREA LECROY	2/24/18 12:00pm	B. Bulley	2/26 1030A



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Lab Use Only
Lab Order ID:
Client Code:

11804746

Sample ID #	Description/Location	Volume/Area	Comments
M-12	BLACK MASTIC		BOTTOM OF
TEM M-13	↓		BRIDGE DECK
M-14	↓		UNDER BLACK
			MATT
BM-15	BLACK MAT		BTWN- BLACK
TEM BM-16	↓		MASTIC &
BM-17	↓		DECK / BEAMS
FP-18	FELT PAPER		ISOLATED TO
TEM FP-19	↓		TOP OF OLD
FP-20	↓		WOOD PIERS
G-21	GASKET		WATER LINE
TEM G-22	↓		PARALLEL TO
G-23	↓		BRIDGE



Bulk Asbestos Analysis by Transmission Electron Microscopy

Semi-Quantitative
Chatfield SOP 1988-02 Rev. 1

Customer: Froehling & Robertson
18 Woods Lake Rd
Greenville, SC 29607

Attn: Andrea LeCroy

Lab Order ID: 11804750

Analysis ID: 11804750_TB

Date Received: 2/26/2018

Date Reported: 3/2/2018

Project: Bridge No. 1770004500300 Lester Road S-45

Sample ID	Description	Organic	Acid Sol.	Asbestos	LCL-UCL
<i>Lab Sample ID</i>	<i>Lab Notes</i>	<i>(Wt. %)</i>	<i>(Wt. %)</i>	<i>(Wt. %)</i>	<i>(Wt. %)</i>
AS-8	Asphalt	6.2%	-	None Detected	
11804750TBS_1					
M-11	Reflector black mastic	21%	-	None Detected	
11804750TBS_2					
BM-14	Black mat	67%	-	None Detected	
11804750TBS_3					
M-17	Black mastic	63%	-	None Detected	
11804750TBS_4					
F-20	Felt paper	94%	-	None Detected	
11804750TBS_5					
G-23	Gasket	98%	-	None Detected	
11804750TBS_6					

Disclaimer: This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government.

Ired Gulley (6)

Analyst

Scientific Analytical Institute, Inc. 4604 Dundas Dr. Greensboro, NC 27407 (336) 292-3888

Approved Signatory



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Lab Use Only
 Lab Order ID: 11804750
 Client Code: _____

Company Contact Information	
Company: FROEHLING AND ROBERTSON	Contact: ANDREW LEROY
Address: 18 WOODS LAKE RD. GREENVILLE, SC 29607	Phone <input checked="" type="checkbox"/> : 864 704 1210
	Fax <input type="checkbox"/> :
	Email <input checked="" type="checkbox"/> : jleeroy@fandr.com

Asbestos Test Types	
PLM EPA 600/R-93/116 (PLM)	<input checked="" type="checkbox"/>
Positive stop	<input checked="" type="checkbox"/>
PLM Point Count 400 (PT4)	<input type="checkbox"/>
PLM Point Count 1000 (PTM)	<input type="checkbox"/>
PCM NIOSH 7400-A Rules (PCM)	<input type="checkbox"/>
B Rules (PCB) <input type="checkbox"/> TWA (PTA) <input type="checkbox"/>	
TEM AHERA (AHE)	<input type="checkbox"/>
TEM Level II (LII)	<input type="checkbox"/>
TEM NIOSH 7402 (TNI)	<input type="checkbox"/>
TEM Bulk Qualitative (TBL)	<input type="checkbox"/>
TEM Bulk Chatfield (TBS)	<input checked="" type="checkbox"/>
TEM Bulk Quantitative (TBO)	<input type="checkbox"/>
TEM Wipe ASTM D6480-05	<input type="checkbox"/>
TEM Microvac ASTM D5755-02	<input type="checkbox"/>
TEM Water EPA 100.2 (TW1)	<input type="checkbox"/>
Other:	<input type="checkbox"/>

Billing/Invoice Information	Turn Around Times	
Company: FROEHLING AND ROBERTSON	90 Min. <input type="checkbox"/>	48 Hours <input type="checkbox"/>
Contact:	3 Hours <input type="checkbox"/>	72 Hours <input type="checkbox"/>
Address:	6 Hours <input type="checkbox"/>	96 Hours <input type="checkbox"/>
	12 Hours <input type="checkbox"/>	120 Hours <input checked="" type="checkbox"/>
	24 Hours <input type="checkbox"/>	144+ Hours <input type="checkbox"/>

PO Number: 05V-0174
 Project Name/Number: BRIDGE NO. 177004500300
 LESTER ROAD S-45

PERFORM PLM & TEM AT THE SAME TIME

Sample ID #	Volume/Area	Comments
CON-1	CONCRETE	RAIL
CON-2		BRIDGE DECK (TOP)
CON-3		BRIDGE DECK (TOP)
CON-4		COLUMN (BOTTOM)
CON-5		BRIDGE DECK (BOTTOM)
AS-6	ASPHALT	ROADWAY
AS-7		
EM AS-8	REFLECTOR BLACK MASTIC	
M-9		2 REFLECTORS
M-10		
TEM M-11		

Total # of Samples _____

Relinquished by	Date/Time	Received by	Date/Time
ANDREW LEROY	2/24/18 12:00pm	BOBULLBY	2/26/18 10:30A

Accepted
 Rejected
 Page 1 of 2
 A-F-017 EXP: 12-1-13



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Lab Use Only
Lab Order ID: 11804156
Client Code: _____

Sample ID #	Description/Location	Volume/Area	Comments
BM-12	BLACK MAT		UNDER BRIDGE
EM BM-13	↓		DECK & BEAMS
EM BM-14	↓		↓
M-15	BLACK MASTIC		BENEATH
EM M-16	↓		BLACK MAT
M-17	↓		↓
F-18	FELT PAPER		WOOD PIERS
EM F-19	↓		↓
F-20	↓		↓
G-21	BASKET		WATER LINE
EM G-22	↓		PARALLEL
G-23	↓		TO BRIDGE

Appendix D

Photographic Documentation



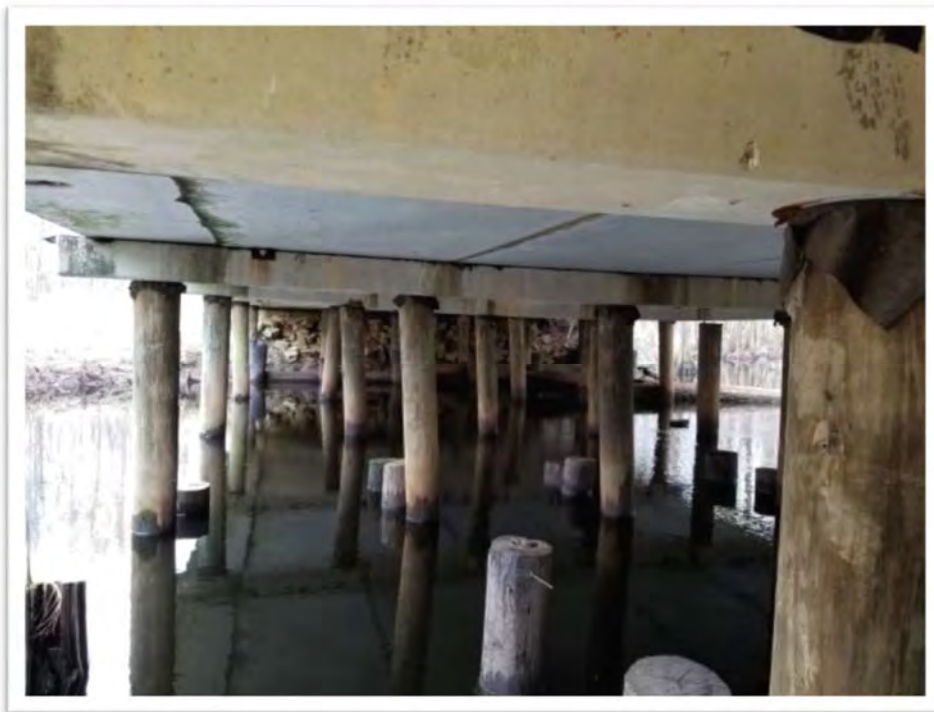
Photograph #01 View of Bridge 2 – Structure No. 1770004500200 – Looking Northeast



Photograph #02 View of Placard on Bridge 2 – Bridge 2 is Located Over the Middle Section of the Little Pee Dee Swamp



Photograph #03 View of Underside of Bridge 2 – Looking Northwest



Photograph #04 Underside of Bridge 2 – Looking Southwest



Photograph #05 Additional View of Bridge 2 – Looking Northeast



Photograph #06 Bridge 2 Abutment – Northeast End of Bridge



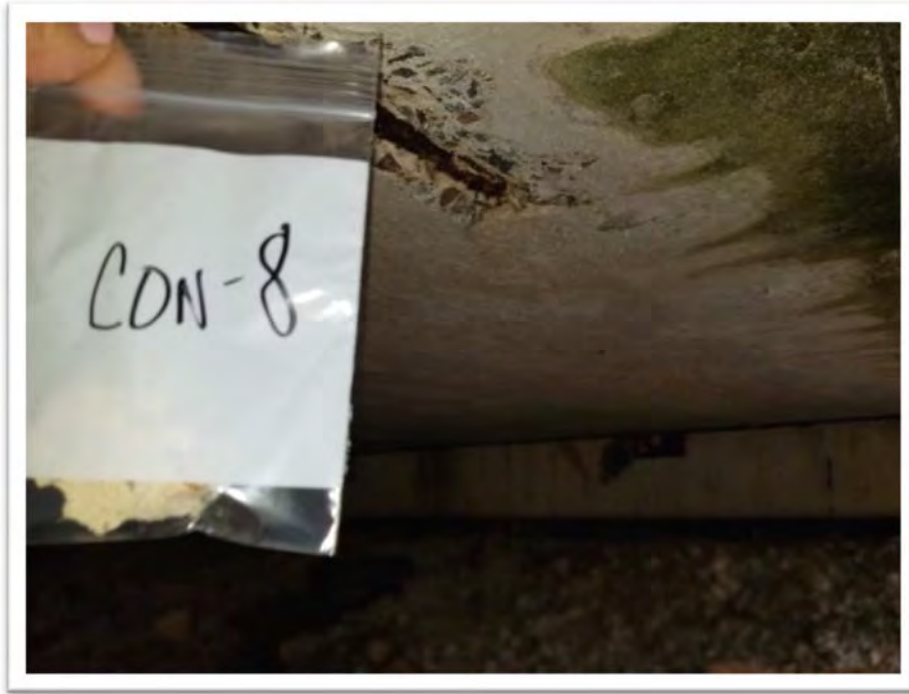
Photograph #07

View of Sample M-1 – Black Mastic Sampling Point Associated with One Observed Reflector on Bridge 2 (None Detected)



Photograph #08

View of Sample AS-4 – Asphalt Sampling Point on the Paved Roadway at the South End of Bridge 2 (None Detected)



Photograph #09 View of Sample CON-8 – Concrete Sampling Point on the Underside of the Deck of Bridge 2 (None Detected)



Photograph #10 Sample M-14– Black Mastic Sampling Point Between Concrete Beams and the Black Bearing Pad on the Underside of the Deck on Bridge 2 (None Detected)



Photograph #11 Sample BM-16 – Black Bearing Pad Sampling Point Between the Deck of Bridge 2 and the Abutment at the North End of the Bridge, East Side (None Detected)



Photograph #12 Sample G-21 – Rubber Gasket Sampling Point on the Water Line Parallel to the West Side of Bridge 2 (None Detected)



Photograph #13 View of Water Line Along the South Side of Bridge 2 – Looking Southwest



Photograph #14 Sample FP-18 – Felt Paper Sampling Point Located Between Wood Bent and Concrete Beam on Bridge 2 (None Detected)



Photograph #15 Bridge 3, Structure No. 1770004500300 – Looking Northeast



Photograph #16 Bridge 3, Structure No. 1770004500300 – Looking Southeast



Photograph #17

View of the Placard on Bridge 3 – Bridge 3 is Located over the Northern Portion of the Little Pee Dee Swamp



Photograph #18

View of Underside of Bridge 3 – Looking Southwest



Photograph #19 View of the Metal and Concrete Railing on Bridge 3 – Looking North



Photograph #20 Sample CON-4 – View of Concrete Sampling Point on a Beam on the Underside of Bridge 3 (None Detected)



Photograph #21 Sample AS-6 – Asphalt Sampling Point on the Southwest End of Bridge 3
(None Detected)



Photograph #22 Sample M-11 – Black Mastic Sampling Point at a Reflector on the Roadway of
Bridge 3 (None Detected)



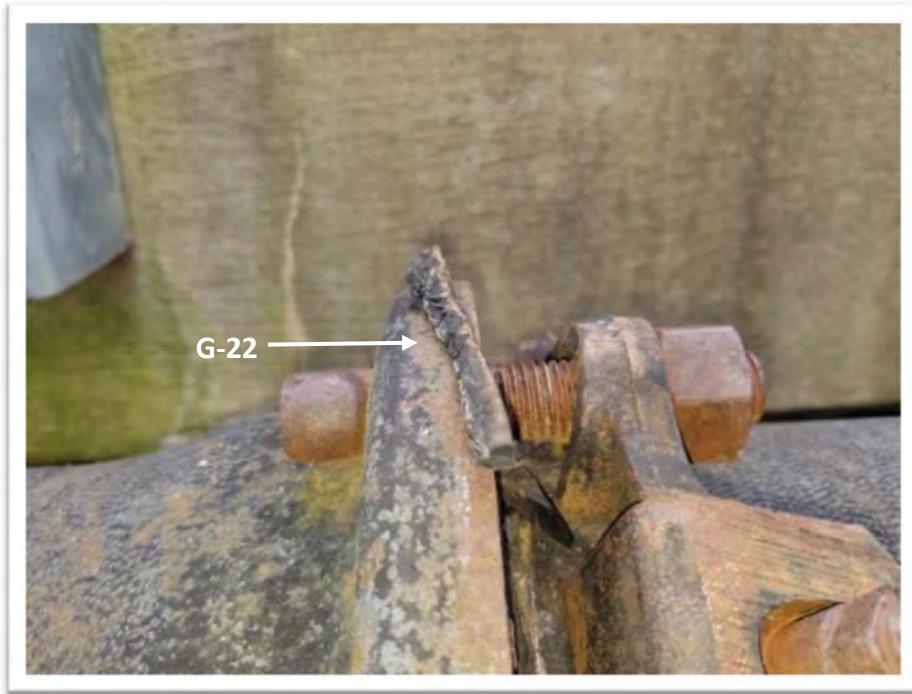
Photograph #23 Sample BM-14 – Black Bearing Pad Sampling Point Between the Deck of Bridge 2 and the Abutment at the Northeast End of the Bridge (None Detected)



Photograph #24 Sample M-16 – Black Mastic Sampling Point Between Concrete Beams and the Black Bearing Pad on the Underside of the Deck on Bridge 2 (None Detected)



Photograph #25 Sample F-18 – Felt Paper Sampling Point Located Between Wood Piers and Concrete Beams on Bridge 3 (None Detected)



Photograph #26 Sample G-22 – Gasket Sampling Point on the Water Line Parallel to the West Side of Bridge 3 (None Detected)

Appendix E

Explanation of XRF Data Table

XRF Data Table

XRF Performance Characteristic Sheet

EXPLANATION OF XRF DATA TABLES

Column	Description
Reading No	Sample numbers
Mode	Data platform used for sample analyses
Date & Time	Date and Time of the reading
Project	Location of the Site
Unit	Description of the general area of the reading
Location	Description of how the area of the reading is situated in relation to the structure
Wall	Orientation of where the reading was collected from
Component	Structural or design element the reading was collected from
Substrate	The type of material underlying the paint or coating
Color	Color of the coated surface
Notes	Additional Records for Tested Components
Concentration (Pb)	XRF reading of lead level (in milligrams per square centimeter (mg/cm ²))
Pb +/-	Variance of the accuracy of the reading
Live Time	Amount of time it took for the XRF to take the reading
Units	Unit of measure that the XRF uses to report readings: mg/cm ² .
Result	Result of the reading: NEG = negative POS = positive NULL = incomplete test/reading error

Reading No.	Mode	Date	Time	Project	Unit	Location	Wall	Component	Substrate	Color	Notes	Lead (Pb) Concentration mg/cm ²	Pb +/-	LiveTime	Match1	Pass/Fail	Results
1	Standardization	22-Feb-18	13:17:21	XRF Standardization										49.37	0.019743	-0.01956	PASS
2	Lead Paint Fixed-Time	22-Feb-18	13:27:07	Calibration				Cal NIST 1.04	red card		Calibration	1.11	0.04	24.12	1.11	surface	Positive
3	Lead Paint Fixed-Time	22-Feb-18	13:52:30	Lester Road Bridges	Bridge 2	Exterior	Floor	Pavement	Asphalt	Black	Surface Test Reading	0	0	25.51	0		Negative
4	Lead Paint Fixed-Time	22-Feb-18	13:53:15	Lester Road Bridges	Bridge 2	Exterior	Floor	Pavement	Asphalt	Black	Surface Test Reading	0	0	25.25	0		Negative
5	Lead Paint Fixed-Time	22-Feb-18	13:54:00	Lester Road Bridges	Bridge 2	Exterior	Floor	Pavement	Asphalt	Black	Surface Test Reading	0	0	25.46	0		Negative
6	Lead Paint Fixed-Time	22-Feb-18	13:55:52	Lester Road Bridges	Bridge 2	Exterior	Floor	Stripe	Asphalt	yellow		0	0	24.82	0		Negative
7	Lead Paint Fixed-Time	22-Feb-18	13:57:24	Lester Road Bridges	Bridge 2	Exterior	Floor	Stripe	Asphalt	white		0	0	24.75	0		Negative
8	Lead Paint Fixed-Time	22-Feb-18	13:58:58	Lester Road Bridges	Bridge 2	Exterior	Floor	Stripe	Asphalt	yellow		0	0	25.1	0		Negative
9	Lead Paint Fixed-Time	22-Feb-18	14:02:30	Lester Road Bridges	Bridge 2	Exterior	Floor	Stripe	Asphalt	white		0	0	25.05	0		Negative
10	Lead Paint Fixed-Time	22-Feb-18	14:07:44	Lester Road Bridges	Bridge 3	Exterior	Floor	Stripe	Asphalt	yellow		0	0	25.22	0		Negative
11	Lead Paint Fixed-Time	22-Feb-18	14:09:51	Lester Road Bridges	Bridge 3	Exterior	Floor	Stripe	Asphalt	white		0	0	24.77	0		Negative
12	Lead Paint Fixed-Time	22-Feb-18	14:12:59	Lester Road Bridges	Bridge 3	Exterior	Floor	Stripe	Asphalt	white		0	0	24.75	0		Negative
13	Lead Paint Fixed-Time	22-Feb-18	14:14:00	Lester Road Bridges	Bridge 3	Exterior	Floor	Stripe	Asphalt	yellow		0	0	25.06	0		Negative
14	Lead Paint Fixed-Time	22-Feb-18	14:15:31	Lester Road Bridges	Bridge 2	Exterior	Rail	Railing	Metal	Gray	Electroplated Coating	0.18	0.02	19.2	0.18	surface	Negative
15	Lead Paint Fixed-Time	22-Feb-18	14:17:15	Lester Road Bridges	Water Pipe	Exterior	Pipe	Water Pipe	Metal	Black	Electroplated Coating	0	0	24.1	0	surface	Negative
16	Lead Paint Fixed-Time	22-Feb-18	14:56:39	Lester Road Bridges	Bridge 3	Exterior	Rail	Railing	Metal	Gray	Electroplated Coating	0.24	0.03	14.43	0.24	surface	Negative
17	Lead Paint Fixed-Time	22-Feb-18	14:57:55	Lester Road Bridges	Bridge 2	Exterior	Rail	Post	Metal	Gray	Electroplated Coating	0.18	0.04	14.72	0.18	surface	Negative

Performance Characteristic Sheet

EFFECTIVE DATE: October 12, 2006

EDITION NO.: 1

MANUFACTURER AND MODEL:

Make: *Innov-X Systems, Inc.*
 Models: *LBP4000 with software version 1.4 and higher*
 Source: *X-ray tube (no radioactive isotopes)*

FIELD OPERATION GUIDANCE

OPERATING PARAMETERS:

Inspection mode, variable reading time.

XRF CALIBRATION CHECK LIMITS:

1.0 to 1.1 mg/cm² (inclusive)

SUBSTRATE CORRECTION:

Not applicable

INCONCLUSIVE RANGE OR THRESHOLD:

INSPECTION MODE READING DESCRIPTION	SUBSTRATE	INCONCLUSIVE RANGE (mg/cm ²)
Results not corrected for substrate bias on any substrate	Brick	0.6 to 1.1
	Concrete	0.6 to 1.1
	Drywall	0.6 to 1.1
	Metal	0.6 to 1.1
	Plaster	0.6 to 1.1
	Wood	0.6 to 1.1

BACKGROUND INFORMATION

EVALUATION DATA SOURCE AND DATE:

This sheet is supplemental information to be used in conjunction with Chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("HUD Guidelines"). Performance parameters shown on this sheet are calculated from the EPA/HUD evaluation using archived building components. Testing was conducted on 146 test locations, with two separate instruments, in December 2005.

OPERATING PARAMETERS:

Performance parameters shown in this sheet are applicable only when properly operating the instrument using the manufacturer's instructions and procedures described in Chapter 7 of the HUD Guidelines.

XRF CALIBRATION CHECK:

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm² in the NIST Standard Reference Material (SRM) used (e.g., for NIST SRM 2579, use the 1.02 mg/cm² film).

If the average (rounded to 1 decimal place) of three readings is outside the acceptable calibration check range, follow the manufacturer's instructions to bring the instrument into control before XRF testing proceeds.

SUBSTRATE CORRECTION VALUE COMPUTATION:

Chapter 7 of the HUD Guidelines provides guidance on correcting XRF results for substrate bias. Supplemental guidance for using the paint film nearest 1.0 mg/cm² for substrate correction is provided:

XRF results are corrected for substrate bias by subtracting from each XRF result a correction value determined separately in each house for single-family housing or in each development for multifamily housing, for each substrate. The correction value is an average of XRF readings taken over the NIST SRM paint film nearest to 1.0 mg/cm² at test locations that have been scraped bare of their paint covering. Compute the correction values as follows:

Using the same XRF instrument, take three readings on a bare substrate area covered with the NIST SRM paint film nearest 1 mg/cm². Repeat this procedure by taking three more readings on a second bare substrate area of the same substrate covered with the NIST SRM.

Compute the correction value for each substrate type where XRF readings indicate substrate correction is needed by computing the average of all six readings as shown below.

For each substrate type (the 1.02 mg/cm² NIST SRM is shown in this example; use the actual lead loading of the NIST SRM used for substrate correction):

$$\text{Correction value} = (1\text{st} + 2\text{nd} + 3\text{rd} + 4\text{th} + 5\text{th} + 6\text{th Reading}) / 6 - 1.02 \text{ mg/cm}^2$$

Repeat this procedure for each substrate requiring substrate correction in the house or housing development.

EVALUATING THE QUALITY OF XRF TESTING:

Randomly select ten testing combinations for retesting from each house or from two randomly selected units in multifamily housing.

Take one XRF reading on each of the ten testing combinations selected for retesting.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below.

Compute the Retest Tolerance Limit by the following steps:

Calculate the average of the original XRF reading and the retest XRF reading for each testing combination.

Square the average for each testing combination.

Add the ten squared averages together. Call this quantity C.

Multiply the number C by 0.0072. Call this quantity D.

Add the number 0.032 to D. Call this quantity E.

Take the square root of E. Call this quantity F.

Multiply F by 1.645. The result is the Retest Tolerance Limit.

Compute the average of all ten original XRF readings.

Compute the average of all ten re-test XRF readings.

Find the absolute difference of the two averages.

If the difference is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

TESTING TIMES:

For the variable-time inspection paint test mode, the instrument continues to read until it has determined whether the result is positive or negative (with respect to the 1.0 mg/cm² Federal standard), with 95% confidence. The following table provides testing time information for this testing mode.

Testing Times Using Variable Reading Time Inspection Mode (Seconds)						
Substrate	All Data			Median for laboratory-measured lead levels (mg/cm ²)		
	25 th Percentile	Median	75 th Percentile	Pb < 0.25	0.25 ≤ Pb < 1.0	1.0 ≤ Pb
Wood, Drywall	2.1	2.3	5.4	2.2	5.4	2.2
Metal	2.6	3.2	5.3	2.7	5.1	5.1
Brick, Concrete, Plaster	3.1	4.0	5.7	3.2	4.0	5.9

CLASSIFICATION OF RESULTS:

When an inconclusive range is specified on the *Performance Characteristic Sheet*, XRF results are classified as positive if they are greater than the upper boundary of the inconclusive range, negative if they are less than the lower boundary of the inconclusive range, or inconclusive if in between. The inconclusive range includes both its upper and lower bounds. If the instrument reads "> x mg/cm²", the value "x" should be used for classification purposes, ignoring the ">". For example, a reading reported as ">1.0 mg/cm²" is classified as 1.0 mg/cm², or inconclusive. When the inconclusive range reported in this PCS is used to classify the readings obtained in the EPA/HUD evaluation, the following False Positive, False Negative and Inconclusive rates are obtained:

- FALSE POSITIVE RATE: 2.5% (2/80)
- FALSE NEGATIVE RATE: 1.9% (4/212)
- INCONCLUSIVE RATE: 16.4% (48/212)

DOCUMENTATION:

A document titled *Methodology for XRF Performance Characteristic Sheets* provides an explanation of the statistical methodology used to construct the data in the sheets, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. For a copy of this document call the National Lead Information Center Clearinghouse at 1-800-424-LEAD.

This XRF Performance Characteristic Sheet was developed by the Midwest Research Institute (MRI) and QuanTech, Inc., under a contract between MRI and the XRF manufacturer. XRF Performance Characteristic Sheets were originally developed by the MRI under a grant from the U. S. Environmental Protection Agency and the U.S. Department of Housing and Urban Development. HUD has determined that the information provided here is acceptable when used as guidance in conjunction with Chapter 7, Lead-Based Paint Inspection, of HUD's *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*.