



**ASBESTOS CONTAINING MATERIAL SURVEY
AND
LEAD BASED PAINT SURVEY REPORT**

SC 277 Northbound Over I-77 Bridge Replacement
Richland County, South Carolina



PREPARED FOR:

South Carolina Department of Transportation
955 Park Street, Room 421
Columbia, South Carolina 29201
Phone: 803.737.0766
Email: HarrisMD@scdot.org
ISSUE DATE: January 3, 2018

F&R PROJECT NUMBER: 65V-0109

SCDOT PROJECT ID: P030487

Yes, Asbestos was found
 No, Asbestos was not found

Yes, Lead-Based Paint was found
 No, Lead-Based Paint was not found

CONDUCTED/PREPARED BY:

REVIEWED BY:

ANDRÉA LECROY
ENVIRONMENTAL SCIENTIST
SC ASBESTOS INSPECTOR BI-01080

JESSE D. PHILLIPS
SENIOR ENVIRONMENTAL PROFESSIONAL



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1.0 EXECUTIVE SUMMARY

Froehling & Robertson, Inc. (F&R) conducted a limited Pre-Demolition Asbestos Containing Material (ACM) Survey and a Lead Based Paint (LBP) Survey on November 6 and December 3, 2017 for the northbound SC 277 Bridge over Interstate 77 (I-77, Charles F. Bolden Freeway) in Richland County, South Carolina at approximately 34°5'36.85"N, 80°57'16.03"W (Subject Property). It is F&R's understanding that the bridge will be replaced and demolition activities will impact structure materials. The below sections document the survey procedures and results.

1.1. Purpose

It is F&R's understanding that the SC 277 Northbound Bridge over I-77 is the subject of a planned demolition wherein all structure components will be impacted. The purpose of the Pre-Demolition Asbestos Survey 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 Subject Property consists of hollow concrete box girder bridge with two northbound lanes (SC 277) that extend approximately 620 feet north across I-77. The bridge is approximately 40 feet wide and 18 feet in height. The superstructure and substructure are constructed of cast-in-place reinforced concrete. The superstructure consists of a hollow concrete girder with reinforcing steel and post-tensioning cables finished with a concrete bridge deck. The substructure includes abutment walls at the southern and northern end of the bridge which provide support to the approach embankments; three interior bents (columns); and wing walls which extend along the slope area leading to the abutment walls at the southern and northern ends of the bridge. The three interior bents support the vertical load of the bridge. Isolated areas of asphalt patched repair areas are located along the concrete bridge deck. A low reinforced concrete barrier rail with metal railing extends along both sides of the bridge deck. The superstructure totals approximately 198,400 SF and the substructure (abutments, bents, wing walls) total approximately 8,000 SF.

2.0 SCOPE OF SERVICES

As outlined in F&R proposal number 1765-00491, the survey included the following services:

- Identification and sampling as necessary of suspect ACMs associated with the SC 277 northbound bridge of I-77
- Testing of surface coatings for the presence of LBP associated with the SC 277 northbound bridge over I-77



Based on information provided by the client, it is our understanding that the SC 277 northbound bridge over I-77 will be replaced and will be subject of a demolition which will impact all structure components. As such, this asbestos containing material and lead based paint survey as performed constitutes a relatively comprehensive structure survey; however, this report shall not be utilized for the determination of presence or absence of asbestos or other Hazardous 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 PRE-RENOVATION ASBESTOS SURVEY

3.1. Asbestos Containing Materials (ACM) Methodology

F&R conducted a limited Pre-Demolition ACM survey of the SC 277 northbound bridge over I-77 located in Richland County, South Carolina on November 6, 2017. F&R returned to the Subject Property on Sunday, December 3, 2017 to sample the mastic associated with reflectors along the concrete roadway on the bridge deck. Due to a high volume of traffic, this material was not safely accessible on November 6, 2017. The purpose of the Pre-Demolition ACM Survey is to identify ACMs that may require appropriate removal, handling, and disposal procedures prior to planned demolition activities at the Subject Property. Federal Regulations (40 CFR Part 61, Subpart M – National Emission Standard for Asbestos (NESHAP)), as well as South Carolina Regulation 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.

The South Carolina Accredited Asbestos Building Inspector responsible for this project was Andréa LeCroy (SC Asbestos Building Inspector BI-01080). The noted Inspector was assisted by Terron Edwards of F&R. Refer to Appendix A for Personnel Accreditation documentation.

This survey was conducted in general accordance with the Federal NESHAP and 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*.



Twenty-five (25) bulk samples of suspect ACMs were collected at the site and analyzed for asbestos. At least three (3) samples of each suspect material were collected and analyzed. The suspect ACM samples were organized as per the AHERA concept of Homogeneous Area (HA) and submitted to 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, five (5) samples of non-friable organically bound (NOB) materials were designated for analysis by Transmission Electron Microscopy (TEM). A total of twenty-five (25) samples were analyzed. The analytical results are presented in Table I. Refer to Appendix A for Laboratory Accreditation documentation. A copy of the laboratory Asbestos Bulk Analysis Report and Chain of Custody Documentation is included in Appendix C.

3.2. Asbestos Findings

The following materials were identified, sampled, and accordingly homogenized based upon similar construction discovered during bulk sampling in the structure:

- Expansion Joint
- Concrete
- Cementitious Material
- Asphalt Patching
- Sealants
- Mastic

The following table presents a summary of survey results from sampling events performed on November 6 and December 3, 2017.

TABLE I: Asbestos Sample Results: November 6, 2017

Homogeneous Area #	Sample Number	Sample Type	Sample Location	Analytical Results
1	EJ-1 EJ-2 EJ-3	Expansion Joint	Bent 3 Bent 3 S. Abutment	NAD ²
2	CON-4 CON-5 CON-6 CON-7 CON-8 CON-9 CON-10	Concrete (Cast-In-Place)	Girder Girder Bridge Deck S. Abutment Bent 1 Bridge Deck S. Wing Wall	NAD
3	CEM-11 CEM-12 CEM-13	Gray Cementitious Material (Grout)	Bent 1 Bent 3 N. Abutment	NAD



Homogeneous Area #	Sample Number	Sample Type	Sample Location	Analytical Results
4	AP-14 AP-15 AP-16	Asphaltic Patching	Bridge Deck	NAD
5	BS-17 BS-18 BS-19*	Black Sealant	North and South End of Bridge at Bridge Approach	NAD
6	GS-20 GS-21 GS-22*	Gray Sealant	Isolated Area at the Top of the North Wing Wall	NAD
7	M-23 M-24 M-25*	Black Mastic	Reflectors Between Lanes on Concrete Roadway	NAD

²NAD: No Asbestos Detected; Analyzed by TEM: *

Refer to Appendix B: Bulk Sample Location Drawings to further describe the locations of collected bulk samples.

3.3. Asbestos Containing Materials

ACMs were not identified during this survey.

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 accessible finish surfaces;

Should additional suspect ACMs be discovered during demolition or cleanup activities, F&R recommends all work to cease. Samples of suspect materials should be collected by a South Carolina licensed asbestos inspector, 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 the ACMs prior to demolition activities.



4.0 LEAD-BASED PAINT SURVEY FINDINGS AND RESULTS

F&R also conducted a limited survey of the Subject Property for Lead-Based Paint (LBP) and other coatings. The purpose of the Limited Survey is to identify LBP that may require appropriate removal, handling, and disposal procedures prior to scheduled demolition activities at the Subject Property. Based on the nature of this survey, when one component tests positive for the presence of lead paint all similar painted components must be assumed to be positive, unless additional testing is performed.

F&R's Terron J. Edwards (EPA LBP Inspector LBP-I-1164100-1), performed the limited testing of surface coatings for lead on November 6, 2017.

4.1. Lead-Based Paint (LBP) 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 Olympus Innov-X Systems LBP-6000 X-Ray Fluorescence (XRF) Spectrometer Lead Analyzer. Only representative, accessible painted, coated, and/or varnished surfaces were tested using the XRF. Collected readings represent component 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. The XRF can measure surface or non-surface concentrations of lead with 95% accuracy at the HUD action level of 1.0 mg/cm². Levels of lead are reported in units of milligrams per square centimeter (mg/cm²). The XRF is able to accurately detect as little as 0.1 µg/cm² of lead. The XRF classifies coated surfaces as "positive", "negative", or "null" for lead content based on the action level (1.0 mg/cm²) 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 mg/cm² NIST Standard) supplied by the XRF manufacturer. It is noted that while in calibration mode, this instrument does not record calibration readings and as such the calibration readings are not included on the XRF Data Table. Additionally, the instrument was calibrated by the supplier, Pine Environmental Services, Inc., on November 3, 2017 prior to F&R's receipt of the equipment. A copy of the instrument calibration report and the XRF Performance Characteristic Sheet is included as an attachment in Appendix D of this report.



Positive: Lead is present at or above the action level of 1.0 mg/cm² on *one or more* of the components.

Negative: Lead is not present at or above the action level of 1.0 mg/cm² on any of the components.

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. Findings and Conclusions

4.2.1. XRF Survey Results

A total of twelve (12) XRF readings were collected from the painted materials associated with the bridge superstructure and substructure. One XRF test reading (#13) was inadvertently collected and was removed from the datasheet; these readings should be disregarded. Six (6) of the readings collected from coated structure materials tested at the Subject Property were positive for LBP when compared to the action level of 1.0 mg/cm². The samples that tested positive for lead are listed below in Table II. Refer to Appendix D, XRF Data Table for a complete listing of all samples and respective information as well as an explanation of the table and Performance Characteristic Sheet.

It should be noted that color descriptions are subjective and that, due to the nature of the environment, identical colors may have been labeled as different depending on the lighting, other colors in the area, and other factors.

Table II: F&R Lead Based Paint Positive Sampling Results

Reading #	Object	Substrate	Color	Sample Location	Wall	Lead Concentration mg/cm ²
3	Access Hatch Frame	Metal	Silver	Bridge Girder	Underside of Girder	5
4	Access Hatch Frame	Metal	Silver	Bridge Girder	Underside of Girder	5
5	Support Column	Metal	Silver	Between Bridge Girder and Abutments	Underside of Girder	5
11	Stripe on Bridge Roadway	Concrete	Yellow	Bridge Deck	Bridge Deck Road Surface	1



Reading #	Object	Substrate	Color	Sample Location	Wall	Lead Concentration mg/cm ²
14	Support Column	Metal	Silver	Between Bridge Girder and Abutment	Underside of Girder	5
15	Access Hatch	Metal	Silver	Bridge Girder	Underside of Girder	5

It is noted that two readings were taken for the yellow paint striping on the concrete roadway on the bridge deck. XRF test reading #11 detected a lead concentration of 1 mg/cm² and XRF test reading #12 was non-detect for lead. The difference in the results of these readings is attributable to historic layers of yellow paint that are present on the concrete roadway. The positive result obtained in test reading #11 supersedes the non-detect results of reading #12. Yellow striping on the concrete roadway on the bridge deck should be considered as lead based paint.

4.2.2. Locations of Detected Lead Based Paint (LBP)

Based on the detection of LBP on specific component types and our observation of an apparent homogenous painting history, the following structure components should be considered to be coated with LBP:

- Silver painted metal access hatch frames located along the perimeter of access ports to the interior of the hollow concrete girder
- Silver painted metal access hatch covers located at select access ports to the interior of the hollow concrete girder
- Silver painted metal support columns located between the bridge girder and pier footings and abutments
- Yellow striping located between the two northbound lanes on the concrete bridge roadway

4.3. Applicable Regulations

4.3.1. OSHA Regulations for Lead-Based Paint

While the majority of materials tested at the site were negative for lead based paint, any painted surface or material 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 (µg/m³) 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 any removal or demolition process (as appropriate) 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 all 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.

4.3.2. EPA Regulations for Lead-Based Paint

For disposal of construction/demolition debris that has LBP, the Environmental Protection Agency (EPA) requires that testing of lead content be performed 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.

5.0 LIMITATIONS

This report has been prepared for the exclusive use of the South Carolina Department of Transportation and/or their agents. This service was performed in accordance with generally accepted environmental practices. No other warranty, expressed or implied, is made. Our conclusions and recommendations are based, in part, upon information provided to us by others and our site observations. We have not verified the completeness or accuracy of the information provided by others, unless otherwise noted. Our observations and recommendations are based upon conditions readily visible at the site at the time of our site visit, and upon current industry standards.

During this study, suspect asbestos samples were submitted for analysis at an NVLAP-accredited laboratory via polarized light microscopy; suspect LBP was analyzed using industry standard methods and practices. Inaccessible areas, such as behind solid ceilings or behind solid walls were not surveyed, therefore some lead-containing materials may not have been identified. As with any similar survey of this nature, actual conditions exist only at the precise locations from which



samples were collected or tested. Areas inspected for LBP containing materials 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 structure 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, where appropriate, sample suspect materials within the structure with regard to the scope of services. However, for any facility, the existence of unique or concealed ACMs or LBP and debris, or other chemicals of concern 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 these 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-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 any local, state, or federal public agencies any 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, any information that may be necessary to prevent any 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 Accreditations
Laboratory Certificates of Accreditations

ANDRÉA LeCROY

Environmental Scientist

alecroy@fandr.com



Education

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

Years of Experience

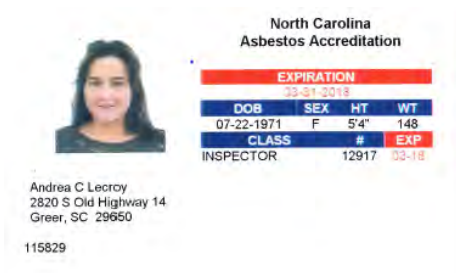
1 Year with F&R
5 Years Total

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".

Adrienne Priselac, Manager, Toxics Office

Land Division

LBP-I-I164100-1

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



W.T. Chinners

W.T. Chinners, Principal Instructor

Joy N. Finch

Joy N. Finch, Training Manager

Not Applicable

EPA Interim Certification Expiration Date

April 6, 2019

NC Expiration Date

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).*

2017-01-01 through 2017-12-31

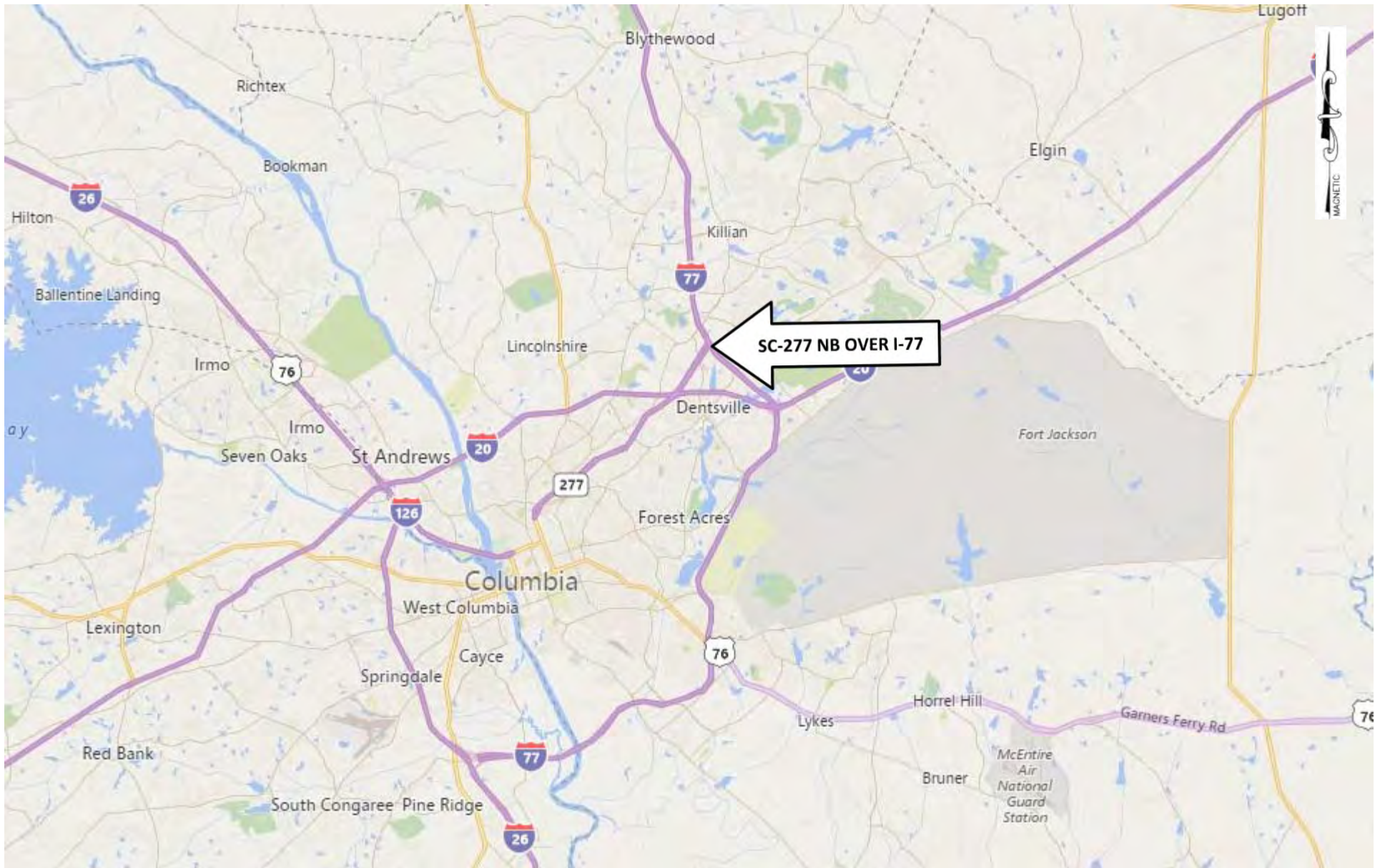
Effective Dates

A handwritten signature in black ink, appearing to read 'Dana S. Lamm'.

For the National Voluntary Laboratory Accreditation Program

Appendix B

Site Location Maps
Bulk Sample Location Drawings



SITE VICINITY MAP



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

Client:	South Carolina Department of Transportation
Project:	SC 277 NB Over I-77 Bridge Replacement ACM & LBP Survey
Location:	Richland County, South Carolina
F&R Project No:	65V-0109
Source:	Bing Maps
Date: January 3, 2018	Scale not specified

Figure 1



SITE LOCATION MAP



FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881

18 Woods Lake Road
 Greenville, SC 29607 | USA
 T 864.271.2840 | F 864.271.8124

Client:	South Carolina Department of Transportation
Project:	SC 277 NB Over I-77 Bridge Replacement ACM & LBP Survey
Location:	Richland County, South Carolina
F&R Project No:	65V-0109
Source:	Bing Maps
Date: January 3, 2018	Scale not specified

Figure 2



SAMPLE LOCATION DIAGRAM



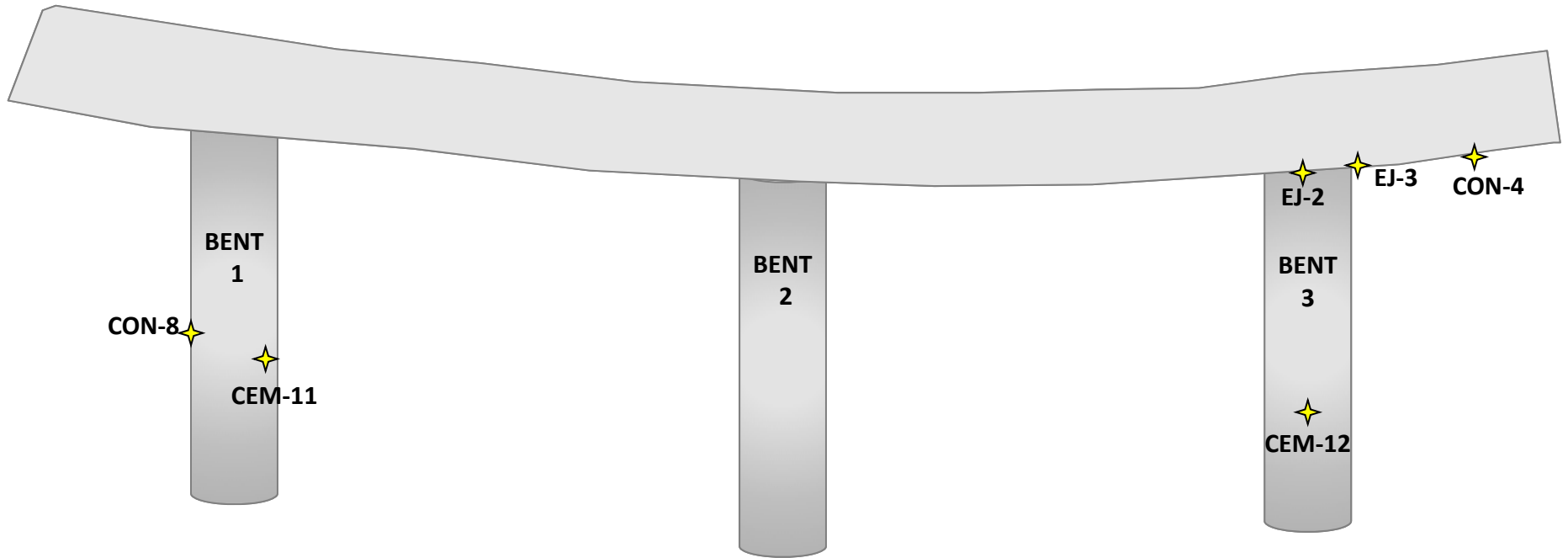
FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881

18 Woods Lake Road
 Greenville, SC 29607 | USA
 T 864.271.2840 | F 864.271.8124

Client:	South Carolina Department of Transportation
Project:	SC 277 NB Over I-77 Bridge Replacement ACM & LBP Survey
Location:	Richland County, South Carolina
F&R Project No:	65V-0109
Source:	F&R
Date: January 3, 2018	Not to Scale

Figure 3



 No Asbestos Detected



SAMPLE LOCATION DIAGRAM

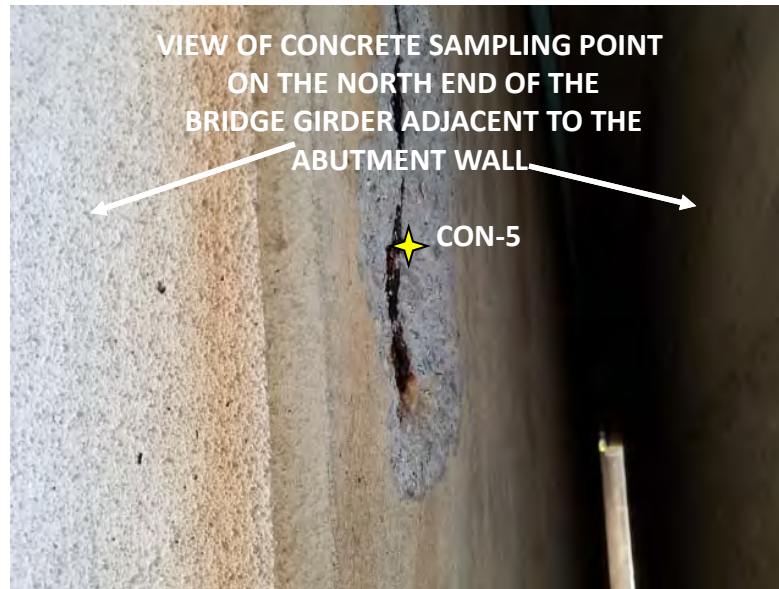


FROEHLING & ROBERTSON, INC.

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

Client:	South Carolina Department of Transportation
Project:	SC 277 NB Over I-77 Bridge Replacement ACM & LBP Survey
Location:	Richland County, South Carolina
F&R Project No:	65V-0109
Source:	F&R
Date: January 3, 2018	Scale not specified

Figure 4



 No Asbestos Detected

SAMPLE LOCATION DIAGRAM



FROEHLING & ROBERTSON, INC.

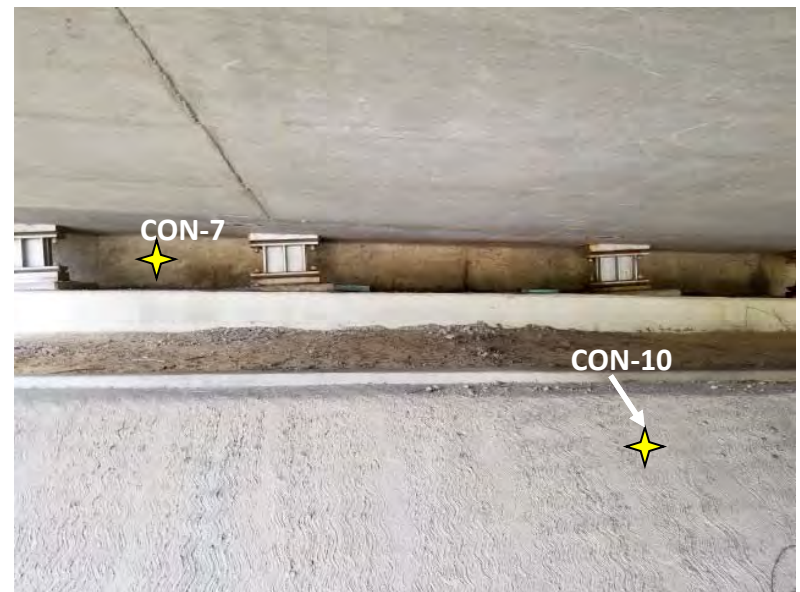
Engineering Stability Since 1881
 18 Woods Lake Road
 Greenville, SC 29607 | USA
 T 864.271.2840 | F 864.271.8124

Client:	South Carolina Department of Transportation
Project:	SC 277 NB Over I-77 Bridge Replacement ACM & LBP Survey
Location:	Richland County, South Carolina
F&R Project No:	65V-0109
Source:	F&R
Date: January 3, 2018	Scale not specified


**VIEW OF EXPANSION JOINT
SAMPLING POINT AT THE INTERFACE
OF THE SOUTH ABUTMENT WALL
AND WING WALL**



**VIEW OF CONCRETE SAMPLING
POINT ON THE SOUTH
ABUTMENT WALL AND ON THE
SOUTH WING WALL**



 No Asbestos Detected

SAMPLE LOCATION DIAGRAM			
	FROEHLING & ROBERTSON, INC. <i>Engineering Stability Since 1881</i> 18 Woods Lake Road Greenville, SC 29607 USA T 864.271.2840 F 864.271.8124	Client:	South Carolina Department of Transportation
		Project:	SC 277 NB Over I-77 Bridge Replacement ACM & LBP Survey
		Location:	Richland County, South Carolina
		F&R Project No:	65V-0109
		Source:	F&R
		Date: January 3, 2018	Scale not specified

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: 1723673
Analysis ID: 1723673_PLM
Date Received: 11/8/2017
Date Reported: 11/13/2017

Project: 65V-0109 - Richland County SC277 NB Over I-77

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
EJ-1	Expansion joint	None Detected	90% Cellulose	10% Other	Black Fibrous Heterogeneous
1723673PLM_1					Teased
EJ-2	Expansion joint	None Detected	70% Cellulose	30% Other	Black Fibrous Heterogeneous
1723673PLM_2					Teased, Dissolved
EJ-3	Expansion joint	Not Analyzed			
1723673PLM_3	TEM				
CON-4	Concrete (cast-in-place)	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1723673PLM_4					Crushed
CON-5	Concrete (cast-in-place)	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1723673PLM_5					Crushed
CON-6	Concrete (cast-in-place)	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1723673PLM_6					Crushed
CON-7	Concrete (cast-in-place)	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1723673PLM_7					Crushed
CON-8	Concrete (cast-in-place)	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1723673PLM_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%.

Bobby Wheatley (22)

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: 1723673
Analysis ID: 1723673_PLM
Date Received: 11/8/2017
Date Reported: 11/13/2017

Project: 65V-0109 - Richland County SC277 NB Over I-77

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
CON-9	Concrete (cast-in-place)	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1723673PLM_9					Crushed
CON-10	Concrete (cast-in-place)	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1723673PLM_10					Crushed
CEM-11	Gray cementitious material (filler material)	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1723673PLM_11					Crushed
CEM-12	Gray cementitious material (filler material)	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1723673PLM_12					Crushed
CEM-13	Gray cementitious material (filler material)	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1723673PLM_13					Crushed
AP-14	Asphaltic patching	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1723673PLM_14					Crushed, Ashed
AP-15	Asphaltic patching	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1723673PLM_15					Crushed, Ashed
AP-16	Asphaltic patching	Not Analyzed			
1723673PLM_16	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%.

Bobby Wheatley (22)

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: 1723673
Analysis ID: 1723673_PLM
Date Received: 11/8/2017
Date Reported: 11/13/2017

Project: 65V-0109 - Richland County SC277 NB Over I-77

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
BS-17	Black sealant	None Detected		100% Other	Black Non Fibrous Homogeneous
1723673PLM_17					Dissolved
BS-18	Black sealant	None Detected		100% Other	Black Non Fibrous Homogeneous
1723673PLM_18					Dissolved
BS-19	Black sealant	Not Analyzed			
1723673PLM_19	TEM				
GS-20	Dark gray sealant	None Detected		100% Other	Gray, Black Non Fibrous Homogeneous
1723673PLM_20					Dissolved
GS-21	Dark gray sealant	None Detected		100% Other	Gray, Black Non Fibrous Homogeneous
1723673PLM_21					Dissolved
GS-22	Dark gray sealant	Not Analyzed			
1723673PLM_22	TEM				

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Bobby Wheatley (22)

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: 1723073
 Client Code: _____

Company Contact Information	
Company: <u>FROEHLING & ROBERTSON</u>	Contact: <u>F. LeCROY</u>
Address: <u>18 WOODS LAKE RD. GREENVILLE, SC 29607</u>	Phone <input checked="" type="checkbox"/> : <u>864-704-1210</u>
	Fax <input type="checkbox"/> : <u>864-271-8124</u>
	Email <input type="checkbox"/> : <u>FLECROY@FANDR.COM</u>

Asbestos Test Types	
PLM EPA 600/R-93/116 (PLM)	<input checked="" type="checkbox"/>
Positive stop	<input 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 D5755-09	<input type="checkbox"/>
TEM Water EPA 100.2 (TW1)	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>

Billing/Invoice Information	Turn Around Times	
Company: <u>FROEHLING & ROBERTSON</u>	90 Min. <input type="checkbox"/>	48 Hours <input type="checkbox"/>
Contact: <u>ANDREA LeCROY</u>	3 Hours <input type="checkbox"/>	72 Hours <input type="checkbox"/>
Address: <u>18 WOODS LAKE RD. GREENVILLE, SC 29607</u>	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: _____
 Project Name/Number: 65V-0109 - RICHLAND COUNTY
SC 277 NB OVER I-77

Sample ID #	Description/Location	Volume/Area	Comments
<u>EJ-1</u>	<u>EXPANSION JOINT</u> ↓		<u>ABUTMENTS & TOP of BENTS (columns)</u> ↓
<u>EJ-2</u>			
<u>TEM EJ-3</u>			
<u>CON-4</u>	<u>CONCRETE (CAST-IN-PLACE)</u> ↓		<u>GIRDER</u>
<u>CON-5</u>			<u>GIRDER</u>
<u>CON-6</u>			<u>DECK (north)</u>
<u>CON-7</u>			<u>ABUTMENT (south)</u>
<u>CON-8</u>			<u>BENT 1 (column)</u>
<u>CON-9</u>			<u>DECK (south)</u>
<u>CON-10</u>			<u>WING WALL</u> ↳ to S. ABUTMENT

Total # of Samples _____

Relinquished by	Date/Time	Received by	Date/Time
<u>Andrea LeCroy</u>	<u>11/7/2017</u> <u>5:00 PM</u>	<u>[Signature]</u>	<u>11/8</u> <u>[Signature]</u>

Accepted
 Rejected



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: 1723985

Analysis ID: 1723985_TBS

Date Received: 11/14/2017

Date Reported: 11/21/2017

Project: 65V-0109 - Richland County SC 277 NB Over I-77

Sample ID	Description	Organic	Acid Sol.	Asbestos	LCL-UCL
Lab Sample ID	Lab Notes	(Wt. %)	(Wt. %)	(Wt. %)	(Wt. %)
EJ-3	Expansion joint	85%	-	None Detected	
1723985TBS_1					
AP-16	Asphaltic patching	18%	-	None Detected	
1723985TBS_2					
BS-19	Black sealant	73%	-	None Detected	
1723985TBS_3					
GS-22	Dark gray sealant	35%	-	None Detected	
1723985TBS_4					

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.

Russell Shelton (4)

Analyst

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

Approved Signatory



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

1723985

Lab Use Only
 Lab Order ID: 1723073
 Client Code: _____

Company Contact Information	
Company: FROEHLING & ROBERTSON	Contact: F. LeCroy
Address: 18 WOODS LAKE RD. GREENVILLE, SC 29607	Phone <input checked="" type="checkbox"/> : 864-704-1210
	Fax <input type="checkbox"/> : 864-271-8124
	Email <input type="checkbox"/> : FLECROY@FARR.COM

Asbestos Test Types	
PLM EPA 600/R-93/116 (PLM)	<input checked="" type="checkbox"/>
Positive stop	<input 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 D5755-09	<input type="checkbox"/>
TEM Water EPA 100.2 (TWI)	<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: _____
 Project Name/Number: 65V-0109 - RICHLAND COUNTY
 SC 277 NB OVER I-77

Sample ID #	Description/Location	Volume/Area	Comments
EJ-1	EXPANSION JOINT ↓ CONCRETE (CAST-IN-PLACE) ↓		ABUTMENTS &
EJ-2		Top of BENTS (columns)	
TEM EJ-3			↓
CON-4		GIRDER	
CON-5		GIRDER	
CON-6		DECK (north)	
CON-7		ABUTMENT (south)	
CON-8		BENT 1 (column)	
CON-9		DECK (south)	
CON-10		WING WALL ↳ to S. ABUTMENT	

Total # of Samples _____

Relinquished by	Date/Time	Received by	Date/Time
F. LeCroy	11/7/2017 5:00 PM	[Signature]	11/8/2017 [Signature]

Accepted
 Rejected



Scientific Analytical Institute

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

1723985
Lab Use Only
Lab Order ID: 1723985
Client Code:

Sample ID #	Description/Location	Volume/Area	Comments
CEM-11	GRAY CEMENTITIOUS MATERIAL ↓ (FILLER MATERIAL)		ISOLATED AREAS ON BENTS & N. BRIDGE ABUTMENT,
CEM-12			
CEM-13			
FP-14	ASPHALTIC PATCHING ↓		ISOLATED AREAS ON BRIDGE DECK
FP-15			
FP-16			
BS-17	BLACK SEALANT ↓		INTERFACE of BRIDGE DECK & ROAD
BS-18			
BS-19			
GS-20	DARK GRAY SEALANT ↓		TOP of NORTH WING WALL ↓ (Spilled - isolated AREA)
GS-21			
GS-22			

TEM

TEM

TEM



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: 1725815

Analysis ID: 1725815_PLM

Date Received: 12/5/2017

Date Reported: 12/7/2017

Project: 65V-0109 - Richland County SC 277 NB over I-77

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
M-23	Black mastic/ reflectors	None Detected		100% Other	Black Non Fibrous Homogeneous
1725815PLM_1					Dissolved
M-24	Black mastic/ reflectors	None Detected		100% Other	Black Non Fibrous Homogeneous
1725815PLM_2					Dissolved
M-25	Black mastic/ reflectors	Not Analyzed			
1725815PLM_3	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%.

Charmel Dozier (3)

Analyst

Approved Signatory



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

Lab Use Only
 Lab Order ID: 1725815
 Client Code: _____

Company Contact Information		Turn Around Times	
Company: <u>FROHLING & ROBERTSON</u>	Contact: <u>A. LeCroy</u>	90 Min. <input type="checkbox"/>	48 Hours <input type="checkbox"/>
Address: <u>18 WOODS LAKE RD.</u>	Phone <input checked="" type="checkbox"/> : <u>804-704-1210</u>	3 Hours <input type="checkbox"/>	72 Hours <input checked="" type="checkbox"/>
<u>GREENVILLE, SC</u>	Fax <input type="checkbox"/> :	6 Hours <input type="checkbox"/>	96 Hours <input type="checkbox"/>
<u>29607</u>	Email <input checked="" type="checkbox"/> : <u>alecroylefandri.com</u>	12 Hours <input type="checkbox"/>	120 Hours <input type="checkbox"/>
		24 Hours <input type="checkbox"/>	144+ Hours <input type="checkbox"/>

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 D5755-09	<input type="checkbox"/>
TEM Water EPA 100.2 (TW1)	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>

PO Number: 65V-0109
 Project Name/Number: 65V-0109 - RICHLAND COUNTY
SC 277 NB OVER
I-77

Sample ID #	Description/Location	Volume/Area	Comments
<u>M-23</u>	<u>BLACK MASTIC / REFLECTORS</u>	<u>< 3 SF</u>	
<u>M-24</u>	↓	↓	
<u>TEM M-25</u>	↓	↓	

Total # of Samples 3

Relinquished by	Date/Time	Received by	Date/Time
<u>ANDREW LeBay</u>	<u>12/4/17 / 15:00</u>	<u>A. Henders</u>	<u>12/15/17</u> <u>12:00</u>



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: 1726132

Analysis ID: 1726132_TBS

Date Received: 12/8/2017

Date Reported: 12/12/2017

Project: 65V-0109 - Richland County SC 277 NB over I-77

Sample ID	Description	Organic	Acid Sol.	Asbestos	LCL-UCL
Lab Sample ID	Lab Notes	(Wt. %)	(Wt. %)	(Wt. %)	(Wt. %)
M-25	Black mastic/reflectors	28%	-	None Detected	
1726132TBS_1					

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.

Russell Shelton (1)

Analyst

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Approved Signatory



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

1726132

Lab Use Only
 Lab Order ID: 1725513
 Client Code: _____

Company Contact Information			
Company:	FROHLING & ROBERTSON	Contact:	F. LeCroy
Address:	18 WOODS LAKE RD GREENVILLE, SC 29607	Phone:	864-704-1210
		Fax:	
		Email:	flecroy@fandri.com
Billing/Invoice Information		Turn Around Times	
Company:	F & R	90 Min.	<input type="checkbox"/>
Contact:	F. LeCROY	48 Hours	<input type="checkbox"/>
Address:	18 WOODS LAKE RD. GREENVILLE, SC 29607	3 Hours	<input type="checkbox"/>
		72 Hours	<input checked="" type="checkbox"/>
		6 Hours	<input type="checkbox"/>
		96 Hours	<input type="checkbox"/>
		12 Hours	<input type="checkbox"/>
		120 Hours	<input type="checkbox"/>
		24 Hours	<input type="checkbox"/>
		144* Hours	<input type="checkbox"/>

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 D5755-09	<input type="checkbox"/>
TEM Water EPA 100.2 (TW1)	<input type="checkbox"/>
Other:	<input type="checkbox"/>

PO Number: 65V-0109
 Project Name/Number: 65V-0109 - RICHLAND COUNTY
 SC 277 NB OVER
 I-77

Sample ID #	Description/Location	Volume/Area	Comments
M-23	BLACK MASTIC / REFLECTORS	< 3 SF	
M-24	↓	↓	
TEM M-25	↓	↓	

Total # of Samples 3

Relinquished by	Date/Time	Received by	Date/Time
F. LeCroy	12/4/17 / 15:00	A. Haulins	12/15/17 12 PM

Appendix D

Explanation of XRF Data Table
XRF Data Table
Instrument Calibration Report
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 the how the area of the reading is situated in relation to the structure.
Wall	Orientation of the where the reading was collected from.
Object	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.
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	Elapsed time of the reading.
Result	Result of the reading: NEG = negative POS = positive
Inspector	Name of licensed personnel that collected the reading.

Reading #	Mode	Date	Time	Project	Unit	Location	Wall	Object	Substrate	Color	Lead (Pb)		Result	Inspector	
											mg/cm ²	Pb +/-			
3	Lead Paint Fixed-Time	6-Nov-17	12:13:14	SC277 over I-77	Bridge	Exterior	Underside of Girder	Access Hatch Frame	Metal	Silver	5	0.22	14.33	Positive	Terron Edwards
4	Lead Paint Fixed-Time	6-Nov-17	12:14:37	SC277 over I-77	Bridge	Exterior	Underside of Girder	Access Hatch Frame	Metal	Silver	5	0.22	17.91	Positive	Terron Edwards
5	Lead Paint Fixed-Time	6-Nov-17	12:21:09	SC277 over I-77	Bridge	Exterior	Underside of Girder	Support Column	Metal	Silver	5	0.36	7.48	Positive	Terron Edwards
6	Lead Paint Fixed-Time	6-Nov-17	12:22:02	SC277 over I-77	Bridge	Exterior	Underside of Girder	Support Column	Concrete	Silver	0	0	7.97	Negative	Terron Edwards
7	Lead Paint Fixed-Time	6-Nov-17	12:26:36	SC277 over I-77	Bridge	Exterior	Bridge Deck Road Surface	Wing Wall	Concrete	White	0	0	6.66	Negative	Terron Edwards
8	Lead Paint Fixed-Time	6-Nov-17	12:29:45	SC277 over I-77	Bridge	Exterior	Bridge Deck Road Surface	Top Rail	Metal	Silver	0.12	0.03	6.32	Negative	Terron Edwards
9	Lead Paint Fixed-Time	6-Nov-17	12:30:36	SC277 over I-77	Bridge	Exterior	Bridge Deck Road Surface	Top Rail	Metal	Silver	0.11	0.02	6.89	Negative	Terron Edwards
10	Lead Paint Fixed-Time	6-Nov-17	12:34:57	SC277 over I-77	Bridge	Exterior	Bridge Deck Road Surface	Stripe	Concrete	White	0	0	6.49	Negative	Terron Edwards
11	Lead Paint Fixed-Time	6-Nov-17	12:35:43	SC277 over I-77	Bridge	Exterior	Bridge Deck Road Surface	Stripe	Concrete	Yellow	1	0.01	3.06	Positive	Terron Edwards
12	Lead Paint Fixed-Time	6-Nov-17	12:36:26	SC277 over I-77	Bridge	Exterior	Bridge Deck Road Surface	Stripe	Concrete	Yellow	0	0.01	5.44	Negative	Terron Edwards
14	Lead Paint Fixed-Time	6-Nov-17	13:11:01	SC277 over I-77	Bridge	Exterior	Bridge Deck Road Surface	Support Column	Metal	Silver	5	0.35	7.43	Positive	Terron Edwards
15	Lead Paint Fixed-Time	6-Nov-17	13:12:09	SC277 over I-77	Bridge	Exterior	Bridge Deck Road Surface	Access Hatch	Metal	Silver	5	0.42	6.3	Positive	Terron Edwards



INSTRUMENT CALIBRATION REPORT

Pine Environmental Services LLC

4037 Darling Court
Lilburn, GA 30047
Toll-free: (800) 842-1088

Pine Environmental Services, Inc.

Instrument ID R197574
Description Innov-X Alpha Series XRF
Calibrated 11/3/2017 10:02:39AM

Manufacturer Innov-X/Olympus Systems	State Certified
Model Number Alpha 2000AS	Status Pass
Serial Number/ Lot Number 11910	Temp °C 22
Location Georgia	Humidity % 51
Department	

Calibration Specifications

Group # 1
Group Name
Test Performed: Yes **As Found Result: Pass** **As Left Result: Pass**

Test Instruments Used During the Calibration

<u>Test Standard ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model Number</u>	<u>Serial Number / Lot Number</u>	<u>(As Of Cal Entry Date)</u> <u>Next Cal Date / Last Cal Date/ Expiration Date</u> <u>Opened Date</u>
-------------------------	--------------------	---------------------	---------------------	---------------------------------------	--

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Jeff Rasmussen

All instruments are calibrated by Pine Environmental Services LLC according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services LLC of any defect within 24 hours of receipt of equipment
Please call 800-301-9663 for Technical Assistance

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*.

INSTRUMENT QC/ PACKING LIST

Description	Olympus Innov-X XRF <u>Alpha</u>
Instrument ID	R197574
Date Prepared	11-3-17



www.pine-environmental.com

Standard Items	Prepared	QC check	Received	Returned to Pine																																				
Innov-X w/ carry case	✓	✓	—	—																																				
iPAQ PDA display w/ CF card	✓	✓	—	—																																				
Stylus for PDA	✓	✓	—	—																																				
Manual, detectable elements periodic table, X-ray warning sign	✓	✓	—	—																																				
Quick reference card	✓	✓	—	—																																				
XRF battery charger and AC cord	✓	✓	—	—																																				
iPAQ Cradle and AC cord	✓	✓	—	—																																				
(3) batteries	✓	✓	—	—																																				
Standardization clip 316 SS	✓	✓	—	—																																				
Pine Software CD with ActiveSync and Windows Mobile Device Center	✓	✓	—	—																																				
Extra Kapton window	✓	✓	—	—																																				
State regulation paperwork (when applicable)	N/A	X	—	—																																				
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4" style="text-align: left;">Soil standards and certificates</th> <th colspan="2" style="text-align: left;">Pb paint standards and certs.</th> </tr> </thead> <tbody> <tr> <td style="width: 15%;">Blank Soil</td> <td style="width: 5%;">—</td> <td style="width: 20%;">NIST 2710a Soil</td> <td style="width: 5%;">—</td> <td style="width: 20%;">NIST 2570 Blank Paint</td> <td style="width: 35%; text-align: center;">✓</td> </tr> <tr> <td>NIST 2586 Soil</td> <td>—</td> <td>NIST 2711 Soil</td> <td>—</td> <td>NIST 2573 Pb paint chip</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>NIST 2702 Soil</td> <td>—</td> <td>NIST 2711a Soil</td> <td>—</td> <td></td> <td></td> </tr> <tr> <td>NIST 2709 Soil</td> <td>—</td> <td>NIST 2780 Soil</td> <td>—</td> <td></td> <td></td> </tr> <tr> <td>NIST 2709a Soil</td> <td>—</td> <td>NIST 2781 Soil</td> <td>—</td> <td></td> <td></td> </tr> </tbody> </table>	Soil standards and certificates				Pb paint standards and certs.		Blank Soil	—	NIST 2710a Soil	—	NIST 2570 Blank Paint	✓	NIST 2586 Soil	—	NIST 2711 Soil	—	NIST 2573 Pb paint chip	✓	NIST 2702 Soil	—	NIST 2711a Soil	—			NIST 2709 Soil	—	NIST 2780 Soil	—			NIST 2709a Soil	—	NIST 2781 Soil	—			✓	✓	—	—
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NIST 2709a Soil	—	NIST 2781 Soil	—																																					
Optional Items																																								
Stand assembly	—	—	—	—																																				
Weld mask	—	—	—	—																																				
Radiation Dosimeter	—	—	—	—																																				

Prepared by: AR
 QC checked by: SP
 Date: 11/3/17

This packing list is to ensure that every item needed to operate the unit was sent and received. Upon receiving a shipment, please fill out the "Received by customer" column. Call Pine within 24 hours of receiving the equipment if any pieces are missing, damaged, or malfunctioning. Thank you for choosing Pine Environmental Services LLC.

31 August 2015

To Whom It May Concern,

The Alpha XRF analyzer model I-3000 is mechanically identical to the LBP-4000 model. The Lead Paint mode calibrated on the I-3000 model is calibrated with precisely the same conditions and acceptance criteria as the Lead Paint Mode on the LBP-4000.

The calibration conditions and acceptance criteria are those used in the Innov-X LBP 4000 PCS of 1 December 2006, Edition 1.

The model name distinction was used for marketing purposes for the primary market that the analyzer was sold into.

As such the Alpha models labeled with I-3000 are consistent with the requirements of the PCS with the exception of model name.

Best Regards,



Ted Shields
Product Manager
Portable XRF

Appendix E

Photographic Documentation

**SC 277 OVER I-77 BRIDGE REPLACEMENT
ASBESTOS CONTAINING MATERIALS AND LEAD BASED PAINT SURVEY REPORT
RICHLAND COUNTY, SOUTH CAROLINA**



Photograph 1: View of the SC 277 North Bound Bridge over I-77 as seen from the eastern abutment, looking south.



Photograph 2: View of the SC 277 north bound bridge over I-77 as seen from the western abutment, looking northeast.



**SC 277 OVER I-77 BRIDGE REPLACEMENT
ASBESTOS CONTAINING MATERIALS AND LEAD BASED PAINT SURVEY REPORT
RICHLAND COUNTY, SOUTH CAROLINA**



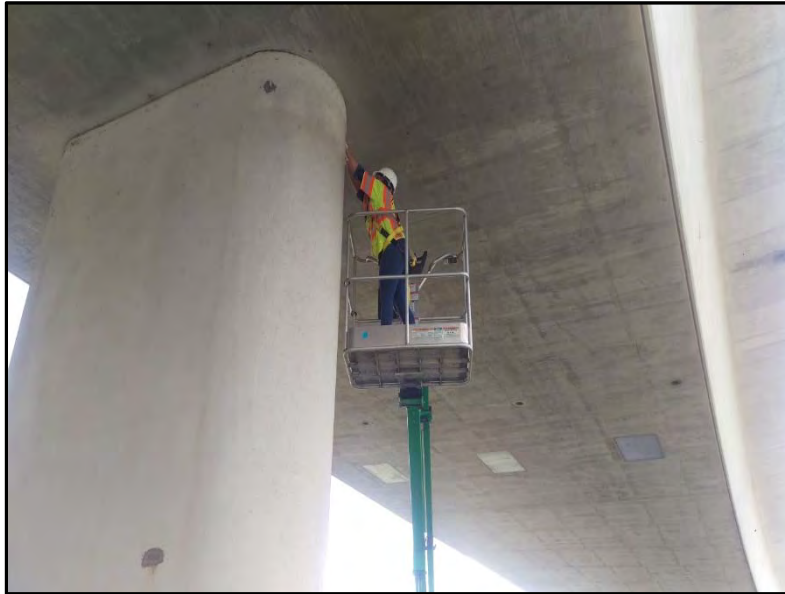
Photograph 3: View of the concrete bridge deck roadway, looking north.



Photograph 4: View of bridge identification number located on the western end of the bridge deck.



**SC 277 OVER I-77 BRIDGE REPLACEMENT
ASBESTOS CONTAINING MATERIALS AND LEAD BASED PAINT SURVEY REPORT
RICHLAND COUNTY, SOUTH CAROLINA**



Photograph 5: View of sampling in-progress on Bent 3.



Photograph 6: View of expansion joint sampling point at the top of Bent 3 (None Detected).

**SC 277 OVER I-77 BRIDGE REPLACEMENT
ASBESTOS CONTAINING MATERIALS AND LEAD BASED PAINT SURVEY REPORT
RICHLAND COUNTY, SOUTH CAROLINA**



Photograph 7: View of access hatches to the hollow concrete box girder. The silver painted metal access hatch frames and access hatches are coated with Lead Based Paint.



Photograph 8: View of concrete sampling point adjacent to an access hatch on the bottom of the concrete girder (None Detected).



**SC 277 OVER I-77 BRIDGE REPLACEMENT
ASBESTOS CONTAINING MATERIALS AND LEAD BASED PAINT SURVEY REPORT
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Photograph 9: View of concrete sampling point at the end of the girder adjacent to the abutment wall (None Detected).



Photograph 10: View of gray cementitious material located at isolated areas on the bents and abutment 2. Bent 1 is pictured in this photo (None Detected).



**SC 277 OVER I-77 BRIDGE REPLACEMENT
ASBESTOS CONTAINING MATERIALS AND LEAD BASED PAINT SURVEY REPORT
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Photograph 11: View of expansion joint sampling point at the interface of the wing wall and the abutment wall (None Detected).



Photograph 12: View of gray mastic sampling point located at the top of the eastern wing wall (None Detected). This material was an isolated spill area at the top of the eastern wing wall.

**SC 277 OVER I-77 BRIDGE REPLACEMENT
ASBESTOS CONTAINING MATERIALS AND LEAD BASED PAINT SURVEY REPORT
RICHLAND COUNTY, SOUTH CAROLINA**



Photograph 13: View of asphalt patching of repaired areas along the bridge deck (None Detected).



Photograph 14: View of black sealant sampling point located at the interface of the roadway and bridge approach (None Detected).



**SC 277 OVER I-77 BRIDGE REPLACEMENT
ASBESTOS CONTAINING MATERIALS AND LEAD BASED PAINT SURVEY REPORT
RICHLAND COUNTY, SOUTH CAROLINA**



Photograph 15: View of black mastic sampling point associated with reflectors that are located along the center of the concrete bridge roadway (None Detected).



Photograph 16: View of silver painted steel support column located between the bridge girder and the abutment. The silver paint is lead based.



**SC 277 OVER I-77 BRIDGE REPLACEMENT
ASBESTOS CONTAINING MATERIALS AND LEAD BASED PAINT SURVEY REPORT
RICHLAND COUNTY, SOUTH CAROLINA**



Photograph 17: View of lead based silver paint located on select painted access hatches on the underside of the concrete girder.



Photograph 18: View of lead based silver paint coated metal access hatch frame located at access hatches on underside of the concrete girder.

