

VISUAL ROOF SURVEY

OAKVIEW APARTMENTS

650 Howard Street
Spartanburg, South Carolina



Prepared for:

City of Spartanburg

145 West Broad Street
Spartanburg South Carolina, 29306-3210

Attention: Mr. Ed Memmott,
City Manager

March 31, 2016



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March 31, 2016

Via email: ememmott@cityofspartanburg.org

City of Spartanburg
145 West Broad Street
Spartanburg SC, 29306-3210

Attention: Mr. Ed Memmott
City Manager

Reference: Report of Roof Survey
Oakview Apartments
650 Howard Street
Spartanburg, South Carolina
REI Project No. GSP1033.001

Dear Mr. Memmott:

Raymond Engineering has completed the Roof Survey at the above referenced site. The purpose of this survey was to determine the overall condition of the roof system at the apartments. This report outlines our understanding of the project information and our findings along with our conclusions.

Executive Summary

A roof survey with limited sampling was performed on the 13 buildings (49 total roof surfaces) at the Oakview Apartments. The purpose was to determine the overall condition of the roof systems and determine the residual value for the roofing systems. The roof membranes are deteriorated past their useful life and past the condition where they could be repaired or upgraded. Our survey observed damaged membranes, negative slopes on the roof, ponded water, damaged drains and gravel stops. Our physical testing of the underlying membrane encountered moist or wet insulation on 75 percent of the samples. Asbestos was detected in 5 of the 8 samples. The exception was 3 of the roof surfaces (totaling approximately 3,000 square feet) that were re-roofed approximately 3 years ago. These 3 roofs were upgraded with a 15 year single ply membrane. These 3 roof systems have a remaining life of approximately 12 years.

Project Information

Our understanding of the project information is based on our telephone conversations with Mr. Ed Memmott and Mr. David Cook with the City of Spartanburg. We were also allowed access to the property by Mr. Bo Owens. Information concerning the property was also gathered from the Spartanburg County Geographical Information System (GIS).

The apartments were located at 650 Howard Street in Spartanburg, South Carolina. The site was bounded to the north by Howard Street, to the east by Preston Street, to the south by Brawley Street, with several units located south of the street, and to the west by Aden Street. According to

the GIS webpage, the property is owned by Freemont Properties, LTD and was constructed in 1948. There are thirteen (13) buildings with (49) forty-nine roof areas totaling approximately 53,000 square feet. Three of the areas were re-roofed approximate 3 years ago with a single ply membrane; the remaining roofs are built up systems.

Findings

The apartment complex has a total of 13 different buildings with 49 different roof areas or elevations. The roof decks were composed of reinforced concrete with a thickened edge over the eave. A brick 4 flue chimney is located in the approximate center of each of the 49 roofs with various vents for natural gas and plumbing located throughout the roof deck. There was a single drain on one corner of the roof deck with a pass through to a downspout mounted on the outside of the structure to the ground. A photographic report for each building is located in the back of this report. These photographs represent an overview of the conditions observed. The following is a summary of the different roof systems observed:

- Thermoplastic polyolefin (TPO) - A .045" thick single ply TPO membrane was observed on three roof areas (approximately 3,000 square feet), and was approximately 3 years old. The overall condition of these roofs was good, with only minor staining due to stagnant water and some accumulation of leaves and debris from the surrounding trees. The roof was sloped to provide adequate positive drainage to the internal roof drains on each section; however, the undersized crickets appeared to be the cause of the minor ponding water. The membrane seams were sufficiently welded, and cut edge sealant was installed on the cut membrane edges. Pre-molded pipe boots were used to flash the pipe penetrations. A draw band and sealant was installed to seal the transition on the boots. The drain strainers were also updated along with a new downspout;
- Modified Bitumen - A two ply modified bitumen roof was observed on five of the roof areas (approximately 5,000 square feet). This roof appeared to have been installed over the original built-up roof (BUR), as well as the spray foam roof. The exposed asphalt on the membrane laps and flashings had severe cracking. The membrane laps were loose and open at several locations. Exposed fasteners were found in the laps and around the perimeter of the roof. Multiple repairs were found throughout with evidence of cracking and lack of adhesion to the elastomeric coating; and
- Spray Foam Insulation (SPF) - A spray polyurethane foam roof with aggregate surfacing was observed on the remaining roof areas (approximately 45,000 square feet). The aggregate used for the surfacing was #57 stone and angular. There were several areas throughout the majority of the roofs missing the aggregate cover and several areas where the aggregate was up to 4 inches thick. The UV protective coating was deteriorated throughout the roof areas; the most deterioration was observed along the roof edges and at the penetrations. The spray foam was not installed consistently and low lying areas were observed throughout. The majority of these roofs had a negative slope across the profile, resulting in ponded water. Additionally, the brick chimneys were covered with the same

foam insulation with deterioration and gaps in the protective coating. The outer edge, or gravel stop, had a wire mesh attached to the side to hold the excess gravel on the roof. In addition to the visual observations, 8 separate roof locations were selected for additional core sampling and analysis. The approximate test locations are shown on the attached Roof Plan at the end of this report. The following testing was performed:

- Roof coring – the roof membrane was sampled by twisting a sharpened steel core barrel through the substrate. The sample was extracted for visual observations and additional testing. The insulation was moist or wet in 6 of the 8 cores performed. The roofing materials collected were placed in an individually sealed container and labeled. The core was repaired using a two ply seal surfacing material with an all-weather roofing cement.
- The 8 samples were forward to an environmental laboratory, using a chain of custody, where asbestos analysis was performed. Polarized Light Microscopy (PLM) analysis revealed Chrysotile fibers ranging from 5 to 25 percent in 5 of the 8 samples. The individual test results are presented in this report.

Organic materials were observed on the roof surfaces adjacent to the trees. These roofs were covered with acorns and leaves from the adjacent oak trees. Several of the other roofs, away from the adjacent trees, had grasses and weeds established on the roof membranes. The majority of the modified style gravel stop had vegetation growing through the sides. The attached photographs depict several of these deviations to the roof.

Conclusions

The roof systems installed on 46 of the 49 roof decks were beyond their useful life. The membranes were too deteriorated to repair or upgrade and the wet insulation in 75 percent of the samples indicated that a complete removal and replacement was required. The spray foam insulation roof UV coatings were damaged and deteriorated and the underlying foam was exposed to the environment. The wet underlying insulation had compressed resulting in negative slopes on the surface and negative drainage to the single drain. The use of angular stone (# 57 stone) to cover the foam insulation coating resulted in punctures to the membrane. The open gaps in the Modified Bitumen membrane were not water tight. Vegetation covering the roof indicated routine maintenance was not being performed.

The residual value of the 49 roof systems was the remaining life of the 3 TPO roofs. Although the downspouts appeared to be in relatively fair condition and several of the units have had sections of the gravel stop replaced, the residual value of these items was minimal due to their age. The downspouts are over 20 years old and the gravel stop cannot be removed and reused without damage.

The TPO roof's residual value was calculated based on the following information:

- Value of the roof system was approximately \$15.00 per square foot installed:
 - Fully adhered, tapered insulation;
 - Fully adhered 45 mil membrane (15 year life expectancy); and
 - Flashing around the perimeter, penetrations and chimney.

- Depreciation value for the system (based on 3 years old);
- Three separate roof areas at 1,008 square foot each (total of 3,024 square foot)

YEAR	STRAIGHT LINE DEPRECIATION	ACCELERATED COST RECOVERY ACT (ACRA) ¹
1	\$3,024	\$2,268
2	3,024	4,536
3	3,024	4,082
TOTAL DEPRECIATION	\$9,072	\$10,082

- Based on the total depreciation value ranging from \$9,072 to \$10,082, the residual value of the single ply membrane was calculated as
 - Initial cost - 3,024 square feet @ \$15.00/ square foot = \$45,360
 - Depreciation value – from the above chart = \$ 9,072
 - Residual Value \$36,288
- Using the ACRA total from above, the residual value is \$34,474.

¹ Accelerated Cost Recovery Act of 1981, Foundations of Financial Management, Stanley B. Block, Richard Irwin, Inc. Third Edition 1984, page 315.

Limitations

The conclusions, and analysis expressed herein have been prepared within a reasonable degree of engineering certainty. They are based on the results and interpretations of the testing and/or data collection activities performed at the site, the information available to Raymond Engineering at the time the report was issued, and the training, knowledge, skill, and experience of the author and licensed professional engineer.

The contents of this report are confidential and intended for the use of City of Spartanburg and its representatives. This document has been signed and sealed in accordance with applicable state statutes. If not signed and sealed by the licensed professional named and shown as its authors, the findings, conclusions, and opinions cannot be relied upon; as such, the document has been provided for information purposes only.

Raymond Engineering appreciates this opportunity to be of service to you. If we can be of further assistance in this or other matters, please do not hesitate to contact us.

Attachments: Roof Plan
Roof Survey Matrix (5 sheets)
Photographic Report (46 photographs on 26 pages)
Asbestos Results (4 sheets and Chain of Custody)

Roof Survey

Oakview Apartments
650 Howard St.
Spartanburg, SC 29303

CERTIFICATIONS

CONSULTANT

DATE	NO.	BY

REVISIONS

DATE	NO.	DESCRIPTION

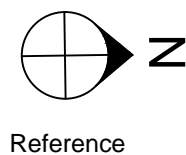
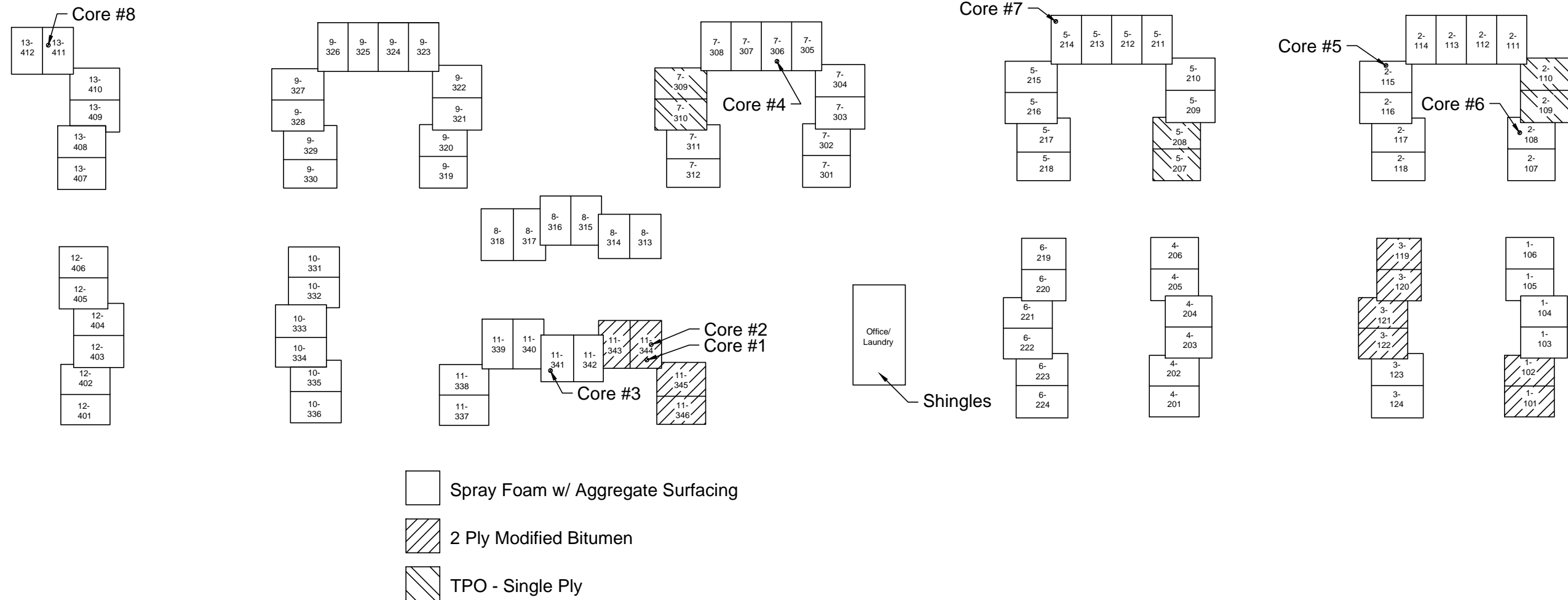
RELEASES

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WERE ISSUED.

PROJECT NO.	GSP1033.001
DESIGN BY:	
DRAWN BY:	
CHECKED BY:	

Roof Plan



Roof Survey

Oakview Apartments

Spartanburg, SC

BUILDING INFORMATION		1						2												3					
		101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124
	Expected Useful Life																								
	Age of Roof System																								
	Membrane and Surfacing																								
	Base Flashings																								
	Counter Flashings																								
	Gravel Stop-Fascia																								
	Pitch Pans/Pipe Penetrations																								
	Expansion/Control Joint Covers/Curbs																								
	Roof Mounted Equipment																								
	Roof Drainage																								
	Downspouts																								
	Total Scoring Analysis																								

86 - 100	Roof system is in good condition.
71-85	Roof system is showing signs of wear.
56-70	Roof system is in poor condition.
< 55	Roof system had failed and requires replacement

Roof Survey Oakview Apartments Spartanburg, SC

BUILDING INFORMATION		4						5												6					
		201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224
	Expected Useful Life																								
	Age of Roof System																								
	Membrane and Surfacing																								
	Base Flashings																								
	Counter Flashings																								
	Gravel Stop-Fascia																								
	Pitch Pans/Pipe Penetrations																								
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Roof Survey
Oakview Apartments
Spartanburg, SC

BUILDING INFORMATION		7											8								
		301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318		
	Expected Useful Life																				
	Age of Roof System																				
	Membrane and Surfacing																				
	Base Flashings																				
	Counter Flashings																				
	Gravel Stop-Fascia																				
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Roof Survey
Oakview Apartments
Spartanburg, SC

BUILDING INFORMATION		9											10								
		319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336		
	Expected Useful Life																				
	Age of Roof System																				
	Membrane and Surfacing																				
	Base Flashings																				
	Counter Flashings																				
	Gravel Stop-Fascia																				
	Pitch Pans/Pipe Penetrations																				
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Roof Survey

Oakview Apartments

Spartanburg, SC

BUILDING INFORMATION	11										12						13					
	337	338	339	340	341	342	343	344	345	346	401	402	403	404	405	406	407	408	409	410	411	412
Expected Useful Life																						
Age of Roof System																						
Membrane and Surfacing																						
Base Flashings																						
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Total Scoring Analysis																						

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71-85	Roof system is showing signs of wear.
56-70	Roof system is in poor condition.
< 55	Roof system had failed and requires replacement



Photograph 1 - North elevation



Photograph 2 - West Elevation



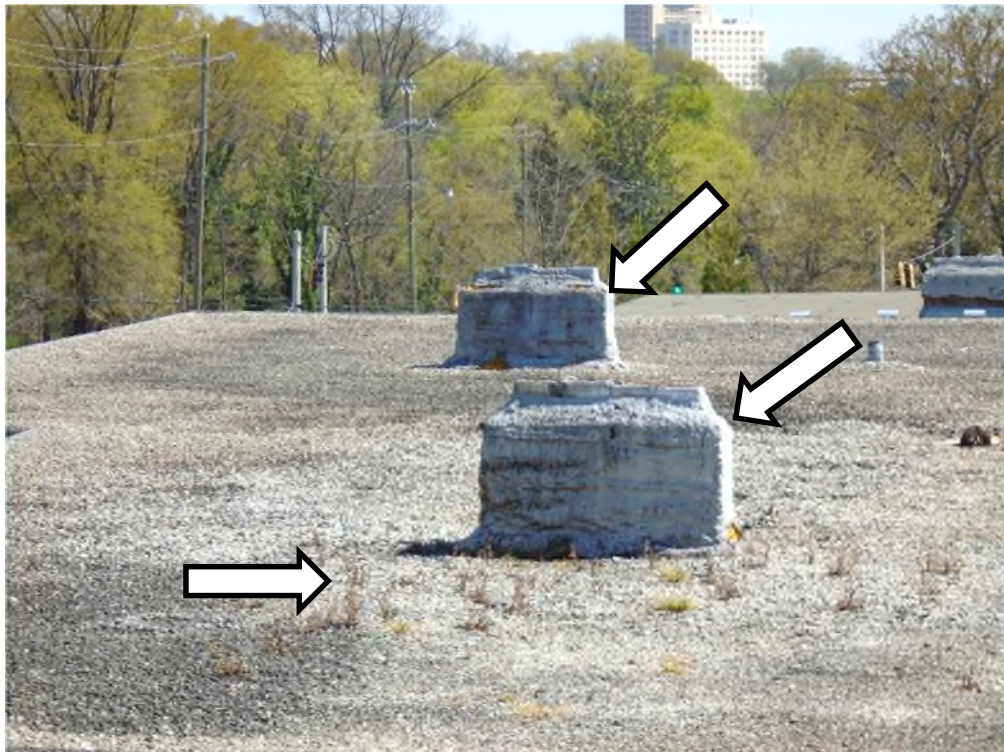
Photograph 3 - South Elevation



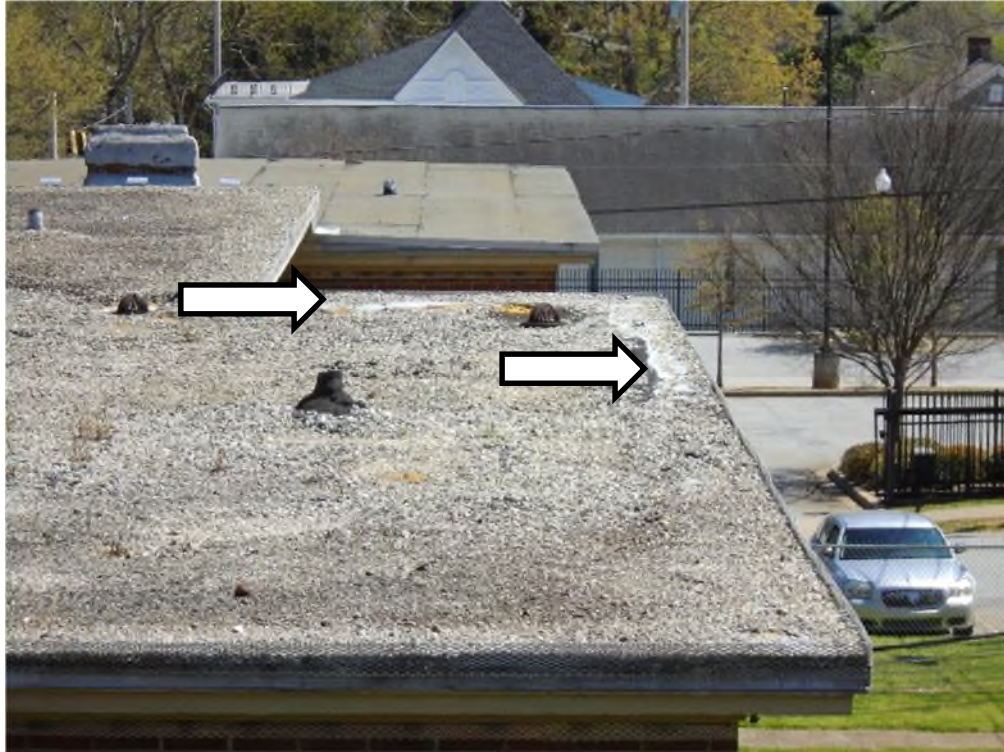
Photograph 4 - East Elevation



Photograph 5 - BLDG 1 - Overview



Photograph 6 - BLDG 1- Vegetation growth and improper repair to chimney



Photograph 7 - BLDG 1 - Displaced aggregate along roof edges



Photograph 8 - BLDG 1 - Moisture staining on ceiling



Photograph 9 - BLDG 2 - TPO roof overview



Photograph 10 - BLDG 2 - Chimney flashing and coating on TPO roof



Photograph 11 - BLDG 2 – Wet insulation in test core



Photograph 12 - BLDG 2 – Deteriorated foam



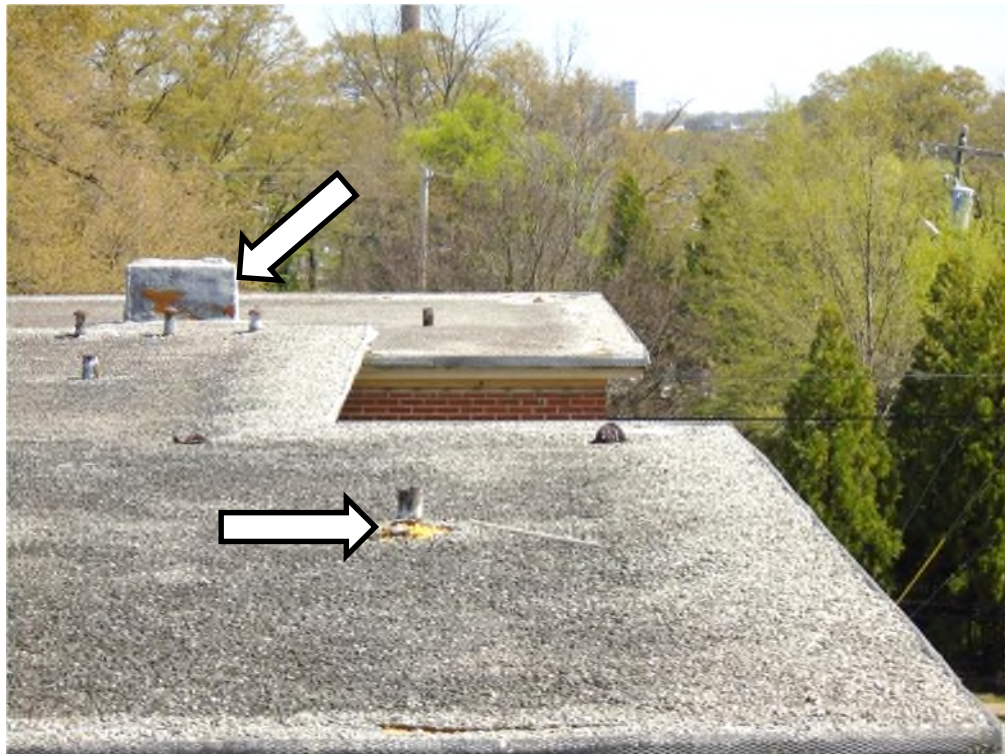
Photograph 13 - BLDG 3 – Overview of Modified Bitumen roof



Photograph 14 - BLDG 3 – Counter flashing in fair condition



Photograph 15 - BLDG 4 – Overview looking east



Photograph 16 - BLDG 4 - Deteriorated foam at chimney and penetrations



Photograph 17 - BLDG 5 - Failed repair to chimney



Photograph 18 - BLDG 5 - Damaged strainer and clogged drain



Photograph 19 - BLDG 5 – Vegetation growth



Photograph 20 - BLDG 5 – Wet insulation at core location



Photograph 21 - BLDG 5 – Minor staining on TPO roof



Photograph 22 - BLDG 5 – Vent pipe flashings in good condition



Photograph 23 - BLDG 6 - Overview



Photograph 24 - BLDG 6 – Wire mesh used as gravel stop



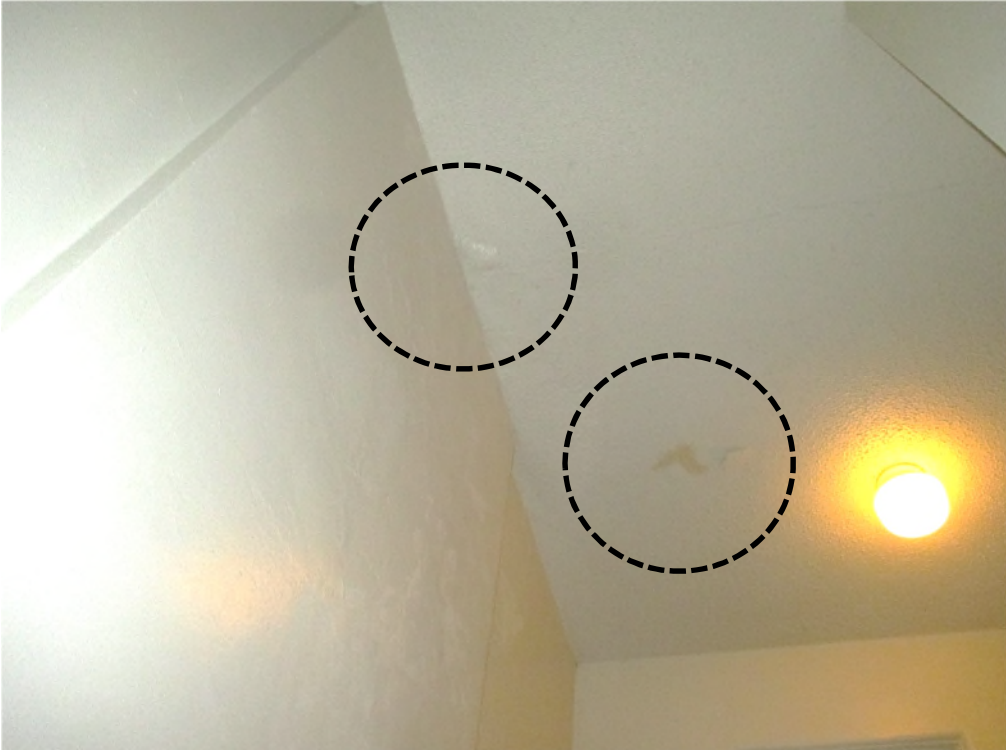
Photograph 25 - BLDG 7 – Minor staining on TPO roof



Photograph 26 - BLDG 7 - Vegetation along roof edge



Photograph 27 - BLDG 7 – Deteriorated pipe flashing



Photograph 28 - BLDG 7 – Moisture staining



Photograph 29 - BLDG 8 – Overview looking west



Photograph 30 - BLDG 8 – Voids in roof surface



Photograph 31 - BLDG 8 – Deteriorated foam at pipe penetration



Photograph 32 - Deteriorated foam at chimney



Photograph 33 - BLDG 9 – Overview



Photograph 34 - BLDG 9 – Repair attempted at northeast corner



Photograph 35 - BLDG 10 - Overview



Photograph 36 - BLDG 10 - Metal flashing upgraded after roof installation



Photograph 37 - BLDG 11 – Loose base flashing at chimney



Photograph 38 - BLDG 11 – Vegetation along roof edge



Photograph 39 - BLDG 11 – Water ponded by improper scupper construction



Photograph 40 - BLDG 11 – Partial ceiling collapse and microbial growth



Photograph 41 - BLDG 12 – Overview looking east



Photograph 42 - BLDG 12 – Deteriorated foam at roof corners



Photograph 43 - BLDG 13 – Overview looking east



Photograph 44 - BLDG 13 – Multiple repairs made to roof at drain



Photograph 45 - BLDG 13 – Deteriorated foam along roof edge



Photograph 46 - BLDG 13 – Multiple repairs to roof at drain



9771D Southern Pine Boulevard
 Charlotte, NC 28273
 704-940-1830 Fax 704-565-4929
 NVLAP Lab Code 102075-0

POLARIZED LIGHT MICROSCOPY

Performed by EPA 600/R-93/116 Method

Asbestos Analysis Summary

Client Name Raymond Engineering Greer
Client Job City of Spart. Oakview Apts

1900 S. Hwy 14 Suite a
 Greer SC 29650

Date Received 3/25/2016

Date Analyzed 3/29/2016

Job Number 4335-15-230

Lab ID:	Sample #:	Appearance	Comments	Asbestos %/Type	Non-Asbestos Fibrous %/Type	Non-Fibrous %/Type
16-3358	1	BLACK FIBROUS		ND	10 SYNTHETIC 10 GLASS	80 OTHER
16-3359	2	BLACK FIBROUS		ND	10 SYNTHETIC 10 GLASS	80 OTHER
16-3360A	3	BLACK FIBROUS	ROOF	ND	15 CELLULOSE	85 OTHER
16-3360B	3	YELLOW SPONGY	FOAM	ND		100 OTHER

Analyzed by: Jane Wasilewski

Additional Comments:

Jane Wasilewski
 Laboratory Manager

For heterogeneous samples easily separated into subsamples, and for layered samples, each component is analyzed separately. ND = None Detected (Asbestos Not Present In Representative Sample). RCF= (Refractory Ceramic Fiber) The results relate only to the items tested. The sample may not be fully representative of the larger material in question. This sheet may not be reproduced except with permission from SME, Inc. This report may not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. Although Polarized Light Microscopy (PLM/Dispersion Staining) (Method EPA 600/R-93/116) is the specified method for analysis of bulk material samples for asbestos under the EPA Asbestos Hazard Emergency Response Act, there have been reports that this method may not identify asbestos when fiber sizes are extremely small or if they are bound in a resinous material. Such materials include floor tile, mastic and asphaltic roofing. Currently, reanalysis by Transmission Electron Microscopy (TEM) to verify results of <1% or "None Detected" for these materials is recommended.

<i>Lab ID:</i>	<i>Sample #:</i>	<i>Appearance</i>	<i>Comments</i>	<i>Asbestos %/Type</i>	<i>Non-Asbestos Fibrous %/Type</i>	<i>Non-Fibrous %/Type</i>
16-3361A	4	BLACK FIBROUS	ROOF	5 CHRYSOTILE	15 CELLULOSE 2 GLASS	78 OTHER
16-3361B	4	BROWN FIBROUS	INSULATION	ND	100 CELLULOSE	
16-3361C	4	YELLOW SPONGY	FOAM	ND		100 OTHER
16-3362A	5	BLACK FIBROUS	ROOF	12 CHRYSOTILE	10 CELLULOSE 2 GLASS	76 OTHER
16-3362B	5	BROWN FIBROUS	INSULATION	ND	100 CELLULOSE	
16-3362C	5	YELLOW SPONGY	FOAM	ND		100 OTHER

Analyzed by: Jane Wasilewski

Additional Comments:

Jane Wasilewski
Laboratory Manager

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<i>Lab ID:</i>	<i>Sample #:</i>	<i>Appearance</i>	<i>Comments</i>	<i>Asbestos %/Type</i>	<i>Non-Asbestos Fibrous %/Type</i>	<i>Non-Fibrous %/Type</i>
16-3363A	6	BLACK FIBROUS	ROOF	15 CHRYSOTILE	10 CELLULOSE	75 OTHER
16-3363B	6	YELLOW SPONGY	FOAM	ND		100 OTHER
16-3364A	7	BLACK FIBROUS	ROOF	10 CHRYSOTILE	15 CELLULOSE	75 OTHER
16-3364B	7	BROWN FIBROUS	INSULATION	ND	100 CELLULOSE	
16-3364C	7	YELLOW SPONGY	FOAM	ND		100 OTHER
16-3365A	8	BLACK FIBROUS	ROOF	25 CHRYSOTILE	10 CELLULOSE	65 OTHER

Analyzed by: Jane Wasilewski

Additional Comments:

Jane Wasilewski
Laboratory Manager

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Lab ID:	Sample #:	Appearance	Comments	Asbestos %/Type	Non-Asbestos Fibrous %/Type	Non-Fibrous %/Type
16-3365B	8	YELLOW SPONGY	FOAM	ND		100 OTHER

Analyzed by: Jane Wasilewski

Additional Comments:

Jane Wasilewski
Laboratory Manager

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BULK SAMPLE

CHAIN OF CUSTODY RECORD 4335-15-230

POLARIZED LIGHT MICROSCOPY
PERFORMED BY EPA 600/R-93/116 METHOD

PROJECT NO. GSD1033001	PROJECT NAME CITY OF SPARTANBURG	RELINQUISHED BY: Walker OZIER	DATE 3/23/16	TIME	RECEIVED BY: <i>[Signature]</i>	DATE 3/25/16	TIME
FACILITY Oakview Apartments		RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME
SAMPLER(S)		DATE TAKEN	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE

SAMPLE #	LAB NUMBER	DATE ANALYZED	ANALYSTS INITIALS	ASBESTOS +	N/D	ARCHIVE NUMBER	DATE ARCH	ARCHIVER INITIALS	SPECIAL INSTRUCTIONS
1 + 2	16-3358, 59								
3	60								
4	61								
5	62								
6	63								
7	64								
8	3365								

Same Day
 24 Hour
 48 Hour
 3-5 Day
 6-10 Day

ALL SAMPLES WILL BE DISPOSED OF AFTER ANALYSIS UNLESS OTHERWISE REQUESTED

By signing below, I warrant that I am authorized to enter into this agreement for the client named below, and that I authorize the above analysis subject to the terms and conditions on the reverse hereof.

AUTHORIZED BY *Walker OZIER*
 DATE/TITLE *3/23/16*
 This agreement is governed by the terms and conditions on the reverse side hereof.

PRINT NAME *Walker Ozier*
 walker.ozier@raymondllc.com
 Analysis charges shall be as included in S&ME, Inc.'s fee schedule in effect at the time of the analysis.

CLIENT INVOICE INFORMATION	Client Name	Raymond Engineering	SEND COPIES OF RESULTS TO	Name, Dept.	
	Client PO#			Co.	
	Address	Greer SC 29650		Address	
	City, State, Zip			City, State, Zip	
	Phone: 864 489 8900	FAX:		Phone:	FAX:

WHITE COPY-LABORATORY
 YELLOW COPY-ACCOUNTING
 PINK COPY-CLIENT