

**CALIFORNIA CONTRACTORS
STATE LICENSE BOARD**

**Berkeley Balcony
Investigation Materials**



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CONTRACTORS STATE LICENSE BOARD

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STATE OF CALIFORNIA
Governor Edmund G. Brown Jr.

May 30, 2017

On June 16, 2015, a fourth floor balcony at the Library Gardens apartment complex in Berkeley, California collapsed, killing six people and seriously injuring seven others.

The Contractors State License Board (CSLB) was one of the multiple agencies involved in the subsequent investigation of the incident. CSLB's responsibility was to try to determine the cause, and what part, if any, the contractors involved in the building of the apartment complex played in the collapse of the balcony.

CSLB's investigation included utilizing the services of an industry expert to examine all facets of the balcony construction.

The information contained here includes that industry expert report, as well as other materials that specifically address the design and construction of the balcony that collapsed.

On May 22, 2017, CSLB formally revoked the contractor's license of Segue Construction, Inc., the general contractor responsible for the building of the apartment complex ([CSLB Press Release](#)). Now that its investigation is complete, CSLB is able to publically release the following materials.

David Fogt
Registrar of Contractors

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[REDACTED]

6 August 2015

[REDACTED]
California Architects Board
2420 Del Paso Rd., Suite 105
Sacramento, CA 95834

Re: Unit 305 & 405 Balcony Destructive Testing Protocol
Project: Library Gardens, 2020 Kittridge St., Berkeley, CA

[REDACTED];

Pursuant to our recent visual investigation of the aforementioned balconies and balcony remnants separately warehoused, and our discussions with the Alameda County DA's office, I have developed the following protocol for further destructive & possible laboratory testing of the unit 305 & 405 balconies at the Library Gardens apartments.

Day 1:

Units 305 & 405 Balconies Destructive Testing Investigation

1. Set up scaffolding extending from the sidewalk below to each of the two balconies in order to provide working platforms for the investigators as well as the destructive testing crew.
2. Remove the existing interior French door plywood barriers within both unit 305 & 405 for direct access to the scaffolding supported work platforms.
3. Remove the existing protective plastic weather barrier to expose the remaining portions of each balcony under the exterior French door and threshold.
4. At the direction of the investigating experts, remove portions of the existing waterproofing membrane, protection board, sheet metal deck to wall and threshold pan flashings, French door, threshold and lower jamb frame, extruded aluminum "bal-form" edge metal, any residual concrete topping slab, exterior plaster, and remaining balcony framing elements such as OSB deck sheathing, micro-lam joists, blocking, etc. as necessary to inspect the as-built installations.
5. Destructive testing may also include carefully removing, securing and bagging various as-built balcony detail samples for possible further laboratory testing as follows;
 - a. Testing of the "Bituthene 3000" waterproofing membrane bond to the galvanized deck to wall and French door pan metal flashing as well as verification of the presence of any primer utilized.
 - b. Testing of the "Bituthene 3000" waterproofing membrane bond to the extruded aluminum "bal-form" edge metal as well as verification of the presence of any primer utilized.
 - c. Testing of the "Bituthene 3000" waterproofing membrane bond to the OSB deck sheathing, verification of the presence of any primer utilized and the presence of any sacrificial membrane over the OSB deck sheathing as noted in architectural detail 12/AD33 as "Sonneborn HML 5000 SL to achieve 15 dry mils.....". Sonneborn HML 5000 is currently named BASF MasterSeal HLM 5000.
 - d. Testing & identification of the light green surface treatment to the top surface of the OSB deck sheathing as previously noted in the initial visual investigation.
6. Reinstall the existing protective plastic weather barrier to protect the remaining portions of each balcony under the exterior French door and threshold and reinstall the French doors, thresholds and interior plywood barriers.

Day 2:

Unit 405 Balcony Remnants Destructive Testing Investigation

1. Secure an approximately 1,000 sf warehouse space with adequate lighting for further analysis and destructive testing of unit 405's balcony remnants, currently stored at the City of Berkeley's Public Works Corporation Yard located at 1326 Allston Way, Berkeley, CA.
2. Remove unit 405's balcony remnants from the trailer and separate out on the concrete floor. Reorient the existing guardrail, upright along with the remaining framing and flashing elements to which it is attached and set over a working platform or supporting base approximately 36" off the floor with access to the underside of the perimeter edges.
3. At the direction of the investigating experts, remove portions of the existing waterproofing membrane, protection board, extruded aluminum "bal-form" edge metal, guardrail and guardrail stanchions, any residual concrete topping slab, exterior plaster, and remaining balcony framing elements such as OSB deck sheathing, micro-lam joists, blocking, etc. as necessary to inspect the as-built installations.
4. Destructive testing may also include carefully removing, securing and bagging various as-built balcony detail samples for possible further laboratory testing as follows:
 - a. Testing of the "Bituthene 3000" waterproofing membrane bond to the extruded aluminum "bal-form" edge metal as well as verification of the presence of any primer utilized.
 - b. Testing of the "Bituthene 3000" waterproofing membrane bond to the OSB deck sheathing, verification of the presence of any primer utilized and the presence of any sacrificial membrane over the OSB deck sheathing as noted in architectural detail 12/AD33 as "Sonneborn HML 5000 SL to achieve 15 dry mils (thickness).....". Sonneborn HML 5000 is currently named BASF MasterSeal HLM 5000.
 - c. Testing & identification of the light green surface treatment to the top surface of the OSB deck sheathing as previously noted in the initial visual investigation.
 - d. Testing and identification of the sheet membrane set under the guardrail stanchions as previously noted during the initial visual investigation and verification of its compatibility with WR Grace's "Bituthene 3000" sheet membrane & "Bituthene LM" liquid membrane.
5. Replace any existing protective plastic weather barrier to protect the remnants of unit 405's balcony.

Day 3:

Unit 305 Balcony Remnants Destructive Testing Investigation

1. Secure an approximately 1,000 sf warehouse space with adequate lighting for further analysis and destructive testing of unit 305's balcony remnants, currently stored at the Alameda County, Santa Rita Jail facility located in Dublin, CA.
2. Remove unit 305's balcony remnants from the trailer set the guardrail upright on the concrete floor and set the balcony remnant, intact over a working platform or supporting base approximately 36" off the floor with access to the underside of the perimeter edges. It may be necessary to have access to the entire underside of the balcony remnant for the removal of the plaster soffit.



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6 August 2015

Page 3: Balcony DT Protocol

Day 3:

Unit 305 Balcony Remnants Destructive Testing Investigation (continued)

3. At the direction of the investigating experts, remove portions of the existing waterproofing membrane, protection board, extruded aluminum "bal-form" edge metal, guardrail and guardrail stanchions, any residual concrete topping slab, exterior plaster, and remaining balcony framing elements such as OSB deck sheathing, micro-lam joists, blocking, etc. as necessary to inspect the as-built installations.
4. Destructive testing may also include carefully removing, securing and bagging various as-built balcony detail samples for possible further laboratory testing as follows;
 - a. Testing of the "Bituthene 3000" waterproofing membrane bond to the extruded aluminum "bal-form" edge metal as well as verification of the presence of any primer utilized.
 - b. Testing of the "Bituthene 3000" waterproofing membrane bond to the OSB deck sheathing, verification of the presence of any primer utilized and the presence of any sacrificial membrane over the OSB deck sheathing as noted in architectural detail 12/AD33 as "Sonneborn HML 5000 SL to achieve 15 dry mils (thickness).....". Sonneborn HML 5000 is currently named BASF MasterSeal HLM 5000.
 - c. Testing & identification of the light green surface treatment to the top surface of the OSB deck sheathing as previously noted in the initial visual investigation.
 - d. Testing and identification of the sheet membrane set under the guardrail stanchions as previously noted during the initial visual investigation and verification of its compatibility with WR Grace's "Bituthene 3000" sheet membrane & "Bituthene LM" liquid membrane.
5. Destructive testing may also include isolated water testing around the as-built "bal-form" metal, "bal-form" weep holes as well as the guardrail stanchions prior to their removal.
6. Replace any existing protective plastic weather barrier to protect the remnants of unit 305's balcony.

I have anticipated three days of testing, as I expect that with the numerous interested parties who will want to be present to watch, inspect and or document the as-built conditions also, the testing will take longer than it would otherwise.

Additionally, I am currently in contact with construction companies whom routinely perform the type of testing described and will get some preliminary budgets from each of them.

Also, I am in the process of identifying one or more material testing labs whom may be able to assist in performing the appropriate ASTM material testing protocol for each.

Thank you for your time.

Robert Burnett Perry, AIA, NCARB, LEED AP
CA Architectural Registration C14239
Perry Consulting Group, Inc.

Cc; [REDACTED] AIA - CA Architects Board
Carl Josephson, SE - JW&A
[REDACTED] CEPD
[REDACTED] DA

[REDACTED]

21 August 2015

[REDACTED]
California Architects Board
2420 Del Paso Rd., Suite 105
Sacramento, CA 95834

Re: Unit 305 & 405 Balcony Sample Laboratory Testing Protocol
Project: Library Gardens, 2020 Kittridge St., Berkeley, CA

[REDACTED]

Pursuant to our recent visual investigation of the aforementioned balconies and balcony remnants separately warehoused, and our discussions with the Alameda County DA's office, I have developed the following protocol for laboratory testing of samples expected to be removed from the unit 305 & 405 balcony remnants at the Library Gardens Apartments.

Laboratory Testing Protocol & Expected Sample Size

Unit 305 Balcony Remnant Attached to Building

A.1 & A.2 (6"x12")

Unit 305 Balcony Remnant @ Warehouse

B.1 & B.2 (12"x12")

C.1 & C.2 (12"x12")

D.1, D.2, E.1 & E.2 (12"x12")

Unit 405 Balcony Remnant Attached to Building

A.1 & A.2 (6"x12")

Unit 405 Balcony Remnant @ Warehouse

B.1 & B.2 (6"x12")

C.1 & C.2 (6"x12")

D.1, D.2, E.1 & E.2 (6"x12")

Laboratory Sample Test Legend

Test Description

- A.1 ASTM D903 – 1998 (2010) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; Adhesion Test of WR Grace "Bituthene 3000" & "Bituthene LM" to the existing deck to wall galvanized sheet metal flashing.
- A.2 Microscopic & Infrared Spectrophotometry test to verify if and or what primer may have been used between the WR Grace "Bituthene 3000" and the deck to wall galvanized sheet metal flashing.
- B.1 ASTM D903 – 1998 (2010) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; Adhesion Test of WR Grace "Bituthene 3000" & "Bituthene LM" to the extruded aluminum "balform" edge metal.
- B.2 Microscopic & Infrared Spectrophotometry test to verify if and or what primer may have been used between the WR Grace "Bituthene 3000" and the extruded aluminum "balform" edge metal.



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21 August 2015

Page 2: Balcony Sample Laboratory Testing Protocol

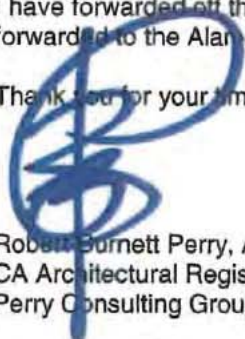
- C.1 ASTM D903 – 1998 (2010) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; Adhesion Test of WR Grace "Bituthene 3000" to the existing OSB Oriented Strain Board deck sheathing.
- C.2 Microscopic & Infrared Spectrophotometry test to verify if and or what primer may have been used between the WR Grace "Bituthene 3000" and the OSB Oriented Strain Board deck sheathing including identification of the observed light green surface treatment as well as whether the specified "Sonneborn HML 5000 SL", currently named BASF MasterSeal HLM 5000 had been applied.
- D.1 ASTM D903 – 1998 (2010) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; Adhesion Test of WR Grace "Bituthene 3000" & "Bituthene LM" to existing (paint primed) metal guardrail stanchion.
- D.2 Microscopic & Infrared Spectrophotometry test to verify if and or what primer may have been used between the WR Grace "Bituthene 3000" & "Bituthene LM" and the (paint primed) metal guardrail stanchion.
- E.1 ASTM D903 – 1998 (2010) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; Adhesion Test of WR Grace "Bituthene 3000" & "Bituthene LM" to existing Fortifiber "FortiFlash 40" membrane flashing set under the (paint primed) metal guardrail stanchion base plate.
- E.2 Microscopic & Infrared Spectrophotometry test to verify if and or what primer may have been used between the WR Grace "Bituthene 3000" & "Bituthene LM" and the Fortifiber "FortiFlash 40" membrane flashing set under the (paint primed) metal guardrail stanchion base plate.

Upon completion of the aforementioned testing, a brief report of test results & findings for each of the tested samples will be requested.

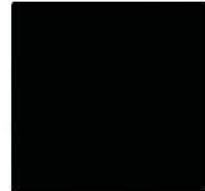
I have identified (3) material testing labs, Anamet, Inc. in Hayward, CA, Applied Materials & Engineering in Oakland, CA & UL's lab in San Jose, CA, who should be able to perform the appropriate ASTM material testing, microscopic & infrared spectrophotometry testing protocol for each sample removed.

I have forwarded off the protocol to each lab so that they may submit a budget estimate which will be forwarded to the Alameda County DA's office.

Thank you for your time.


Robert Burnett Perry, AIA, NCARB, LEED AP
CA Architectural Registration C14239
Perry Consulting Group, Inc.

Cc; [REDACTED] AIA - CA Architects Board
Carl Josephson, SE – JW&A
[REDACTED] CEPD
[REDACTED] DA



November 30, 2015

LABORATORY NUMBER:



CUSTOMER AUTHORIZATION:

Cost Proposal Accepted by [Redacted]
Alameda County District Attorney's Office

DATE SUBMITTED:

October 7, 2015

REPORT TO:

Alameda County District Attorney's Office

REGARDING:

Mechanical Testing and Infrared Spectroscopy,
Unit 305 & 405 Balcony Remnant Samples,
Library Gardens, 2020 Kittridge St., Berkeley, CA

1.0 SUBJECT

Seven balcony remnant samples were submitted for mechanical testing, microscopic examination, and Fourier transform infrared spectroscopy (FTIR) per the laboratory testing protocol provided by [Redacted] dated 21 August 2015 (copy attached).

2.0 SAMPLES SUBMITTED

Table 1 – Sample Numbers and Identifications

Sample No.	Sample Identification
305A	Unit 305 Balcony Remnant Attached to Building, 5 October 2015
305B	Unit 305 Balcony Remnant @ Warehouse, 7 October 2015
305C	Unit 305 Balcony Remnant @ Warehouse, 7 October 2015
305DE	Unit 305 Balcony Remnant @ Warehouse, 7 October 2015
405A	Unit 405 Balcony Remnant Attached to Building, 5 October 2015
405B	Unit 405 Balcony Remnant @ Warehouse, 6 October 2015
405DE	Unit 405 Balcony Remnant @ Warehouse, 6 October 2015





Lab. No. [REDACTED]
November 30, 2015

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3.0 TEST SUMMARY

3.1 Sample Preparation for Peel Testing

Each sample was individually photographed and the proposed one inch wide peel specimen locations were marked on the sample. Excess material was removed from the sample, leaving a test section consisting of the Bituthene layer and the metal substrate, the Oriented Strand Board (OSB) or the Fortiflash 40. Next, each sample was cut into one inch strips as per ASTM D903-98 using a DoALL model ML band saw. Since sample 305C did not have any suitable material to be gripped, an aluminum backing was bonded to the OSB. The remaining concrete on sample 405B was broken out in order to obtain testable samples. One inch of the Bituthene membrane was peeled from the substrate metal, the Fortiflash 40 film or the OSB from each sample in order to clamp it in the top grip. Photographic documentation of the samples and prepared peel test specimens are presented in Appendix A.

3.2 Peel Testing

Peel testing was conducted on the balcony remnant samples using an Instron tensile tester, model 5985, calibrated traceable to the National Institute of Standards and Technology (NIST). Each prepared specimen was placed on an alignment plate and clamped using the top grip. The Bituthene membrane was bent down in order to clamp it in the bottom grip. Once the specimen was clamped in both grips, the Bituthene membrane was peeled from the substrate metal, the Fortiflash 40 or the OSB at an angle of 180° at a crosshead rate of 6 inches per minute until the membrane was entirely peeled off, as per ASTM D903-98. The peak and average loads as a function of distance peeled were recorded.

3.3 Microscopic Examination

Microscopic examination was conducted on cross sections of the membrane portion of Sample 305C to determine the number of membrane layers present and the thickness of each layer. The examination was conducted using a Leica M205 C optical microscope equipped with a Leica DFC420 digital camera.

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3.4 FTIR

FTIR analysis was conducted on the balcony remnant samples using a Thermo Scientific Fourier transform infrared spectrophotometer, model Nicolet iS50 FT-IR equipped with a Nicolet Continuum FT-IR Microscope. The FTIR methodology employed was attenuated total reflection (ATR), using diamond and germanium crystals.

Samples 305A and 405A were analyzed for the presence of primer between the "Bituthene" membrane and the galvanized sheet metal.

Samples 305B and 405B were analyzed for the presence of primer between the "Bituthene" membrane and the extruded aluminum "balform" edge metal.

Sample 305C was analyzed for the presence of primer between the "Bituthene" membrane and the OSB deck sheathing. In addition, the sample was analyzed to determine whether the specified "Sonneborne HML 5000 SL" membrane (now known as "BASF MasterSeal HLM 5000 SL") had been utilized.

Samples 305DE and 405DE were analyzed for the presence of primer between the "Bituthene" membrane and the primed/painted metal guardrail stanchion. In addition, the samples were analyzed for the presence of primer between the "Bituthene" membrane and the "Fortiflash 40" membrane flashing set beneath the primed/painted metal guardrail stanchion base plate.

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4.0 RESULTS

4.1 Peel Testing

A summary of the mechanical testing results can be found in Table 2 and Table 3 below. A detailed record of individual tests are available upon request.

Table 2 – Summary of Peel Test Results, Sample Set from Unit 305

Specimen No.	Width (in)	Peak Load (lbf)	Average Load (lbf)	Average Peel Strength (lbf/in)
305A-1	1.1	18	12.9	11.7
305A-2	1.0	14	11.1	11.1
305A-3	1.0	12	8.1	8.1
305A-4	1.0	15	10.0	10.0
305A-5	1.1	21	16.9	15.4
305B-1	1.1	13	11.4	10.4
305B-2	1.0	14	11.9	11.9
305B-3	1.0	14	12.8	12.8
305B-4	1.1	15	12.7	11.5
305B-5	1.2	11	9.3	7.8
305C-1	N/A*	N/A*	N/A*	N/A*
305C-2	1.1	4	2.4	2.2
305C-3	N/A*	N/A*	N/A*	N/A*
305C-4	1.2	1	0.6	0.5
305D-1-Stanchion	1.0	6	3.0	3.0
305D-2-Stanchion	1.1	4	1.6	1.5
305E-1-Substrate Metal	1.0	17	11.9	11.9
305E-2-Substrate Metal	1.1	21	16.3	14.8
305E-3-Substrate Metal	1.2	7	3.2	2.7
305E-4-Substrate Metal	N/A*	N/A*	N/A*	N/A*
305E-5-Substrate Metal	1.2	15	9.8	8.2
305E-6-Substrate Metal	1.0	14	7.2	7.2
305E-1-Fortiflash	N/A**	N/A**	N/A**	N/A**
305E-2-Fortiflash	N/A**	N/A**	N/A**	N/A**
305E-3-Fortiflash	1.2	14	10.5	8.8
305E-4-Fortiflash	1.2	8	4.8	4.0
305E-5-Fortiflash	1.2	16	8.9	7.4
305E-6-Fortiflash	1.0	14	8.7	8.7
305E-7-Fortiflash	N/A*	N/A*	N/A*	N/A*

N/A* - Bond peeled prior to testing

N/A** - No Fortiflash 40 present in specimen

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November 30, 2015

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Table 3 – Summary of Peel Test Results, Sample Set from Unit 405

Specimen No.	Width (in)	Peak Load (lbf)	Average Load (lbf)	Average Peel Strength (lbf/in)
405A-1	1.0	19	12.6	12.6
405A-2	1.0	14	10.1	10.1
405A-3	1.0	14	10.0	10.0
405A-4 Part 1	1.1	20	10.2	9.3
405A-4 Part 2	1.1	13	10.2	9.3
405A-5	1.1	16	12.5	11.4
405B-1	N/A*	N/A*	N/A*	N/A*
405B-2	N/A*	N/A*	N/A*	N/A*
405B-3	N/A*	N/A*	N/A*	N/A*
405B-4	N/A*	N/A*	N/A*	N/A*
405B-5	N/A*	N/A*	N/A*	N/A*
405D-1-Stanchion	1.0	4	0.7	0.7
405D-2-Stanchion	1.0	3	0.3	0.3
405E-1-Fortiflash	1.1	17	7.8	7.1
405E-2-Fortiflash	1.1	9	4.6	4.2
405E-3-Fortiflash	1.1	12	5.9	5.4

N/A* - Bond peeled prior to testing

4.2 Microscopic Examination and FTIR

The membrane portion of Sample 305C exhibited two distinct regions. The first region exhibited three separate membrane layers that consisted of one "Bituthene" type self-adhered membrane layer sandwiched between two similar polyurethane type membrane layers. The area of the region was approximately 1.5 inches by 5 inches. The second region consisted of one "Bituthene" type self-adhered membrane layer that covered the remaining area of approximately 3.5 inches by 5 inches. The average thickness and range of the each membrane layer are presented below in Table 4.

Table 4 – Summary of Membrane Thickness Results, Sample 305C

Region	Layer	Thickness, mils
first	bottom, polyurethane type membrane	average = 78, range = 0 - 113
	middle, "Bituthene" type self-adhered membrane	average = 55 ¹ , range = 40 - 63 ¹
	top, polyurethane type membrane	average = 71, range = 0 - 110
second	one "Bituthene" type self-adhered membrane	average = 59 ¹ , range = 50 - 73 ¹

¹ includes polyethylene plastic film thickness of ~ 5 mils

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A summary of the FTIR results for all samples are presented below in Table 5.

Table 5 – Summary of FTIR Results, All Samples

Sample No.	Material Detected/Not Detected	Material Characterization	FTIR Spectrum No.
305A	primer detected	acrylic polymer	1 and 2
305B	primer detected	acrylic polymer	3 and 4
305C	primer detected membrane detected	acrylic polymer urethane polymer	5, 6, 7, and 8 9
305DE	Test D - primer not detected Test E - primer not detected	n/a n/a	10, 11, and 12 13 and 14
405A	primer detected	acrylic polymer	15
405B	primer detected	acrylic polymer	16
405DE	Test D - primer detected Test E - primer detected	acrylic polymer acrylic polymer	17, 18, and 19 20, 21, and 22

The FTIR spectra are included with this report under separate cover.

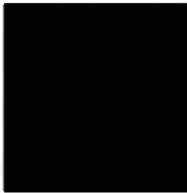
5.0 DISCUSSION

5.1 Peel Testing

All samples were tested in conformance with ASTM D903-98 except when noted. Specimen 305C-1 and Specimen 305C-3 were unable to be tested, as the OSB delaminated from itself prior to testing. Specimen 305C-2 and Specimen 305C-4 were tested, but did not properly test peel strength, as the OSB delaminated from itself during testing. Specimen 305E-1-Fortiflash and Specimen 305E-2-Fortiflash were unable to be tested, as they did not contain Fortiflash 40. Specimen 305E-4-Substrate Metal and Specimen 305E-7-Fortiflash were unable to be tested, as the bond peeled after specimen preparation. Sample 405B was unable to be tested after the concrete was removed, as it was discovered the bond had failed prior to receiving the sample.

5.2 Microscopic Examination and FTIR

Based upon the FTIR spectra obtained, an acrylic type primer was utilized between the "Bituthene" membrane and the substrate metal, OSB, or "Fortiflash 40" on balcony remnant samples 305A, 305B, 305C, 405A, 405B, and 405DE. The Material Safety Data Sheet for "Bituthene Primer WP-3000" states that the material is an acrylic polymer. No primer was detected between the "Bituthene" membrane and the primed/painted metal guardrail stanchion or "Fortiflash 40" on balcony remnant sample 305DE.



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Based upon the microscopic examination and the FTIR spectra obtained on Sample 305C, a layer of similar polyurethane type membrane was utilized above and below a single layer of "Bituthene" type self-adhered membrane on a 1.5 inch by 5 inch section of the sample. The remaining 3.5 inch by 5 inch section of the sample was absent of polyurethane membrane and showed only the one layer of "Bituthene" type self-adhered membrane. Based upon the FTIR spectra obtained and published product information, the polyurethane type membrane found present could be "Bituthene Liquid Membrane LM and Deck Prep" – an asphalt-modified polyurethane – or "BASF MasterSeal HLM 5000" – a bitumen-modified polyurethane.

Submitted by:



Associate Director, Chemical Analysis and Testing

Reviewed by:



Quality Manager

and



Mechanical Testing Engineer



Lab No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

Appendix A
Sample and Test Specimen Photographs



Figure 1 (a)



Figure 1 (b)





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November 19, 2015

Alameda County District Attorney's Office

Appendix A
Sample and Test Specimen Photographs

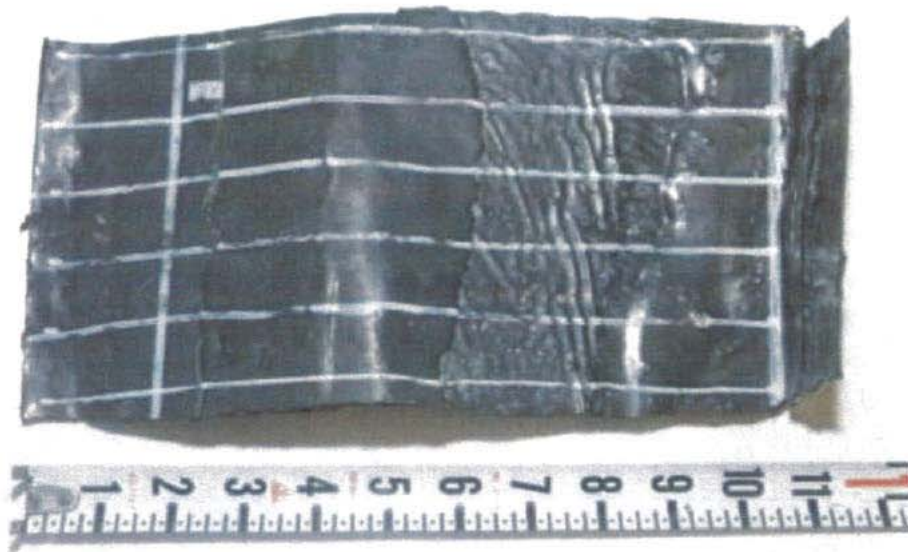


Figure 1 (c)

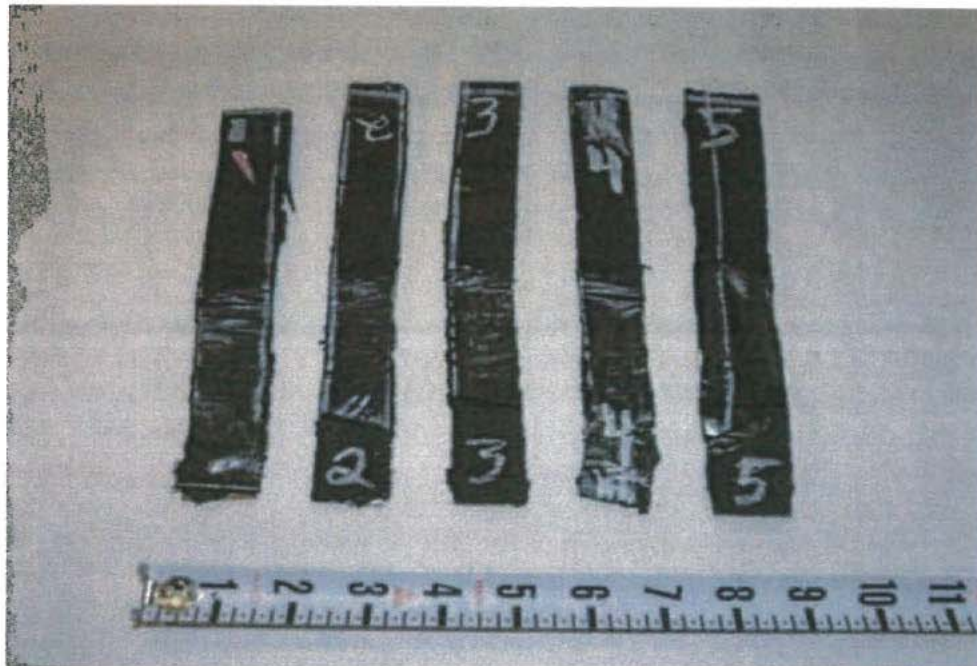


Figure 1 (d)

Figure 1- Photos of sample 305A showing a) as received Bituthene layer b) as received layer of substrate metal and OSB c) cutting lines (d) cut specimens.



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Appendix A
Sample and Test Specimen Photographs



Figure 2 (a)



Figure 2 (b)



Lab No. [REDACTED]
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Appendix A
Sample and Test Specimen Photographs



Figure 2 (c)

Figure 2– Photos of Sample 305B showing (a) as received Bituthene layer (b) as received metal substrate and OSB layer (c) cut specimens.

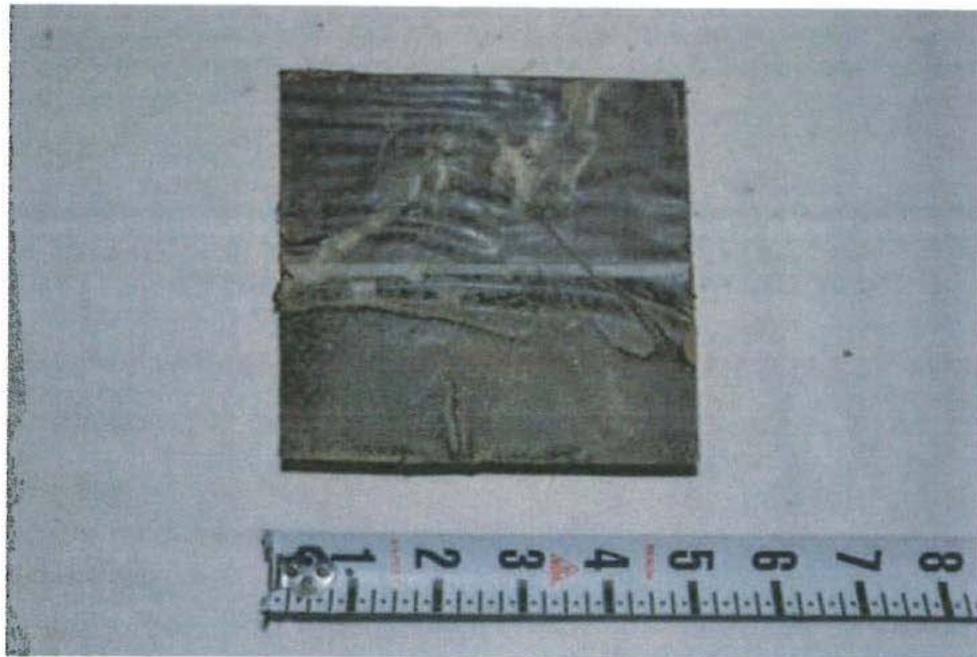


Figure 3 (a)



Lab No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

Appendix A
Sample and Test Specimen Photographs



Figure 3 (b)



Figure 3 (c)



Lab No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

Appendix A
Sample and Test Specimen Photographs

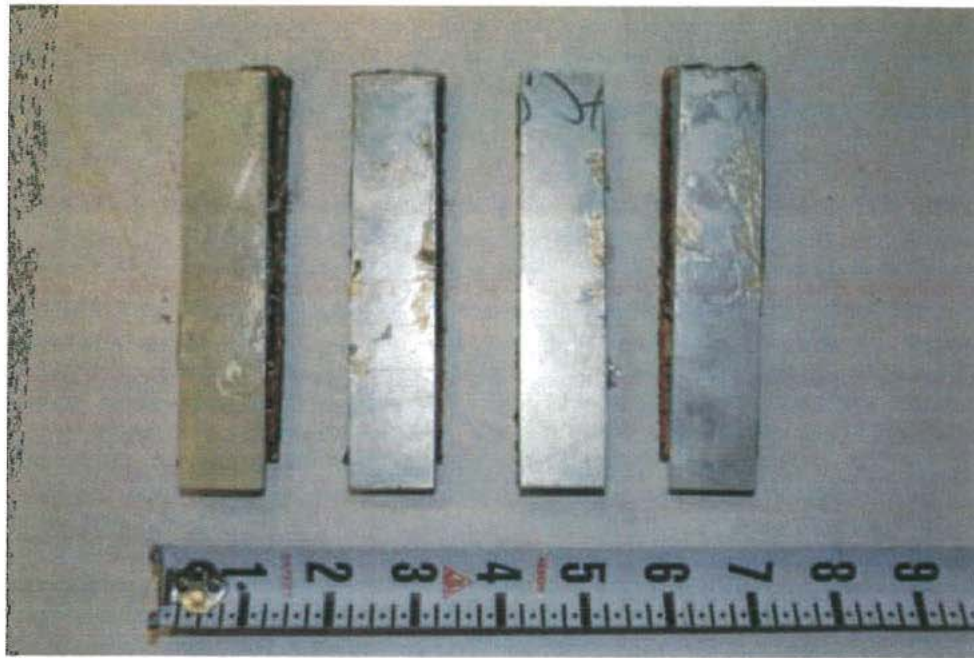


Figure 3 (d)

Figure 3— Photos of Sample 305C showing (a) as received Bituthene layer (b) as received OSB (c) cutting lines (d) cut specimens bonded to aluminum backing.

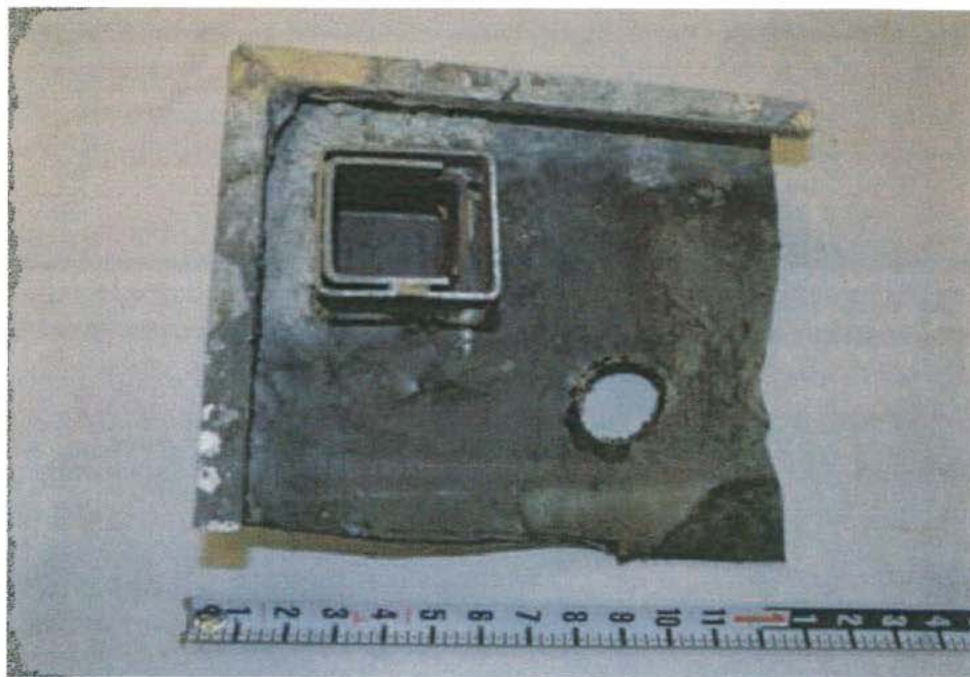


Figure 4 (a)



Lab No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

Appendix A
Sample and Test Specimen Photographs



Figure 4 (b)



Figure 4 (c)



Lab No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

Appendix A
Sample and Test Specimen Photographs



Figure 4 (d)



Figure 4 (e)



Lab No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

Appendix A
Sample and Test Specimen Photographs

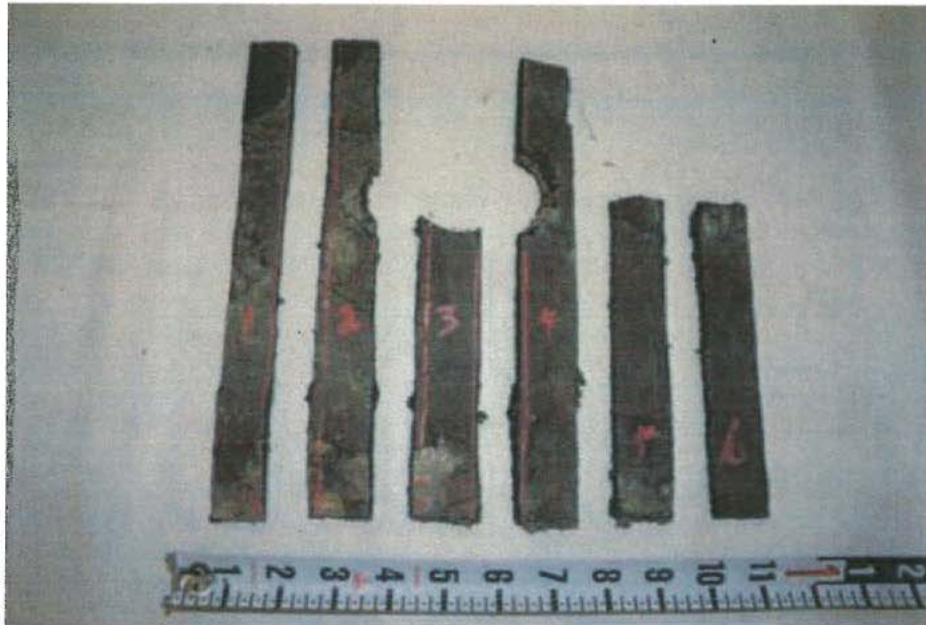


Figure 4 (e)

Figure 4 – Photos of sample 305D/E showing (a) as received Bituthene layer (b) as received substrate metal and OSB layer (c) cutting lines and stanchion vs. Fortiflash 40 samples (d) Bituthene layer from cut 305D specimens (e) metal stanchion from cut 305D specimens (f) cut 305E specimens.



Figure 5 (a)



Lab No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

Appendix A
Sample and Test Specimen Photographs

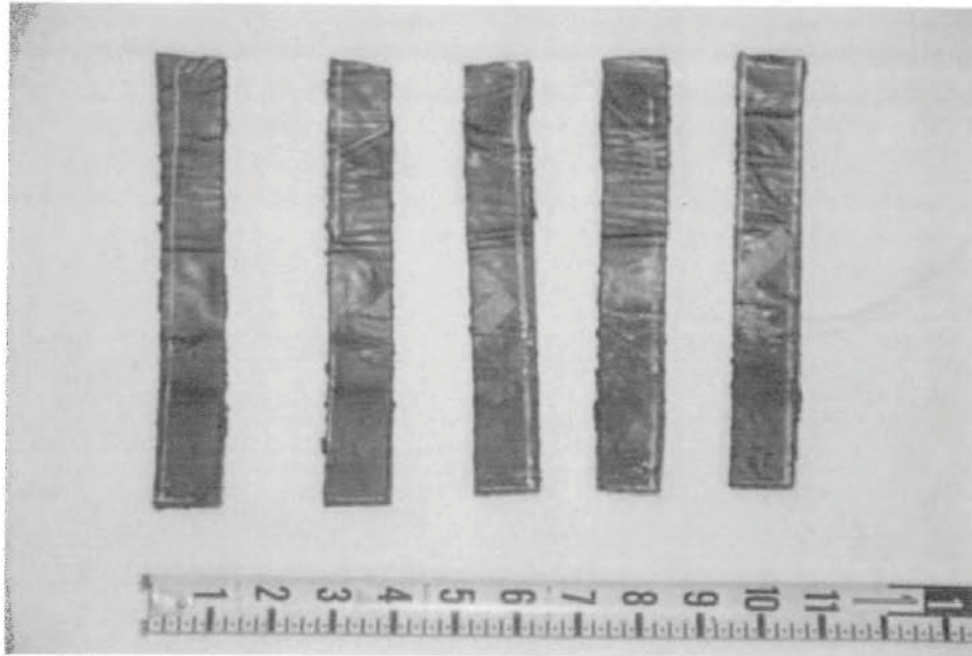


Figure 5 (b)

Figure 5 – Photos of sample 405A showing (a) as received Bituthene layer with cutting lines (b) cut specimens.

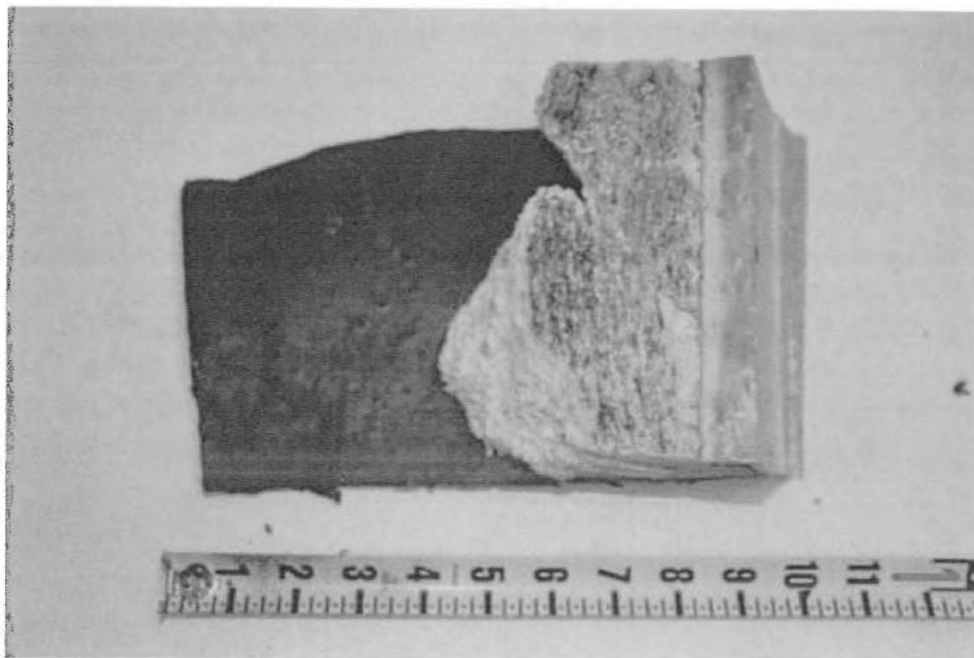


Figure 6 (a)



Lab No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

Appendix A
Sample and Test Specimen Photographs

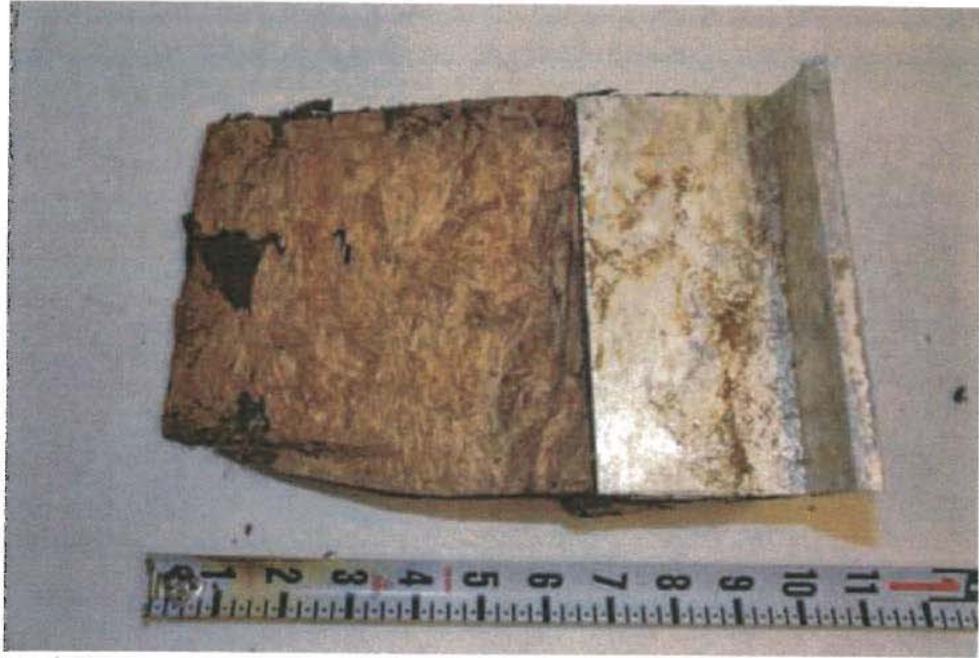


Figure 6 (b)



Figure 6 (c)



Lab No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

Appendix A
Sample and Test Specimen Photographs



Figure 6 (d)

Figure 6 – Photos of sample 405B showing (a) as received Bituthene layer with concrete block (b) as received OSB layer (c) side view of pre-testing failure (d) top view of pre-testing failure.

Once the concrete block was broken away from the sample, it was determined that it was unable to be tested for peel strength, as the bond had failed prior to receiving the sample.



Lab No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

Appendix A
Sample and Test Specimen Photographs



Figure 7 (a)



Figure 7 (b)



Lab No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

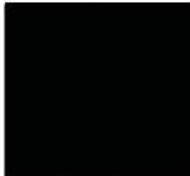
Appendix A
Sample and Test Specimen Photographs



Figure 7 (c)



Figure 7 (d)



Lab No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

Appendix A
Sample and Test Specimen Photographs

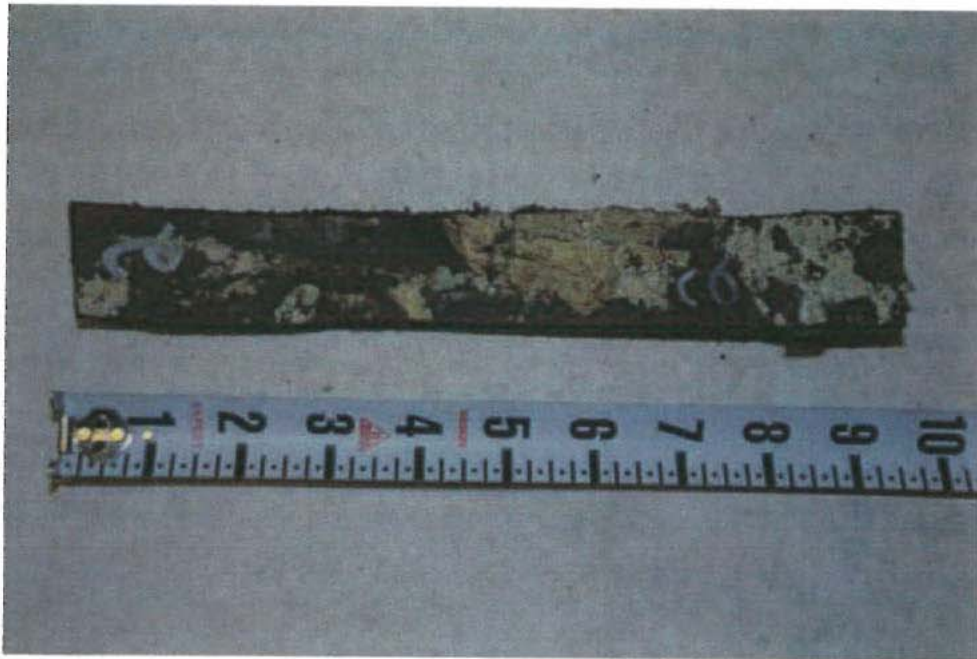


Figure 7 (e)

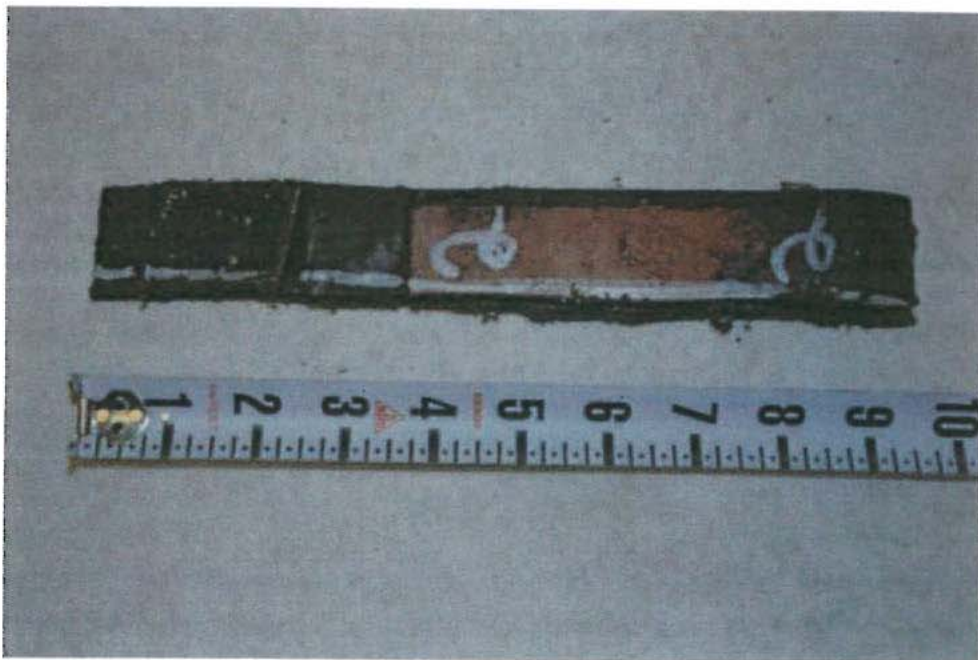


Figure 7 (f)



Lab No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

Appendix A
Sample and Test Specimen Photographs

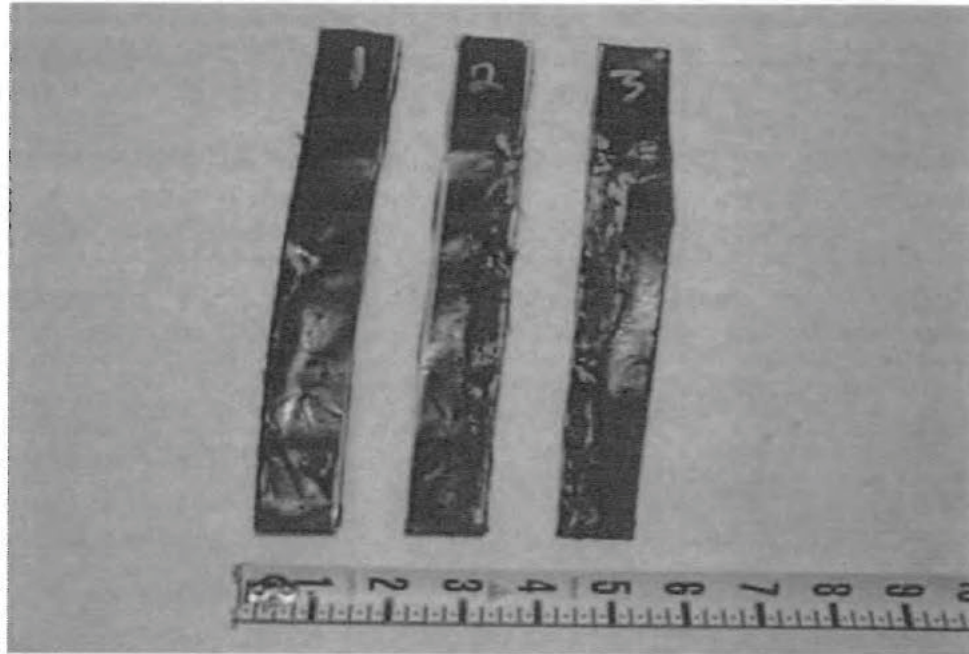


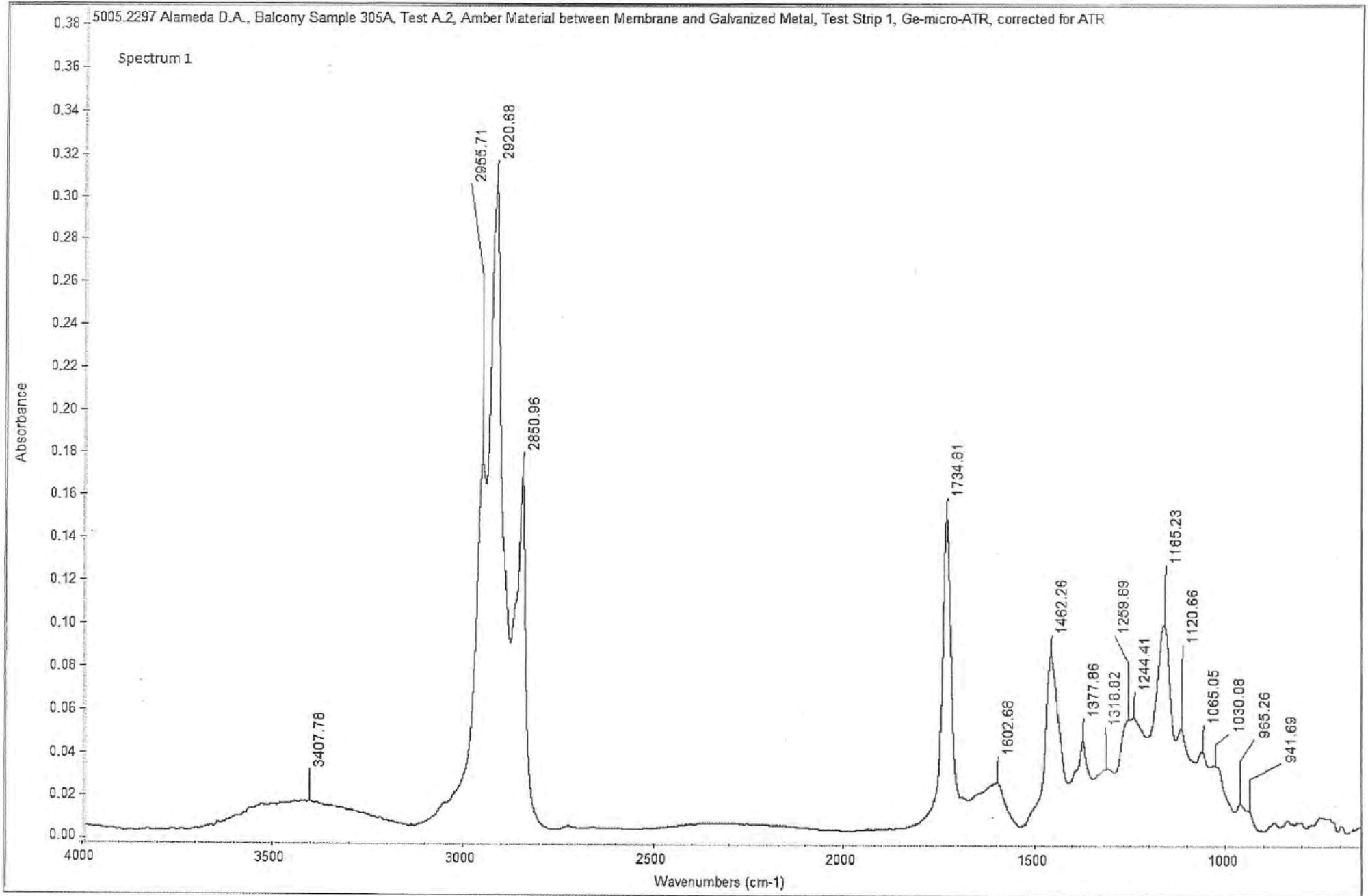
Figure 7 (g)

Figure 7 – Photos of sample 405D/E showing (a) as received Bituthene layer (b) as received OSB layer (c) Bituthene layer of specimen 405D-1 (d) metal stanchion layer of specimen 405D-1 (e) Bituthene layer of specimen 405D-2 (f) metal stanchion layer of cut specimen 405D-2 (g) 405E cut specimens.

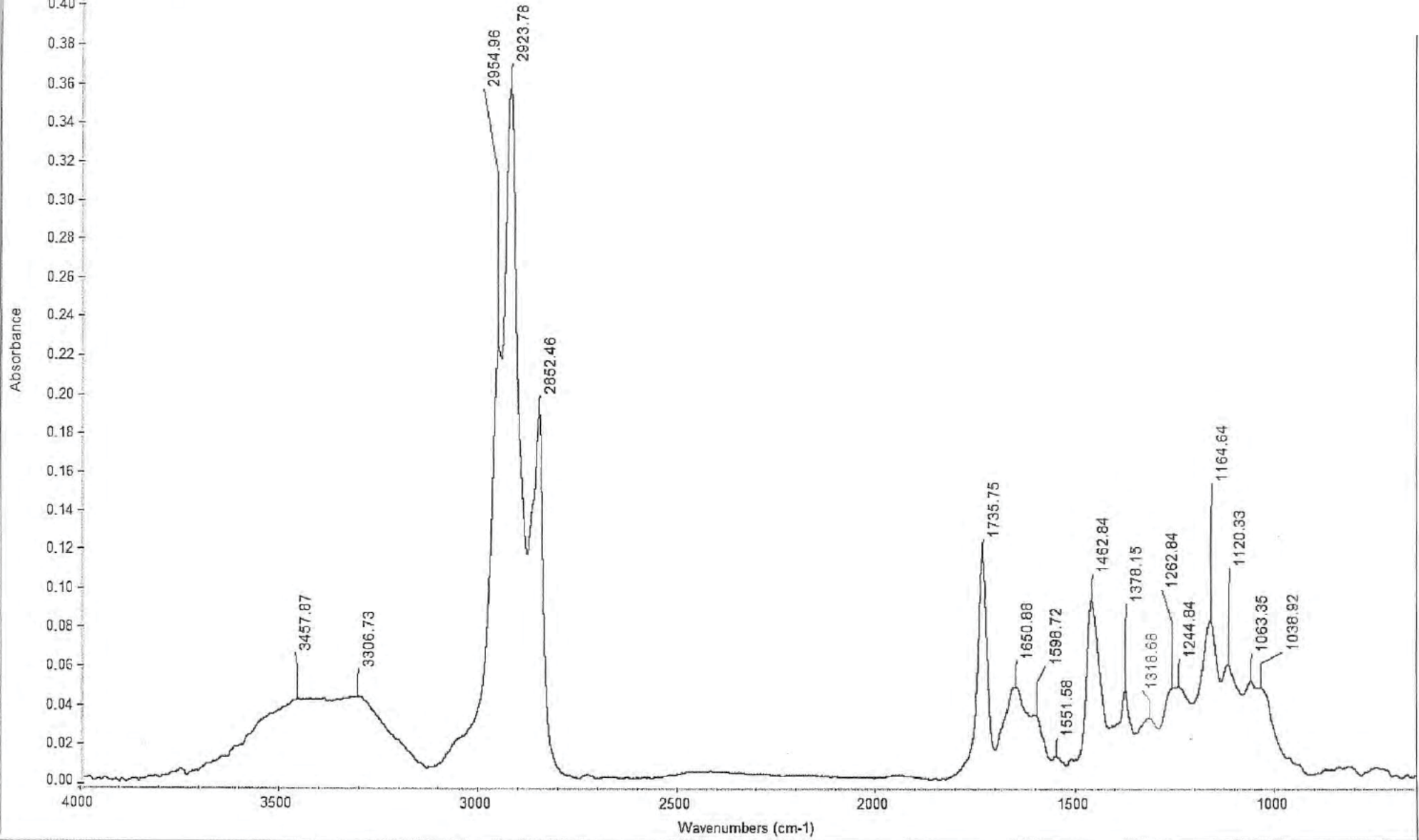
Lab. No. [REDACTED]
November 19, 2015

Alameda County District Attorney's Office

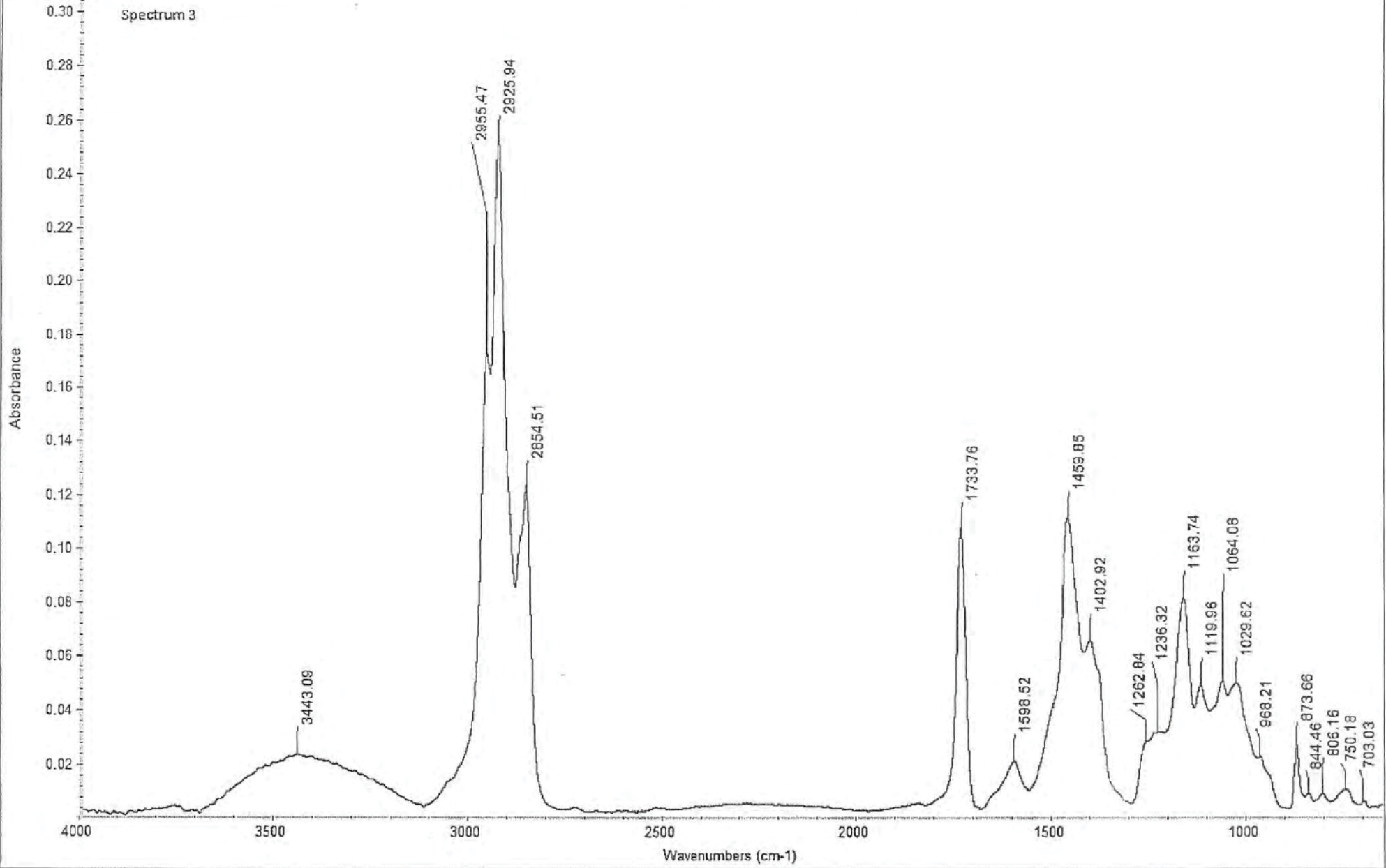
FTIR Spectra
Unit 305 & 405 Balcony Samples, Library Gardens, Berkeley, CA



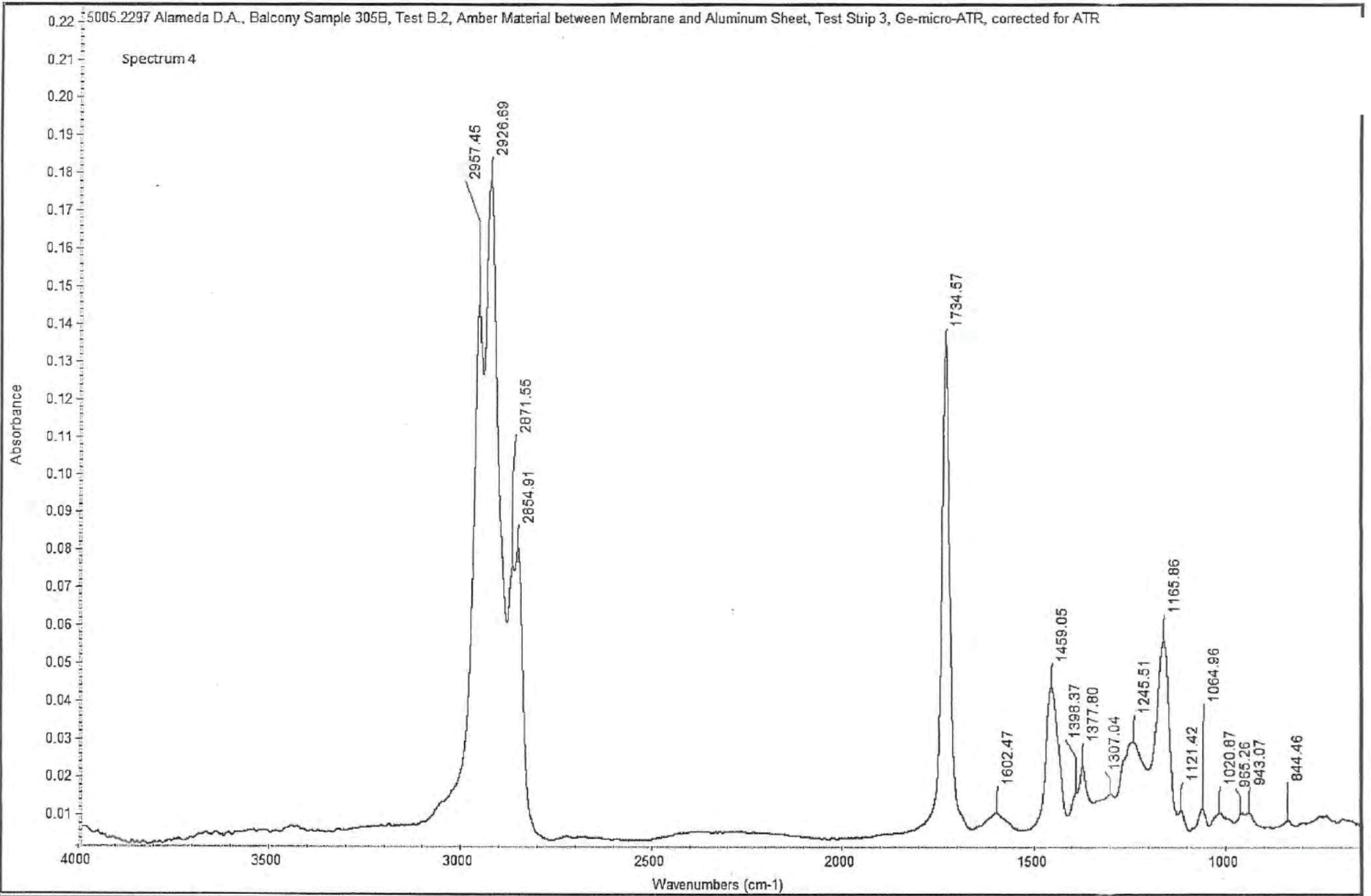
Spectrum 2

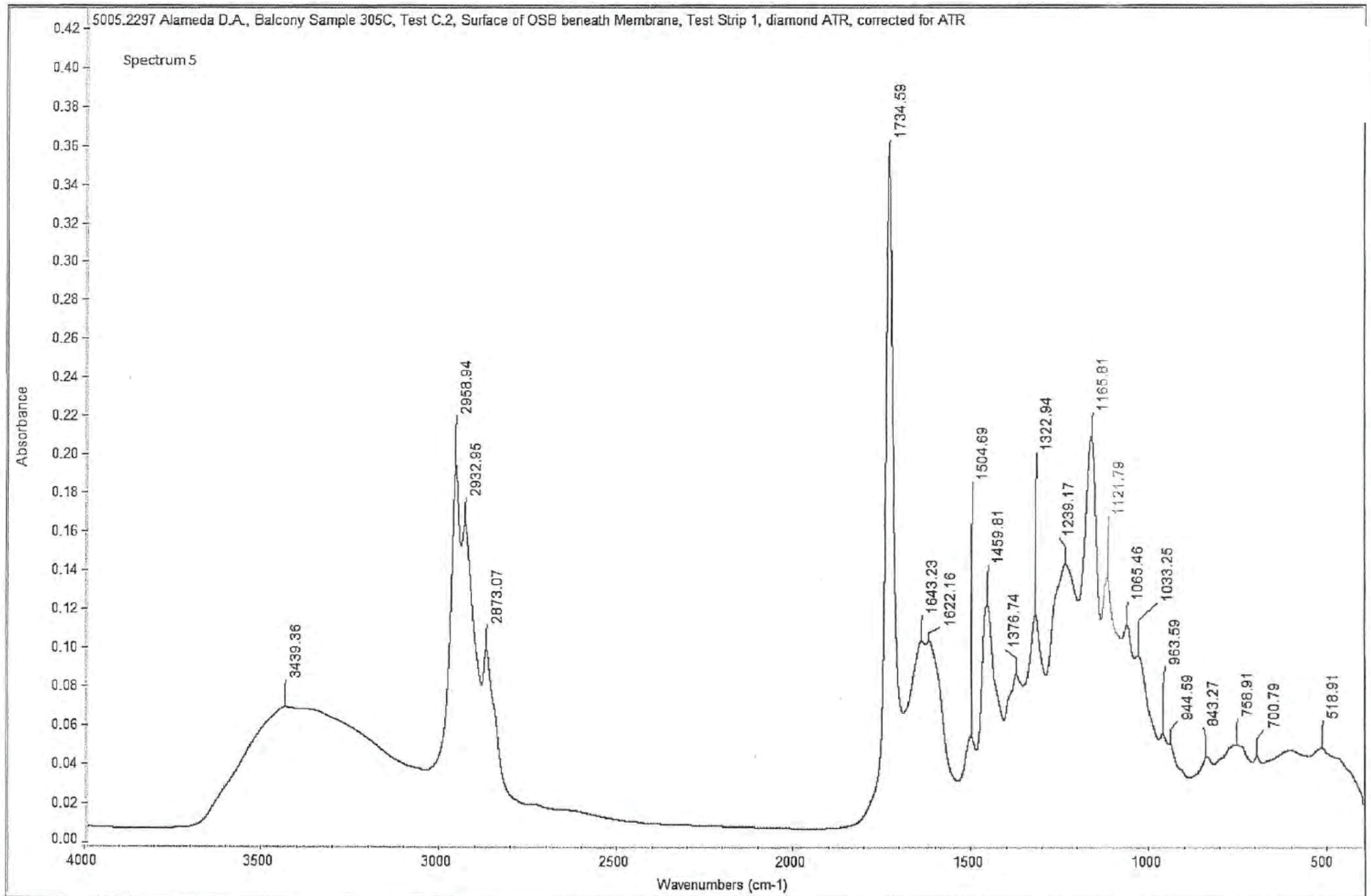


5005.2297 Alameda D.A., Balcony Sample 305B, Test B.2, Amber Material between Membrane and Aluminum Sheet, Test Strip 2, Ge-micro-ATR, corrected for ATR

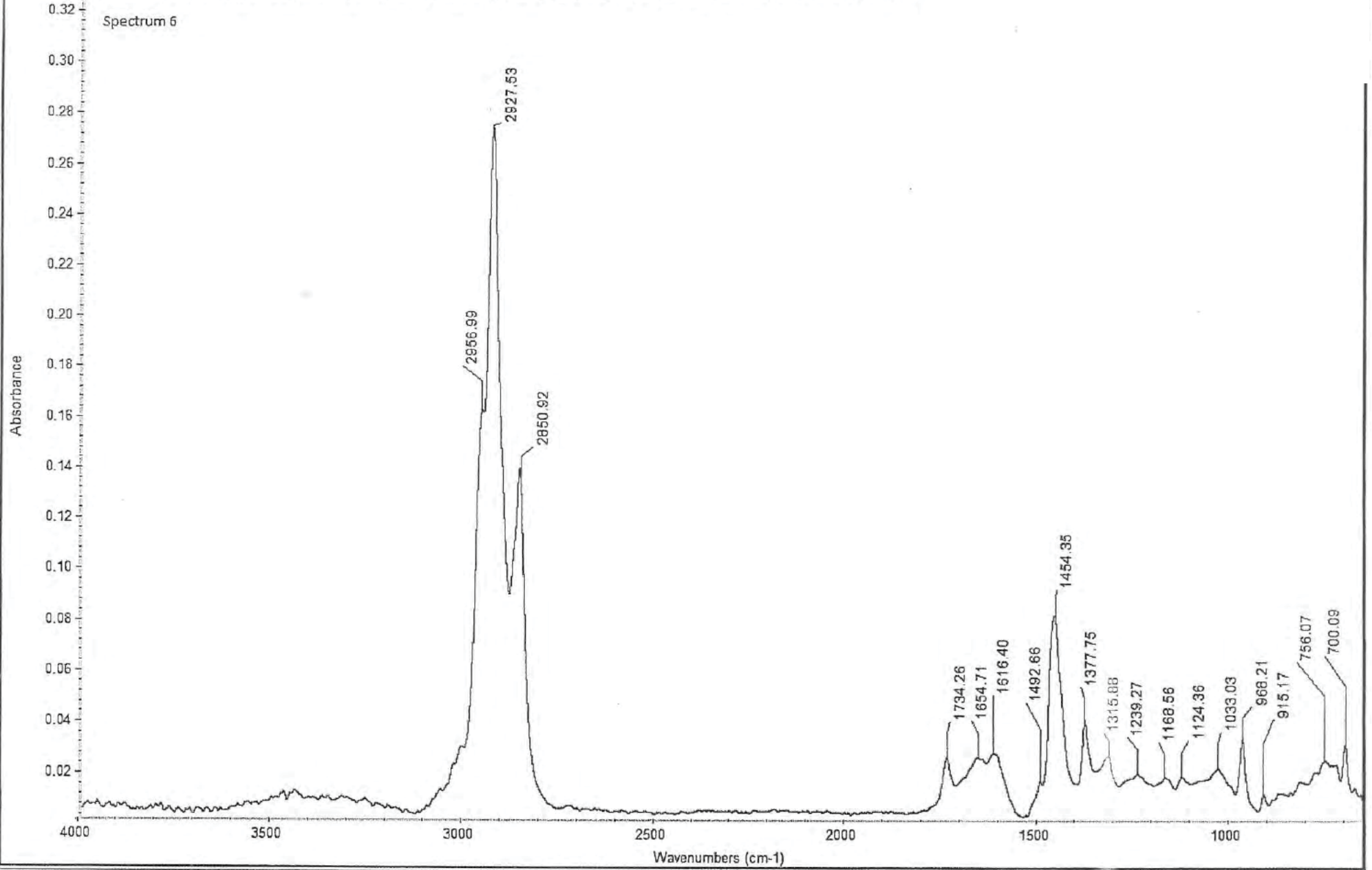


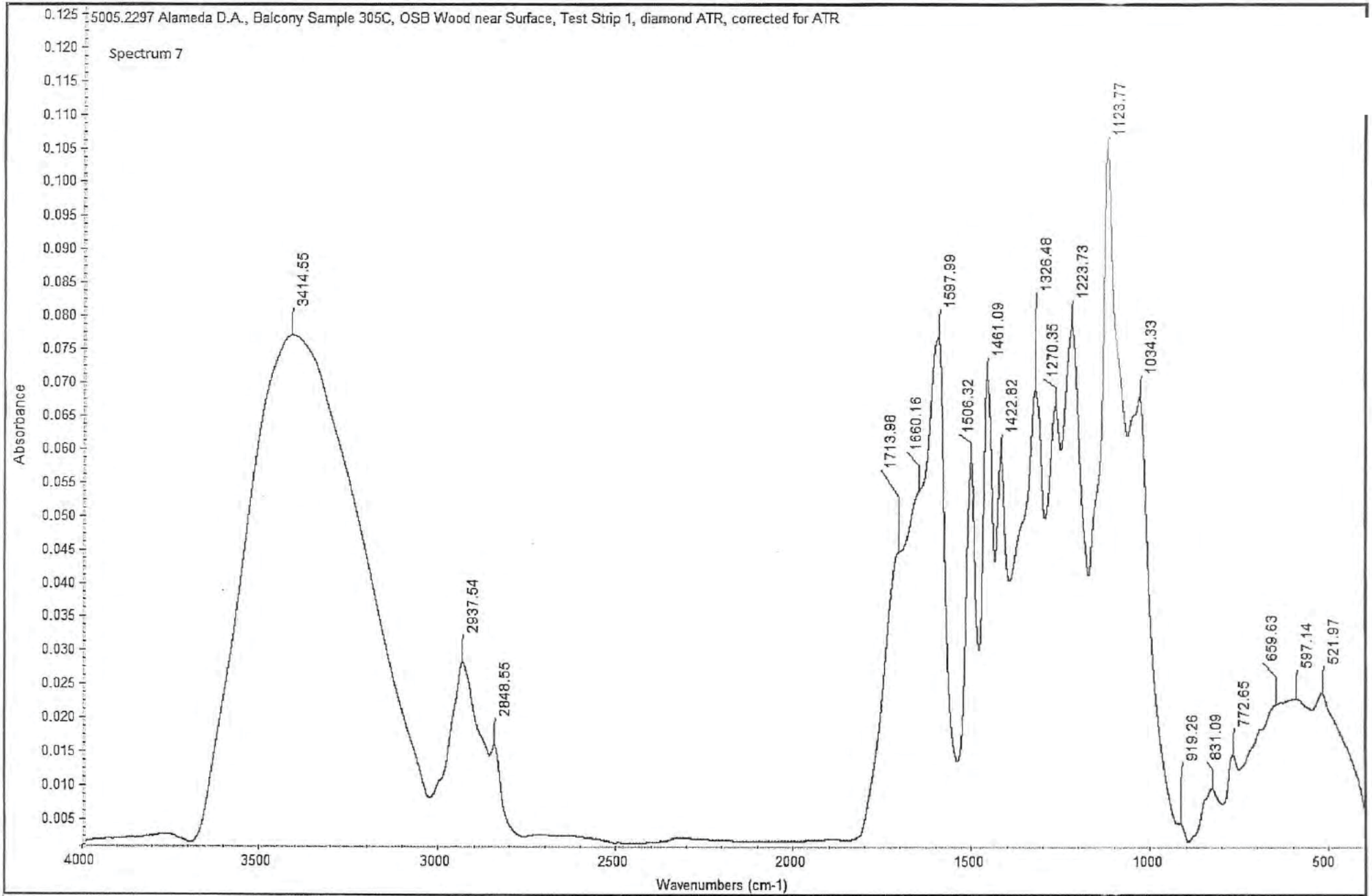
Spectrum 4



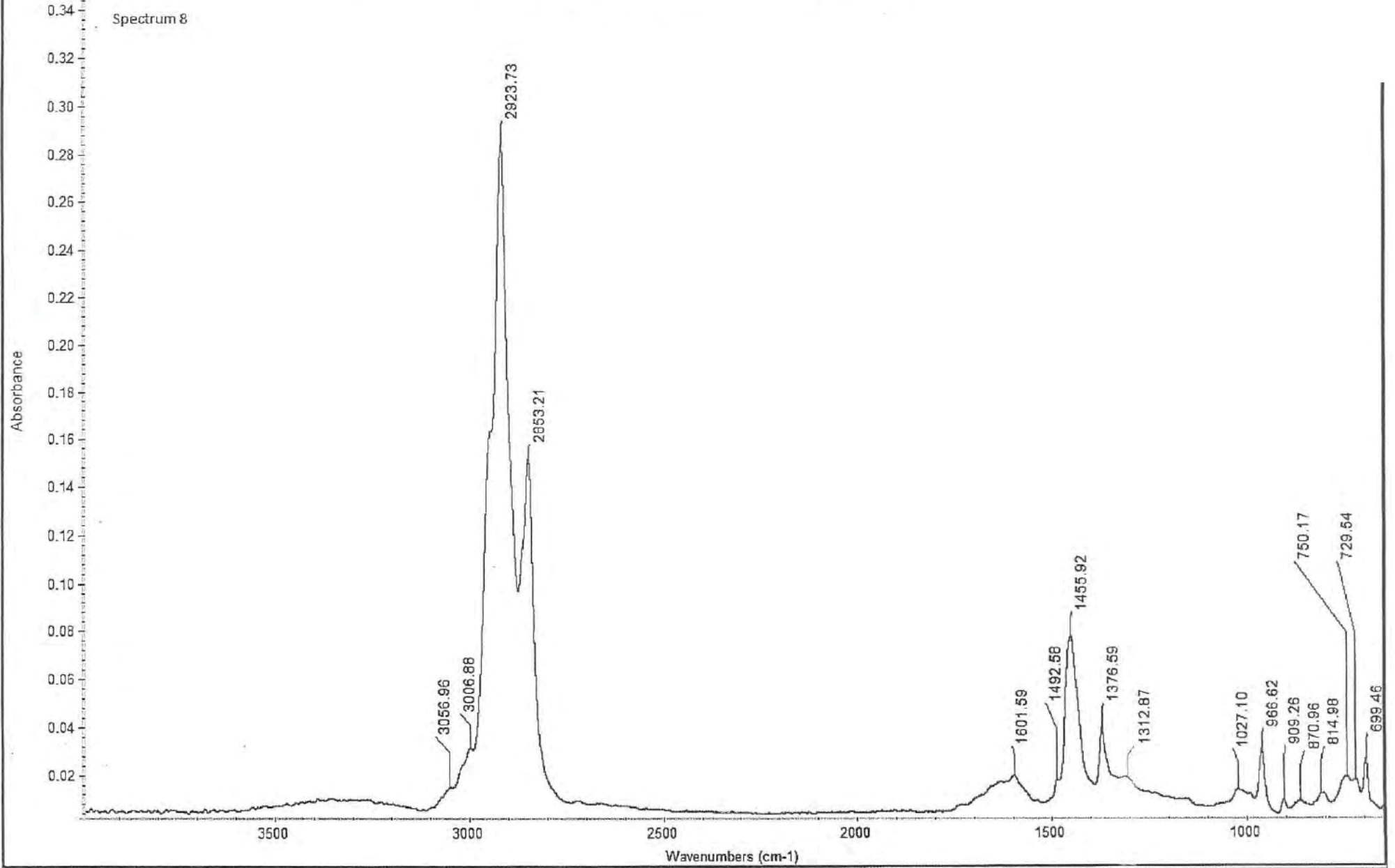


5005.2297 Alameda D.A., Balcony Sample 305C, Test C.2, Membrane / OSB Interface, Test Strip 4, Ge micro-ATR, corrected for ATR

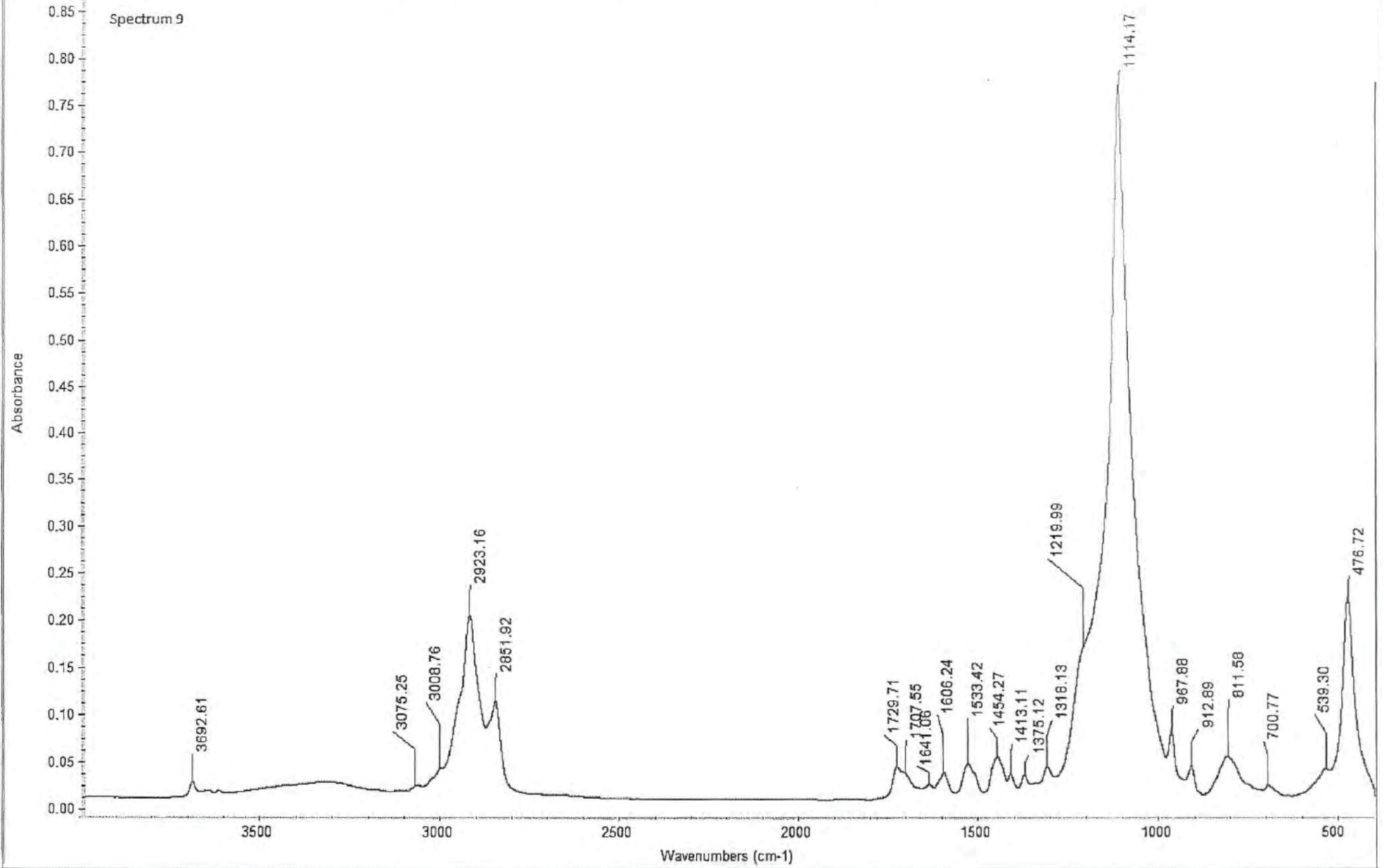


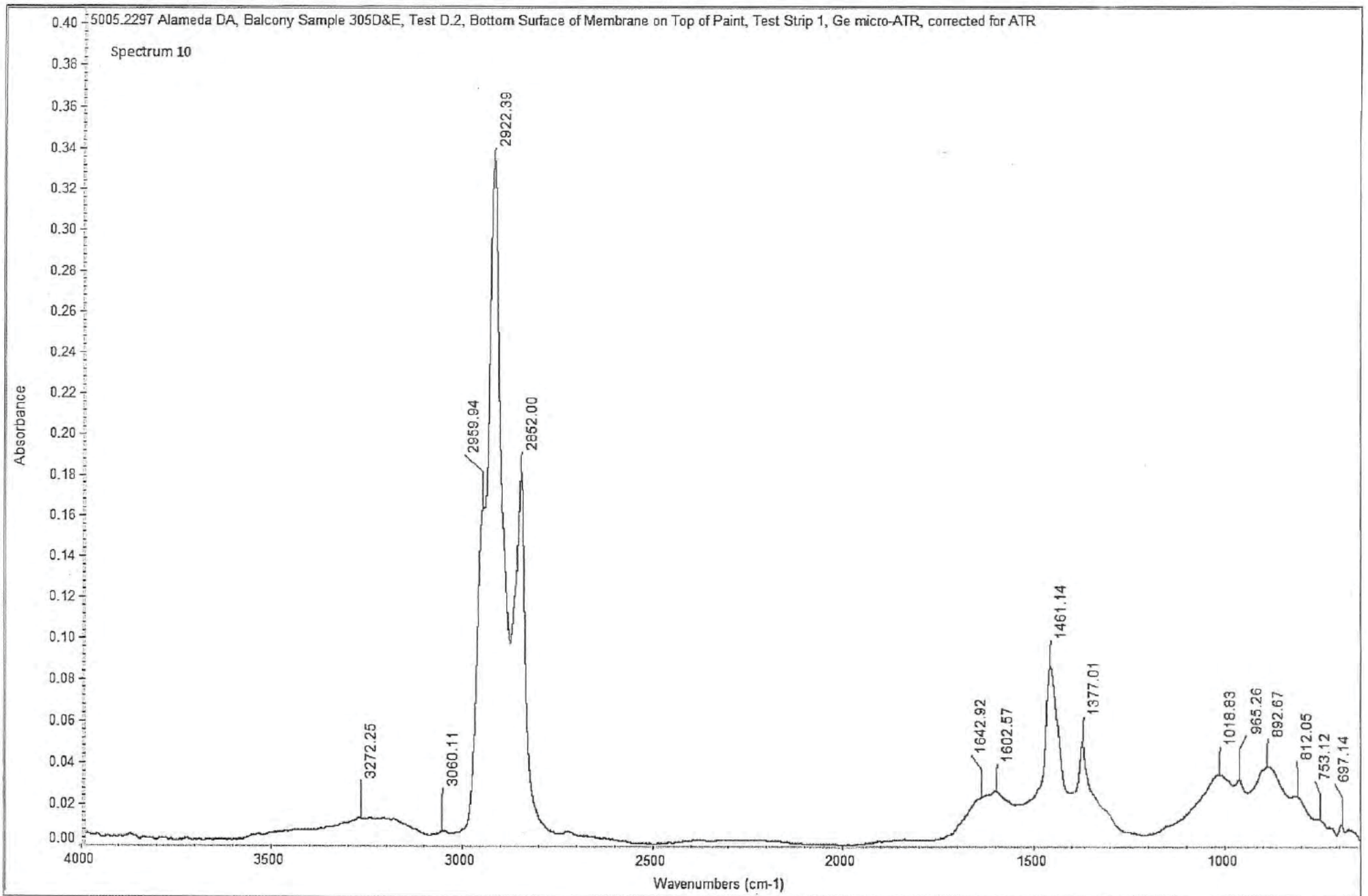


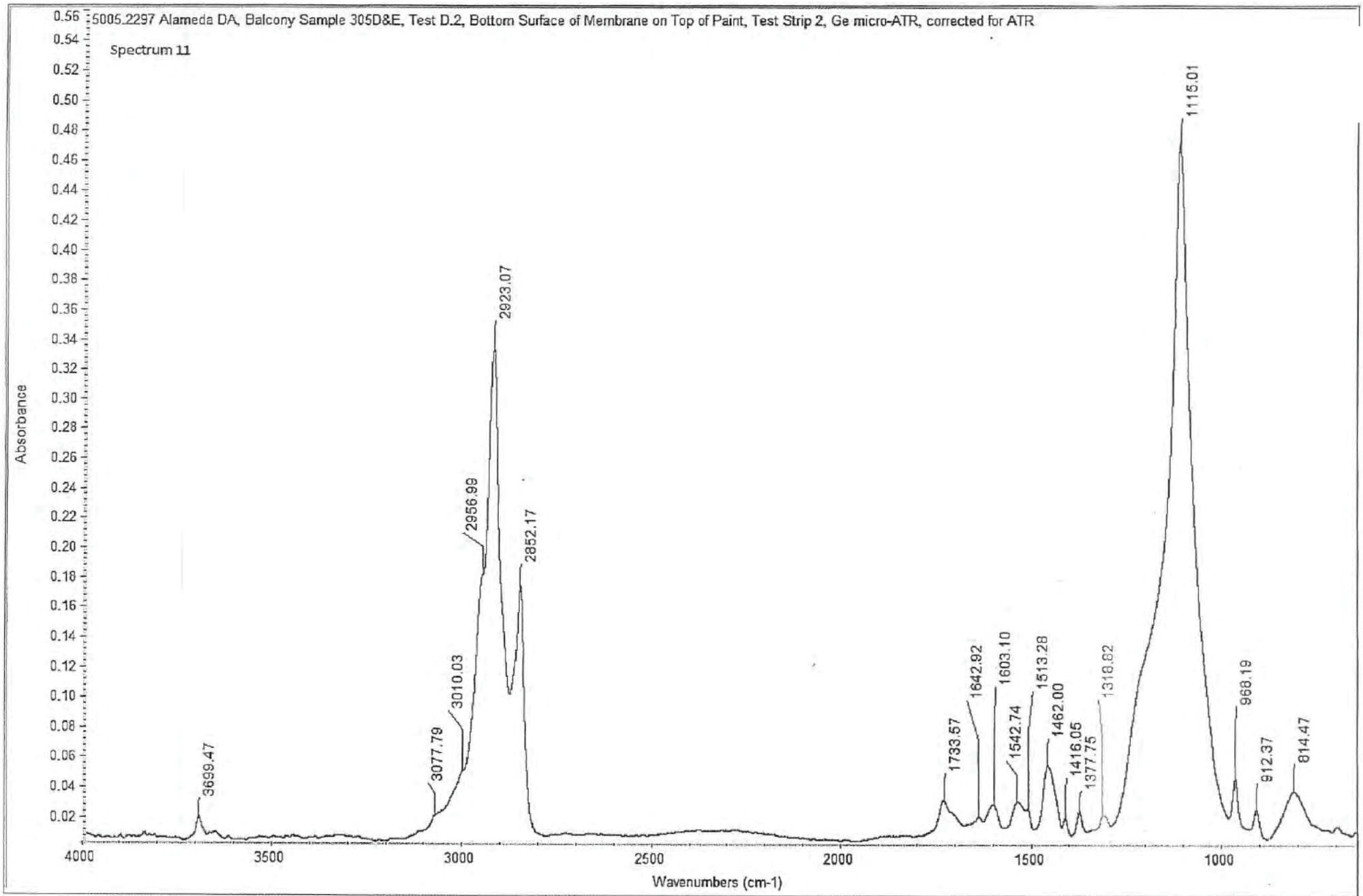
5005_2297 Alameda D.A., Balcony Sample 305C, Test C.2, Membrane Layer next to OSB, Test Strip 2, Ge micro-ATR, corrected for ATR

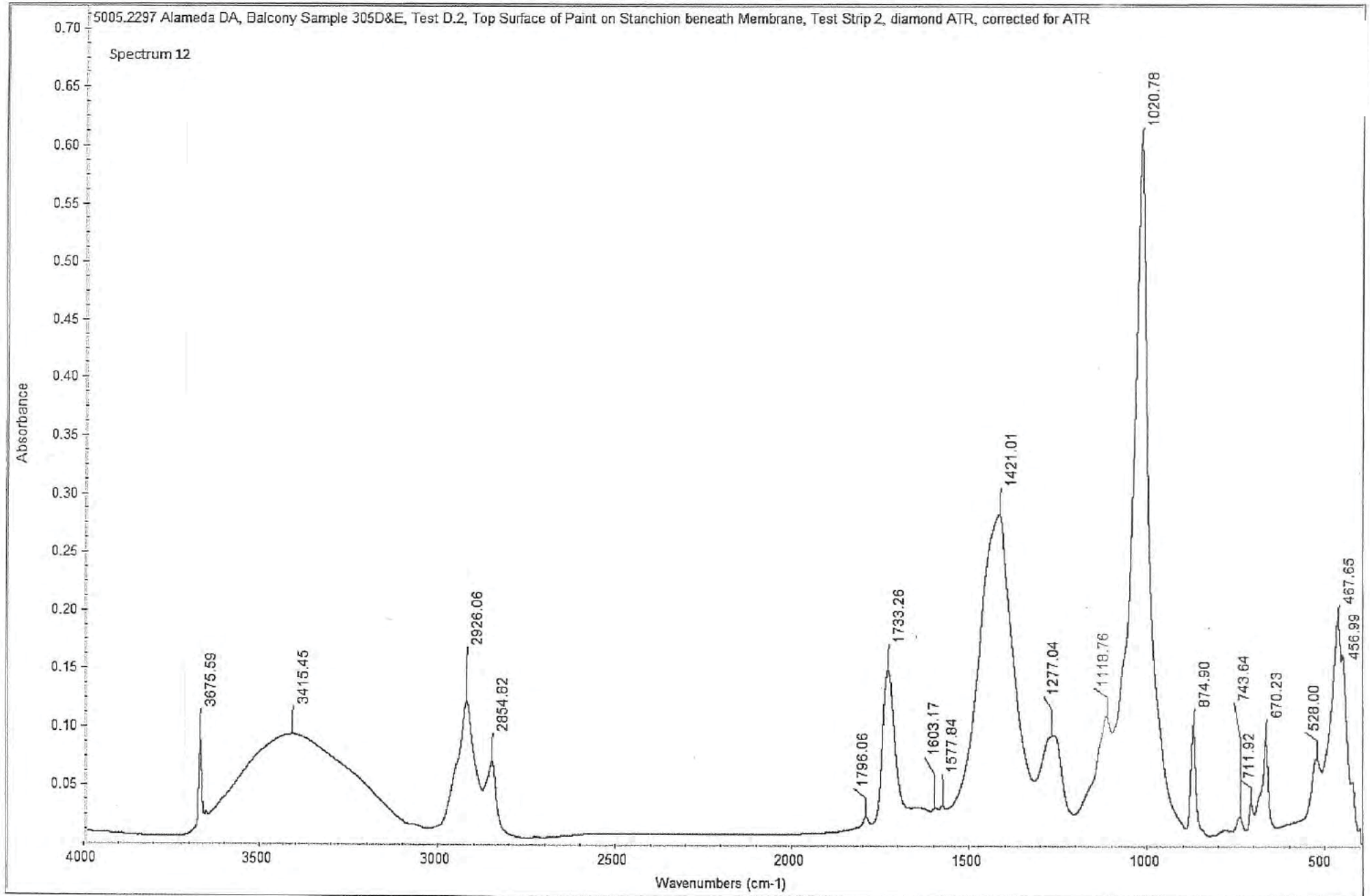


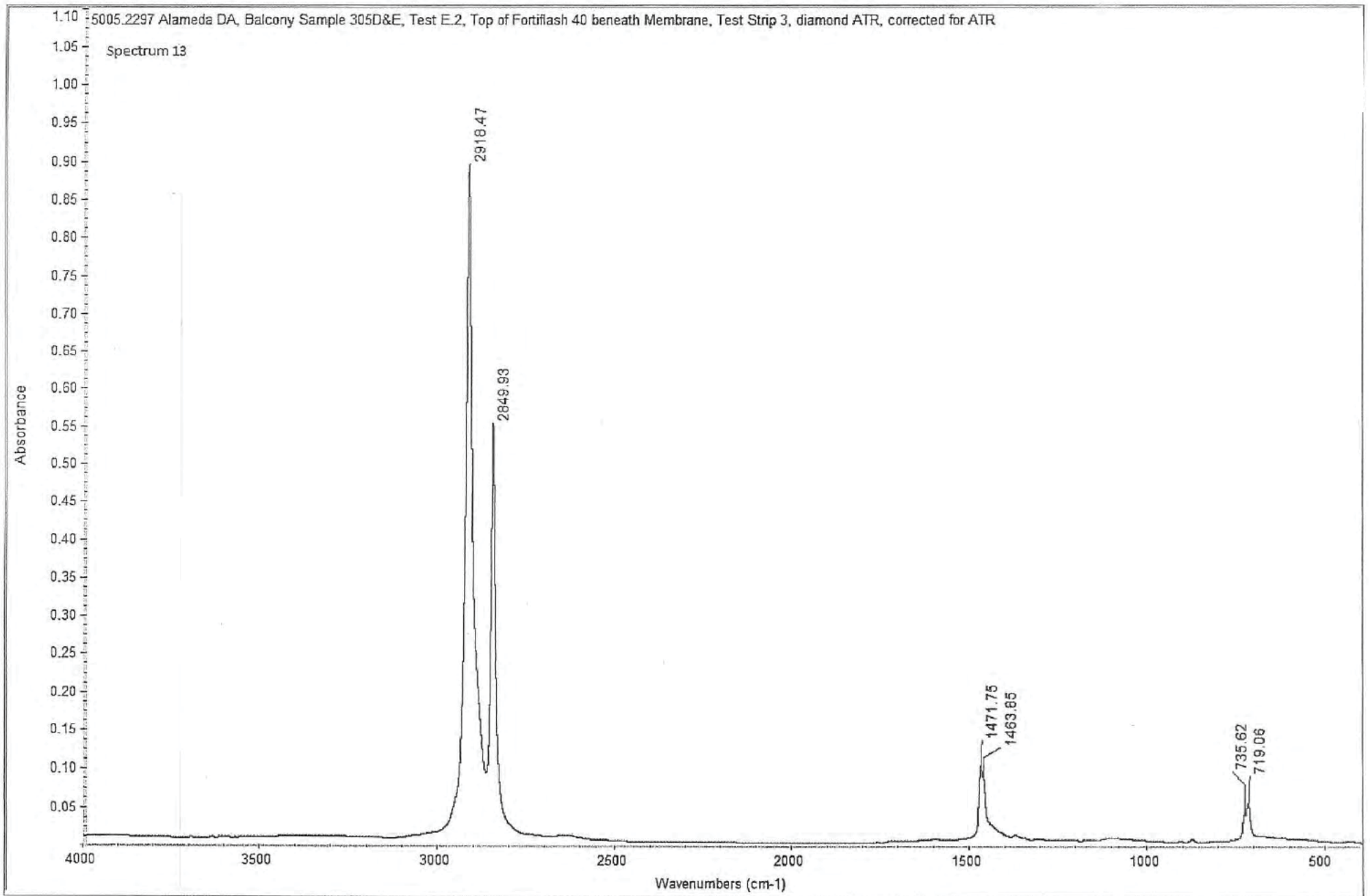
5005.2297 Alameda D.A., Balcony Sample 305C, Test C.2, Outermost Membrane Layer, Test Strip 4, diamond ATR, corrected for ATR

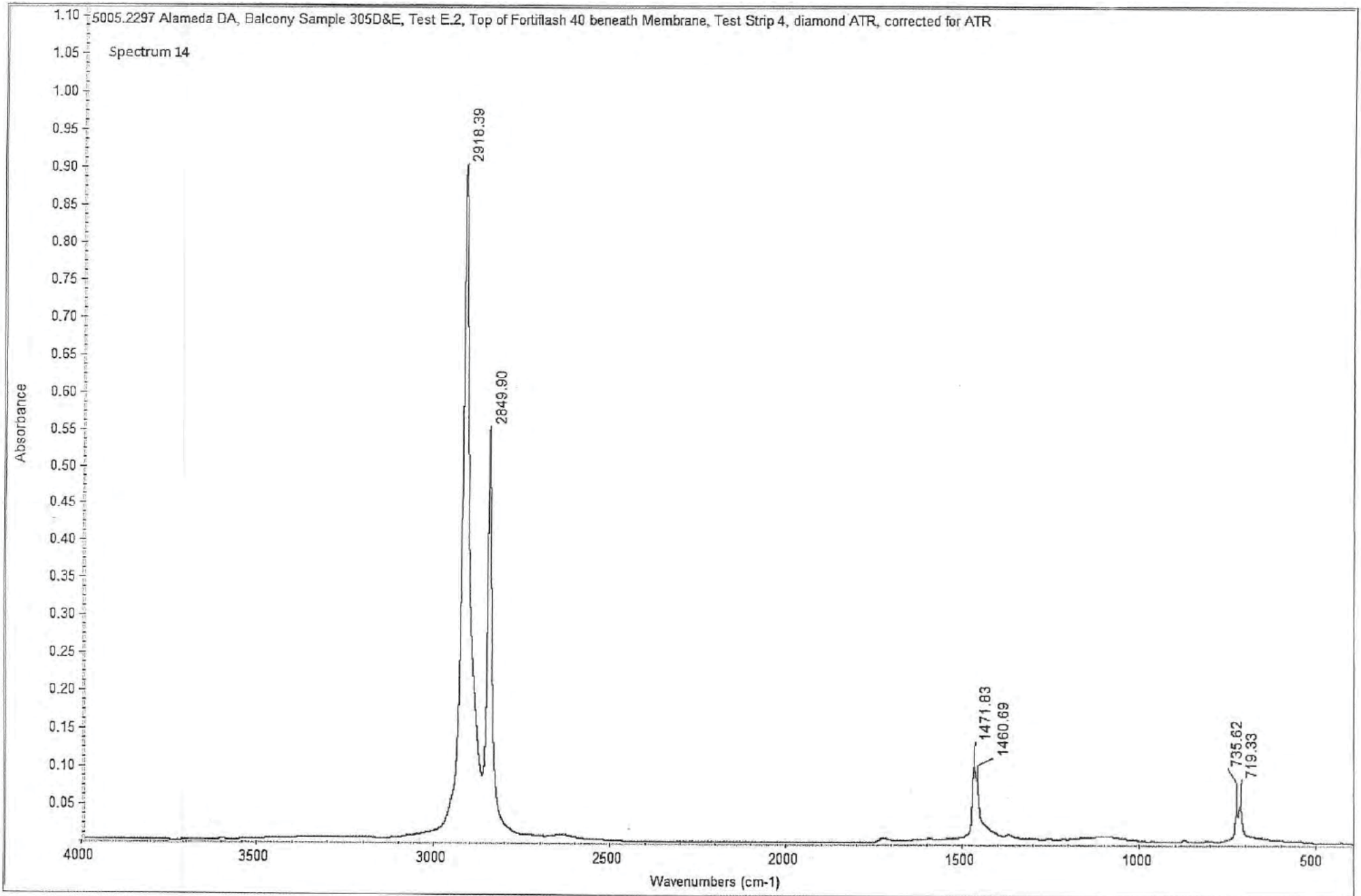


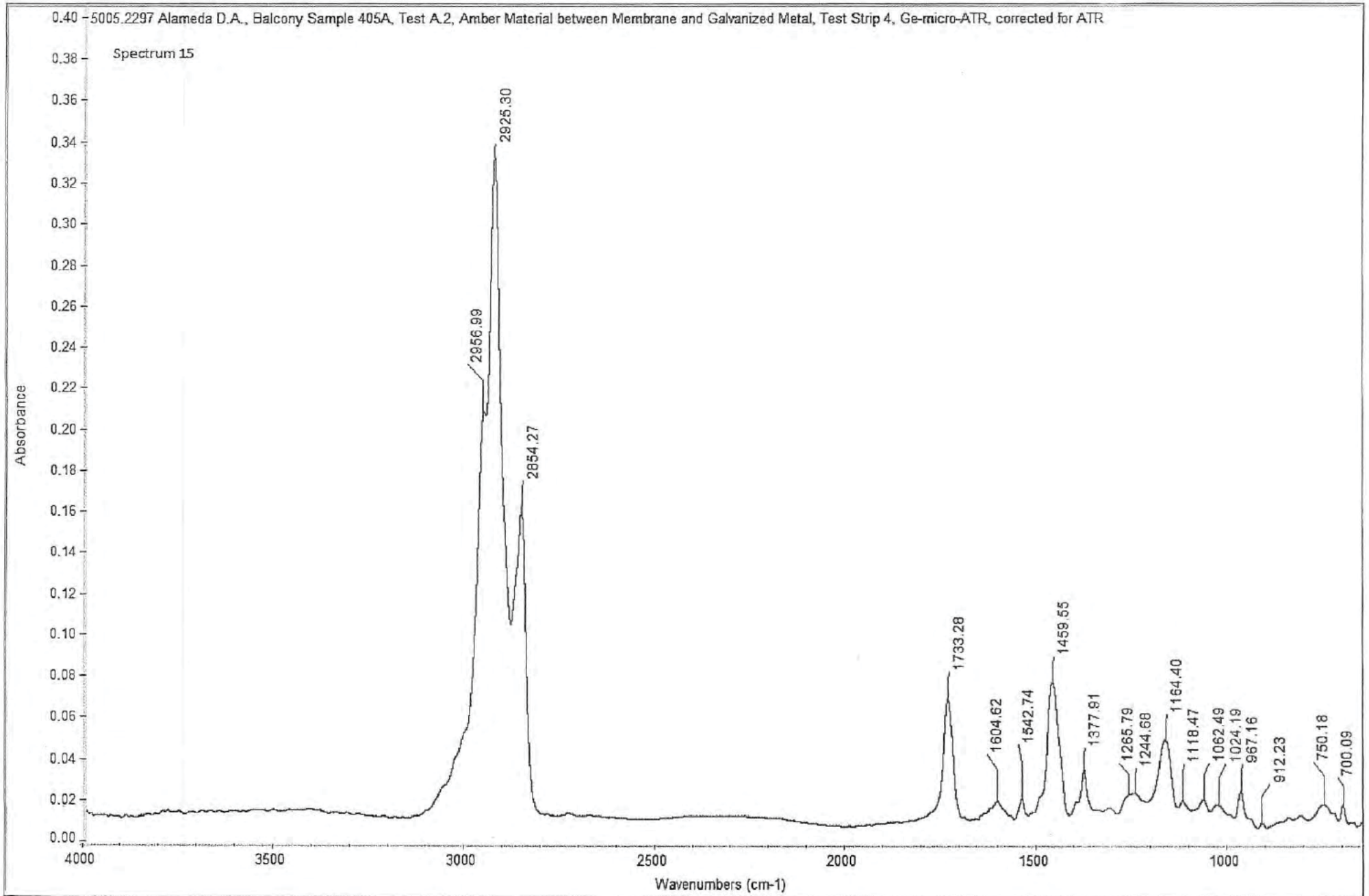




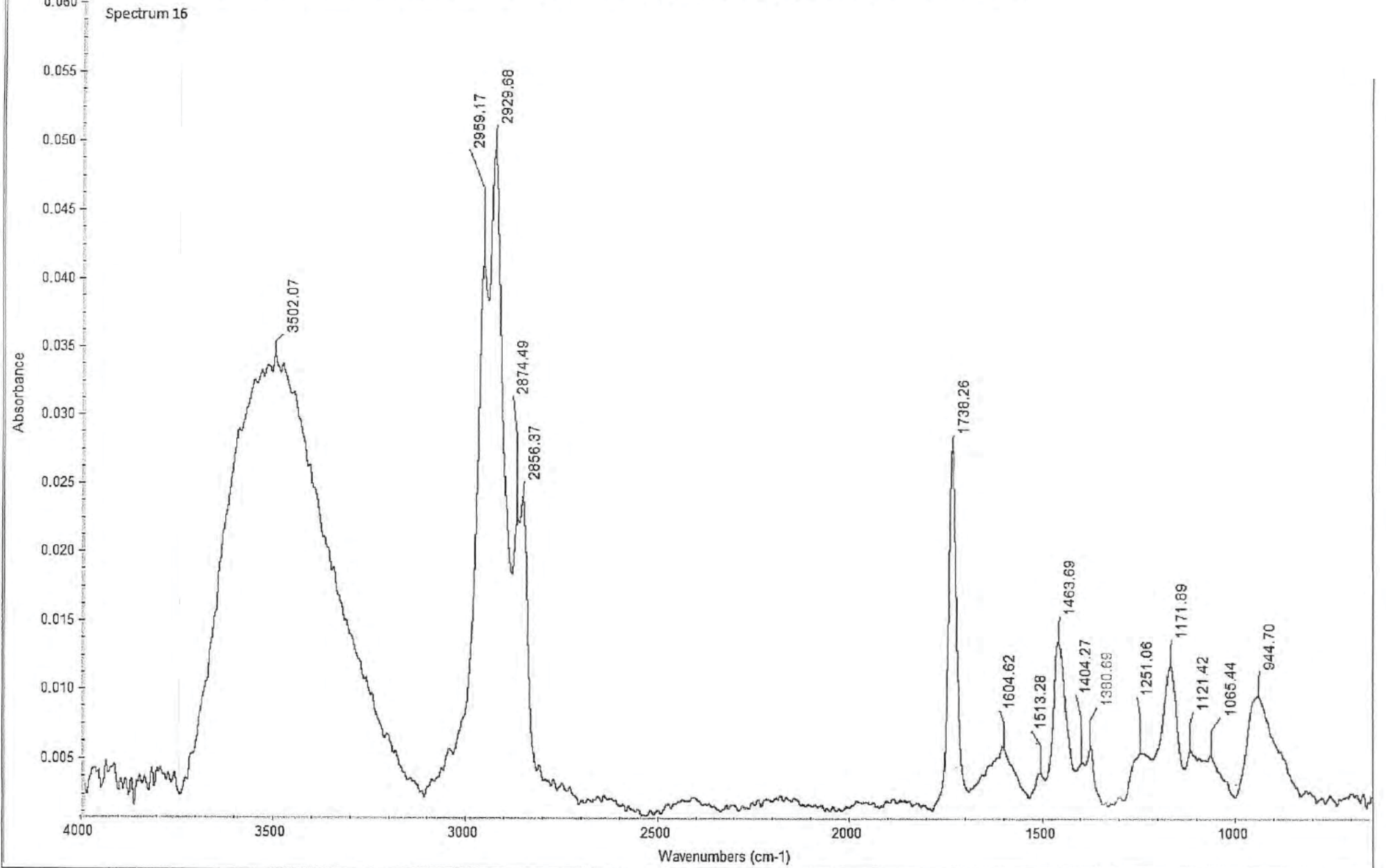


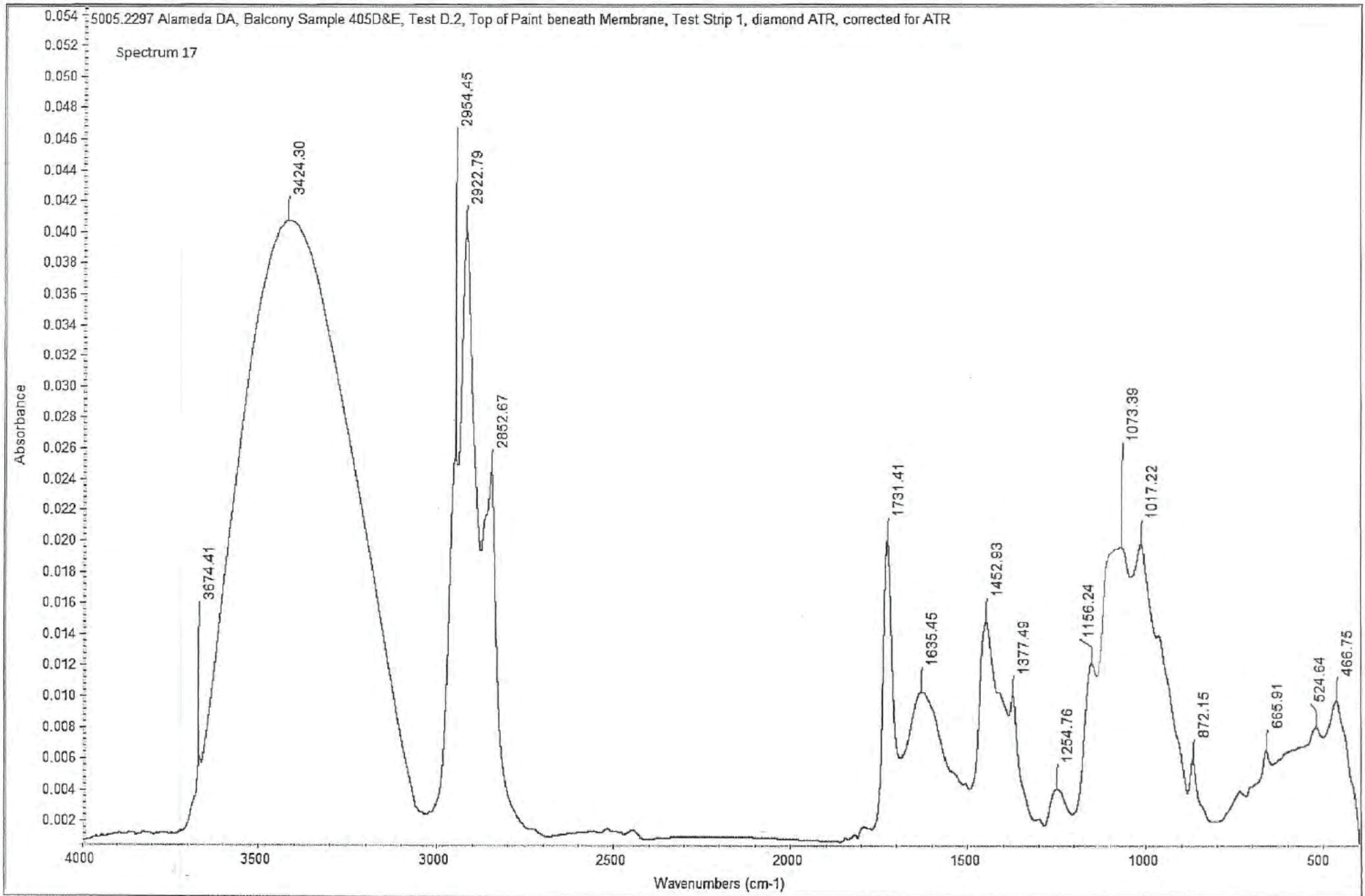






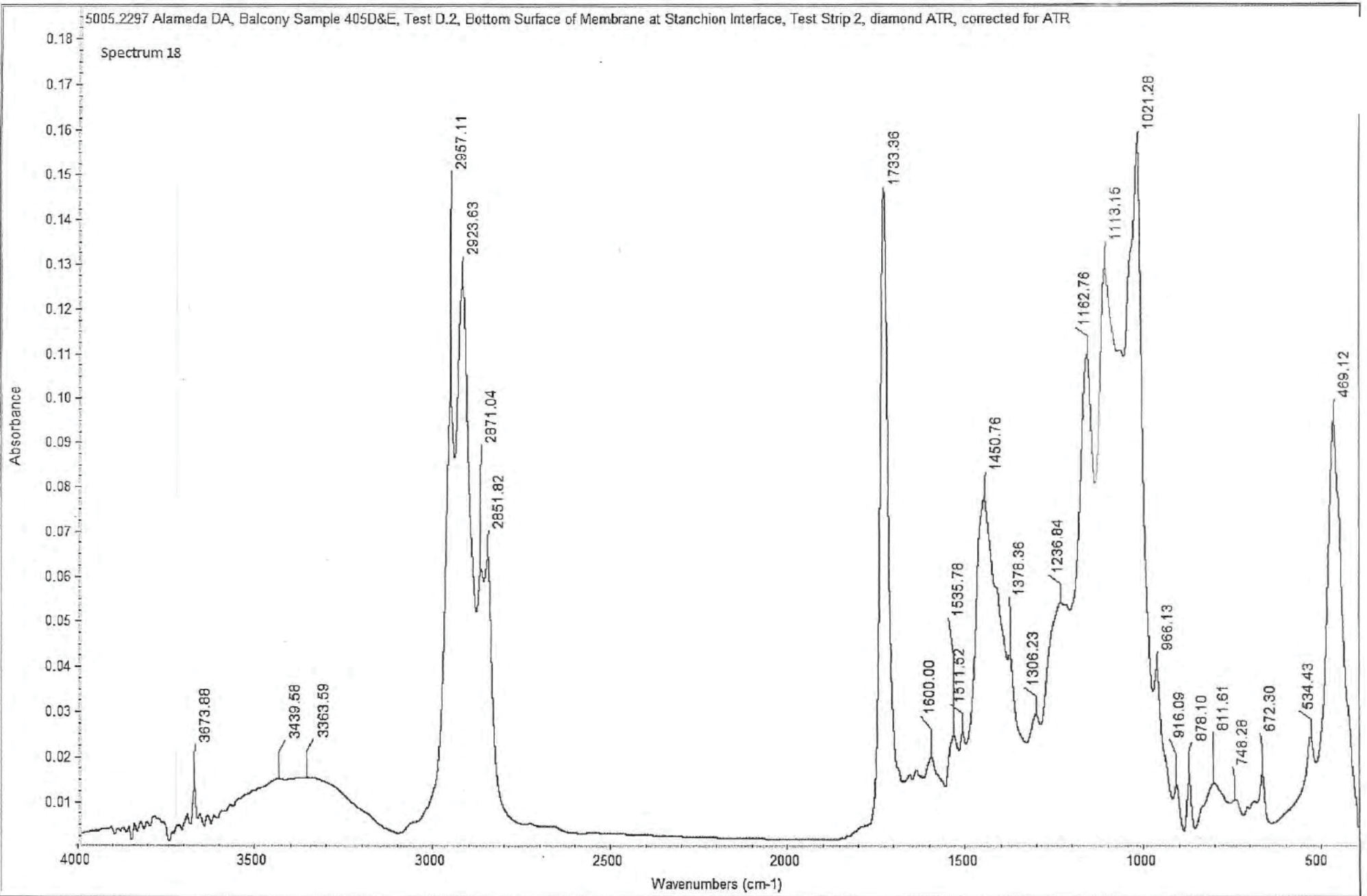
5005.2297 Alameda D.A., Balcony Sample 405B, Test B.2, Amber Material between Membrane and Aluminum Sheet, Ge-micro-ATR, corrected for ATR





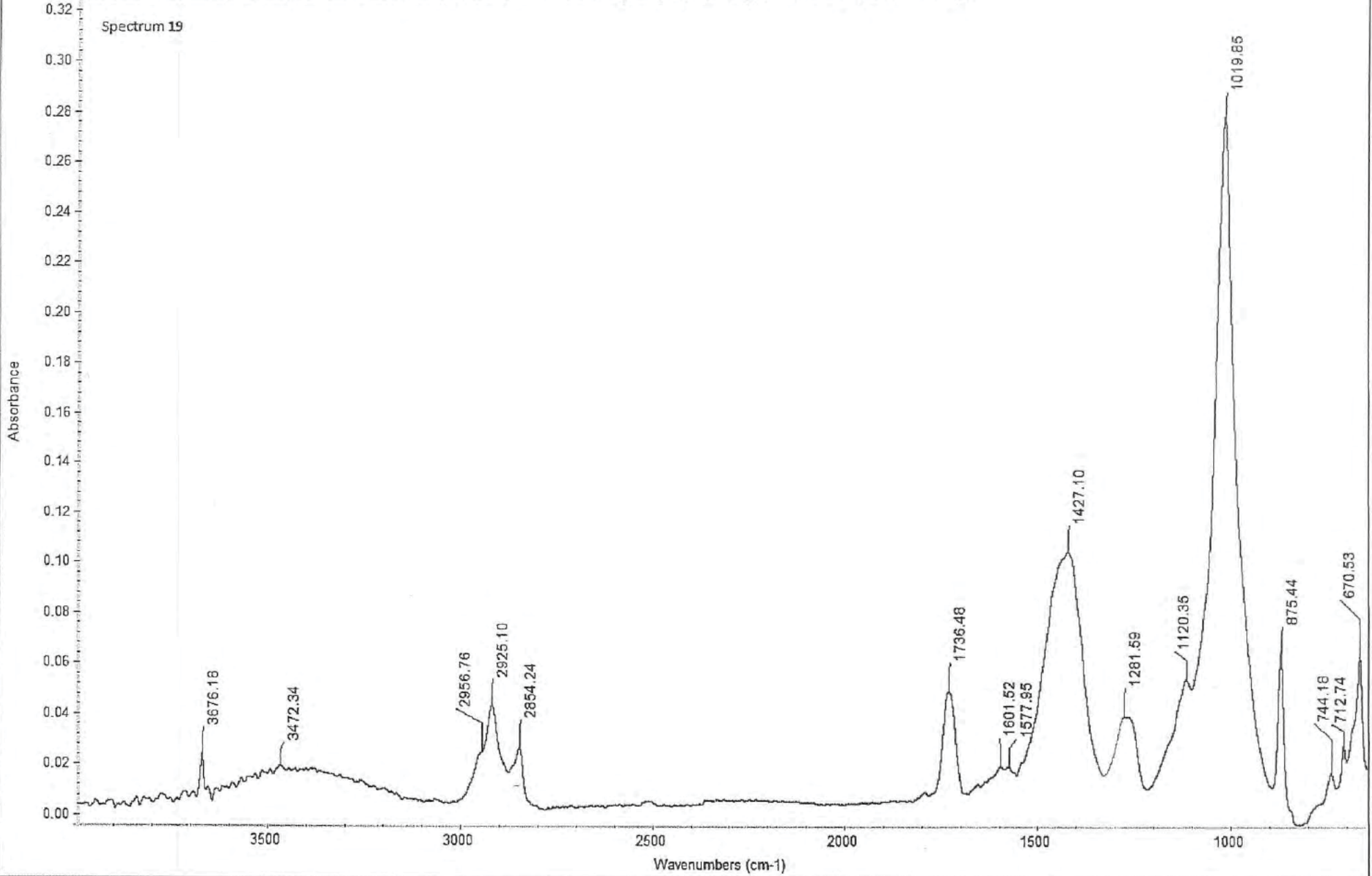
5005.2297 Alameda DA, Balcony Sample 405D&E, Test D.2, Bottom Surface of Membrane at Stanchion Interface, Test Strip 2, diamond ATR, corrected for ATR

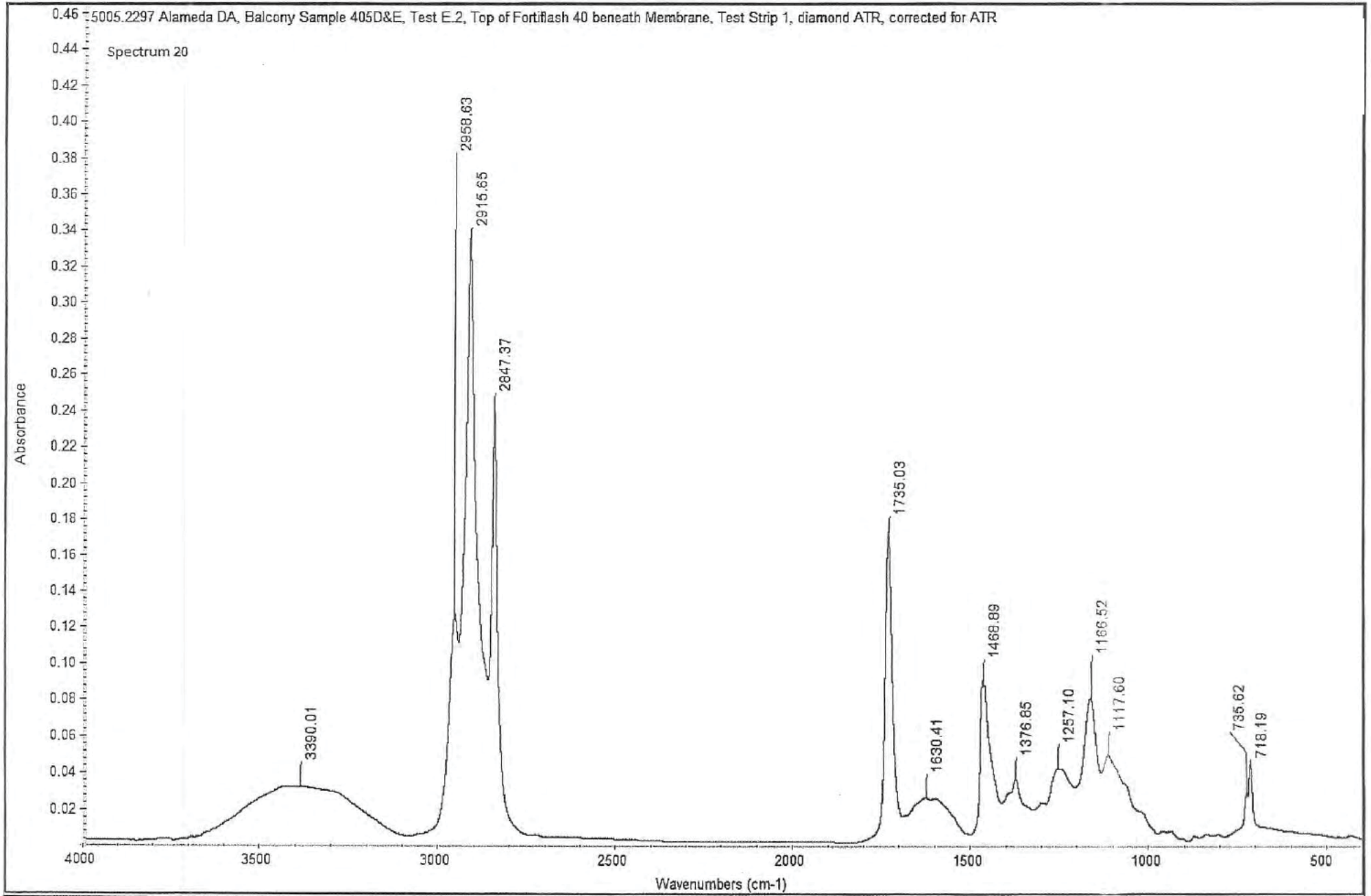
Spectrum 18

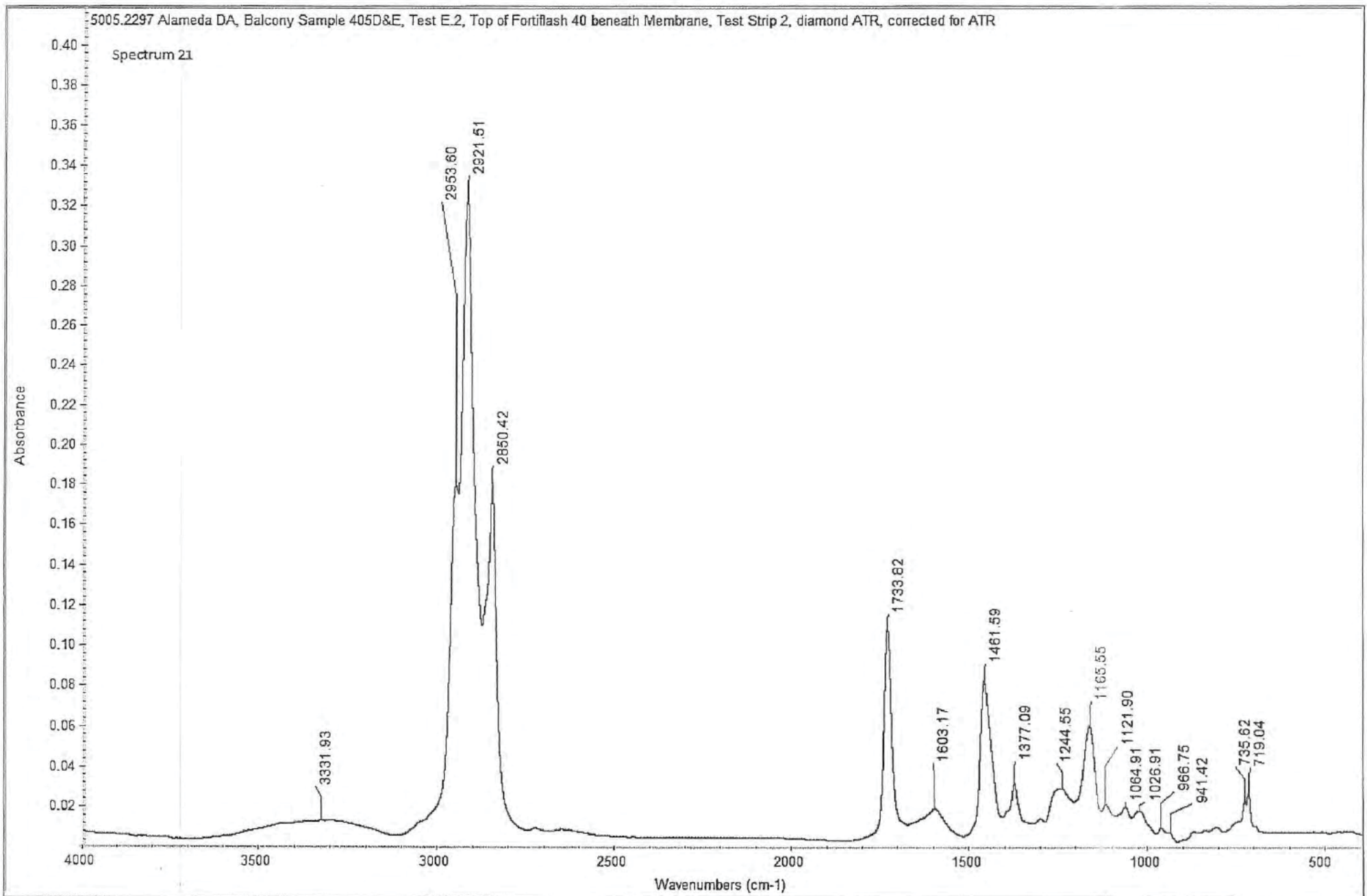


5005.2297 Alameda DA, Bal;cony Sample 405D&E, Test D.2, Stanchion Primer/Paint (exemplar), Test Strip 2, Ge micro-ATR, corrected for ATR

Spectrum 19

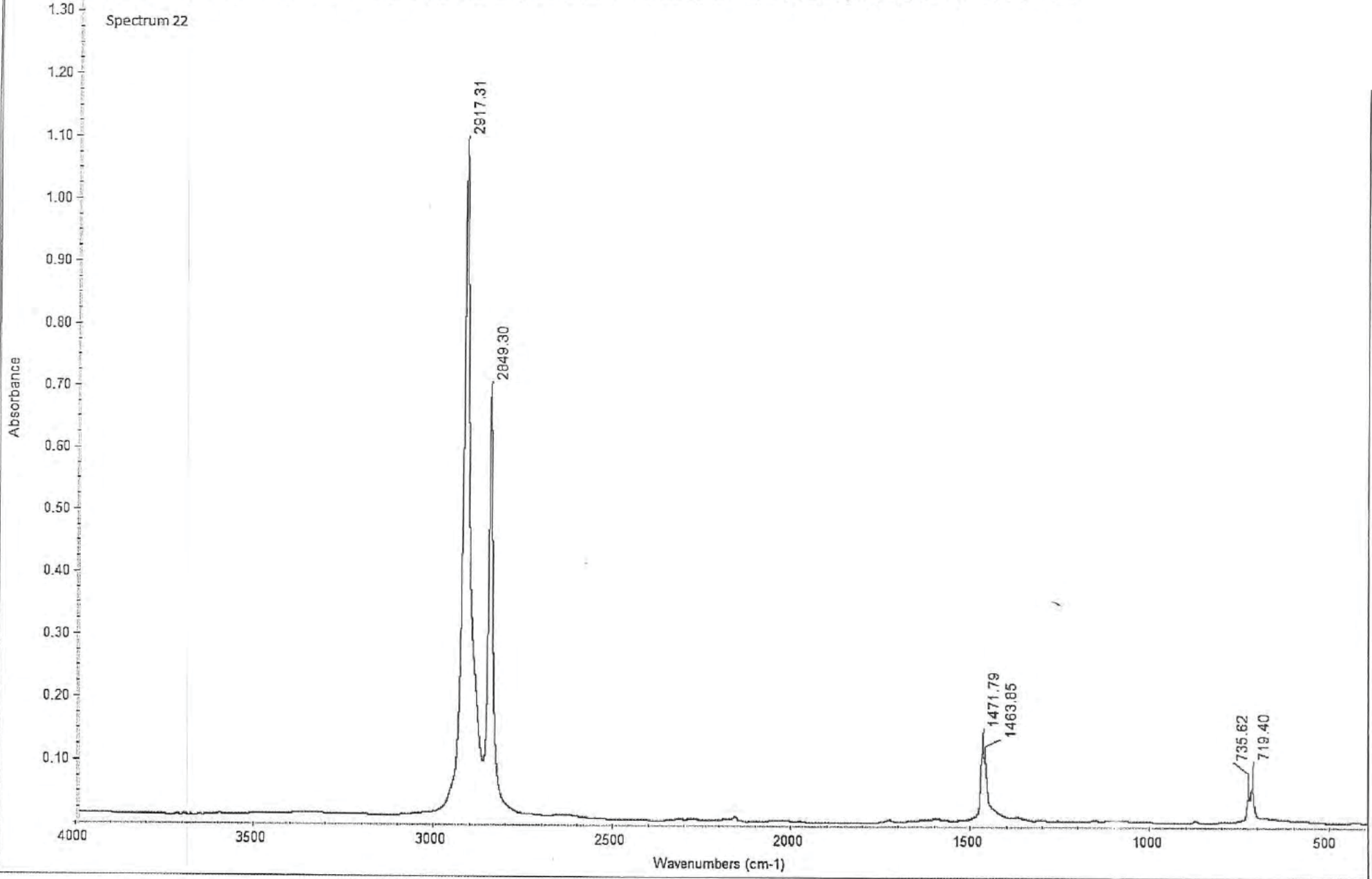






5005.2297 Alameda DA, Balcony Sample 405D&E, Top of Fortiflash 40 beneath Membrane, after Hexanes Wash, Test Strip 1, diamond ATR, corrected for ATR

Spectrum 22



[REDACTED]

15 December, 2015

[REDACTED]

California Contractor's State License Board
9821 Business Park Drive
Sacramento, CA 95827

Project: Library Gardens Apartment Balcony Collapse
Subject: Construction Summary Report

[REDACTED]

Pursuant to the California Contractor's State License Board's request, I have performed an initial onsite investigation, reviewed various documents noted below and prepared the Construction Summary Report. Additionally, I have performed onsite visual & destructive testing investigations at the subject project located at 2020 Kittredge St., Berkeley, CA as well as the remnants of the balconies at Units 405 & 305. Exhibit "C" attached to this report contains a specific comparison of the design of various balcony components versus the as-built conditions found in the field through visual observation, destructive testing & laboratory analysis. This Construction Summary Report is organized by the following sections.

- 1.0 Background
- 2.0 Issues to Analyze
- 3.0 Documents Reviewed
- 4.0 Site Investigations
- 5.0 Findings
- 6.0 Summary Conclusions




City of Berkeley Photo 0109 taken on 16 June 2015



City of Berkeley Photo 0110 taken on 16 June 2015

1.0 Background

This analysis and report arises from the 16 June 2015 collapse of Unit 405's cantilever balcony onto Unit 305's balcony below at the Library Gardens apartment complex located at 2020 Kittredge St., Berkeley, CA in which (6) students lost their lives and (7) students were injured.



2.0 Issues to Analyze

The California Contractor's State License Board has requested [REDACTED] analyze the as-built construction of the aforementioned failed balcony. Additionally, we have been asked to coordinate our analysis with the Alameda County DA's office, the California Board of Professional Engineers, Land Surveyors and Geologists & the California Architect's Board.

The following Construction Summary Report therefore focuses on work of the various contractors involved and the as-built construction.

3.0 Documents Reviewed

The following documents have been provided to and reviewed by [REDACTED] in preparation of this report.

Alameda County DA's Office Photographs & Video

- DA [REDACTED]'s Photos & Video taken on 26 June 2015
- DA [REDACTED] Photos sent via e-mail – 17 July 2015
- DA [REDACTED] Photo sent via e-mail – 21 October 2015

City of Berkeley Building Department Investigation & Photos

- City of Berkeley Photos taken on 16 June 2015 & 24 June 2015
- City of Berkeley Building Department – Building Permit Records
- City of Berkeley Building Department – Memorandum & Staff Recommendations – 23 June 2015

Design Consultants:

[REDACTED] Project File Documents & Instruments of Service

- [REDACTED]'s Owner Architect Agreement for Phase 1 - 15 March 2000 & Phase 2 – 24 April 2003
- [REDACTED]'s Construction Drawings – Plan Check Set 8 – 30 September 2004
- [REDACTED]'s Construction Drawings – Permit Set – 26 January 2005
- [REDACTED]'s Project Specifications Manual – 100% Review Set – 21 April & 28 September 2004
- Various e-mails regarding the balconies, waterproofing and penetration flashing membranes
- Various Submittals regarding the podium & subterranean waterproofing
- Various RFI responses to questions pertaining to the balcony waterproofing & guardrailing
- Various project closeout punch lists

[REDACTED] Structural Calculations

- Supplemental Structural Calculations dated 21 May 2004
- Structural Calculations dated 22 April 2005

Independent Roofing Consultants, Documents

- Final Roof Inspection dated 26 December 2006

[REDACTED] Documents

- Consulting Agreement & various waterproofing design review documents



3.0 Documents Reviewed – continued

Construction Contractors:



Project File Documents

- Owner Contractor Agreement dated 6 October 2004 w/ addendums
- Various submittals for products required under the Project Manual
- Daily Logs from 1 November 2004 to 20 December 2006



Documents

- Sub-Contract Agreement & Scope of Work dated 23 February 2005 (Framing)



Documents

- Sub-Contract Agreement & Scope of Work dated 10 May 2005 (Waterproofing)
- Submittal 046 – 07140 Fluid Applied Waterproofing (none for Bituthene 3000)



Documents

- Sub-Contract Agreement & Scope of Work dated 21 April 2005 (Metal Guardrails)
- Submittal 055 - 05500 Deco Gates & Rails




Documents

- Sub-Contract Agreement & Scope of Work dated 14 April 2005 (Sheet Metal)
- Submittal 041 – 07600 Sheet Metal Flashing



Documents

- Submittal 049 – 09220 Exterior Plastering



Documents

- Submittal 063 - 03540 Hardrock Concrete – Deck Topping



Documents

- Submittal 066 – 08710 Doors & Frames



3.0 Documents Reviewed - continued

Reference Codes, Standards & Research Publications:

California's Architect's Practice Act

- CA Business & Professions Code – Division 3; Chapter 3 – Architecture
- CA Code of Regulations Title 16 – Division 2 CAB; Article 9 - Professional Conduct

Reference Building Codes

- 1998 CBC California Building Code – Vol 1 & 2
- 1998 CFC California Fire Code


ASTM Reference Standards

- ASTM D903 – 1998 (2010) – Peel or Stripping Strength of Adhesive Bonds
- ASTM D 1876 – 2008 (2015) – Peel Resistance of Adhesives (T-Peel Test)
- ASTM D 5076 – 2013 – Measuring Voids in Waterproof Membranes
- ASTM STP 1084 – Building Deck Waterproofing

Gypsum Association – Fire Resistance Design Manual

- 2000, 2003 & 2006 GA 600 Fire Resistance Manual

OSB - Oriented Strain Board Literature

- 2003 June – Moisture Exchange – Performance of OSB & Plywood Structural Panels by 
- 2009 The Engineered Wood Association - OSB Exposure Classifications

Product Manufacturer's Publications:

WR Grace "Bituthene 3000" Product Literature

- WR Grace's "Bituthene 3000" & "Bituthene LM" Product Literature
- WR Grace's 071325 Self Adhered Waterproofing Guide Specifications
- WR Grace's "Bituthene 3000" & "Bituthene LM" Application Instructions
- WR Grace's Technical Letter 8 – Waterproofing over Plywood Substrates

BASF "MasterSeal HLM 5000" Product Literature

- BASF "MasterSeal HLM 5000" Product Information & Technical Data Guide
- BASF e-mail regarding OSB not an acceptable substrate dated 9 October 2015

Fortifiber "Fortiflash 40" Product Literature

- Fortifiber "Fortiflash 40" Product Information & Technical Bulletins
- Fortifiber "Fortiflash 40" Specification Guide
- Fortifiber "Fortiflash 40" Flashing Details

Enduro-Kote Product Literature

- Enduro-Kote Application Guidelines
- Enduro-Kote ICC ESR-2245 Traffic Coating
- Enduro-Kote e-mail regarding recommendation to install over plywood dated 16 October 2015

Pli-Dek Product Literature

- Pli-Dek Application Instructions
- Pli-Dek Technical Bulletin regarding installation recommendations over OSB sheathing



3.0 Documents Reviewed - continued

Exhibits:

A. National Oceanic & Atmospheric Administration Rainfall Data – Berkeley, CA

- Monthly Rainfall Data for Berkeley, CA from July 2005 thru December 2006

B. [REDACTED] – Hayward, CA

- Final Laboratory Analysis – 30 November 2015 w/ attachments

C. [REDACTED]

- Balcony Design vs As-Built Summary – 14 December 2015

4.0 Site Investigations

29 July 2015

Included visual investigation, photos and notes of:

Library Gardens Units 305 & 405 Cantilever Balconies

- The remaining portions of the cantilever balconies at Units 305 & 405 of the Library Gardens apartment complex located at 2020 Kittridge St., Berkeley, CA.



Unit 405 Balcony Photo 5458 – 29 July 2015



Unit 405 Balcony Photo 5459 – 29 July 2015

Remnants of Unit 405's Cantilever Balcony

- The removed remnants of Unit 405's cantilever balcony which had been moved to and stored at the City of Berkeley's Public Works Corporation Yard located at 1326 Allston Way, Berkeley, CA.



Unit 405 Balcony Remnants Photo 5498 – 29 July 2015



Unit 405 Balcony Remnants Photo 5616 – 29 July 2015

4.0 Site Investigations – continued

Remnants of Unit 305's Cantilever Balcony

- The removed remnants of Unit 305's cantilever balcony which had been moved to and stored at the Alameda County, Santa Rita Jail facility located in Dublin, CA.



Unit 305 Balcony Remnants Photo 5667 – 29 July 2015



Unit 305 Balcony Remnants Photo 5703 – 29 July 2015



Unit 305 Balcony Remnants Photo 5646 – 29 July 2015



Unit 305 Balcony Remnants Photo 5710 – 29 July 2015

4.0 Site Investigations – continued

5th October 2015

Included visual & destructive testing investigation, material samples, photos and notes of:

Library Gardens Units 305 & 405 Cantilever Balconies

- The remaining portions of the cantilever balconies at Units 305 & 405 of the Library Gardens apartment complex located at 2020 Kittridge St., Berkeley, CA.



Unit 305 Balcony Photo 5920 – 5 October 2015



Unit 305 Balcony Photo 5936 – 5 October 2015



Unit 405 Balcony Photo 5822 – 5 October 2015



Unit 405 Balcony Photo 5774 – 5 October 2015

4.0 Site Investigations – continued

6th October 2015

Included visual & destructive testing investigation, material samples, photos and notes of:

Remnants of Units 305 & 405 Cantilever Balconies

The removed remnants of Units 305 & 405 cantilever balconies, had been moved to and stored at a warehouse located at 51 W. Trident Ave., Alameda, CA.



Unit 305 Balcony Remnant Photo 6062 – 6 October 2015



Unit 305 Balcony Remnant Photo 6070 – 6 October 2015



Unit 405 Balcony Remnant Photo 5954 – 6 October 2015



Unit 405 Balcony Remnant Photo 5978 – 6 October 2015



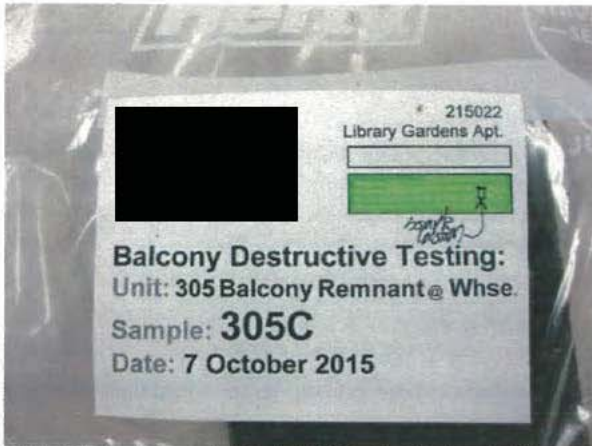
4.0 Site Investigations – continued

7th October 2015

Included photos of samples left for laboratory analysis:

Test Samples Removed From Units 305 & 405 Cantilever Balconies & Balcony Remnants

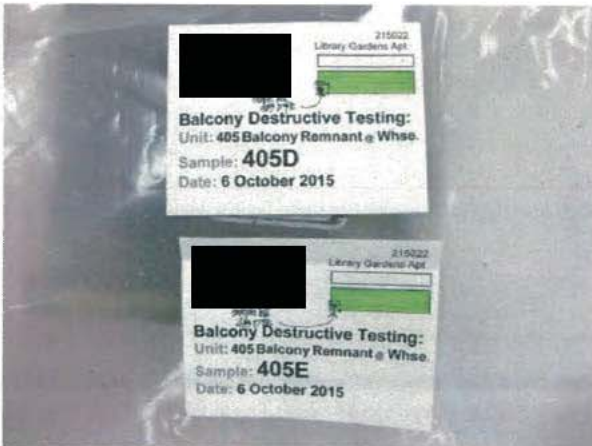
The Test samples removed from Unit 305 & 405's cantilever balconies and balcony remnants were delivered to [REDACTED] laboratory located at 26102 Eden Landing Road, Suite 3, Hayward, CA.



Unit 305 Test Sample Photo 6233 – 7 October 2015



Unit 305 Test Sample Photo 6235 – 7 October 2015



Unit 405 Test Sample Photo 6247 – 7 October 2015



Unit 405 Test Sample Photo 6249 – 7 October 2015

Test Samples delivered to [REDACTED] for Laboratory Analysis included the following;

Unit 305 Cantilever Balcony & Remnant

- 305A French door pan flashing & waterproof membrane
- 305B Balfarm edge metal & waterproof membrane
- 305C OSB Deck sheathing & waterproof membrane
- 305D/E Guardrail stanchion & waterproof membrane

Unit 405 Cantilever Balcony & Remnant

- 405A French door pan flashing & waterproof membrane
- 405B Balfarm edge metal & waterproof membrane
- 405D/E Guardrail stanchion & waterproof membrane



5.0 Findings


The following summarizes our findings with respect to a review of the documents provided to us to date within the categories listed below:

Owner Architect Agreements for Phase 1 dated 15 March 2000 & for Phase 2 dated 24 April 2003

- The Phase 1 Owner/Architect Agreement contains the traditional Basic Services for architectural, structural, mechanical, electrical & plumbing professional services to be performed in the typical Schematic Design, Design Development, Construction Documents, Bidding & Negotiations & Construction Administration Phases as well as adding in a Design/Build Phase for coordination and review of various contractor and sub-contractor design/build services.
- The Phase 2 Owner/Architect Agreement appears to reflect a substantial change in the original program to eliminate two levels of parking garage. Additionally, the agreement refers to the Construction Administration Phase as Construction Observation Phase and includes the Architect's Standard of Care for the work to be performed in paragraph 1.1.3.

Construction Drawings & Details (Permit Set dated 26 January 2005)

- The construction drawings (permit set) dated 26 January 2005 include architectural, structural, mechanical, electrical, plumbing, landscape, civil & security drawing sheets and references the specifications in the Project Manual. Specific references to the subject balcony at units 305 & 405 are included but not limited to the following drawings:
 - **Sheet A131** – Fourth Floor Building Plan; references unit 1405 as a plan type B8R.
 - **Sheet A201** – North Elevation; shows balconies at both unit 1405 as well as unit 1305.
 - **Sheet A211** – Kittredge Street Elevation; shows balconies at units 1405 & 1305 also.
 - **Sheet A412** – Unit Type B8 Floor Plan variations including the 4th floor level and balcony guardrail references to details 2 & 12/ AD81.
 - **Sheet AD16 - Wall Section K3**; includes a section through the balconies at units 1405 & 1305 as well as references to details 2/AD81 & 12/AD33.
 - **Detail 5/AD22 – 1-Hour Floor/Ceiling: Decks**; includes "Enduro-Kote" direct adhered deck coating system over plywood sheathing for a 1 hour rated deck assembly.
 - **Detail 14/AD30 – French Door: Threshold @ Deck**; includes French door threshold pan flashing, waterproofing and a concrete overlay for an exterior deck assembly.
 - **Detail 12/AD33 – Flashing @ French Door: Balcony Deck**; similar to detail 14/AD30 shows French door threshold pan flashing, waterproofing over plywood sheathing but also includes a sacrificial Sonneborn HML 5000 membrane for an exterior balcony deck assembly.
 - **Detail 2/AD50 – Edge to Wall Transition**; includes the termination of the deck edge to wall termination along the outside edge of a balcony deck or roof.
 - **Detail 3/AD50 – Flashing Pan @ Patio Slab**; includes an isometric view of the French door pan flashing extending out onto an exterior balcony deck.
 - **Detail 2/AD81 – Guardrail @ Private Deck**; shows a section through the balcony guardrail with respect to the perimeter balform/T-bar edge metal.
 - **Detail 6/AD81 – Edge Detail: Catwalk/ Decks**; shows the dimensional requirements for the balcony deck perimeter balform/ T-bar edge metal.
 - **Detail 10/AD81 – Threshold Flashing**; shows the intersection of the French door threshold pan metal and the balcony deck to wall metal.
 - **Detail 18/AD81 – Stanchion Connection**; shows the balcony deck guardrail stanchion attachment to the perimeter deck edge and balform/T-bar edge metal.
 - **Sheet S1.6 – Unit B8 3rd & 4th Floor Framing Plan**; notes a single layer of ¾" plywood with a concrete overlay and notched & cantilever microlam joists. Additionally, general note 8 requires the upper floor private deck cantilever joists to be pressure treated.
 - **Sheet S2.4A – Fourth Floor Framing Plan**; also includes general note 8 regarding the requirement that upper floor private deck cantilever joists be pressure treated.



5.0 Findings - continued

Project Specifications Manual

- The Project Specification Manual, initially dated 21 April 2004 and subsequently updated on 28 September 2004 contain various specification sections referencing the work associated with the subject balcony decks at units 305 & 405 as follows:
 - **03530 Concrete Toppings;**
 - Balcony concrete topping slab
 - **05520 Handrails & Railings;**
 - Balcony perimeter guardrail
 - **06110 Wood Framing & Sheathing;**
 - Balcony plywood/ OSB/ pressure treatment
 - **06185 Glue Laminated Members;**
 - Laminated balcony floor joists
 - **07140 Fluid Applied Waterproofing;**
 - Podium deck waterproofing, not balcony decks
 - **07186 Waterproof Coating over Plywood Decks;**
 - Traffic bearing waterproof membranes
 - Later used for the WR Grace "Bituthene 3000" sheet membrane by clarification.
 - Specifically prohibits the use of OSB sheathing.
 - **07620 Sheet Metal Flashings;**
 - Balcony deck to wall & threshold pan metal flashings
 - **07920 Joint Sealants;**
 - Balcony flashing sealant
 - **09220 Lath & Plaster;**
 - Exterior wall & balcony lath & plaster and wall opening flashing membranes


Reference Building Codes

- 1998 CAB – California Building Code
- 1998 CMC – California Mechanical Code
- 1998 CEC – California Electrical Code
- 1998 CPC – California Plumbing Code
- California Title 24 Energy Standards

- all codes as amended and adopted by the City of Berkeley

Product Manufacturer's Recommendations

- Sacrificial Membrane per Detail 12/AD33;
 - Sonneborn HML 5000 now referred to as BASF MasterSeal HLM 5000
 - According to BASF technical support, "OSB is not a suitable substrate for the MasterSeal products"
- Balcony Waterproofing per Detail 12/AD33;
 - WR Grace "Bituthene 3000", "Bituthene 3000 LM" liquid membrane & "Bituthene Primer WP-3000".
 - WR Grace's product information only references installation of the "Bituthene" products over "Exposure 1" or "Exterior" exposure rated plywood panels.
- Waterproof Membrane under Guardrail Stanchion & Perimeter Bal-form Metal per Detail 2/AD81;
 - WR Grace "Ice & Water Shield" as called for in detail.
 - Should be compatible with WR Grace's "Bituthene 3000".
 - Fortifiber "Fastflash 40" as built in the field only under the guardrail stanchion base plate.
 - Appears to have questionable compatibility with WR Grace's "Bituthene 3000".



5.0 Findings - continued

Owner Contractor Agreement dated 6 October 2004

- Owner Contractor Agreement dated 6 October 2004, between the [REDACTED] (owner) & [REDACTED] (general contractor) is a Cost Plus Fee agreement which is capped with a Guaranteed Maximum Price.
- General Conditions to the Agreement between Owner & Contractor is also dated 6 October 2004 and attached to the Owner Contractor Agreement.
- The First Amendment to the Owner Contractor Agreement is dated 20 January 2005 and amends the Guaranteed Maximum Price from \$25,750,000 to \$25,541,845.

AIA A401 Standard Form of Agreement Between Contractor and Subcontractor

- [REDACTED] – **Balcony Framer**
 - Subcontractor Agreement dated 23 February 2005 includes Addendum “A” Scope of Work for **Rough Framing**, with Alternate to include “Window Installation with furnish and install Moistop (flashing)” including specification sections **06110 Wood Framing and Sheathing**, 06175 Wood Trusses & **06185 Glue Laminated Timber**.
- [REDACTED] – **Balcony Guardrail**
 - Subcontract Agreement dated 21 April 2005 includes Addendum “A” Scope of Work for **Metal Fabrications & Misc. Metals**, including specification sections 05120 Structural Steel, 05510 Metal Stairs & Ladders, **05520 Handrails & Railings**, 05530 Gratings, 05550 Exterior Stair Nosings, 05730 Ornamental Formed Metal-Building & 10530 Awnings.
- [REDACTED] – **Lath & Plaster**
 - Not provided for review as of the date of this report.
- [REDACTED] – **Balcony Waterproofing**
 - Subcontract Agreement dated 10 May 2005 includes Addendum “A” Scope of Work for **Fluid Applied Waterproofing**, including specification sections **07140 Fluid Applied Waterproofing** & “Furnish and install of Bituthene 3000 (Sheet Waterproofing) at building perimeter walls and into door openings.”
- [REDACTED] – **Balcony Door & Threshold**
 - Not provided for review as of the date of this report.
- [REDACTED] – **Balcony Deck Flashing**
 - Subcontract Agreement dated 14 April 2005 includes Addendum “A” Scope of Work for **HVAC, Vents, Sheet Metal & Flashing & Trim, Sheet Metal Roof, Gutters and Downspouts**, including specification sections 15700 Heating, Ventilation & Air Conditioning, 10230 Vents, **07620 Sheet Metal Flashing & Trim, specifically “2 i) Flashing at Balconies and French Doors”**, 07410 Metal Roofing & 07714 Gutters & Downspouts.

Design Meeting Minutes

- **Job Meeting No. 1 – 18 June 2001** is the first mention of the City of Berkeley’s DRC Committee requesting to have balconies along the Kittridge Street Elevation to break up the façade.



5.0 Findings - continued

Construction Meeting Minutes

- None provided for review as of the date of this report.

Submittals

- **03530 Concrete Toppings**
 - **Submittal 063-03540 Hardrock Concrete**
 - Summittal from Insul-Flo for balcony deck topping slabs includes a (6) sack – 2,500 psi concrete mix design for the balcony deck topping slabs.
- **05520 Handrails & Railings**
 - **Submittal 055-05500 Deco Gates & Rails**
 - Submittal by [REDACTED] (balcony guardrail), includes details, elevations and notations on sheet D13 for the balcony guardrails at units 305 & 405; reference file number 05-001303 – page 6. Base plates are noted as follows:
 - "j" – 3/16" x 4" x 4-1/4" w/ (2) 3/8" x 4" lag screws
 - "k" – 3/16" x 4" x 5-1/2" w/ (4) 3/8" x 4" lag screws
- **06110 Wood Framing & Sheathing**
 - Submittal has not been provided for review as of the date of this report
- **06185 Glue Laminated Members**
 - Submittal has not been provided for review as of the date of this report
- **07140 Fluid Applied Waterproofing**
 - **Submittal 046 – 07140 Fluid Applied Waterproofing**
 - **14 December 2005 – EPRO – 10 Year** submittal from [REDACTED] intended for the podium deck slab waterproofing, forwarded by [REDACTED] to [REDACTED] and returned "Rejected".
 - **21 December 2005 – Tremco Tremproof 250GC** submittal from [REDACTED] intended for the podium deck slab waterproofing, forwarded by [REDACTED] to [REDACTED] and returned "Note Comments, Resubmittal Not Required".
 - **7 April 2006 - Tremco Tremproof 250GC** substitution submittal from [REDACTED] intended for the podium deck waterproofing, forwarded by [REDACTED] to [REDACTED].
- **07186 Waterproof Coating over Plywood Decks**
 - Submittal has not been provided for review as of the date of this report for the WR Grace "Bituthene 3000", "Bituthene Primer" or the "Bituthene 3000 LM"
- **07620 Sheet Metal Flashings**
 - **Submittal 041 – 07600 Sheet Metal Flashing**
 - Submittal by [REDACTED] (sheet metal), includes reference to the following balcony related flashing details;
 - One Piece Threshold Pan Flashing per detail 14/AD30
 - One Piece Threshold Pan Flashing per detail 12/AD33
 - One Piece Threshold Pan Flashing per detail 3/AD50
 - One Piece Threshold Pan Flashing per detail 10/AD81
 - Deck Edge to Wall Transition Flashing per detail 2/AD50



5.0 Findings - continued

- **09220 Lath & Plaster**
 - **Submittal 049 – 09220 Exterior Plaster**
 - Submittal by [REDACTED] (lath & plaster), includes product information for exterior plaster, accessories and Fortifiber “Fastflash 25” self-sealing membrane.

RFI – Request for Information

- **RFI 95 – 1 hr Rated Concrete Overlay at Stairs - 31 May 2005 Response by [REDACTED]**
 - Detail 6/AD22 1 hr Floor @ Stairs occurs at all stair landings; Detail 14/AD22 2 hr Floor Ceiling occurs at exterior decks
- **RFI 99 – Unit B8 Third & Fourth Floor Balcony Deck Waterproofing vs Concrete Overlay - 25 May 2005 Response by [REDACTED]**
 - The B8 unit plan on sheet A412 indicates note 3.12 for the deck assembly - lightweight concrete see Detail 4/AD21.
 - Note 5.12 to incate the metal guardrail – see details 2 and 12/ AD81.
 - The hardrock occurs when the deck is over a stair enclosure. See also response to RFI 95.
- **RFI 306 – Bituthene Membrane under Concrete @ Private Decks - 9 January 2006 - Response by [REDACTED]**
 - Hardrock concrete at decks occur at 2-hr conditions if applicable. See also Detail 12/AD33 Flashing @ French Door: Balcony Deck similar.
- No other RFIs have been provided for review as of the date of this report.

Clarifications, Architect's Supplemental Instructions


- **ASI 2 – Response to RFI 12.2 Balcony Railings – 24 October 2002**
 - Updates Balcony Guardrail elevation with drawing ASI 12.5

Change Orders

- No change orders have been provided for review as of the date of this report.

Construction Daily Logs

- **September 2005**
 - 2nd - [REDACTED] starts installing 3rd floor joists @ Bldg. #1.
 - 8th - [REDACTED] starts installing 3rd floor sheathing @ Bldg. #1.
 - 28th - [REDACTED] starts installing 4th floor joists @ Bldg. #1.
- **October 2005**
 - 3rd - [REDACTED] starts installing 4th floor sheathing @ Bldg. #1.
 - 11th - Bldg. Dept. approves nailing of 4th floor sheathing @ Bldg. #1.
 - 26th - First mention of rainfall at project site.
- **November 2005**
 - 18th - [REDACTED] starts installing lath paper on Kettredge St. elevation of Bldg. #1.
- **December 2005**
 - 8th - [REDACTED] starts podium waterproofing work @ Bldg. #1.



5.0 Findings - continued

- **January 2006**
 - 11th - Bldg. Dept. approves lath on Kettredge St. elevation @ Bldg. #1.
 - 13th - [REDACTED] starts scratch coat on Kettredge St. elev. of Bldg. #1.
 - 16th - [REDACTED] starts brown coat on Kettredge St. elev. of Bldg. #1.
 - 18th - [REDACTED] starts sheet metal work on 3rd Floor @ Bldg. #1. (no reference specific to balcony deck flashing)
 - 24th - [REDACTED] starts delivery of exterior doors to Bldg. #1.
 - 26th - [REDACTED] starts installation of exterior doors @ Bldg. #1.
 - 26th - [REDACTED] starts sheet metal work on 4th Floor @ Bldg. #1. (no reference specific to balcony deck flashing)
- **February 2006**
 - [REDACTED]
- **March 2006**
 - 1st - [REDACTED] starts gypcrete installation @ Bldg. #1.
 - 6th - [REDACTED] starts work on 4th floor @ Bldg. #1. (appears to be related to interior painting)
 - 9th - [REDACTED] begins finish coat @ Bldg. #1.
 - 16th - [REDACTED] starts scratch coat of two balconies on Kettredge St. elev. @ Bldg. #1.
 - 24th - Mold noted found at unit 1202 @ Bldg. #1.
- **April 2006**
 - 19th - Issues: continued removal of mold on 2nd floor units & start of dehumidifying (10) units.
 - 26th - [REDACTED] begins balcony railing (guardrail) installation @ bldg. #1.
 - 26th - [REDACTED] begins exterior primer & paint finish on Kettredge St. elev. @ Bldg. #1.
- **May 2006**
 - 5th - Issues: completed mold removal (10) second floor units @ Bldg. #1.
 - 5th - [REDACTED] completes finish coat on Kettredge St. elev. @ Bldg. #1.
 - 9th - [REDACTED] patches finish coat at balconies on Bldg. #1.
 - 12th - Issues: last mention of humidifying (10) units @ Bldg. #1.
 - 22nd - Issues: (2) men reset fans & filters per Benchmark recommendations on second floor @ bldg. #1.
 - 23rd - Last mention of rainfall at project site.
- **June 2006**
 - 7th - Issues: need to retest units 1201 & 1210 @ Bldg. #1.
 - 13th - Issues: Unit 1210 mold testing.
- **July 2006**
- **August 2006**
 - 1st - [REDACTED] starts waterproofing balconies @ Bldg. #1 with IRC (WP consultants) observing waterproofing operations.
 - 2nd - [REDACTED] continues waterproofing balconies @ Bldg. #1 with IRC (WP consultants) observing waterproofing operations.
 - 3rd - [REDACTED] flood tests balconies @ Bldg. #1 with IRC (WP consultants) observing waterproofing operations.
 - 4th - [REDACTED] flood tests balconies @ Bldg. #1 with IRC (WP consultants) observing waterproofing operations.
 - 7th - [REDACTED] flood tests balconies @ Bldg. #1 with IRC (WP consultants) observing waterproofing operations.

Applications for Payment

- No Applications for Payment have been provided for review as of the date of this report.



5.0 Findings - continued

Project Closeout Documents

- **Punch List – 21 August 2006**
 - Exterior Punch List for Building #1 includes;
 - [REDACTED] to "paint ..around "unit French Door Frames".
 - [REDACTED] to "install thresholds".
- **Punch List – 23 April 2007**
 - Owner has accepted all work as of 19 April 2007

6.0 Summary Conclusions

- The design & construction documents consisting of drawings, details and specifications as prepared by [REDACTED] for the Library Gardens Apartments should have been sufficient for the general contractor ([REDACTED]) and the various sub contractors to construct the subject cantilever balconies at units 305 & 405 in a manner that with little maintenance should have been able to perform as intended for the life expectancy of the building.
- The failure mechanism which ultimately resulted in the collapse of Unit 405's balcony appears to be dry rot damage which had occurred along the top of the cantilever balcony deck joists and subsequently failed under the imposed loads on the evening of the incident. A preliminary design and load analysis by [REDACTED] SE; [REDACTED] Consulting Structural Engineers (report pending) suggests that the imposed load of the (13) students was well within the design limits of the balcony structure.
- The location of the dry rot along the top of the joists suggests long term moisture saturation of the the (3) layers (+/-2") of OSB Oriented Strand Board in direct contact with the joists.
- Additional locations of water damage and dry rot were found to the wall OSB sheathing and the face of the doubled deck joists along the deck edge to wall interface.
- Factors which appear to have contributed to the encapsulated moisture saturation, dry rot & ultimate structural failure include the following;
 1. Failure to provide pressure treated micro-lam joists. (pending laboratory analysis)
 2. Substitution of (3) layers (+/-2") of OSB sheathing, which according to the referenced research, once saturated, OSB does not release encapsulated moisture very quickly. It is not known at this time how much moisture was retained within the OSB sheathing at the time of encapsulation by the exterior plaster & subsequent balcony waterproofing installation.
 3. Failure to provide the specified sacrificial membrane noted in detail 12/AD33, which could have protected the OSB sheathing from moisture saturation. Laboratory analysis by [REDACTED] confirms this in test sample 305C.
 4. Between when [REDACTED] completed the balcony framing & sheathing on the 11th of October 2005 and when [REDACTED] completed the balcony waterproof membrane on the 2nd of August 2006, there is no mention of framing protection from inclement weather in [REDACTED] Construction's Daily Logs, during which time it rained 38.78".
 5. Mold was discovered in a number of 2nd floor units within the same Building #1 with unit 305 & 405, which prompted [REDACTED] to initiate mold removal & dehumidifying (10) units between 24 April 2006 & 13 June 2006.



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6.0 Summary Conclusions - continued

6. At Unit 305, the balcony deck to wall prefabricated sheet metal flashing was not lapped over any membrane or lath paper at the outside face of the double joist balcony framing, which resulted in extensive damage & dry rot to the building wall OSB sheathing and the lower outside face of the double joist balcony framing below the flashing termination.
7. At Unit 405, the balcony deck to wall prefabricated sheet metal flashing was not lapped over any membrane or lath paper at the building wall plane, also resulting in extensive damage & dry rot to the building wall OSB sheathing and the lower outside face of the double joist balcony framing below the flashing termination.
8. The perimeter extruded aluminum bal-form edge metal was not set over WR Grace "Ice & Water Shield" waterproof membrane as required in detail 2/AD81, to which the "Bituthene 3000" could seal to. Instead, Fortifiber "Fastflash 40" was lapped over the horizontal leg of the bal-form edge metal in the area below guardrail stanchion and provided a possible incompatibility issue between products from different manufacturers.
9. The bal-form edge metal was also not supported along the outside edge and cantilevered out approximately 1" unsupported, where it only slightly overlapped the exterior plaster and (2) layers of lath paper along the bottom edge. The outer face of the double joist balcony deck framing under the bal-form edge metal at unit 305 was found still damp and most of the lath paper had deteriorated upon removal of the exterior plaster finish, nearly four months after the balcony remnant had been removed from the building and stored in a weather protected environment.
10. The guardrail stanchion metal base plate was not set over WR Grace "Ice & Water Shield" waterproof membrane as required in detail 2/AD81 to which the "Bituthene 3000" could seal to. Instead, Fortifiber "Fastflash 40" was set under the guardrail stanchion metal base plate and provided a possible incompatibility issue between products from different manufacturers. Additionally, no "Bituthene Primer" was found through laboratory analysis between the metal base plate and the "Bituthene 3000" membrane which resulted in poor membrane adhesion. At one location during destructive testing, moisture was still present between the metal base plate and the waterproof membrane.
11. The guardrail stanchion base plate lag screws found were 3" in length, and not the 4" called for in the approved shop drawings. This resulted in poor embedment into the deck framing and in a number of locations the lag screws completely missed the framing members below the OSB sheathing.

This concludes my Construction Summary Report with respect to the aforementioned case. I reserve the right to supplement this report should additional information become available. Should you have any questions or wish additional information, please don't hesitate to call or e-mail.

Thank you for your time.

Robert Burnett Perry, AIA, NCARB, LEED AP
Perry Consulting Group, Inc.
California Architectural Registration C14239
California General Contractor's License B-750921





Exhibit “A”

National Oceanic & Atmospheric Administration
Rainfall Data for Berkeley, CA

July 2005 through December 2006.

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations.

Generated on 11/24/2015

Observation Time Temperature: 0800 Observation Time Precipitation: 2400

P r e l i m i n a r y	Y e a r	M o n t h	D a y	Temperature (F)			Precipitation(see **)					Evaporation		Soil Temperature (F)											
				24 hrs. ending at observation time		at O b s e r v a t i o n	24 Hour Amounts ending at observation time				At Obs Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in depth			8 in depth								
				Max.	Min.		Rain, melted snow, etc. (in)	F l a g	Snow, ice pellets, hail (in)	F l a g				Snow, ice pellets, hail, ice on ground (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.					
	2005	7	1	73	53	61	0.00		0.0		0														
	2005	7	2	72	52		0.00		0.0		0														
	2005	7	3	70	52		0.00		0.0		0														
	2005	7	4	73	52		0.00		0.0		0														
	2005	7	5	74	52	59	0.00		0.0		0														
	2005	7	6	72	54	63	0.00		0.0		0														
	2005	7	7	83	53	59	0.00		0.0		0														
	2005	7	8	75	54	61	0.00		0.0		0														
	2005	7	9	74	56		0.00		0.0		0														
	2005	7	10	72	56		0.00		0.0		0														
	2005	7	11	77	56	64	0.00		0.0		0														
	2005	7	12	86	57	65	0.00		0.0		0														
	2005	7	13	83	54	62	0.00		0.0		0														
	2005	7	14	74	54		0.00		0.0		0														
	2005	7	15	77	52		0.00		0.0		0														
	2005	7	16	77	53		0.00		0.0		0														
	2005	7	17	80	54		0.00		0.0		0														
	2005	7	18	76	54	61	0.00		0.0		0														
	2005	7	19	75	58	60	0.00		0.0		0														
	2005	7	20	74	55	61	0.00		0.0		0														
	2005	7	21	74	55	59	0.00		0.0		0														
	2005	7	22	71	56	64	0.00		0.0		0														
	2005	7	23	77	55		0.00		0.0		0														
	2005	7	24	92	55		0.00		0.0		0														
	2005	7	25	74	53		0.00		0.0		0														
	2005	7	26	74	52		0.00		0.0		0														
	2005	7	27	73	53		0.00		0.0		0														
	2005	7	28	72	54		0.00		0.0		0														
	2005	7	29	72	54		0.00		0.0		0														
	2005	7	30	72	55		0.00		0.0		0														
	2005	7	31	74	54		0.00		0.0		0														
			Summary	75.5	54.1		0.00		0.0		0														

** flags in Preliminary indicate the data have not completed processing and quality control and may not be identical to the original observation
 ty, or blank, cells indicate that a data observation was not reported.
 und Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown
 This data value failed one of NCDC's quality control tests.

*values in the Precipitation category above indicate a TRACE value was recorded.

*values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.

Data value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations.

Elev: 310 ft. Lat: 37.874° N Lon: 122.260° W
 Station: BERKELEY, CA US GHCND:USC00040693

Generated on 11/24/2015

Observation Time Temperature: 0800 Observation Time Precipitation: 2400

P r e l i m i n a r y	Y e a r	M o n t h	D a y	Temperature (F)		at O b s e r v a t i o n	Precipitation(see **)					Evaporation		Soil Temperature (F)						
				24 hrs. ending at observation time			24 Hour Amounts ending at observation time				At Obs Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in depth			8 in depth			
				Max.	Min.		Rain, melted snow, etc. (in)	F l a g	Snow, ice pellets, hail (in)	F l a g	Snow, ice pellets, hail, ice on ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.	
	2005	8	1	77	54		0.00		0.0		0									
	2005	8	2	76	52		0.00		0.0		0									
	2005	8	3	75	55		0.00		0.0		0									
	2005	8	4	73	54		0.00		0.0		0									
	2005	8	5	74	51		0.00		0.0		0									
	2005	8	6	77	52		0.00		0.0		0									
	2005	8	7	75	52		0.00		0.0		0									
	2005	8	8	72	54		0.00		0.0		0									
	2005	8	9	72	54		0.00		0.0		0									
	2005	8	10	74	54		0.00		0.0		0									
	2005	8	11	73	50		0.00		0.0		0									
	2005	8	12	77	52		0.00		0.0		0									
	2005	8	13	72	53		0.00		0.0		0									
	2005	8	14	66	53		0.00		0.0		0									
	2005	8	15	67	53	57	0.00		0.0		0									
	2005	8	16	65	55	64	0.00		0.0		0									
	2005	8	17	73	53	57	0.00		0.0		0									
	2005	8	18	69	54	58	0.00		0.0		0									
	2005	8	19	64	54	57	0.00		0.0		0									
	2005	8	20	68	52		0.00		0.0		0									
	2005	8	21	70	54		0.00		0.0		0									
	2005	8	22	72	52		0.00		0.0		0									
	2005	8	23	73	52		0.00		0.0		0									
	2005	8	24	70	50		0.00		0.0		0									
	2005	8	25	68	54		0.00		0.0		0									
	2005	8	26	73	52		0.00		0.0		0									
	2005	8	27	75	50		0.00		0.0		0									
	2005	8	28	80	50		0.00		0.0		0									
	2005	8	29	76	53	61	0.00		0.0		0									
	2005	8	30	84	55	69	0.00		0.0		0									
	2005	8	31	88	57	68	0.00		0.0		0									
			Summary	73.2	52.9		0.00		0.0											

** flags in Preliminary indicate the data have not completed processing and quality control and may not be identical to the original observation
 ty, or blank, cells indicate that a data observation was not reported.

und Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown

this data value failed one of NCDC's quality control tests.

values in the Precipitation category above indicate a TRACE value was recorded.

values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.

Data value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations.

Generated on 11/24/2015

Observation Time Temperature: 0800 Observation Time Precipitation: 2400

P r e l i m i n a r y	Y e a r	M o n t h	D a y	Temperature (F)			Precipitation(see **)					Evaporation		Soil Temperature (F)										
				24 hrs. ending at observation time		at O b s e r v a t i o n	24 Hour Amounts ending at observation time				At Obs Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in depth			8 in depth							
				Max.	Min.		Rain, melted snow, etc. (in)	F l a g	Snow, ice pellets, hail (in)	F l a g				Snow, ice pellets, hail, ice on ground (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.				
	2005	9	1	88	55	59	0.00		0.0		0													
	2005	9	2	71	53	57	0.00		0.0		0													
	2005	9	3	71	53		0.00		0.0		0													
	2005	9	4	72	53		0.00		0.0		0													
	2005	9	5	71	52		0.00		0.0		0													
	2005	9	6	76	53	60	0.00		0.0		0													
	2005	9	7	70	53	59	0.00		0.0		0													
	2005	9	8	68	54	60	0.00		0.0		0													
	2005	9	9	68	56		0.00		0.0		0													
	2005	9	10	62	52		0.00		0.0		0													
	2005	9	11	73	53		0.00		0.0		0													
	2005	9	12	71	53	57	0.00		0.0		0													
	2005	9	13	65	51	55	0.00		0.0		0													
	2005	9	14	65	51	57	0.00		0.0		0													
	2005	9	15	67	51	56	0.00		0.0		0													
	2005	9	16	66	52		0.00		0.0		0													
	2005	9	17	70	52		0.00		0.0		0													
	2005	9	18	70	51		0.00		0.0		0													
	2005	9	19	74	48	66	0.00		0.0		0													
	2005	9	20	84	52	56	0.00		0.0		0													
	2005	9	21	64	53	59	T		0.0		0													
	2005	9	22	73	51	57	0.00		0.0		0													
	2005	9	23	71	52	58	0.00		0.0		0													
	2005	9	24	69	49		0.00		0.0		0													
	2005	9	25	76	48		0.00		0.0		0													
	2005	9	26	83	54	60	0.00		0.0		0													
	2005	9	27	71	54	58	0.00		0.0		0													
	2005	9	28	73	51	60	0.00		0.0		0													
	2005	9	29	83	51		0.00		0.0		0													
	2005	9	30	86	53		0.00		0.0		0													
			Summary	72.4	52.1		0.00		0.0															

--- ** flags in Preliminary indicate the data have not completed processing and quality control and may not be identical to the original observation
 ty, or blank, cells indicate that a data observation was not reported.
 und Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown
 This data value failed one of NCDC's quality control tests.
 values in the Precipitation category above indicate a TRACE value was recorded.
 values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.
 value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations.

Elev: 310 ft. Lat: 37.874° N Lon: 122.260° W
 Station: BERKELEY, CA US GHCND:USC00040693

Generated on 11/24/2015

Observation Time Temperature: 0800 Observation Time Precipitation: 2400

P r e l i m i n a r y	Y e a r	M o n t h	D a y	Temperature (F)		at O b s e r v a t i o n	Precipitation(see **)				Evaporation		Soil Temperature (F)						
				24 hrs. ending at observation time			24 Hour Amounts ending at observation time				At Obs Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in depth			8 in depth		
				Max.	Min.		Rain, melted snow, etc. (in)	F l a g	Snow, ice pellets, hail (in)	F l a g	Snow, ice pellets, hail, ice on ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2005	10	1	86	56		0.00	0.0		0									
	2005	10	2	73	50		0.00	0.0		0									
	2005	10	3	72	47		0.00	0.0		0									
	2005	10	4	72	46	53	0.00	0.0		0									
	2005	10	5	72	50	65	0.00	0.0		0									
	2005	10	6	79	52	59	0.00	0.0		0									
	2005	10	7	77	50	56	0.00	0.0		0									
	2005	10	8	70	49		0.00	0.0		0									
	2005	10	9	73	48		0.00	0.0		0									
	2005	10	10	73	51	59	0.00	0.0		0									
	2005	10	11	78	51	56	0.00	0.0		0									
	2005	10	12	67	49	56	0.00	0.0		0									
	2005	10	13	73	49	57	0.00	0.0		0									
	2005	10	14	80	50	63	0.07	0.0		0									
	2005	10	15	64	50		0.15	0.0		0									
	2005	10	16	68	49		0.00	0.0		0									
	2005	10	17	78	55	76	0.00	0.0		0									
	2005	10	18	78	53	61	0.00	0.0		0									
	2005	10	19	67	57	60	0.00	0.0		0									
	2005	10	20	68	51	57	0.00	0.0		0									
	2005	10	21	68	49		0.00	0.0		0									
	2005	10	22	66	49		0.00	0.0		0									
	2005	10	23	64	51	54	0.00	0.0		0									
	2005	10	24	68	50	54	0.00	0.0		0									
	2005	10	25	63	52	57	0.00	0.0		0									
	2005	10	26	59	47	54	0.16	0.0		0									
	2005	10	27	63	52	58	0.00	0.0		0									
	2005	10	28	64	54		0.03	0.0		0									
	2005	10	29	71	53		0.04	0.0		0									
	2005	10	30	65	45		0.00	0.0		0									
	2005	10	31	69	47	57	0.00	0.0		0									
			Summary	70.6	50.4		0.45	0.0											

** flags in Preliminary indicate the data have not completed processing and quality control and may not be identical to the original observation

ty, or blank, cells indicate that a data observation was not reported.

und Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown

*his data value failed one of NCDC's quality control tests.

*values in the Precipitation category above indicate a TRACE value was recorded.

*values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.

Data value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

Record of Climatological Observations
These data are quality controlled and may not be identical to the original observations.
Generated on 10/08/2015

Observation Time Temperature: 0800 Observation Time Precipitation: 2400

P r e l i m i n a r y	Y e a r	M o n t h	D a y	Temperature (F)			Precipitation(see **)					Evaporation		Soil Temperature (F)											
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in depth			8 in depth								
				Max.	Min.		Rain, melted snow, etc. (in)	F l a g	Snow, ice pellets, hail (in)	F l a g				Snow, ice pellets, hail, ice on ground (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.					
	2005	11	1	74	50	61	0.00		0.0		0														
	2005	11	2	70	53	56	0.00		0.0		0														
	2005	11	3	61	46	56	0.02		0.0		0														
	2005	11	4	63	53	58	0.18		0.0		0														
	2005	11	5	64	45		0.00		0.0		0														
	2005	11	6	63	49		0.00		0.0		0														
	2005	11	7	64	56	61	0.84		0.0		0														
	2005	11	8	65	48	54	0.17		0.0		0														
	2005	11	9	63	52	61	0.00		0.0		0														
	2005	11	10	69	50	58	0.00		0.0		0														
	2005	11	11	65	50		0.00		0.0		0														
	2005	11	12	60	45		0.00		0.0		0														
	2005	11	13	66	47		0.00		0.0		0														
	2005	11	14	66	53		0.00		0.0		0														
	2005	11	15	72	53	65	0.00		0.0		0														
	2005	11	16	74	56		0.00		0.0		0														
	2005	11	17	75	51	59	0.00		0.0		0														
	2005	11	18	75	52	66	0.00		0.0		0														
	2005	11	19	76	49		0.00		0.0		0														
	2005	11	20	71	48		0.00		0.0		0														
	2005	11	21	72	46		0.00		0.0		0														
	2005	11	22	71	47		0.00		0.0		0														
	2005	11	23	69	46		0.00		0.0		0														
	2005	11	24	68	46		0.00		0.0		0														
	2005	11	25	60	51		0.40		0.0		0														
	2005	11	26	61	41		0.00		0.0		0														
	2005	11	27	56	38		0.00		0.0		0														
	2005	11	28	56	42	55	0.53		0.0		0														
	2005	11	29	57	45	55	0.18		0.0		0														
	2005	11	30	56	45	50	0.00		0.0		0														
				Summary	66.1	48.4		2.32		0.0															

The ** flags in Preliminary indicate the data have not completed processing and quality control and may not be identical to the original observation
pty, or blank, cells indicate that a data observation was not reported.
Ground Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown
* This data value failed one of NCDC's quality control tests.
* values in the Precipitation category above indicate a TRACE value was recorded.
* values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.
* a value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations.

Elev: 310 ft. Lat: 37.874° N Lon: 122.260° W
Station: BERKELEY, CA US GHCND:USC00040693

Generated on 10/08/2015

Observation Time Temperature: 0800 Observation Time Precipitation: 2400

P r e l i m i n a r y	Y e a r	M o n t h	D a y	Temperature (F)			Precipitation(see **)				Evaporation		Soil Temperature (F)												
				24 hrs. ending at observation time		at O b s e r v a t i o n	24 Hour Amounts ending at observation time				At Obs Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in depth			8 in depth								
				Max.	Min.		Rain, melted snow, etc. (in)	F l a g	Snow, ice pellets, hail (in)	F l a g				Snow, ice pellets, hail, ice on ground (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.					
	2005	12	1					1.70		0.0		0													
	2005	12	2					0.01		0.0		0													
	2005	12	3							0.0		0													
	2005	12	4							0.0		0													
	2005	12	5							0.0		0													
	2005	12	6							0.0		0													
	2005	12	7				47	0.02	A	0.0		0													
	2005	12	8		54	45	51	0.00		0.0		0													
	2005	12	9		58	49	57	0.00		0.0		0													
	2005	12	10					0.00		0.0		0													
	2005	12	11					0.00		0.0		0													
	2005	12	12					0.00		0.0		0													
	2005	12	13					0.00		0.0		0													
	2005	12	14				46	0.00		0.0		0													
	2005	12	15		57	43	50	0.00		0.0		0													
	2005	12	16		58	39	45	0.00		0.0		0													
	2005	12	17					0.52		0.0		0													
	2005	12	18					2.84		0.0		0													
	2005	12	19				58	0.22		0.0		0													
	2005	12	20		60	50	60	0.15		0.0		0													
	2005	12	21					0.94		0.0		0													
	2005	12	22					1.14		0.0		0													
	2005	12	23							0.0		0													
	2005	12	24							0.0		0													
	2005	12	25					0.95	A	0.0		0													
	2005	12	26					0.46		0.0		0													
	2005	12	27					0.30		0.0		0													
	2005	12	28					0.79		0.0		0													
	2005	12	29					0.02		0.0		0													
	2005	12	30					1.39		0.0		0													
	2005	12	31					2.04		0.0		0													
				Summary	57.4	45.2		13.49		0.0		0													

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ly, or blank, cells indicate that a data observation was not reported.
and Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown
his data value failed one of NCDC's quality control tests.
alues in the Precipitation category above indicate a TRACE value was recorded.
values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.
Data value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

Record of Climatological Observations

Elev: 310 ft. Lat: 37.874° N Lon: 122.260° W

Station: BERKELEY, CA US GHCND:USC00040693

These data are quality controlled and may not be identical to the original observations.

Generated on 10/08/2015

Observation Time Temperature: 0800 Observation Time Precipitation: 2400

P r e l i m i n a r y	Y e a r	M o n t h	D a y	Temperature (F)			Precipitation(see **)					Evaporation		Soil Temperature (F)										
				24 hrs. ending at observation time		at O b s e r v a t i o n	24 Hour Amounts ending at observation time				At Obs Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in depth			8 in depth							
				Max.	Min.		Rain, melted snow, etc. (in)	F l a g	Snow, ice pellets, hail (in)	F l a g				Snow, ice pellets, hail, ice on ground (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.				
	2006	1	1				0.52																	
	2006	1	2				0.58																	
	2006	1	3				0.16																	
	2006	1	4				0.01																	
	2006	1	5	66	45	52	0.00		0.0															
	2006	1	6	63	46	53	0.03		0.0															
	2006	1	7				0.22																	
	2006	1	8				0.00		0.0															
	2006	1	9	63	41	47	0.00		0.0															
	2006	1	10	57	43	47	0.00		0.0															
	2006	1	11	56	46	55	0.09		0.0															
	2006	1	12	58	43	52	0.00		0.0															
	2006	1	13	60	45	49	0.01		0.0															
	2006	1	14	62	47		0.69		0.0															
	2006	1	15	52	38		0.00		0.0															
	2006	1	16	53	40		0.00		0.0		0													
	2006	1	17	54	43	48	0.49		0.0		0													
	2006	1	18	58	46	49	0.16		0.0		0													
	2006	1	19	55	40	44	0.00		0.0		0													
	2006	1	20	54	39	44	0.00		0.0		0													
	2006	1	21	54	44		0.05		0.0		0													
	2006	1	22	54	41		0.00		0.0		0													
	2006	1	23	61	42	48	0.00		0.0		0													
	2006	1	24	64	49	51	0.00		0.0		0													
	2006	1	25	64	45		0.00		0.0		0													
	2006	1	26	59	41	47	0.00		0.0		0													
	2006	1	27	56	43	50	0.39		0.0		0													
	2006	1	28	55	45		0.37		0.0		0													
	2006	1	29	55	46		0.00		0.0		0													
	2006	1	30	57	45	51	0.26		0.0		0													
	2006	1	31	55	41	47	0.00		0.0		0													
			Summary	57.8	43.4		4.03		0.0															

* flags in Preliminary indicate the data have not completed processing and quality control and may not be identical to the original observation
pty, or blank, cells indicate that a data observation was not reported.

Ground Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown

* This data value failed one of NCDC's quality control tests.

* values in the Precipitation category above indicate a TRACE value was recorded.

* values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.

Data value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations.

Generated on 11/24/2015

Observation Time Temperature: 0800 Observation Time Precipitation: 2400

P r e l i m i n a r y	Y e a r	M o n t h	D a y	Temperature (F)		a t O b s e r v a t i o n	Precipitation(see **)				Evaporation		Soil Temperature (F)							
				24 hrs. ending at observation time			24 Hour Amounts ending at observation time				At Obs Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in depth			8 in depth			
				Max.	Min.		Rain, melted snow, etc. (in)	F l a g	Snow, ice pellets, hail (in)	F l a g	Snow, ice pellets, hail, ice on ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.	
	2006	6	1	72	54		0.00		0.0		0									
	2006	6	2	75	55		0.00		0.0		0									
	2006	6	3	77	55		0.00		0.0		0									
	2006	6	4	80	58		0.00		0.0		0									
	2006	6	5	76	55		0.00		0.0		0									
	2006	6	6	76	53		0.00		0.0		0									
	2006	6	7	72	52	65	0.00		0.0		0									
	2006	6	8	79	52	61	0.00		0.0		0									
	2006	6	9	73	52	58	0.00		0.0		0									
	2006	6	10	70	52		0.00		0.0		0									
	2006	6	11	63	52		0.00		0.0		0									
	2006	6	12	61s	55	66s	0.00		0.0		0									
	2006	6	13	66	54	62	0.00		0.0		0									
	2006	6	14	69	50	58	0.00		0.0		0									
	2006	6	15	72	51	70	0.00		0.0		0									
	2006	6	16	77	56	68	0.00		0.0		0									
	2006	6	17	89	55		0.00		0.0		0									
	2006	6	18	86	52		0.00		0.0		0									
	2006	6	19	79	50	59	0.00		0.0		0									
	2006	6	20	76	51		0.00		0.0		0									
	2006	6	21	79s	54	81s	0.00		0.0		0									
	2006	6	22	93	62	81	0.00		0.0		0									
	2006	6	23	90	53	61	0.00		0.0		0									
	2006	6	24	73	53		0.00		0.0		0									
	2006	6	25	71	55		0.00		0.0		0									
	2006	6	26	75	55	60	0.00		0.0		0									
	2006	6	27	82	55	61	0.00		0.0		0									
	2006	6	28	69	57	64	0.00		0.0		0									
	2006	6	29	73	55	63	0.00		0.0		0									
	2006	6	30	75	55	61	0.00		0.0		0									
			Summary	75.6	53.9		0.00		0.0											

*** flags in Preliminary indicate the data have not completed processing and quality control and may not be identical to the original observation
 ty, or blank, cells indicate that a data observation was not reported.
 und Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown
 *his data value failed one of NCDC's quality control tests.
 values in the Precipitation category above indicate a TRACE value was recorded.
 values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.
 value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

Record of Climatological Observations
 These data are quality controlled and may not be
 identical to the original observations.
 Generated on 10/08/2015

Observation Time Temperature: 0800 Observation Time Precipitation: 2400

P r e l i m i n a r y	Y e a r	M o n t h	D a y	Temperature (F)		at O b s e r v a t i o n	Precipitation(see **)					Evaporation		Soil Temperature (F)						
				24 hrs. ending at observation time			24 Hour Amounts ending at observation time					At Obs Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in depth			8 in depth		
				Max.	Min.		Rain, melted snow, etc. (in)	F l a g	Snow, ice pellets, hail (in)	F l a g	Snow, ice pellets, hail, ice on ground (in)				Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2006	10	1	64	49		0.00		0.0		0									
	2006	10	2	66	49	61	0.00		0.0		0									
	2006	10	3	70	48	60	0.00		0.0		0									
	2006	10	4	70	54	66	0.09		0.0		0									
	2006	10	5	66	51		0.52		0.0		0									
	2006	10	6	68	48		0.00		0.0		0									
	2006	10	7	60	49		0.00		0.0		0									
	2006	10	8	72	49		0.00		0.0		0									
	2006	10	9	81	51		0.00		0.0		0									
	2006	10	10	77	51	67	0.00		0.0		0									
	2006	10	11	69	48	65	0.00		0.0		0									
	2006	10	12	73	48		0.00		0.0		0									
	2006	10	13	68	53	58	0.00		0.0		0									
	2006	10	14	68	54		0.00		0.0		0									
	2006	10	15	66	51		0.00		0.0		0									
	2006	10	16	69	52	58	0.00		0.0		0									
	2006	10	17	69	47	59	0.00		0.0		0									
	2006	10	18	73	49	71	0.00		0.0		0									
	2006	10	19	79	49		0.00		0.0		0									
	2006	10	20	80	52		0.00		0.0		0									
	2006	10	21	84	54		0.00		0.0		0									
	2006	10	22	85	51		0.00		0.0		0									
	2006	10	23	79	46		0.00		0.0		0									
	2006	10	24	80	50	56	0.00		0.0		0									
	2006	10	25	67	45	64	0.00		0.0		0									
	2006	10	26	77	52	66	0.00		0.0		0									
	2006	10	27	75	55	63	0.00		0.0		0									
	2006	10	28	82	49		0.00		0.0		0									
	2006	10	29	83	48		0.00		0.0		0									
	2006	10	30	83	48	57	0.00		0.0		0									
	2006	10	31	81	48	59	0.00		0.0		0									
			Summary	73.0	49.9		0.61		0.0											

** flags in Preliminary indicate the data have not completed processing and quality control and may not be identical to the original observation
 ty, or blank, cells indicate that a data observation was not reported.

und Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown

his data value failed one of NCDC's quality control tests.

values in the Precipitation category above indicate a TRACE value was recorded.

values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.

Data value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations.

Elev: 310 ft. Lat: 37.874° N Lon: 122.260° W

Generated on 10/08/2015

Station: BERKELEY, CA US GHCND:USC00040693

Observation Time Temperature: 0800 Observation Time Precipitation: 2400

P r e l i m i n a r y	Y e a r	M o n t h	D a y	Temperature (F)			Precipitation(see **)					Evaporation		Soil Temperature (F)						
				24 hrs. ending at observation time		a t O b s e r v a t i o n	24 Hour Amounts ending at observation time				A t O b s T i m e	24 Hour Wind Movement (mi)	A m o u n t o f E v a p. (in)	4 in depth			8 in depth			
				Max.	Min.		Rain, melted snow, etc. (in)	F l a g	Snow, ice pellets, hail (in)	F l a g				Snow, ice pellets, hail, ice on ground (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2006	11	1	65	45	65	0.00		0.0		0									
	2006	11	2	67	52	61	0.30		0.0		0									
	2006	11	3	63	55	56	0.38		0.0		0									
	2006	11	4	68	50		0.00		0.0		0									
	2006	11	5	66	50		0.00		0.0		0									
	2006	11	6	71	52	64	0.00		0.0		0									
	2006	11	7	76	52	70	0.00		0.0		0									
	2006	11	8	74	55	60	0.01		0.0		0									
	2006	11	9	68	45	56	0.00		0.0		0									
	2006	11	10	65	41		0.00		0.0		0									
	2006	11	11	65	48		0.00		0.0		0									
	2006	11	12	59	40		0.00		0.0		0									
	2006	11	13	63	45		0.00		0.0		0									
	2006	11	14	61	48	54	0.93		0.0		0									
	2006	11	15	66	45		0.00		0.0		0									
	2006	11	16	67	49	60	0.01		0.0		0									
	2006	11	17	66	55		0.00		0.0		0									
	2006	11	18	66	48		0.00		0.0		0									
	2006	11	19	69	50		0.00		0.0		0									
	2006	11	20	68	50		0.00		0.0		0									
	2006	11	21	64	52		0.00		0.0		0									
	2006	11	22	66	48		0.00		0.0		0									
	2006	11	23	63	41		0.00		0.0		0									
	2006	11	24	62	37		0.00		0.0		0									
	2006	11	25	60	40		0.00		0.0		0									
	2006	11	26	64	40		0.00		0.0		0									
	2006	11	27	53	43		0.00		0.0		0									
	2006	11	28	55	37	51	0.42		0.0		0									
	2006	11	29	56	38	44	0.00		0.0		0									
	2006	11	30	56	39	48	0.00		0.0		0									
			Summary	64.4	46.3		2.05		0.0											

** flags in Preliminary indicate the data have not completed processing and quality control and may not be identical to the original observation, or blank, cells indicate that a data observation was not reported.
 and Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown
 his data value failed one of NCDC's quality control tests.
 alues in the Precipitation category above indicate a TRACE value was recorded.
 alues in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.
 value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations.

Generated on 10/08/2015

Observation Time Temperature: 0800 Observation Time Precipitation: 2400

P r e l i m i n a r y	Y e a r	M o n t h	D a y	Temperature (F)			Precipitation(see **)					Evaporation		Soil Temperature (F)						
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in depth			8 in depth			
				Max.	Min.		Rain, melted snow, etc. (in)	F i a g	Snow, ice pellets, hail (in)	F i a g				Snow, ice pellets, hail, ice on ground (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2006	12	1	61	39	48	0.00		0.0		0									
	2006	12	2	64	41		0.00		0.0		0									
	2006	12	3	64	47		0.00		0.0		0									
	2006	12	4	67	41	55	0.00		0.0		0									
	2006	12	5	68	42	61	0.00		0.0		0									
	2006	12	6	70	42	54	0.00		0.0		0									
	2006	12	7	67	41	57	0.00		0.0		0									
	2006	12	8	69	45	66	0.52		0.0		0									
	2006	12	9	66	50		0.67		0.0		0									
	2006	12	10	62	45		0.24		0.0		0									
	2006	12	11	59	43	53	0.08		0.0		0									
	2006	12	12	57	50	55	1.46		0.0		0									
	2006	12	13	58	52	57	0.04		0.0		0									
	2006	12	14	59	54	58	0.04		0.0		0									
	2006	12	15	59	45	49	0.23		0.0		0									
	2006	12	16	55	35		0.00		0.0		0									
	2006	12	17	49	35		0.00		0.0		0									
	2006	12	18	52	33	51	0.00		0.0		0									
	2006	12	19	58	33	41	0.00		0.0		0									
	2006	12	20	54	35	48	0.00		0.0		0									
	2006	12	21	55	42	52	0.60		0.0		0									
	2006	12	22	54	38		0.00		0.0		0									
	2006	12	23	57	38		0.00		0.0		0									
	2006	12	24	59	41		0.00		0.0		0									
	2006	12	25	56	41		0.00		0.0		0									
	2006	12	26	59	46		0.57		0.0		0									
	2006	12	27	63	46		0.08		0.0		0									
	2006	12	28	56	41		0.00		0.0		0									
	2006	12	29	59	38		0.00		0.0		0									
	2006	12	30	56	36		0.00		0.0		0									
	2006	12	31	58	38		0.00		0.0		0									
			Summary	59.7	41.7		4.53		0.0											

** flags in Preliminary indicate the data have not completed processing and quality control and may not be identical to the original observation, or blank, cells indicate that a data observation was not reported.

Ground Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown
his data value failed one of NCDC's quality control tests.

Values in the Precipitation category above indicate a TRACE value was recorded.

Values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.

Data value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

10. Balcony Deck Perimeter Bal-form Edge Metal - continued

- Code Issues:
 - None

- Responsible Trades:
 - General Contractor
 - Waterproofing Subcontractor
 - Bal-form Edge Metal Installer
 - Lath & Plaster Subcontractor

- Comments:
 - The bal-form/T-bar edge metal, deck to wall & threshold pan flashing, and guardrail stanchions would have been in place prior to the application of the Bituthene 3000 & Bituthene 3000 LM waterproof membranes and the lath paper & exterior plaster finish.

- Questions:
 - Where is Submittal?
 - Who installed the bal-form/T-bar edge metal?
 - When was the bal-form/T-bar edge metal installed?
 - Why was the bal-form/T-bar edge metal not set over the specified Grace "Ice & Water Shield" sheet membrane in detail 2/AD81?
 - Why was the bal-form/T-bar edge metal not fully supported along the outside edge?

11. Balcony Deck Guardrail Stanchions

- Design
 - Drawings:
 - NA
 - Details:
 - Detail 2/AD81 Guardrail @ Private Deck
 - "2"x2" tube steel stanchion"
 - "For conn. see 18/AD81"
 - "Metal flashing – see detail 6/AD81"
 - "Grace "Ice & Water Shield" under base plate and flashing"
 - Detail 18/AD81 Stanchion Connection
 - Deck sheathing is shown extending out to fully support the bal-form/T-bar edge metal.
 - "Deck edge T-bar. see detail 6/AD81"
 - "Provide extra layer of self-adhering Bituthene over plate. Min. 4" overlap beyond plate"
 - "Steel plate per struc. drawings"
 - "T.S. sleeve. weld to plate"
 - "2"x3" T.S. stanchion @ 72" O.c. max. weld to T.S. sleeve"
 - Specifications:
 - "Spec Section 05520 Handrails & Railings"
 - 2.2 Metals
 - B. Steel Tube: ASTM A500
 - 2.3 Other Materials
 - B. Grace "Ice and Water Shield" bituthene membrane
 - 2.5 Finishes
 - A. Steel Railings: Cleaned and shop primed, for paint finish
 - 3.2 Installation
 - C. Attach handrails to wall with wall brackets as detailed, using Grace "Ice and Water Shield" bituthene membrane for interface with building paper "
 - Manufacturer's Recommendations:
 - NA
- Construction Administration
 - Submittal:
 - [REDACTED] (balcony guardrail)
 - Submittal 055-05500 Deco Gates & Rails includes details, elevations and notations on sheet D13 for the balcony guardrails at units 305 & 405; reference file number 05-001303 – page 6. Base plates are noted as follows:
 - "j" – 3/16" x 4" x 4-1/4" w/ (2) 3/8" x 4" lag screws
 - "k" – 3/16" x 4" x 5-1/2" w/ (4) 3/8" x 4" lag screws
 - [REDACTED] (lath & plaster)
 - Submittal 049-09220 Exterior Plaster includes product information for Fortifiber "Fastflash 25" self-sealing membrane.

11. Balcony Deck Guardrail Stanchions - continued

- Construction Administration
 - Request for Information (RFI):
 - ASI – 12.5 (Architect's Supplemental Instructions) dated 28 October 2002 revised the guardrail design to include 3" sq. posts.
 - Change Order:
 - NA
 - Meeting Minutes/ E-Mail:
 - NA
 - Construction Daily Logs:
 - April 2006
 - 26th - Larco begins balcony railing (guardrail) installation @ bldg. #1.
- As-Built:
 - Unit 305 & 405 Balcony Decks
 - A layer of "Fortifiber Fastflash 40" sheet membrane was found under the guardrail stanchion plate and over the OSB and bal-form/T-bar edge metal. At one location moisture was present between the stanchion steel plate and the "Fortifiber Fastflash 40" membrane.
 - 2-1/2" square tube steel stanchion was found continuously welded to a steel plate of varying sizes depending on the location the balcony deck. The steel plate is coated with a red paint primer and typically some exhibited rust. No "Bituthene Primer WP 3000" appeared to be present to the stanchion steel plate.
 - 3" square tube steel guardrail posts were welded to the stanchion posts through drilled holes in the sides of the posts which were sealed with sealant.
 - A test on one such stanchion at Unit 305's balcony deck showed no leakage after 30 minutes of a static water test.
 - (2-4) 3" lag screws were used to fasten each guardrail stanchion plate into the deck framing. Some missed the deck framing and only extended through the 2" of OSB approximately 3/8" – 1/2". Lag screws, which did extend through the OSB sheathing and into the framing members, only had the 3/8" – 1/2" of embedment. Most of the lag screws showed signs of rust deterioration.
 - "Bituthene 3000" & "Bituthene 3000 LM" were lapped over the "Fortifiber Fastflash 40" and the stanchion steel plate.

11. Balcony Deck Guardrail Stanchions - continued

• Laboratory Testing:

• [Redacted] Laboratory Analysis dated 30 November 2015

- Confirms in Test Sample 405D/E that an acrylic polymer similar to "Bituthene Primer WP 3000" had been installed over the guardrail stanchion metal plate prior to the installation of the "Bituthene 3000" & "Bituthene 3000 LM" membranes.
- At Test Sample 305D/E however, no acrylic primer similar to "Bituthene Primer WP 3000" had been installed over the guardrail stanchion metal plate prior to the installation of the "Bituthene 3000" & "Bituthene 3000 LM" membranes.

• ASTM D903-98 Peel Strength of Adhesive Bond Test confirmed the following:

Test Sample	(#) of Strip Tests	Results Range*	Bond
305D (metal)	(2) strips	1.5 – 3.0 lbf/in	Poor
305E (alum)	(6) strips, (1) de-bonded	2.7 – 14.8 lbf/in	Mixed
305E (memb.)	(6) strips, (2) de-bonded**	4.0 – 8.8 lbf/in	Fair
405D (metal)	(2) strips	0.3 – 0.7 lbf/in	Poor
405E (memb.)	(3) strips	4.2 – 7.1 lbf/in	Fair

*according to WR Grace's Guide Specifications for "Bituthene 3000", a typical value based on the ASTM D903 should be in the range of 9 lbs/in. (lbf/in is the same as lbs/in)

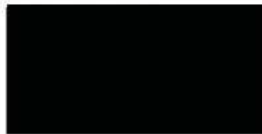
** an additional test strip had no "Fastflash 40" membrane found below the "Bituthene 3000"

• Code Issues:

- None

• Responsible Trades:

- General Contractor
- Waterproofing Subcontractor
- Guardrail Subcontractor
- Lath & Plasterer



• Comments:

- Guardrail Stanchions would have been in place prior to the application of the Bituthene 3000 & Bituthene LM waterproofing.

• Questions:

- Why were 3" long lag screws utilized in lieu of the 4" long lag screws included in submittal 055-05500 Deco Gates & Rails?
- Why was blocking not provided to fully engage the lag screws which missed the framing members?
- Why was the guardrail stanchion plates not set over the specified Grace "Ice & Water Shield" sheet membrane in detail 2/AD81 but rather Fortifiber "Fastflash 40"?
- When was the Fortifiber "Fastflash 40" sheet membrane installed?
- Was the Fortifiber "Fastflash 40" sheet membrane approved by WR Grace as a compatible alternative to WR Grace's "Ice & Water Shield" membrane?

[Redacted] AIA, NCARB, LEED AP

California Architectural Registration [Redacted]

15 December 2015

Balcony Design vs As Built Summary

This summary arises from the 16 June 2015 collapse of Unit 405's cantilever balcony onto Unit 305's balcony below at the Library Gardens apartment complex located at 2020 Kittredge St., Berkeley, CA in which (6) students lost their lives and (7) students were injured.

Pursuant to joint effort by the Alameda County's DA's Office, the California Architect Board, the California Board of Professional Engineers, Land Surveyors and Geologists & the California Contractors State License Board, I have been asked to performed an initial onsite investigation, reviewed various documents provided for review and have performed destructive testing investigations at the subject project located at 2020 Kittredge St., Berkeley, CA as well as the remnants of the balconies at Units 405 & 305.

This report contains a specific comparison of the design of the various balcony components versus the as built conditions found in the field through visual observation, destructive testing & laboratory analysis.



City of Berkeley Photo 0109 taken on 16 June 2015



City of Berkeley Photo 0110 taken on 16 June 2015

Balcony Deck Components Investigated

1. Cantilever Floor Joists
2. Balcony Deck Sheathing
3. Balcony Deck Sacrificial Membrane
4. Balcony Deck Waterproof Membrane
5. Balcony Deck Protection Board
6. Balcony Deck Perimeter Expansion Board
7. Balcony Deck Concrete Overlay
8. French Door Threshold Pan Flashing
9. Balcony Deck to Wall Flashing
10. Balcony Deck Perimeter Bal-form Edge Metal
11. Balcony Deck Guardrail Stanchions

1. Cantilever Floor Joists

- Design
 - Drawings:
 - Sheet S1.6 Unit B8 Floor Framing calls for
 - 1-3/4"x11-7/8" ML @ 16" o/c, notch microlams at deck from 9-1/4" to 7-1/4"
 - And shows tapered slope in diagram
 - Sheet S1.6 Note 8 calls for
 - "Top Floor Only, PT (pressure treated) joists required at private decks and open catwalks extending 6'-0" into covered area."
 - Details:
 - NA
 - Specifications:
 - Spec Section 06185 Glue Laminated Members
 - 2.2B Adhesive: ASTM D-2559, wet use type
 - Structural Calcs:
 - [REDACTED] (structural engineer) Structural Calculations dated 22 April 2005 incorporates "Trust Joist" LDF 1-3/4" x 11-7/8" @ 16" o/c for cantilever floor framing.
 - Manufacturer's Recommendations:
 - NA
- Construction Administration
 - Submittal:
 - [REDACTED] Construction (framer)
 - None provided to date pertaining to spec section 06185 Glue Laminated Members – Cantilever Floor Joists.
 - Request for Information (RFI):
 - NA
 - Change Order:
 - NA
 - Meeting Minutes/ E-Mails:
 - NA
 - Construction Daily Logs:
 - September 2005
 - 2nd - [REDACTED] starts installing 3rd floor joists @ building #1.
 - 28th - [REDACTED] starts installing 4th floor joists @ building #1.
- As-Built:
 - Unit 305 & 405 Balcony Decks
 - Found 1-3/4" x 11-7/8" MLs provided at 16" o/c
 - Tapered from 9-1/2" to 8" for an approximate slope of 1/4" per foot.
 - Joists don't appear to be pressure treated.

1. Cantilever Floor Joists - continued

- Laboratory Testing:
 - Awaiting lab testing results. [REDACTED] SE coordinating.
- Code Issues:
 - None
- Responsible Trades:
 - General Contractor [REDACTED]
 - Framing Subcontractor [REDACTED]
- Comments:
 - The proper notch of the floor joists to eliminate the need for multiple layers of deck sheathing would have been 1-3/8" down to 10-1/2" and tapering to 9-1/4" for a 1/4" / ft. slope.
- Questions:
 - Where is framing Submittal from [REDACTED]?
 - Where is the Change Order for not providing Pressure Treated LDF Joists if it is determined that joists were not pressure treated?
 - Who approved not providing Pressure Treated LDF Joists if it is determined that joists were not pressure treated?

2. Balcony Deck Sheathing

- Design
 - Drawings:
 - Sheet S1.6 Unit B8 Floor Framing calls for
 - "3/4" T/G Plywood w/ 10d at 6" o/c and 10" o/c w/ topping over S.A.D for slope."
 - Details:
 - Detail 12/AD33
 - "double wood floor per structural"
 - Specifications:
 - Spec Section 06110 Wood Framing & Sheathing
 - "2.2 Treated Materials. A. Preservative-Treated Materials. AWPA C2 Lumber and AWPA C9 plywood label by an inspection agency approved by ALSC's Board of Review. After treatment, kiln-dry lumber and plywood to 19 and 15 percent content, respectively. Treat indicated items and the following:
 - 1. Wood members in connection with roofing, flashing, vapor barriers, and waterproofing "
 - "2.6 Panel Products. A. Wood-Based Structural-Use Panels: Oriented Strand Board (OSB); DOC PS 2. Provide plywood complying with DOC PS 1, where plywood is indicated:
 - 3. Combination Subfloor-Underlayment EPA-rated Strud-I-Floor, Exposure 1."
 - "3.3 Workmanship. B. Selection of lumber pieces
 - 1. Carefully select the members. Verify that all related lumber plywood, and other materials are in accordance with plans, specifications, and code regarding species, grade, and treatment."
 - "3.3 Workmanship. J. Installation of structural sheathing
 - 3. Contractor shall provide and install all floor, roof and deck sheathing in accordance with the structural requirements herein and as shown on the structural drawings, as well as in conformance with all written requirements of the manufacturers and/or installers of waterproofing, floor underlayment and roofing materials. Notify the Architect of any conflicts in these requirements prior to proceeding "
 - Spec Section 07186 Waterproofing over Plywood Decks
 - "3.1 B 5 Oriented Strain Board (OSB) is not an acceptable substrate."
 - Structural Calcs:
 - [REDACTED] (structural engineer) Structural Calculations dated 22 April 2005 incorporates notes use of 3/4" plywood sub-floor in floor design loading.

2. Balcony Deck Sheathing - continued

- Design
 - Manufacturer's Recommendations:
 - **WR Grace Technical Letter #8 Waterproofing Plywood Substrates**
 - "Use plywood panels which meet the American Plywood Association (APA) Exposure 1 or Exterior exposure durability classification. According to the APA, Exposure 1 panels "are designed for applications where long construction delays may be expected prior to providing protection, or where high moisture conditions may be encountered in service." Exterior panels "are designed for applications subject to permanent exposure to the weather or to moisture."
 - Use plywood panels with B-grade or better veneer to minimize surface preparation."
 - Plywood substrates should be clean, dry, frost-free. Free of projections and smooth, with flush panel joints. When using Bituthene waterproofing system, patch knots and superficial damage with Bituthene Liquid Membrane."
- Construction Administration
 - Submittal:
 - [REDACTED] (framer)
 - None provided to date pertaining to spec section 06110 Wood Framing & Sheathing – Balcony Deck Sheathing.
 - Request for Information (RFI):
 - NA
 - Change Order:
 - NA
 - Meeting Minutes/ E-Mail:
 - NA
 - Construction Daily Logs:
 - **September 2005**
 - 8th - [REDACTED] starts installing 3rd floor sheathing @ bldg. #1.
 - **October 2005**
 - 3rd - [REDACTED] starts installing 4th floor sheathing @ bldg. #1.
- As-Built:
 - **Unit 305 & 405 Balcony Decks**
 - Found an initial layer of ¼" OSB and (2) subsequent layers of 5/8" OSB for a total thickness of approximately 2".
- Laboratory Testing:
 - Awaiting lab testing results: [REDACTED] SE coordinating.
- Code Issues:
 - Follow manufacturer's recommendations.

2. Balcony Deck Sheathing - continued

- Responsible Trades:
 - General Contractor
 - Framing Subcontractor
 - Waterproofing Subcontractor

- Comments:
 - It is unknown at this time how much moisture was retained in the (3) layers of OSB, (approx. 2") prior to the encapsulation by the deck waterproofing and exterior plaster finish.

- Questions:
 - Where is Submittal?
 - Where is Change Order?
 - Who authorized, accepted and requested change from plywood to OSB?
 - Did Waterproofing consultants review change to OSB?
 - Did waterproofing subcontractor object to the installation of the "Bituthene 3000" over the OSB in lieu of the specified plywood sheathing?
 - Was the OSB balcony deck sheathing protected from inclement weather after it was installed and prior to the application of the waterproof membrane over (10) months later?

3. Balcony Deck Sacrificial Membrane

- Design
 - Drawings:
 - NA
 - Details:
 - Detail 12/AD33
 - "provide sacrificial memb. prior to Bituthene 3000 application"
 - "apply Sonneborn HML 5000 SL to achieve 15 dry mills. Reinforce joints w/ Sonoshield reinforcing fabric embedded into a bed of NP-1 sealant"
 - "apply per manufacturer's recommendations"
 - Specifications:
 - NA
 - Manufacturer's Recommendations:
 - Now referred to as BASF MasterSeal HLM 5000
 - BASF MasterSeal HLM 5000 Technical Data Guide includes exterior plywood as a suitable substrate for exterior horizontal applications.
 - According to [REDACTED] BASF's Building Systems Technical Support, "OSB is not a suitable substrate for the MasterSeal products."
- Construction Administration
 - Submittal:
 - [REDACTED] (waterproofing)
 - No submittal has been provided regarding the sacrificial membrane called out in detail 12/AD33 at this time.
 - Request for Information (RFI):
 - NA
 - Change Order:
 - NA
 - Meeting Minutes/ E-Mail:
 - NA
 - Construction Daily Logs:
 - Rainfall records during & after the balcony decks were framed and prior to being covered between September 2005 & August 2006.

• September 2005	0.00"
• October 2005	0.45"
• November 2005	2.32"
• December 2005	13.49"
• January 2006	4.03"
• February 2006	3.23"
• March 2006	9.42"
• April 2006	5.32"
• May 2006	0.52"
• June 2006	0.00"
• July 2006	0.00"
• August 2006	0.00"
Total	38.78"

3. Balcony Deck Sacrificial Membrane – continued

- Construction Administration
 - Construction Daily Logs:
 - **September 2005**
 - 2nd - [REDACTED] starts installing 3rd floor joists @ Bldg. #1.
 - 8th - [REDACTED] starts installing 3rd floor sheathing @ Bldg. #1.
 - 28th - [REDACTED] starts installing 4th floor joists @ Bldg. #1.
 - **October 2005**
 - 3rd - [REDACTED] starts installing 4th floor sheathing @ Bldg. #1.
 - 11th - Bldg. Dept. approves nailing of 4th floor sheathing @ Bldg. #1.
 - 26th - First mention of rainfall at project site.
 - **November 2005**
 - 18th - [REDACTED] starts installing lath paper on Kettredge St. elevation of Bldg. #1.
 - **December 2005**
 - 8th - [REDACTED] starts podium waterproofing work @ Bldg. #1.
 - **January 2006**
 - 11th - Bldg. Dept. approves lath on Kettredge St. elevation @ Bldg. #1.
 - 13th - [REDACTED] starts scratch coat on Kettredge St. elev. of Bldg. #1.
 - 16th - [REDACTED] starts brown coat on Kettredge St. elev. of Bldg. #1.
 - 18th - [REDACTED] starts sheet metal work on 3rd Floor @ Bldg. #1. (no reference specific to balcony deck flashing)
 - 24th - [REDACTED] starts delivery of exterior doors to Bldg. #1.
 - 26th - [REDACTED] starts installation of exterior doors @ Bldg. #1.
 - 26th - [REDACTED] starts sheet metal work on 4th Floor @ Bldg. #1. (no reference specific to balcony deck flashing)
 - **February 2006**
 - [REDACTED]
 - **March 2006**
 - 1st - [REDACTED] starts gypcrete installation @ Bldg. #1.
 - 6th - [REDACTED] starts work on 4th floor @ Bldg. #1. (appears to be related to interior painting)
 - 9th - [REDACTED] begins finish coat @ Bldg. #1.
 - 16th - [REDACTED] starts scratch coat of two balconies on Kettredge St. elev. @ Bldg. #1.
 - 24th - Mold noted found at unit 1202 @ Bldg. #1.
 - **April 2006**
 - 19th - Issues: continued removal of mold on 2nd floor units & start of dehumidifying (10) units.
 - 26th - [REDACTED] begins balcony railing (guardrail) installation @ bldg. #1.
 - 26th - [REDACTED] begins exterior primer & paint finish on Kettredge St. elev. @ Bldg. #1.
 - **May 2006**
 - 5th - Issues: completed mold removal (10) second floor units @ Bldg. #1.
 - 5th - [REDACTED] completes finish coat on Kettredge St. elev. @ Bldg. #1.
 - 9th - [REDACTED] patches finish coat at balconies on Bldg. #1.
 - 12th - Issues: last mention of humidifying (10) units @ Bldg. #1.
 - 22nd - Issues: (2) men reset fans & filters per Benchmark recommendations on second floor @ bldg. #1.
 - 23rd - Last mention of rainfall at project site.
 - **June 2006**
 - 7th - Issues: need to retest units 1201 & 1210 @ Bldg. #1.
 - 13th - Issues: Unit 1210 mold testing.

3. Balcony Deck Sacrificial Membrane – continued

- Construction Administration
 - Construction Daily Logs:
 - July 2006
 - August 2006
 - 1st – [REDACTED] starts waterproofing balconies @ Bldg. #1 with IRC (WP consultants) observing waterproofing operations.
 - 2nd – [REDACTED] continues waterproofing balconies @ Bldg. #1 with IRC (WP consultants) observing waterproofing operations.
 - 3rd – [REDACTED] flood tests balconies @ Bldg. #1 with IRC (WP consultants) observing waterproofing operations.
 - 4th – [REDACTED] flood tests balconies @ Bldg. #1 with IRC (WP consultants) observing waterproofing operations.
 - 7th – [REDACTED] flood tests balconies @ Bldg. #1 with IRC (WP consultants) observing waterproofing operations.
- As-Built:
 - Unit 305 & 405 Balcony Decks
 - No sacrificial membrane was observed during destructive testing.
- Laboratory Testing:
 - [REDACTED]'s Laboratory Analysis dated 30 November 2015
 - Microscopic examination confirms that no continuous sacrificial membrane had been installed over the balcony deck OSB sheathing as required by detail 12/AD33. The observed "polyurethane" membrane that was identified in only a portion of test sample 305C between the OSB and the "Bituthene 3000" sheet membrane appears to be the "Bituthene 3000 LM" which had been used at lap joints and the perimeter edges of the "Bituthene 3000" membrane installation.
 - ASTM D903-98 Peel Strength of Adhesive Bond Test confirmed the following:

Test Sample	(#) of Strip Tests	Results Range	Bond
305C	(4) strips, (2) OSB delam.	.5 – 2.2 lbf/in	Poor

*according to WR Grace's Guide Specifications for "Bituthene 3000", a typical value based on the ASTM D903 should be in the range of 9 lbs/in. (lbf/in is the same as lbs/in)
- Code Issues:
 - None
- Responsible Trades:
 - General Contractor [REDACTED]
 - Waterproofing Subcontractor [REDACTED]
- Comments:
 - NA
- Questions:
 - Who was to install sacrificial membrane?
 - Why was it not installed?

4. Balcony Deck Waterproof Membrane

- Design
 - Drawings:
 - NA
 - Details:
 - Detail 12/AD.33 Flashing @ French Door Balcony Deck
 - "Bituthene 3000 membrane over primer WP-3000"
 - "Lap per manuf. Requirements (2" min) Apply membrane from low point to the high point so that laps shed water. Stagger all end laps"
 - "5" of Liquid Membrane" noted lapping over door threshold pan metal.
 - "Bituthene Liquid fillet" noted at vertical offset at door threshold.
 - "Pan flashing per detail 3/AD50 & 10/AD81. Set to Bituthene w/ sealant approved by waterproofing manuf."
 - "Bituthene 3000 membrane w/ 4" vertical leg – fold Bituthene horizontal @ door sill & run under pan flashing."
 - Detail 2/AD81 Guardrail @ Private Deck
 - "Grace "Ice & Water Shield" under base plate (guardrail stanchion) and flashing (perimeter bal-form/ T-bar)"
 - Specifications:
 - Spec Section 07186 Waterproofing over Plywood Decks
 - "2.1 Products shall be Enduro-Kote or Pli-dek, 1-hour deck coating in Adobe color."
 - "2.2 Related Materials:
 - 1. Plywood Minimum 3/4" exterior grade AC or better, blocked and supported at all edges, fastened with screws, ring-shank or equivalent non-backing nails."
 - "3.1 Preparation: B. All plywood to be coated shall carry a grade trademark of APA Exterior A-C or better
 - 1. Plywood substrate shall be a minimum of 3/4-inch thick, laid over joists on 16" centers and secured with screws, ring-shank nails or equivalent non-backing nails.
 - 2. Plywood shall be clean and dry, free from voids of loose particles.
 - 3. Plywood shall be protected from moisture to prevent weathering and delamination of the substrate. A protective construction coat may be applied to the plywood substrate at a rate of 75 square ft. per gallon.
 - 4. Plywood substrate shall be designed and constructed to freely drain and eliminate the ponding of water. Slope 1/4" per foot.
 - Oriented Strand Board (OSB) is not an acceptable substrate."
 - "3.2 Installation:
 - A. Comply with manufacturer's written instructions and recommendations for methods and rates of waterproofing application, texture and seal coats.
 - D. Waterproof Membrane: Apply in strict accordance with manufacturer's written instructions. Allow to cure."
 - WR Grace "Bituthene 3000" is not a referenced product.

4. Balcony Deck Waterproof Membrane - continued

- Design
 - Manufacturer's Recommendations:
 - Enduro-Kote's Application Guideline
 - 1.3 Condition of Plywood Substrate and Surfaces:
 - 1.33 Plywood shall be a minimum (19/32) 5/8-inch nominal thick exterior grade. (Wood substrate must comply with ICC-ES Acceptance Criteria for walking decks AC39, Section 1.2 for exterior grade plywood)
 - 1.34 Verify that the deck will drain properly per The Code. Sloping for drainage shall be a minimum of 1/4"-inch per lineal foot.
 - 1.35 Verify that the plywood substrate is solid, without damage to the surface, or any soft spots, and that the fastening is installed in accordance with applicable codes, and ICC-ES #2245.
 - 1.36 Surface of the plywood must be dry and clean. Foreign material, that may prevent the bonding of ENDURO-KOTE, must be removed."
 - According to Chris Proulx, Enduro Products: "We are not aware of any problems with Enduro-Kote installed over OSB, however our recommendation is to install over plywood."
 - Pli-Dek System's Application Instructions for Plywood Substrates:
 - 1A. Substrate Inspection/ Preparation:
 - 1. Pli-Dek materials must be applied over sound dry exterior grade plywood decks. "Contact Pli-Dek Systems, Inc. for installation approvals over OSB substrates."
 - 1B. Plywood:
 - 1. Plywood shall be a minimum of 16mm, 5/8" (3/4" recommended) exterior grade, and have a maximum span between supports of 410mm (16") on center. All plywood shall be securely fastened to the supports with screws or ring shank nails spaced in accordance with APA guidelines and the Building Code.
 - 3. The plywood surface shall be clean, dry, and free of dirt, dust, oil, paint, or any other contaminants that may impair adhesion.
 - 6. Plywood should be installed with a 6.4mm/3m (1/4") per linear foot slope. Decks with parapet enclosures must be sloped to a drain or scupper."
 - Pli-Dek System, Inc.'s Technical Bulletin regarding OSB Substrates – 9 April 2015:
 - Intended Use. Pli-Dek recognizes that OSB is used as exposure 1 sheathing in exterior decking applications. Pli-Dek has a "Limited Material Warranty" application of Pli-Dek lath system over a minimum substrate thickness of 19/32" OSB. Ensure OSB has not been exposed to inclement weather for extended time periods resulting in delamination prior to installation of the OSB."

4. Balcony Deck Waterproof Membrane - continued

- Design
 - Manufacturer's Recommendations:
 - WR Grace Technical Letter #8 Waterproofing Plywood Substrates
 - "Use plywood panels which meet the American Plywood Association (APA) Exposure 1 or Exterior exposure durability classification. According to the APA, Exterior 1 panels "are designed for applications where long construction delays may be expected prior to providing protection, or where high moisture conditions may be encountered in service." Exterior panels "are designed for applications subject to permanent exposure to the weather or to moisture."
 - Use plywood panels with B-grade or better veneer to minimize surface preparation."
 - Plywood substrates should be clean, dry, frost-free. Free of projections and smooth, with flush panel joints. When using Bituthene waterproofing system, patch knots and superficial damage with Bituthene Liquid Membrane."
 - WR Grace's Specification Recommendations 071325 Self-Adhering Sheet Waterproofing:
 - "3.02 Preparation of Substrates:
 - D. Wood Substrates: Apply waterproofing membrane over securely fastened sound surface. All joints and fasteners shall be flush to suitable flush surface."
 - E. Related Materials: Treat joints and install flashing as recommended by waterproofing manufacturer
 - "3.03 Installation:
 - A. Refer to manufacturer's literature for recommendations on installation, including but not limited to the following:
 - 1. Apply primer at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of primer.
 - 4 Apply protection board and related materials in accordance with manufacturer's recommendations."
 - WR Grace's Surface Treatment Recommendations
 - Bituthene Primer WP-3000
 - Bituthene Primer WP-3000 is used to prime all structural concrete, masonry or wood surfaces on which Bituthene membranes will be applied.

4. Balcony Deck Waterproof Membrane - continued

- Construction Administration
 - Submittal:
 - [REDACTED] (waterproofing)
 - No submittal has been provided at this time regarding the "Bituthene 3000" waterproof membrane called out in detail 12/AD33 and later to be accepted in spec section 07186 Waterproof Coating over Plywood Decks.
 - Request for Information (RFI):
 - RFI 99 Response dated 25 May 2005
 - Suggests confusion by the subcontractors as to whether the balcony decks get the concrete overlay or the direct adhered traffic bearing Enduro Kote waterproof membrane. The Architect's response is not clear but does reference details 2 & 12/ AD33.
 - RFI 306 Response dated 9 January 2006
 - Suggests that waterproofing subcontractor has yet to install "Bituthene 3000" on Balcony Decks and is still unclear whether a concrete topping slab over "Bituthene 3000" sheet membrane is to be applied to the Balcony Decks. Architect's Response is not clear but does reference detail 12/ AD33.
 - Change Order:
 - NA
 - Meeting Minutes/ E-Mail:
 - E-Mail dated 25 June 2004 from the Architect [REDACTED]
 - Suggests revising the waterproof membrane in spec section 07186 Waterproof Coating over Plywood Decks to include the use of WR Grace's "Bituthene 3000" in a hand written note.
 - Construction Daily Logs:
 - Rainfall records during & after the balcony decks were framed and prior to being covered between September 2005 & March 2006.

• September 2005	0.00"
• October 2005	0.45"
• November 2005	2.32"
• December 2005	13.49"
• January 2006	4.03"
• February 2006	3.23"
• March 2006	9.42"
• April 2006	5.32"
• May 2006	0.52"
• June 2006	0.00"
• July 2006	0.00"
• August 2006	0.00"
Total	38.78"

4. Balcony Deck Waterproof Membrane - continued

- Construction Administration
 - Construction Daily Logs:
 - **September 2005**
 - 2nd - [REDACTED] starts installing 3rd floor joists @ Bldg. #1.
 - 8th - [REDACTED] starts installing 3rd floor sheathing @ Bldg. #1.
 - 28th - [REDACTED] starts installing 4th floor joists @ Bldg. #1.
 - **October 2005**
 - 3rd - [REDACTED] starts installing 4th floor sheathing @ Bldg. #1.
 - 11th - Bldg. Dept. approves nailing of 4th floor sheathing @ Bldg. #1.
 - 26th - First mention of rainfall at project site.
 - **November 2005**
 - 18th - [REDACTED] starts installing lath paper on Kettredge St. elevation of Bldg. #1.
 - **December 2005**
 - 8th - [REDACTED] starts podium waterproofing work @ Bldg. #1.
 - **January 2006**
 - 11th - Bldg. Dept. approves lath on Kettredge St. elevation @ Bldg. #1.
 - 13th - [REDACTED] starts scratch coat on Kettredge St. elev. of Bldg. #1.
 - 16th - [REDACTED] starts brown coat on Kettredge St. elev. of Bldg. #1.
 - 18th - [REDACTED] starts sheet metal work on 3rd Floor @ Bldg. #1. (no reference specific to balcony deck flashing)
 - 24th - [REDACTED] starts delivery of exterior doors to Bldg. #1.
 - 26th - [REDACTED] starts installation of exterior doors @ Bldg. #1.
 - 26th - [REDACTED] starts sheet metal work on 4th Floor @ Bldg. #1. (no reference specific to balcony deck flashing)
 - **February 2006**
 - **March 2006**
 - 1st - [REDACTED] starts gypcrete installation @ Bldg. #1.
 - 6th - [REDACTED] starts work on 4th floor @ Bldg. #1. (appears to be related to interior painting)
 - 9th - [REDACTED] begins finish coat @ Bldg. #1.
 - 16th - [REDACTED] starts scratch coat of two balconies on Kettredge St. elev. @ Bldg. #1.
 - 24th - Mold noted found at unit 1202 @ Bldg. #1.
 - **April 2006**
 - 19th - Issues: continued removal of mold on 2nd floor units & start of dehumidifying (10) units.
 - 26th - [REDACTED] begins balcony railing (guardrail) installation @ bldg. #1.
 - 26th - [REDACTED] begins exterior primer & paint finish on Kettredge St. elev. @ Bldg. #1.
 - **May 2006**
 - 5th - Issues: completed mold removal (10) second floor units @ Bldg. #1.
 - 5th - [REDACTED] completes finish coat on Kettredge St. elev. @ Bldg. #1.
 - 9th - [REDACTED] patches finish coat at balconies on Bldg. #1.
 - 12th - Issues: last mention of humidifying (10) units @ Bldg. #1.
 - 22nd - Issues: (2) men reset fans & filters per Benchmark recommendations on second floor @ bldg. #1.
 - 23rd - Last mention of rainfall at project site.
 - **June 2006**
 - 7th - Issues: need to retest units 1201 & 1210 @ Bldg. #1.
 - 13th - Issues: Unit 1210 mold testing.
 - **July 2006**

4. Balcony Deck Waterproof Membrane – continued

- Construction Administration
 - Construction Daily Logs:
 - August 2006
 - 1st – [REDACTED] starts waterproofing balconies @ Bldg. #1 with IRC ([REDACTED]) observing waterproofing operations.
 - 2nd – [REDACTED] continues waterproofing balconies @ Bldg. #1 with IRC ([REDACTED]) observing waterproofing operations.
 - 3rd – [REDACTED] flood tests balconies @ Bldg. #1 with IRC ([REDACTED]) observing waterproofing operations.
 - 4th – [REDACTED] flood tests balconies @ Bldg. #1 with IRC ([REDACTED]) observing waterproofing operations.
 - 7th – [REDACTED] flood tests balconies @ Bldg. #1 with IRC ([REDACTED]) observing waterproofing operations.
- As-Built:
 - Unit 305 & 405 Balcony Decks
 - Appears that WR Grace "Bituthene 3000" & "Bituthene 3000 LM" Liquid Membrane was installed directly over the OSB deck sheathing.
 - "Bituthene 3000 LM" appears to have been used at perimeter flashings, at laps and guardrail stanchions.
 - "Bituthene 3000" was not extended under the pan flashings at the French door threshold or the perimeter aluminum bal-form/ T-bar edge metal, but was installed over the horizontal leg at the deck level with the application of what appeared to be a primer.
- Laboratory Testing:
 - [REDACTED]'s Laboratory Analysis dated 30 November 2015
 - Confirms in Test Sample 305C that no continuous sacrificial membrane had been installed over the balcony deck OSB sheathing as required by detail 12/AD33, however an acrylic polymer primer, similar to "Bituthene Primer WP 3000" had been installed prior to the installation of the "Bituthene 3000" & "Bituthene 3000 LM" membranes.
 - ASTM D903-98 Peel Strength of Adhesive Bond Test confirmed the following:

Test Sample	(#) of Strip Tests	Results Range	Bond
305C	(4) strips, (2) OSB delam.	.5 – 2.2 lbf/in	Poor

*according to WR Grace's Guide Specifications for "Bituthene 3000", a typical value based on the ASTM D903 should be in the range of 9 lbs/in. (lbf/in is the same as lbs/in)

4. Balcony Deck Waterproof Membrane – continued

- Code Issues:
 - None

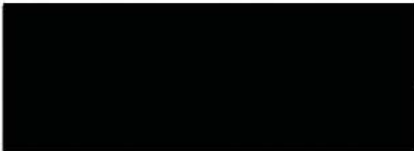
- Responsible Trades:
 - General Contractor
 - Waterproofing Subcontractor

- Comments:
 - The deck to wall & threshold pan flashing, bal-form/T-bar edge metal and guardrail stanchions would have been in place prior to the application of the "Bituthene 3000" & "Bituthene 3000 LM" waterproof membranes and the exterior plaster finish.

- Questions:
 - Where is Submittal?
 - Was OSB substrate approved by WR Grace as an acceptable alternative to plywood?
 - Was a moisture test done to the OSB prior to the waterproof membrane installation?

5. Balcony Deck Protection Board

- Design
 - Drawings:
 - NA
 - Details:
 - Detail 12/AD.33 Flashing @ French Door, Balcony Deck
 - "1/8" asphaltic hardboard for protection BD
 - Specifications:
 - NA
 - Manufacturer's Recommendations:
 - WR Grace's Specification Recommendations 071325 Self-Adhering Sheet Waterproofing:
 - "2.01 Materials:
 - D. Protection Board:
 - 2. Asphalt Hardboard. A pre-molded semi-rigid protection board consisting of bitumen, mineral core and reinforcement. Provide 3mm (0.125") thick hardboard on horizontal surfaces not receiving steel reinforcing slab
- Construction Administration
 - Submittal:
 - [REDACTED] (waterproofing)
 - Submittal 046-07140 Fluid Applied Waterproofing, utilized for the podium between slab waterproofing, includes a recommendation for the use of "Tremco's Protection Mat"
 - No submittal has been provided at this time regarding the 1/8" asphaltic hardboard protection board called out in detail 12/AD33 and later to be accepted in spec section 07186 Waterproof Coating over Plywood Decks.
 - [REDACTED] (deck concrete topping slab)
 - Submittal 063-03540 Hardrock Concrete for balcony deck topping slabs does not include any reference to a protection board per detail 12/AD33.
 - Request for Information (RFI):
 - NA
 - Change Order:
 - NA
 - Meeting Minutes/ E-Mail:
 - NA
 - Construction Daily Logs:
 - Protection systems were noted being installed for the TREMCO horizontal waterproof membranes on the Podium Deck but not for the balconies @ Bldg #1.



5. Balcony Deck Protection Board

- As-Built:
 - Unit 305 & 405 Balcony Decks
 - Found a layer of 1/8" asphaltic protection board over the "Bituthene 3000" waterproof sheet membrane.

- Laboratory Testing:
 - None

- Code Issues:
 - None

- Responsible Trades:
 - General Contractor
 - Waterproofing Subcontractor
 - Concrete Overlay Subcontractor

- Comments:
 - None

- Questions:
 - None



6. Balcony Deck Perimeter Expansion Board

- Design
 - Drawings:
 - NA
 - Details:
 - Detail 12/AD 33 Flashing @ French Door Balcony Deck
 - 3/8" thick asphalt expansion joint
 - Specifications:
 - NA
 - Manufacturer's Recommendations:
 - NA
- Construction Administration
 - Submittal:
 - [REDACTED] (deck concrete topping slab)
 - Submittal 063-03540 Hardrock Concrete for balcony deck topping slabs does not include any reference to a perimeter expansion board per detail 12/AD33.
 - Request for Information (RFI):
 - NA
 - Change Order:
 - NA
 - Meeting Minutes/ E-Mail:
 - NA
 - Construction Daily Logs:
 - NA
- As-Built:
 - Unit 305 & 405 Balcony Decks
 - None found
- Laboratory Testing:
 - None
- Code Issues:
 - None
- Responsible Trades:
 - General Contractor
 - Concrete Topping Subcontractor
- Comments:
 - None
- Questions:
 - None




7. Balcony Deck Concrete Overlay

- Design
 - Drawings:
 - Sheet S1.6 Unit B8 Floor Framing calls for
 - "3/4" T/G Plywood w/ 10d at 6" o/c and 10" o/c w/ topping over S.A.D for slope."
 - Details:
 - Detail 12/AD.33 Flashing @ French Door: Balcony Deck
 - "2" minimum concrete"
 - Detail 2/AD81 Guardrail @ Private Deck
 - "2-1/2" hardrock
 - Detail 6/AD81 Edge Detail: Catwalk/Decks
 - "2" min. of hardrock conc."
 - Detail 10/S5.2 Cant. Exterior Deck
 - "Topping over plywood"
 - Specifications:
 - NA
 - Manufacturer's Recommendations:
 - NA
- Construction Administration
 - Submittal:
 - [REDACTED] (deck concrete topping slab)
 - Submittal 063-03540 Hardrock Concrete for balcony deck topping slabs includes a (6) sack – 2,500 psi concrete mix design for the balcony deck topping slabs.
 - Request for Information (RFI):
 - NA
 - Change Order:
 - NA
 - Meeting Minutes/ E-Mail:
 - NA
 - Construction Daily Logs:
 - [REDACTED] is noted as installing a hardrock concrete topping slab over the exterior balconies @ Bldg. #5 in August of 2006 but no mention of installing the hardrock concrete topping slab over the exterior balconies @ Bldg. #1.
- As-Built:
 - Unit 305 & 405 Balcony Decks
 - Found $\leq 2"$ concrete overlay. Due to build-up of membrane layers, guardrail stanchion plates & perimeter flashings at some areas the concrete thickness was reduced to less than 2".



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7. Balcony Deck Concrete Overlay

- Laboratory Testing:
 - Awaiting lab testing results.  SE coordinating.
- Code Issues:
 - None
- Responsible Trades:
 - General Contractor 
 - Concrete Topping Subcontractor 
- Comments:
 - None
- Questions:
 - None

8. French Door Threshold Pan Flashing

- Design
 - Drawings:
 - NA
 - Details:
 - Detail 12/AD.33 Flashing @ French Door Balcony Deck
 - "Pan flashing per detail 3/AD50 & 10/AD81"
 - "Sheet Metal "L" Flashing"
 - Detail 3/AD50 Flashing Pan @ Patio Door
 - Notes "Z" shaped sheet metal pan with a turned up leg under the threshold, a vertical offset of between 0" & 1-1/2" and "caulk beads" prior to threshold installation.
 - "24 GA. GI. Flashing pan by prior by sheet metal contr. Installed prior to door – install over Vulkem 201 or 450. typ. See 10/AD81 for additional info."
 - Detail 10/AD81 Threshold Flashing
 - Notes a "Z" shaped sheet metal pan with a turned up leg and a 3" width under the threshold, a 1-1/2" vertical offset and a 6" horizontal leg at the balcony deck sheathing, including the following notes.
 - "Max. 1/4" rise" noted for the turned up leg under the threshold
 - "6"x6" metal flashing w/ 4" min. @ door frame" for the adjacent deck to wall sheet metal.
 - "Solder joints" for the pan metal at the door opening wrap
 - "Overlap metal 6" min. in bed of sealant"
 - Specifications:
 - Spec Section 07186 Waterproofing over Plywood Decks
 - "2.2 Related Materials.
 - 2. Metal Flashing: Bonderized (etched and galvanized), minimum 26 gauge"
 - 3. Sealant: Urethane based, as approved by manufacturer for control and expansion joints.
 - "3.1 Preparation, B: Metal Flashing
 - 1. Metal shall have a bonderized finish (etched and galvanized) and be a minimum of 26 gauge.
 - 2. Metal flashing must be installed in accordance with acceptable waterproofing techniques as indicated on the manufacturer's detail drawings
 - 3. Metal flashing shall be fastened 3" on center with galvanized metal non-backing nails or anchors. Flashing must be nailed down flat with no buckles.
 - 4. All metal flashing must have 3" overlap at the connecting seams. Corners must be tight and the entire perimeter must be flashed. Overlaps shall be treated with a 4" strip of fiberglass saturated with deck seal tape.
 - 5. All joints and seams must be caulked with a urethane sealant. Remove all excess sealant from the plywood and flashing
 - 6. Metal must be clean and dry, free from grease, oils, dirt and debris prior to application"
 - Spec Section 07620 Sheet Metal Flashing & Trim
 - Primarily addresses sheet metal roof flashings.

8. French Door Threshold Pan Flashing - continued

- Design
 - Manufacturer's Recommendations:
 - WR Grace's Specification Recommendations 071325 Self-Adhering Sheet Waterproofing:
 - "3.02 Preparation of Substrates
 - E. Related Materials: Treat joints and install flashing as recommended by waterproofing manufacturer."
 - "3.03 Installation:
 - A. Refer to manufacturer's literature for recommendations on installation, including but not limited to the following
 - 1. Apply primer at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of primer."
 - WR Grace's Surface Treatment Recommendations:
 - Bituthene Primer WP-3000
 - Bituthene Primer WP-3000 is used to prime all structural concrete, masonry or wood surfaces on which Bituthene membranes will be applied.
- Submittal:
 - [REDACTED] (sheet metal)
 - Submittal 041-07600 Sheet Metal Flashing includes reference to the following balcony related flashing details:
 - One Piece Threshold Pan Flashing per detail 14/AD30
 - One Piece Threshold Pan Flashing per detail 12/AD33
 - One Piece Threshold Pan Flashing per detail 3/AD50
 - One Piece Threshold Pan Flashing per detail 10/AD81
 - Deck Edge to Wall Transition Flashing per detail 2/AD50
- Request for Information (RFI):
 - NA
- Change Order:
 - NA
- Meeting Minutes/ E-Mail:
 - Punch List dated 21 August 2006
 - Lists the need for thresholds to be installed by SAC-A1 (finish carpenter) on building #1. It is not clear if the pertains to the exterior balcony French door thresholds or not.
- Construction Daily Logs:
 - January 2006
 - 18th - [REDACTED] starts sheet metal work on 3rd Floor @ Bldg. #1. (no reference specific to balcony deck flashing)
 - 24th - [REDACTED] starts delivery of exterior doors to Bldg. #1.
 - 26th - [REDACTED] starts installation of exterior doors @ Bldg. #1.
 - 26th - [REDACTED] starts sheet metal work on 4th Floor @ Bldg. #1. (no reference specific to balcony deck flashing)

8. French Door Threshold Pan Flashing - continued

- As-Built:
 - Unit 305 & 405 Balcony Decks
 - Found a two piece pan flashing in lieu of the single "Z" shaped configuration which had been installed prior to the "Bituthene 3000" & "Bituthene 3000 LM" membranes.
 - Deck flashing has vertical leg of 2" and horizontal leg of 6"
 - Threshold sheet metal pan flashing is 3-1/2" wide with 1/2" slight upturn edge and silicone sealant under the threshold and a 2" vertical counter flashing over the deck metal with "Bituthene 3000 LM" in between.
 - Laps at adjacent deck to wall flashings were sealed with a bed of urethane type sealant.
 - Neither flashing piece was installed over a waterproof membrane.
 - "Bituthene 3000" & "Bituthene 3000 LM" were lapped over the two piece pan flashing with what appeared to be a primer coat.

- Laboratory Testing:

- [Redacted] s Laboratory Analysis dated 30 November 2015
 - Confirms in Test Samples 305A & 405A that an acrylic polymer similar to "Bituthene Primer WP 3000" had been installed over the galvanized sheet metal pan flashing prior to the installation of the "Bituthene 3000" & "Bituthene 3000 LM" membranes.

- ASTM D903-98 Peel Strength of Adhesive Bond Test confirmed the following:

Test Sample	(#) of Strip Tests	Results Range	Bond
305A	(5) strips	8.1 – 15.4 lbf/in	Good
405A	(3) strips	9.3 – 12.6 lbf/in	Good

*according to WR Grace's Guide Specifications for "Bituthene 3000", a typical value based on the ASTM D903 should be in the range of 9 lbs/in. (lbf/in is the same as lbs/in)

- Code Issues:

- None

- Responsible Trades:

- General Contractor
- Waterproofing Subcontractor
- Sheet Metal Subcontractor

- Comments:

- The French door sheet metal pan flashing & deck to wall flashing should have been in place prior to the French Door & Threshold Installation.

- Questions:

- Who authorized, accepted and requested change in pan flashing configuration?
- When was the threshold pan flashing installed?
- Why was the pan flashing not sandwiched between layers of the waterproof membrane?

9. Balcony Deck to Wall Flashing

- Design
 - Drawings:
 - NA
 - Details:
 - Detail 2/AD50 Edge to Wall Transition
 - Notes a prefabricated deck to wall transition to an outside deck edge at a Built Up roof, similar to the balcony deck to wall transition to an outside deck edge.
 - Difference would be that the cant configuration would not be necessary on the balcony deck.
 - No dimensions are noted.
 - Detail 10/AD81 Threshold Flashing
 - "6"x6" metal flashing (deck to wall) w/ 4" min. @ door frame (pan metal)
 - "Solder joints" for the pan metal at the door opening wrap.
 - "Overlap metal 6" min. in bed of sealant"
 - Specifications:
 - Spec Section 07186 Waterproofing over Plywood Decks
 - "2.2 Related Materials:
 - 2. Metal Flashing: Bonderized (etched and galvanized), minimum 26 gauge"
 - 3. Sealant: Urethane based, as approved by manufacturer for control and expansion joints.
 - "3.1 Preparation, B. Metal Flashing.
 - 1. Metal shall have a bonderized finish (etched and galvanized) and be a minimum of 26 gauge.
 - 2. Metal flashing must be installed in accordance with acceptable waterproofing techniques as indicated on the manufacturer's detail drawings.
 - 3. Metal flashing shall be fastened 3" on center with galvanized metal, non-backing nails or anchors. Flashing must be nailed down flat with no buckles.
 - 4. All metal flashing must have 3" overlap at the connecting seams. Corners must be tight and the entire perimeter must be flashed. Overlaps shall be treated with a 4" strip of fiberglass saturated with deck seal tape.
 - 5. All joints and seams must be caulked with a urethane sealant. Remove all excess sealant from the plywood and flashing.
 - 6. Metal must be clean and dry, free from grease, oils, dirt and debris prior to application."
 - Spec Section 07620 Sheet Metal Flashing & Trim
 - Primarily addresses sheet metal roof flashings

9. Balcony Deck to Wall Flashing - continued

- Design
 - Manufacturer's Recommendations:
 - WR Grace's Specification Recommendations 071325 Self-Adhering Sheet Waterproofing:
 - "3.02 Preparation of Substrates:
 - E. Related Materials: Treat joints and install flashing as recommended by waterproofing manufacturer."
 - "3.03 Installation:
 - A. Refer to manufacturer's literature for recommendations on installation, including but not limited to the following
 - 1. Apply primer at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of primer."
 - WR Grace's Surface Treatment Recommendations:
 - Bituthene Primer WP-3000
 - Bituthene Primer WP-3000 is used to prime all structural concrete, masonry or wood surfaces on which Bituthene membranes will be applied.
- Construction Administration
 - Submittal:
 - [REDACTED] (sheet metal)
 - Submittal 041-07600 Sheet Metal Flashing includes reference to the following balcony related flashing details:
 - Deck to Wall Flashing per detail 10/AD81
 - Deck Edge to Wall Transition Flashing per detail 2/AD50
 - [REDACTED] (lath & plaster)
 - Submittal 049-09220 Exterior Plaster includes product information for Fortifiber "Fastflash 25" self-sealing membrane.
 - Request for Information (RFI):
 - NA
 - Change Order:
 - NA
 - Meeting Minutes/ E-Mail:
 - E-Mail dated 23 June 2004
 - The Architect [REDACTED] suggests that the Lath & Plasterer was expected to install the Fortifiber "Moistop" flashing at the time of the lath installation. Fortifiber "Fastflash 40" was installed in lieu of "Moistop" where observed in and around the balcony decks which is a superior product.

9. Balcony Deck to Wall Flashing – continued

- Construction Administration
 - Construction Daily Logs:
 - **November 2005**
 - 18th - ██████ starts installing lath paper on Kettredge St. elevation of Bldg. #1.
 - **January 2006**
 - 11th - Bldg. Dept. approves lath on Kettredge St. elevation @ Bldg. #1.
 - 13th - ██████ starts scratch coat on Kettredge St. elev. of Bldg. #1.
 - 16th - ██████ starts brown coat on Kettredge St. elev. of Bldg. #1.
 - 18th - ██████ starts sheet metal work on 3rd Floor @ Bldg. #1. (no reference specific to balcony deck flashing)
 - 24th - ██████ starts delivery of exterior doors to Bldg. #1.
 - 26th - ██████ starts installation of exterior doors @ Bldg. #1.
 - 26th - ██████ starts sheet metal work on 4th Floor @ Bldg. #1. (no reference specific to balcony deck flashing)
 - **March 2006**
 - 9th - ██████ begins finish coat @ Bldg. #1.
 - 16th - ██████ starts scratch coat of two balconies on Kettredge St. elev. @ Bldg. #1.
- As-Built:
 - Unit 305:
 - Deck to wall flashing found to be approx. 24 gauge galvanized sheet metal "L" configuration, 3" horizontal & 6" vertical. A urethane sealant was found between overlapping metal.
 - The outside transition metal was found to be prefabricated sheet metal set behind the deck to wall metal extending 4" vertical up the wall, 4" horizontal out onto the deck, 6" along the deck to wall, 6" down the face of the double joist framing and 5" beyond the deck framing termination.
 - The prefabricated sheet metal was lapped over a piece of Fortifiber Fastflash 40 at the building wall plane but no flashing or lath paper extended up under the flashing at the outside face of the double joist balcony framing.
 - Extensive damage & dry rot was found to the building wall plane OSB sheathing and the lower outside face of the double joist balcony framing below the flashing termination.
 - Bituthene 3000 & Bituthene 3000 LM was lapped over the deck to wall flashing with what appeared to be a primer coat.
 - Unit 405:
 - Deck to wall flashing found to be approx. 24 gauge galvanized sheet metal "L" configuration, 3" horizontal & 6" vertical which had been cut at 45 degrees along the outside corner of the recessed door. A urethane sealant was found between overlapping metal.
 - The outside transition metal was found to be prefabricated sheet metal set behind the deck to wall metal extending 4" vertical up the wall, 4" horizontal out onto the deck, 6" along the deck to wall, 5" down the face of the double joist framing and 4" beyond the deck framing termination.
 - The prefabricated sheet metal was not lapped over any flashing or lath paper at the building wall plane at the double joist balcony framing.
 - Extensive damage & dry rot was found to the building wall plane OSB sheathing and the lower outside face of the double joist balcony framing.
 - Bituthene 3000 & Bituthene 3000 LM was lapped over the deck to wall flashing with what appeared to be a primer coat.

9. Balcony Deck to Wall Flashing - continued

• Laboratory Testing:

○ [Redacted] 's Laboratory Analysis dated 30 November 2015

- Confirms in Test Samples 305A & 405A that an acrylic polymer similar to "Bituthene Primer WP 3000" had been installed over the galvanized sheet metal pan flashing prior to the installation of the "Bituthene 3000" & "Bituthene 3000 LM" membranes.

- ASTM D903-98 Peel Strength of Adhesive Bond Test confirmed the following:

Test Sample	(#) of Strip Tests	Results Range	Bond
305A	(5) strips	8.1 – 15.4 lbf/in	Good
405A	(3) strips	9.3 – 12.6 lbf/in	Good

*according to WR Grace's Guide Specifications for "Bituthene 3000", a typical value based on the ASTM D903 should be in the range of 9 lbs/in. (lbf/in is the same as lbs/in)

• Code Issues:

- None

• Responsible Trades:

- General Contractor
- Waterproofing Subcontractor
- Sheet Metal Subcontractor
- Lath & Plaster Subcontractor



• Comments:

- The French door pan flashing & deck to wall flashing should have been in place prior to the French Door & Threshold Installation.

• Questions:

- When was the deck to wall flashing installed?
- Why was the deck to wall flashing not lapped over a membrane or (2) layers of lath paper below the outside balcony edge?
- When was the Fortifiber "Fastflash 40" wall flashing and lath paper installed?

10. Balcony Deck Perimeter Bal-form Edge Metal

- Design
 - Drawings:
 - NA
 - Details:
 - Detail 2/AD81 Guardrail @ Private Deck
 - A (1x) block is shown to support the outside edge of the bal-form/T-bar edge metal
 - "Metal flashing – see detail 6/AD81"
 - "Grace "Ice & Water Shield" under base plate and flashing"
 - Detail 6/AD81 Edge Detail. Catwalk/Decks
 - Bal-form/T-bar metal dimensioned as follows:
 - 2" vertical dimension above the membrane level
 - 3" vertical dimension below the membrane level overlapping the exterior plaster finish.
 - 5" overall vertical dimension.
 - 2-1/2" horizontal leg dimension.
 - Deck sheathing is shown extending out to fully support the bal-form/T-bar edge metal.
 - "Bituthene 3000 over T-bar"
 - "T-bar edge trim fastened per manufacturer's specs"
 - "Provide 1/2" x 1/4" weep slots @ 8" o/c"
 - "Drip edge"
 - "Provide 1/4" liquid Bituthene fillet"
 - "Exterior cement plaster over building paper"
 - Detail 18/AD81 Stanchion Connection
 - Deck sheathing is shown extending out to fully support the bal-form/T-bar edge metal.
 - "Deck edge T-bar, see detail 6/AD81"
- Specifications:
 - NA
- Manufacturer's Recommendations:
 - WR Grace's Specification Recommendations 071325 Self-Adhering Sheet Waterproofing:
 - "3.02 Preparation of Substrates:
 - E. Related Materials Treat joints and install flashing as recommended by waterproofing manufacturer."
 - "3.03 Installation:
 - A. Refer to manufacturer's literature for recommendations on installation, including but not limited to the following
 - 1. Apply primer at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of primer."

10. Balcony Deck Perimeter Bal-form Edge Metal - continued

- Design
 - Manufacturer's Recommendations:
 - WR Grace's Surface Treatment Recommendations:
 - Bituthene Primer WP-3000
 - "Bituthene Primer WP-3000" is used to prime all structural concrete, masonry or wood surfaces on which Bituthene membranes will be applied.
- Construction Administration
 - Submittal:
 - [REDACTED] (sheet metal)
 - Submittal 041-07600 Sheet Metal Flashing does not reference the balcony deck perimeter bal-form edge metal.
 - [REDACTED] (lath & plaster)
 - Submittal 049-09220 Exterior Plaster includes product information for Fortifiber "Fastflash 25" self-sealing membrane.
 - Request for Information (RFI):
 - NA
 - Change Order:
 - NA
 - Meeting Minutes/ E-Mail:
 - NA
 - Construction Daily Logs:
 - November 2005
 - 18th - [REDACTED] starts installing lath paper on Kettredge St. elevation of Bldg. #1.
 - January 2006
 - 11th - Bldg. Dept. approves lath on Kettredge St. elevation @ Bldg. #1.
 - 13th - [REDACTED] starts scratch coat on Kettredge St. elev. of Bldg. #1.
 - 16th - [REDACTED] starts brown coat on Kettredge St. elev. of Bldg. #1.
 - 18th - [REDACTED] starts sheet metal work on 3rd Floor @ Bldg. #1. (no reference specific to balcony deck flashing)
 - 26th - [REDACTED] starts sheet metal work on 4th Floor @ Bldg. #1. (no reference specific to balcony deck flashing)
 - March 2006
 - 9th - [REDACTED] begins finish coat @ Bldg. #1.
 - 16th - [REDACTED] starts scratch coat of two balconies on Kettredge St. elev. @ Bldg. #1.
 - April 2006
 - 26th - [REDACTED] begins balcony railing (guardrail) installation @ bldg. #1.
 - May 2006
 - 9th - [REDACTED] patches finish coat at balconies on Bldg. #1.
 - August 2006
 - 1st - [REDACTED] starts waterproofing balconies @ Bldg. #1 with IRC (WP consultants) observing waterproofing operations.
 - 2nd - [REDACTED] continues waterproofing balconies @ Bldg. #1 with IRC ([REDACTED]) observing waterproofing operations.

10. Balcony Deck Perimeter Bal-form Edge Metal - continued

- As-Built:

- Unit 305 & 405 Balcony Decks

- Found an extruded aluminum bal-form/ T-bar edge metal of the following dimensions,
 - 2" vertical dimension above the membrane level.
 - 1-3/4" vertical dimension below the membrane level lightly overlapping the exterior plaster finish.
 - 3-3/4" overall vertical dimension.
 - Top edge termination has a 3/4" horizontal and a 1/2" vertical return
 - 3" horizontal leg, with approximately 2" over the deck sheathing and 1" cantilever out over the exterior plaster finish. No blocking, backing or extended deck sheathing was provided.
 - 1/4" round weep holes were found at 16" o/c.
 - Bal-form/T-bar was set directly over the OSB sheathing, not over a waterproof membrane and fastened with self-tapping screws along the center of the horizontal flange.
 - Exterior plaster & (2) layers of lath paper were only extended slightly higher than the bottom edge of the bal-form/T-bar edge metal drip edge.
 - The outer face of the double joist balcony deck framing was found still damp & most of the lath paper deteriorated upon removal of the exterior plaster finish at Unit 305's balcony deck remnant.
 - Mitered outside corners and end abutting deck to wall metal was found sealed with a urethane type sealant.
 - "Bituthene 3000" & "Bituthene 3000 LM" lapped over horizontal flange with what appears to be a primer coat. "Bituthene 3000 LM" was specifically removed from blocking the weep holes.
 - Concrete topping slab did completely fill a number of weep holes.

- Laboratory Testing:

- s Laboratory Analysis dated 30 November 2015

- Confirms in Test Samples 305B & 405B that an acrylic polymer similar to "Bituthene Primer WP 3000" had been installed over the extruded aluminum bal-form edge metal prior to the installation of the "Bituthene 3000" & "Bituthene 3000 LM" membranes.
 - ASTM D903-98 Peel Strength of Adhesive Bond Test confirmed the following:

Test Sample	(#) of Strip Tests	Results Range	Bond
305B	(5) strips	7.8 – 12.8 lbf/in	Good
405B	no results due to debonding prior to testing		

*according to WR Grace's Guide Specifications for "Bituthene 3000", a typical value based on the ASTM D903 should be in the range of 9 lbs/in. (lbf/in is the same as lbs/in)



Planning & Development Department
Building & Safety Division

MEMORANDUM

TO: [REDACTED] Director, Planning and Development Department
FROM: [REDACTED] Manager of Building and Safety Division *AD*
DATE: June 23, 2015
SUBJECT: Staff Recommendation Related to Library Gardens Balcony Collapse at
2020 Kittredge Street

Mr. [REDACTED]

The Building and Safety Division offers our deepest condolences to the families and friends of the young adults who lost their lives in the tragic event at 2020 Kittredge Street. We extend our prayers and wishes of quick recovery to those that were injured.

Building and Safety Division staff are committed to identifying all the factors involved in this tragedy, and to offering specific recommendations for steps which can help prevent such an event from happening again. The scope of this analysis is limited to the direct observations of the Building and Safety Division staff in the immediate aftermath of the balcony collapse. Forensic examination and laboratory tests are outside the scope of the review.

The purpose of this analysis is to identify potential contributing factors to this tragedy, so that the City of Berkeley can take proactive measures to prevent future such events through changes to its local codes. This memo: 1) summarizes staff's actions in response to the balcony collapse; 2) describes staff's on-site observations; 3) confirms the original review of the relevant construction documents approved by the City; and 4) makes recommendations to the City Council to adopt new and modified regulations as local amendments to its codes to enhance the safety of existing housing and future construction in Berkeley.

1. Summary of Incident and Initial Analysis

At approximately 12:30 am on June 16, 2015, there was a structural collapse of a cantilevered balcony at 2020 Kittredge Street, Unit 405. This 5-story building contains

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██████████ Director

June 23, 2015

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176 residential units and received its Certificate of Occupancy from the City of Berkeley on January 12, 2007. Attachment 1 includes summary information about the building permit process and categorization of the structure.

In response to a Berkeley Police Department (PD) request for assistance, ██████████ Building Official, and ██████████ Senior Building Inspector, arrived at the site of the balcony collapse at approximately 2:30 am. Upon arrival, Building & Safety Staff (also referred to in this document as Inspectors) were directed to Sergeant ██████████ of the Berkeley PD. Sergeant ██████████ informed the inspectors that several people had died as the result of the balcony collapse and others were taken to the hospital. Sergeant ██████████ requested that the inspectors perform an immediate damage assessment.

The inspectors performed a visual exterior examination of the building envelope from the street in the immediate vicinity of the collapsed balcony, and were then escorted by a representative of Berkeley PD to Unit 405 to inspect the immediate area of collapse. The Berkeley PD was on scene in Unit 405 and had not released the unit to the tenant. The inspectors observed from the exterior French doors of Unit 405 that the cantilevered balcony joists had completely sheared off approximately 16 – 20 inches from the exterior building face. A torn bituthene membrane hung over the joist ends.

The inspectors observed that the deck joist ends protruding from the exterior wall appeared to be severely dry rotted.

The inspectors were then escorted by a representative of Berkeley PD to Unit 305 located directly below Unit 405 to further observe the damage and to examine the condition of the collapsed balcony. The inspectors observed that the collapsed balcony hinged 90 degrees downward and rested against the building supported by the lower Unit 305 balcony guardrail. Some of the bituthene membrane was still connected to the remaining structure above. The guardrail from the collapsed balcony was detached. It had flipped 180 degrees, landing on the lower Unit 305 balcony guardrail. The stucco soffit underside of Unit 405's balcony was intact, hanging over the exterior French doors of Unit 305. This prevented the inspectors from opening the doors, but they were able to view the protruding floor joist ends above through a narrow space between the hanging stucco plane and the top of the French doors. They were also able to get a closer look at the apparently dry rotted debris scattered on Unit 305's balcony. The inspectors placed caution tape across the balcony doorway and affixed a red placard prohibiting any access to the balcony of Unit 305.

The inspectors then proceeded downstairs to meet with the property management company ██████████'s representatives. The inspectors' immediate concern was that other weather-exposed balconies in the building could also be structurally compromised, and they inquired as to the location of any other cantilevered balconies in the building. ██████████'s property manager, ██████████, informed the inspectors that two more balconies existed in Units 202 and 144 (subsequently corrected to 244). The inspectors

were then escorted to Units 202 and 244, where they requested and were permitted entry by the tenants. The inspectors examined the balconies from the exterior doorways. No signs of distress were observed. However, since the condition of the balcony framing could not be verified at that time, the inspectors placed caution tape across the balcony doorways and affixed red placards prohibiting any access to the balconies until a follow-up structural evaluation could be performed. The inspectors then returned to the property management office and issued a Notice of Violation requiring the building owner to:

1. Immediately remove the debris of Unit 405's balcony from Unit 305's balcony.
2. Install a barricade at the balcony doorway of Unit 405.
3. Provide a structural evaluation of Unit 305's balcony within 48 hours.
4. Provide a structural evaluation of the balconies in Units 202 and 144 (subsequently corrected to 244) within 48 hours.

The inspectors left the scene at 6:30 am and by 8:00 am debriefed the City Manager's Office of the results of their initial review.

A. Field Analysis June 16th

On June 16, 2015, ██████████ Building Official, and ██████████ Supervising Building Inspector, were present on the site throughout the day continuing with their damage assessment and assessing whether additional safety precautions were needed.

City staff stayed in direct contact with: (A) Greystar (the property manager), (B) ██████████ (the owner), (C) ██████████ Property Restoration, who was contracted by the owner to perform balcony removal, (D) ██████████, S.E. (Structural Engineer) w/ ██████████, who was contracted by the owner to perform a structural assessment, and (E) ██████████, PhD, S.E. w/ ██████████ Engineers Architects Material Scientists.

Building and Safety staff issued a revised Notice of Violation informing the property owner that all the debris from the collapsed balcony were to be removed and to be made available to City staff to transport to the storage facility at the City Corporation Yard. Prior to the removal of the balcony, the Supervising Building Inspector and a Berkeley Police photographer were hoisted in a platform lift to closely observe and photograph the conditions at the collapsed Unit 405 balcony.

From this location, the Supervising Building Inspector observed that the joist ends protruding from the exterior wall appeared to be extensively rotted at the failure points.

Towards the end of the day, the Unit 405 balcony was removed by ██████████ under the direct observation of Building and Safety staff, in a two-piece lift and loaded onto a City Public Works truck with a flat bed trailer. Public Works crews collected the remaining

██████████ Director

June 23, 2015

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debris from the public right-of-way. The Unit 405 balcony and the collected debris were then transported to the City Corporation Yard for secure storage.

Immediately following the removal of the Unit 405 balcony, the Unit 305 balcony was temporarily hoisted by crane to provide an additional vertical support. A Belfor crew cut exploratory openings on the underside of the balcony. Upon further review it was determined that the framing members supporting Unit 305 balcony appeared to be dry rotted at the exposed locations potentially presenting a danger of structural failure. Upon further consultation with the engineers present on the site, ██████████ S.E. and ██████████ PhD, S.E., the Building and Safety Division issued a second amended Notice of Violation declaring the Unit 305 balcony unsafe and a collapse hazard endangering public safety, and ordering the following corrective measures:

1. Within 24 hours, remove the Unit 305 balcony to the extent necessary to remedy the immediate hazard.
2. Immediately board the door openings from Unit 305 to the exterior balcony and board all exterior openings directly below the Unit 305 balcony.
3. Apply for and obtain the necessary permits to perform all work required to restore the building envelope within the time frame listed in the notice.

B. Field Analysis June 17th

On June 17, ██████████ Building Official, and ██████████ Supervising Building Inspector, were present on the site throughout the day. Around 9:00 am, the ██████████ crew started disassembling and dissecting the Unit 305 balcony. The Supervising Building Inspector requested and was provided access via a man lift for an up close visual observation of the partially deconstructed Unit 305 balcony. The Supervising Building Inspector observed an approximately one foot wide open segment exposing the assembly layers. The Supervising Building Inspector observed what appeared to be two layers of oriented strand board (OSB) decking over the floor joists, a water proof membrane over the decking, and a base sheet material covered by approximately 2 inches of concrete. The Supervising Building Inspector also observed significant rot and decay to the outer support joist that seemed to decrease on the supporting joists towards the center of the balcony. Over the course of the day, numerous investigators inspected, measured and photographed the conditions at the Unit 305 balcony. By 7:30 pm, the Unit 305 balcony was removed and taken by Belfor Construction to their offsite secure storage facility. Upon removal of the two unsafe balconies in Units 405 and 305, the Building Official allowed the removal of the boarding protecting openings directly below the removed Unit 305 balcony.

C. Additional Follow-Up June 18th

On June 18th at 9:53 am, ██████████ Managing Directors ██████████ and ██████████ delivered the Structural Observation Report to the Building & Safety Division assessing the conditions of the two remaining balconies of Units 202 and 244. The report indicated that these balconies did not use the cantilevered framing

systems. Three access holes were cut into the gypsum board ceiling on the underside of each balcony for inspection. According to the structural observation report no signs of distress or water damage were observed at the Units 202 and 244 balconies.

In conclusion, based on the inspections and observations of the City of Berkeley's Building and Safety Division staff, the deck joist ends protruding from the exterior wall at Unit 405 appear to be severely dry rotted. Having completed this analysis, all materials which had been retained by the City are being released back to the property owner.

2. Code Analysis of Balcony Details as Shown on the Approved Plans

The following is the analysis from Building and Safety Division staff of the permitted Architectural and Structural Plans and Calculations related to the balcony construction at 2020 Kittredge (hereafter, collectively referred to as "Approved Plans"). This staff analysis assesses the Approved Plans' adherence to the 1998 California Building Code (CBC) which was in effect at the time of application submittal. Staff cannot make copies of these plans for others to review, per the prohibition on copying without the written permission of the architects and engineers who prepared them (California Health and Safety Code Section 19851). However, the approved plans are available for review in Planning Administration Office at 2120 Milvia Street, 3rd floor.

Balcony Construction

The balcony was designed using a 2-inch thick concrete topping slab installed over 1/8-inch asphaltic hardboard over a bituthene membrane underlayment over a primer as shown in Detail 12 on Sheet AD33 of the Approved Plans. Structural support was provided by two (2) layers of 3/4-inch tongue and groove oriented strand board (OSB) sheathing installed on 1 3/4 x 11 7/8 inches laminated veneer lumber (LVL) joists which were notched down to 9 1/4 inches at the transition to the exterior and then sloped to a minimum depth of 7 1/4 inches at the joist ends as indicated in Detail 12 on Sheet AD33 and Unit B8 3rd/4th Floor Framing Plan on Sheet S1.6 of the Approved Plans. The Joist Legend on Sheet S1.6 of the Approved Plans specified that the perimeter framing of the balcony was to be formed by doubled up framing members. The bottom of the balcony was to be finished with metal lath and 5/8-inch minimum thickness cement plaster as required by 1998 CBC Table 7C Item #13-1.2 and as referenced in Detail 5 on Sheet AD22 of the Approved Plans.

Structural Design

Pursuant to 1998 CBC Section 1607.3.1 and Table 16-A, exterior balconies serving residential dwelling units were required to be designed using a live load of 60 pounds per square foot minimum. The design dead load varies for each application depending on the construction materials. A determination of the 45 pounds per square foot dead load was provided on Page a-3 of the structural calculations based on the floor assembly specified in Detail 12 on Sheet AD33 and Details 4 and 5 on Sheet AD22 of the Approved Plans. The calculations supporting the design of the balcony framing can be found on Pages a-42 and a-43 of the structural calculations. The load analysis

conservatively used the least dimension of the framing member at the cantilever and back span. The maximum stress ratio was determined to be 0.299, with bending stress controlling the design.

Fire Resistive Construction

Pursuant to 1998 CBC Section 310.2.2, multi-family residential structures more than two stories in height were required to be of not less than one-hour fire-resistive construction throughout, including projections. In order to achieve the required fire rating, an assembly conforming to 1998 CBC Table 7C Item #13-1.2 was specified in Detail 12 on Sheet AD33 and Detail 5 on Sheet AD22 of the Approved Plans.

Flashing

Pursuant to 1998 CBC Section 1402.2, openings in the exterior walls exposed to weather were required to be flashed in such a manner as to make the opening weatherproof. The flashing requirements applicable to the French doors leading to the balcony were specified in Detail 12 on Sheet AD33, Detail 3 on Sheet AD50 and Detail 10 on Sheet AD81 of the Approved Plans.

Weather Exposed Surfaces

Pursuant to 1998 CBC Section 1402.3, balconies exposed to weather and sealed underneath were required to be waterproofed and sloped a minimum of ¼ unit vertical in 12 units horizontal (2 percent slope) for drainage. Detail 12 on Sheet AD33 and the Unit B8 3rd/4th Floor Framing Plan on Sheet S1.6 of the Approved Plans specify the required slope satisfying drainage requirements.

Pursuant to 1998 CBC Section 2306.9, wood structural members supporting moisture-permeable floors that are exposed to the weather, such as concrete, were required to have natural resistance to decay or be treated wood unless separated from such floors by an impervious moisture barrier. Bituthene membrane over primer was specified in Detail 12 on Sheet AD33 of the Approved Plans.

Moisture Content

Pursuant to the 1997 Edition of National Design Standard for Wood Construction (NDS) Section 2.3.3, a moisture content of 19 percent is recognized as an appropriate upper limit for a dry condition of service for lumber used in wood structures. This requirement is reflected in Carpentry Note #14 on Sheet S0.1 of the Approved Plans. However, as the balcony structure utilized an engineered wood product, it was subject to the more restrictive limitations established under International Code Council (ICC) Evaluation Report ER-4979 (issued April 1st 2002) Section 4.3, which required the end-use average equilibrium moisture content of the structural composite lumber to be equal to or less than 16 percent.

Ventilation

Pursuant to 1998 CBC Section 1505.3 and 2306.7, ventilation is required for enclosed spaces at attics and under-floor spaces between the bottom of the floor joists and the earth under the building. Ventilation of other concealed spaces was not required.

Code Mandated Inspections per 1998 CBC Section 108.5

The following are the CBC sections mandating inspection (*italics in original*):

108.5 Required Inspections.

108.5.1 General. Reinforcing steel or structural framework of any part of any building or structure shall not be covered or concealed without first obtaining the approval of the building official.

Protection of joints and penetrations in fire-resistive assemblies shall not be concealed from view until inspected and approved.

The *[for HCD 1] enforcing agency*, upon notification, shall make the inspections set forth in the following sections.

108.5.2 Foundation inspection. *[For HCD 1] Inspection should be made after excavations for footings is complete and any required reinforcing steel is in place. For concrete foundations, any required forms shall be in place prior to inspection. All materials for the foundation shall be on the job site; however, where concrete is ready mixed in accordance with approved nationally recognized standards, the concrete need not be on the job site. Where the foundation is to be constructed of approved treated wood, additional inspections may be required by the building official.*

108.5.3 Concrete slab or under-floor inspection. *[For HCD 1] Inspection should be made after all in-slab or under-floor building service equipment, conduit, piping accessories and other ancillary equipment items are installed, but before any concrete is placed or floor sheathing installed, including the subfloor.*

108.5.4 Frame inspection. *{For HCD 1} Inspection should be made after the roof, all framing, fire blocking and bracing are in place and all conduits, plumbing pipes, chimneys and vents are complete and the rough electrical, plumbing, and heating wires, conduit, plumbing pipes and ducts are approved.*

108.5.5 Lath or gypsum board inspection. *[For HCD 1] Inspection should be made after all lathing and gypsum board, interior and exterior, are in place, but before any plastering is applied or before gypsum board joints and fasteners are taped and finished.*

108.5.6 Final inspection. *[For HCD 1] Inspection should be made after finish grading and the building is completed and ready for occupancy.*

In summary, Building and Safety Division staff confirms that the Approved Plans complied with the applicable CBC requirements in effect at that time, and also that all CBC-mandated inspections were conducted.

Staff Recommendation To Adopt Local Amendments To CBC And The Berkeley Housing Code (BMC Chapter 19.40)

In order to reduce the possibility of the formation of dry rot or other moisture-related damage in future new construction, and to help ensure the safety of existing residential housing structures, the Building and Safety Division recommends emergency adoption of the following code amendments based on local climatic conditions. These amendments would increase the ventilation requirements and impose material restrictions for newly constructed balconies and similar space exposed to weather and sealed underneath, as well as institute maintenance inspections on a regular schedule post-construction.

BMC Chapter 19.28 Berkeley Building Code:

- Add Section 1203.6 to read as follows:
Section 1203.6 Ventilation of weather exposed enclosed assemblies. Balconies, landings, decks, stairs and similar spaces exposed to the weather and sealed underneath shall have cross ventilation for each separate space by containing ventilation openings protected against the entrance of rain and snow. Blocking and bridging shall be arranged so as not to interfere with the movement of air. The net free ventilating area shall not be less than 1/150th of the area of the space ventilated. Ventilation openings shall comply with Section 1203.2.1. An access panel of sufficient size shall be provided on the underside of the enclosed space to allow for periodic inspection.
Exception: An access panel is not required where the ceilings applied directly to the underside of joists are easily removable using only common tools.
- Add Section 1404.13 to read as follows
Section 1404.13 Projections exposed to weather. Balconies, landings, decks, stairs and similar floor projections exposed to the weather and sealed underneath shall be constructed of naturally durable wood, preservative-treated wood, corrosion resistant (e.g., galvanized) steel, or similar approved materials.
- Amend Section 2304.11.4.2 as follows:
Section 2304.11.4.2 Wood structural members. Wood structural members that support moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, shall be of naturally durable or preservative-treated wood ~~unless separated from such floors or roofs by an impervious moisture barrier.~~

- Amend Section 2304.11.5 as follows:
Section 2304.11.1 Supporting members for permanent appurtenances.
Naturally durable or preservative-treated wood shall be utilized for those portions of wood members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances where such members are exposed to the weather ~~without adequate protection from a roof, eave, overhang or other covering to prevent moisture or water accumulation on the surface or at joints between members.~~

BMC Chapter 19.40 Berkeley Housing Code:

- Add Section 601.4 to read as follows
Section 601.4 Structural Maintenance. All exterior elevated wood and metal decks, balconies, landings, stairway systems, guardrails, handrails, or any parts thereof in weather-exposed areas of Group R-1 and R-2 Occupancies, as defined in the Building Code, shall be inspected within six months of adoption of this section, and every five years thereafter, by a licensed general contractor, or a structural pest control licensee, or a licensed architect, or a licensed engineer, verifying that the elements are in general safe condition, in adequate working order, and free from hazardous dry rot, fungus, deterioration, decay, or improper alteration. Property owners shall provide proof of compliance with this section by submitting an affidavit form provided by the Housing Code Enforcement Office. The affidavit shall be signed by the responsible inspecting party and submitted to the Housing Code Enforcement Office.

Staff from the Berkeley Building and Safety Division believe that immediate adoption of the recommendations within this memo will be a step towards improving the safety of Berkeley residents in both existing buildings and those which will be built in the future.

cc: [REDACTED] City Manager
[REDACTED] Deputy City Manager
[REDACTED] City Attorney

██████████ Director

June 23, 2015

Page 10 Re: Staff Recommendation Related to Library Gardens – 2020 Kittredge St.

Attachment 1: Building Summary

Applicable Code: 1998 California Building Code

Building Permit No 02-858

Date of Application: 03/05/2002

Date of Issuance: 11/15/2004

Date of Final Inspection: 01/04/2007

Date of Certificate of Occupancy: 01/12/2007

Occupancy/Use: Group R Division 1 Apartment House

No. of Residential Units: 176

Type of Construction: V 1-HR over I-F.R.

Stories: 5

Sprinkler System: Yes

[REDACTED]

Consulting Structural Engineers

December 16, 2015

[REDACTED] Enforcement Program Manager
Board for Professional Engineers and Land Surveyors
2535 Capital Oaks Drive, Suite 300
Sacramento, CA 95833-2944

Subject: Review of structural engineering work related to the balcony collapse on June 16, 2015
at Library Garden Apartments in Berkeley, California
Board Investigative Case #2015-07-161

Dear [REDACTED]:

We have reviewed the documents and circumstances that relate to the engineering of the balconies of the Library Garden Apartments that collapsed on June 16, 2015. The purpose of this letter is to outline the results of our investigation and to offer an opinion as to whether or not we found the work by the engineers of record to be negligent or incompetent relating to the balcony construction.

BACKGROUND

On June 16, 2015 at approximately 12:40 am the fifth floor balcony of Apartment 405 at the Library Garden Apartments in Berkeley which was crowded with students celebrating a birthday party collapsed. The collapse resulted in six deaths and seven injuries, several of which were serious injuries. Subsequently, the City of Berkeley removed both the remnants of the fifth floor balcony and a major portion of the fourth floor balcony, which were respectively stored in a garage at the Berkeley Corporation Yard and in a storage container at the Santa Rita Correctional Facility in the City of Dublin, California.

On June 30, 2015, [REDACTED] S.E. participated in a conference call with several governmental entities to discuss the collapse and the need for additional technical experts. On July 9, a meeting was held at one of the Alameda County District Attorneys offices in Oakland with representatives of the various interested governmental agencies, including the Board for Professional Engineers, Land Surveyors and Geologists (BPELSG). The discussion centered around how to proceed with the investigation and the division of responsibilities between the various experts. That same day, Mr. [REDACTED] made a visit to the Library Garden Apartments to see the conditions of the site.



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Concurrent with that meeting and at the request of BPELSG staff, our office was engaged to determine if any of the structural engineering work related to the failed balcony at the Library Garden Apartments was negligent or incompetent, and to determine if there was cause to open an enforcement case against any of the engineers of record associated with the project. This investigation is being undertaken by [REDACTED], S.E. and [REDACTED], S.E., both of [REDACTED]. Our understanding was that while our initial investigation as to be on behalf of BPELSG, it was likely that our continued investigation may be on behalf of one or more governmental entities that were also involved in the investigation.

On July 29, Mr. [REDACTED] and Mr. [REDACTED] attended a meeting with [REDACTED], the Alameda County District Attorney, to outline the direction of the investigation and discuss the progress to date. That same day, Msrs. [REDACTED] and [REDACTED] (along with the architectural experts) were able to physically examine the Library Gardens building, as well as the remains of the balconies at the Berkeley Corporation Yard and Santa Rita facility as previously described. On October 5 and 6, Msrs. [REDACTED] and [REDACTED] participated in the destructive testing (examination) of original construction materials that remained at the fourth and fifth floors of the Library Gardens building, and the remnants of the two balconies which had both been moved to a warehouse at Alameda Point, the former Naval Air Station Alameda. During that testing our office was able to obtain several material samples that we are in the process of having tested.

Our office has received considerable materials to review as they have become available through various investigators. Upon request, a list of documents may be produced. Most notably we received [REDACTED] construction drawings for the project dated April 28, 2005 and structural calculations dated April 22, 2005.

DISCUSSIONS

There were two structural engineering firms involved in this project as engineers of record (EOR). The EOR for the parking garage/podium deck was [REDACTED] (Civil: No. [REDACTED]) with [REDACTED], California. The drawings for that portion of work was signed and



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sealed by [REDACTED]. The EOR for the wood-frame portion of the building above the podium deck was [REDACTED] (Civil: No. [REDACTED]) with [REDACTED], [REDACTED], California, (hereinafter "[REDACTED]") who also signed and sealed his work. Mr. [REDACTED]'s license is currently listed as "Delinquent" on the BPELSG website. The EOR of the portion of the work that relates to the wood balconies is Mr. [REDACTED]. We were not made aware of any problems or issues related to the work of [REDACTED] or [REDACTED], and we have not examined their work as part of this investigation.

The Library Gardens Apartment complex was permitted during the 2004-2005 time period. The drawings for the podium portion of the structure prepared by [REDACTED] were approved by the City of Berkeley Planning and Development Department of the Building and Safety Division on September 27, 2004. The drawings for the portion of the building above the podium deck prepared by [REDACTED] were approved by the Building and Safety Division on July 8, 2005. The project was to be designed, permitted, and constructed pursuant to the 2001 California Building Code (1997 Uniform Building Code).

As mentioned earlier, the structural engineering work that is related to the failed balcony was performed by [REDACTED]. A review of the [REDACTED] structural calculations showed that the balcony was designed for a live load of 60 pounds per square foot (psf), and a dead load of 45 psf. The 2001 CBC required a live load on residential balconies of 60 psf. Beginning with the 2010 CBC, the live load requirement for balconies changed to be the live load of the space that the balconies served, which in this case would have been 40 psf. The dead load for the decks used in the [REDACTED] calculations was generally consistent with the detailing provided in the [REDACTED] drawings, which included among other things two inches of concrete topping, one 3/4" layer of plywood sheathing, and 1-3/4" x 11-7/8" Microlams at 16" on center (o.c.). Architectural detail 12/AD33 shows "double wood floor per structural" but the architectural details on Sheet AD81 graphically depict only one layer plywood and detail 5/AD22 calls out for "1 Layer of 5/8" T&G Plywood Deck Sheathing." While the calculations specifically call out for 2 x 10 @16" o.c. at 2.8 psf, the floor joists specified for the deck are 1-3/4" x 11-7/8" Microlams which at the cantilever are notched to 9-1/4" and tapered to 7-1/4", and which average 3.2 psf at the cantilevered deck. On the interior of the unit (the back span of the deck joists) the floor topping was reduced from 1 1/2" light-weight concrete to 1" gypcrete. [REDACTED] allowed 3.0 psf



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conservatively for "Fire protection and electrical," the actual weight which is less than 1 psf. [REDACTED] also allowed for a "miscellaneous" load of 3.0 psf. [REDACTED]'s dead loads totaled 43.3 psf but in his calculations he mistakenly totaled to 44.3 psf and rounded up to 45 psf, which effectively added 1.7 psf to his assumed dead load. Given the catch-all "miscellaneous" loads used in the structural calculations and the rounding up, [REDACTED]'s design dead loads were conservative, and the minor variations that may have been expected in weights of the materials used in the original design are inconsequential. In actuality, however, three layers of sheathing were installed at the exterior deck (one layer of 3/4" OSB and two layers of 5/8" OSB) for a total weight of 6.5 psf for the floor sheathing and the actual thickness of the concrete topping varied from 2-1/8" to 1", with an average thickness of about 1-3/4" and with an average weight of 21.9 psf. The dead loads (weights) of the as-built condition of the deck still appear to be slightly less than the loads used in [REDACTED]'s calculations. For our analysis we used a dead load of 48 psf which is even more conservative than the loads used by [REDACTED].

Using a live load of 40 psf on the back span (interior) of the deck joists and 60 psf on the cantilevered portion of the joists, using an exterior (cantilevered) dead load of 48 psf, and assuming a uniform depth of the floor joists of 7 1/4", we calculated that the shear and bending stresses, as well as deflections, were well within allowable limits. We did a second calculation, using the thirteen people with an average weight of 180 pounds each, and applied that load to the outermost two feet of the cantilever. This load is in excess of what was required by code and applies more than all of the 60 psf live loading to outer two feet of the deck. We still found that the allowable stresses and deflections in the joists were well within limits. If this analysis was conducted using the current requirement for 40 psf live loading for the balcony instead of the 60 psf required in 2005, the calculated stresses would be even further reduced compared to the allowable. Based on these analyses, we have come to the conclusion that the design of the deck joists by [REDACTED] was well within the standard of care.

There were several other items that we noted on the drawings that are worth discussing. First of all, Note No. 8 on Sheet S1.6 states as follows:

8. TOP FLOOR ONLY: P.T. (PRESSURE TREATED) JOISTS
REQUIRED AT PRIVATE DECKS AND OPEN CATWALKS



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EXTENDING 6'-0" INTO COVERED AREA.

The top floor being referred to would be the fifth floor of the building, and would included the balcony deck at Unit 405. The purpose of this note is not completely clear, nor is any other information provided that specifies the type of pressure treatment to be used. On review of the literature for Microlams (specifically Trus Joist LVLs, which were used on the project), only limited pressure treatment options are available for LVLs. According to their website, Trus Joist does not recommend the pressure treatment of LVLs, however at the time of construction, the chemicals available for pressure treatment of Microlams were: "HI-Clear II™" manufactured by Permapost Co. and "Trib® II" and "TruCore® I" manufactured by Honolulu Wood Treating LLC. On the West Coast the pressure treatment chemical used with LVLs is the "HI-Clear II™" product. While "HI-Clear II™" contains both an insecticide and a fungicide, it is only rated for Service Level 1 (SL1), Use Category 1 (UC1) when applied to LVLs. SL1/UC1 is intended where conditions are "Dry, but risk of insect (termite) damage" and for an in-service moisture content less than 16 percent. It is not intended for damp conditions or conditions subject to even occasional sources of moisture. In Hawaii, LVLs are available treated with "TruCore® I", which can be appropriate for Use Category 2, but that treatment is not available in California. What purpose was intended by [REDACTED] by specifying pressure treatment of the LVLs and whether or not he was even aware of these distinctions in pressure treatment is unknown. In either case, however, if the waterproofing system had been sound and not compromised, pressure treatment would have been unnecessary and may only have been called out as a secondary consideration (i.e. "belt and suspenders").

Secondly, there is some ambiguity in the structural drawings prepared by [REDACTED] as to whether the floor sheathing is to be "plywood" or "OSB—oriented strand board." Note No. 8 in the Carpentry Notes on Sheet S0.1 states as follows:

8. PLYWOOD TO BE CONTINUOUS OVER TWO (2) OR MORE SPANS AND FACE GRAIN PERPENDICULAR TO SUPPORT.

PLYWOOD OR ORIENTED STRAND BOARD FOR ROOF: ½" (32/16) 5 PLY STANDARD GRADE.
SEE ARCHITECTURAL DRAWINGS FOR EXPOSED OVERHANGS AND CEILINGS.

PLYWOOD OR ORIENTED STRAND BOARD FOR FLOORS: TONGUE AND GROOVE, U.N.O.



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On the plan sheets and on the details prepared by [REDACTED] there is some distinction between generic "floor sheathing" and "plywood." For example, on the plans entitled "UNIT B8 - 3RD/4TH FLR. FRMG. PLAN" on Sheet S1.6 which is specifically for the deck at Unit 405, the call-out for the deck sheathing states "3/4" T/G PLYWOOD." However, the call-out for the floor and deck sheathing on *all* of the plans on Sheets S1.1 through S1.9 is for "3/4" T&G PLYWOOD." On the detail sheets beginning with Sheet S5.2, there is a distinction between the sheathing specified on the interior of the units versus the sheathing at the exterior decks. The interior sheathing is called out as generic "floor sheathing" (e.g. Details 1 through 9) and the exterior deck details have the sheathing called out as "plywood" (e.g. Details 10, 13 and 14). In the Section 06110 Wood Framing and Sheathing of the specifications for the project (100% Review Set 07/10/03), Section 2.6 A. states the following :

Wood-Based Structural-Use Panels: Oriented Strand Board (OSB): DOC PS2. Provide plywood complying with DOC PS 1, where plywood is indicated.

Furthermore, in the specifications for the project, Section 7186 Waterproof Coating Over Plywood Decks specifically states the following:

3.1 PREPARATION

...

B. ALL PLYWOOD TO BE COATED SHALL CARRY THE GRADE TRADEMARK OF APA EXTERIOR A-C OR BETTER.

...

5. ORIENTED STRAND BOARD (OSB) IS NOT AN ACCEPTABLE SUBSTRATE.

Clearly, plywood (as opposed to OSB) was indicated on the Mason drawings in multiple locations.

We noted several issues during the physical investigations that were conducted at the property as well as observations that were made of the remnants of the fourth and fifth floor decks.

- The exterior deck was constructed with OSB rather than the plywood called for in the



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drawings.

- There were three layers of OSB rather than the one layer of plywood specified in the structural drawings. Two layers were 5/8" OSB and one layer was 3/4" OSB.
- The deck joist were notched twice rather than the one notch called out for on the structural drawings.
- While material testing of the floor joists is still pending, it does not appear that the floor joists were pressure-treated.

Coupling the requirements in both the sheathing and waterproofing specifications with the call-outs on the drawings prepared by [REDACTED], a reasonable contractor should have concluded that plywood *only* was to be used on the exterior decks. Given the information provided, if the contractor still believed an ambiguity existed, the contractor would have had the obligation to clarify the design intent with a Request for Information (RFI). We have seen no such RFIs regarding this issue. Furthermore, we have seen no site visit reports by either [REDACTED] or the architect that acknowledges the use of OSB at the exterior decks.

We found no RFI or submittals that approved the use of non-pressure treated Microlams as specified in the drawings. Again, we found no site visit reports by [REDACTED] or the architect that mentioned or acknowledged the use of the non-pressure treated products.

CONCLUSIONS

The work prepared by [REDACTED] is completely unrelated to the balcony failure at the Library Gardens Building. Therefore, we have no finding of negligence or incompetence with [REDACTED]'s work with regard to the balcony failure.

We take no exception with the design or detailing of the cantilevered floor joists by [REDACTED]. While the



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intent of and the specification for the pressure-treatment of the floor-joists was not clear in the [REDACTED] drawings, pressure-treatment would not have been required had the waterproofing system been sound and was not compromised. Also, while there was some ambiguity in the drawings prepared by [REDACTED] regarding the material to be used in the floor sheathing, from a purely structural standpoint either OSB or plywood would have been acceptable, particularly if the waterproofing system had been sound. Clearly, plywood (*not* OSB) was required in the architectural specifications, and a strict interpretation of the [REDACTED] drawings coupled with the wood specifications previously discussed would have required plywood be used at the decks as opposed to OSB, the carpentry note notwithstanding. At this point, however, we have not been able to determine from the documents that we have received, who (if anyone) approved the change from plywood to OSB, or who approved the elimination of the pressure treatment of the LVLs, both of which contributed to an earlier deterioration of the decks than might have otherwise occurred.

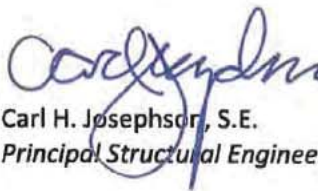
At this point, based on the information that we have reviewed, it is our opinion that Mr. [REDACTED]'s work as it relates to the balcony at Library Gardens was neither negligent nor incompetent.

OPINION OF NEGLIGENCE/INCOMPETENCE: No Finding of Negligence or Incompetence

We appreciate the opportunity to be of service. Please give me a call if you have any questions related to the issue raised in this report.

Sincerely,

[REDACTED]


Carl H. Josephson, S.E.
Principal Structural Engineer



[REDACTED]

Senior Associate Structural Engineer

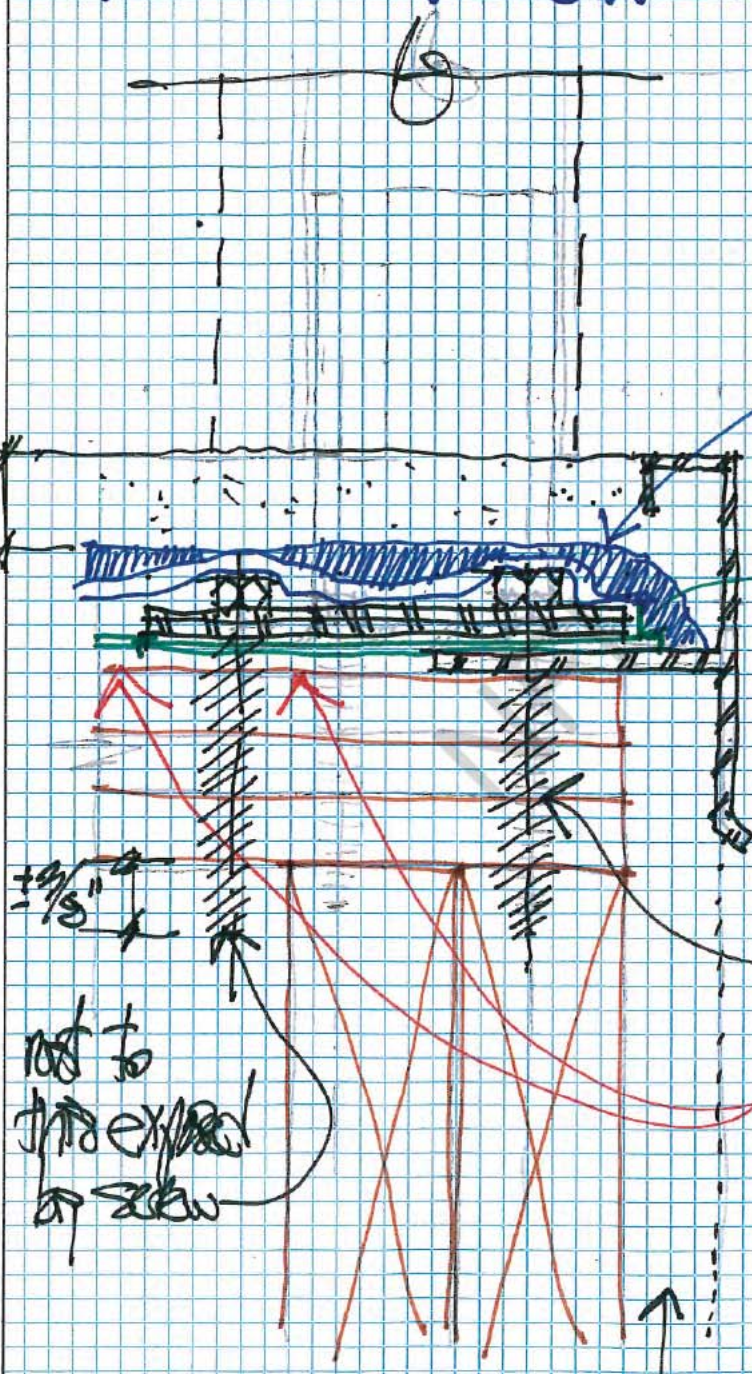


Date: 5-7 October 2015
Project: [redacted]
By: [signature]

UNIT: 305

Guardrail Sanction

2" SPC.



bitume "Lyn" ORC "Bitume."
*no bitume found, planned
to red prime int. structure

fastener w/ fast. plate OR
ORC ORC "Bolero" only
@ Guardrail Sanction!
"mistake" still present below
sanction w/ member.

3" hex. head of screw

change to ORC below
member



30

plate previously removed

not to
the extent
of screw



Report Date: December 18, 2015

LABORATORY RESULTS


Client & Address: 

Test: Determination of Preservative treatment in wood samples

TP ID	Sample #	Cis – Permethrin (PPM)
721095	Unit 305 LVL Joist #3- #5 Core	1.03
721096	Unit 405 LVL Joist #3 – Core #2	1.37

Note – No Trans-Permethrin was detected in the samples.

The wood samples received were analyzed via analytical procedures from the American Wood Protection Association (AWPA) manual.

Note: These samples were submitted by the client. These results should not be construed as acceptance or rejection of any lot or lots which may be in question.  waives all responsibility for any damages resulting from the usage and/or implementation of the products or data described in the report.

Report Authorized By:

Manager, 



City of Berkeley



Certificate of Occupancy

Planning Department, Building and Safety Division

This Certificate is issued pursuant to the requirements of Section 109 of the California Building Code. At the time of issuance of this permit, the structure was in compliance with the applicable ordinances of the City regulating building construction or use. The Building Official may, in writing, suspend or revoke this Certificate if a subsequent violation is discovered or if the Certificate was issued in error or information supplied was incorrect.

Use Classification: **Mixed Residential, Commercial**

Building Permit No.: **02-858**

Retail and Parking Garage

Occupancy Group: **R-1, S-3 and B**

Type of Construction: **Residential Type V-1HR, Retail and Parking Garage Type 1-FR Sprinklered**

Owner of Building: [REDACTED]

Owner's Address: [REDACTED]

Building Address: **2020 Kittredge Street**

APN: **057-2028-014-02**

Description of work: **New Construction of Mixed Use Residential, Retail and Parking Garage**

Condition/Limitation: **NONE**

Building Inspector: [REDACTED]

[REDACTED]

Fire Marshal

[REDACTED]

Building Official

1/12/07

Date