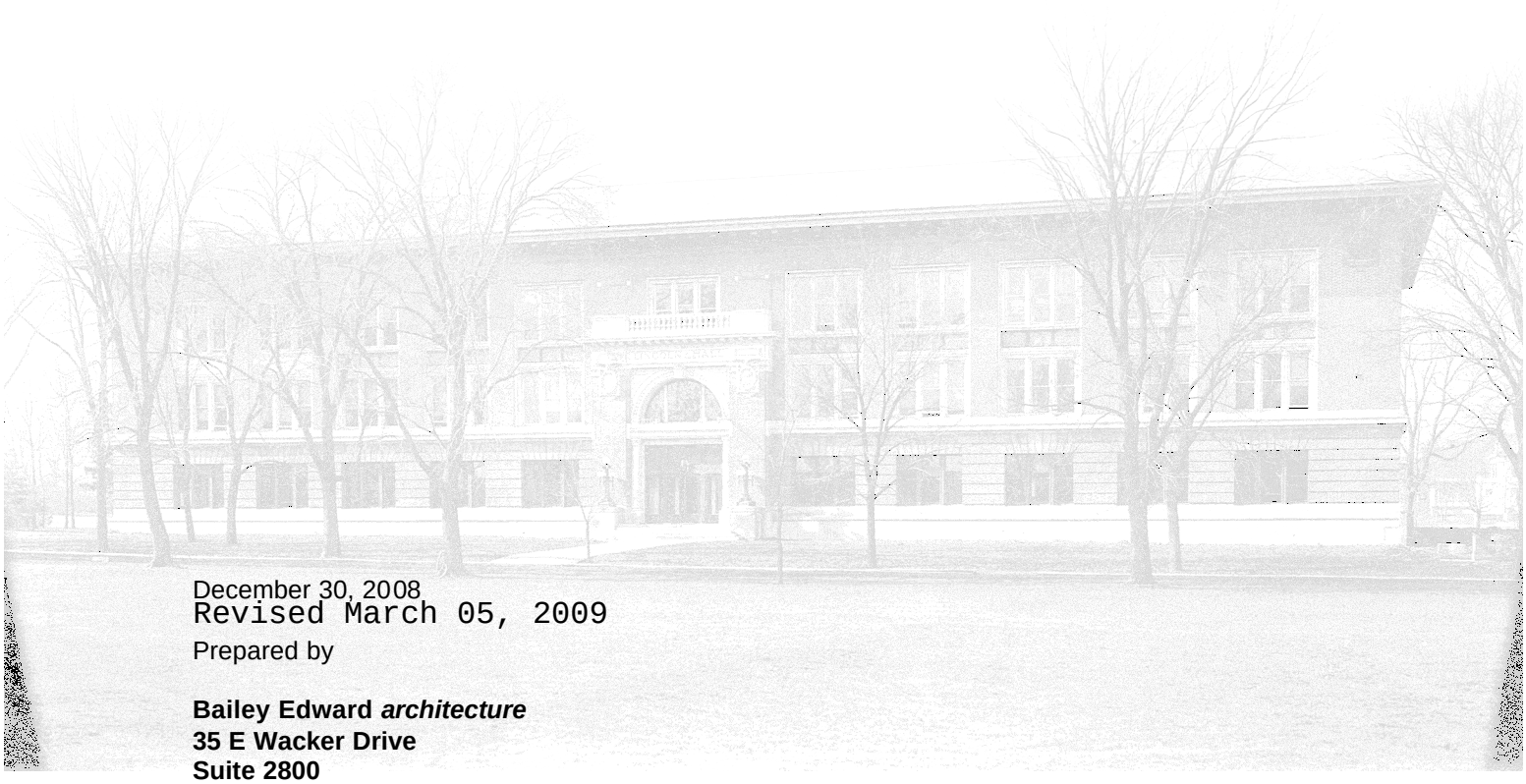
Lincoln Hall Windows Research Report

A Case Study of Options for Treatment for Windows at Lincoln Hall, University Of Illinois, Urbana Champaign

Prepared for

Capital Development Board
Project Number 830-010-327



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Contents

Section 1 Executive Summary

1 Lincoln Hall was built in 1910 – 1928 facing the quadrangle of the University of Illinois' Urbana/Champaign campus, and it is eligible for the National Register. The building is being rehabilitated under a State of Illinois Capital Development Board project. Part of the scope of work for this LEED Gold targeted project is to address the existing windows in terms of energy consumption. Three options were developed for upgrading:

1.1 Replace existing windows with new aluminum clad wood operable windows.

1.2 Restore existing windows complete with retrofitted hermetically sealed double glazing.

1.3 Minimally repair the existing window, ensure proper operation, and add an operating storm.

2 The purpose of this report is to provide empirical data to assess these options.

3 Bailey Edward Architecture, in conjunction with OWP/P was hired to have mock-ups installed, perform in-situ testing of those mock-ups, document all results, and prepare a matrix of criteria with which to assess the options.

4 The mock-ups were installed on the west wall, main floor of Lincoln Hall in May of 2008. One window was restored by a qualified restoration company, and reinstalled on site by the same company. This same company installed the new aluminum-clad window. The storm window options were installed by their suppliers. After the windows were installed, the interior face of the existing exterior wall was upgraded by installing steel stud furring, expanding polyicynene insulation, and drywall. This proposed wall assembly gives a thermal upgrade to the solid masonry wall, provides an air seal of the masonry, and an air seal for the connection of the window to the wall.

5 Once construction was complete, the windows were tested for air infiltration in the field by an independent testing company. The window assemblies were then computer modeled to determine their U-value, based on the construction of the mock-up. (See Architectural Testing reports in appendices.) This data was fed into the energy simulation for the building. (See Appendix)

6 Criteria were listed and defined, as outlined in Section III Scoring Criteria. Each window option was then assessed in terms of its performance relative to that criterion. (See Section IV, Discussion.) These results were then compared using a matrix. (See Section V, Evaluation Matrix.)

7 There was extended discussion regarding the options, methodology, criteria, and evaluation. It is hoped that all comments from all perspectives were captured in the discussion section of this report. Several drafts were generated, and discussed at meetings.

8 This study is to develop a strategy only for the Lincoln Hall building. It is not intended, nor appropriate, to extrapolate this information to other buildings which are not identical in nature.

9 The study is based on extrapolating data for a fifty year time frame. This time frame assumes that the wood, glass, aluminum, assemblies and finishes will last that duration.

Table 1 – Participants in this study:

Lead Architect for Lincoln Hall	OWP/P 111 South Washington Street, 2100 Chicago, Illinois, 60602	Charles Smith AIA Ron Harrison, AIA
Historic Consultant	Bailey Edward Design (BE) 35 East Wacker Drive, Suite 2800 Chicago, Illinois, 60601	Robin E. Whitehurst AIA, LEED AP Susan D. Turner, AIA
Testing Services	Architectural Testing Inc (ATI) 9608 South Franklin Drive Franklin, Wisconsin, 53132	Josh Brandt Dave Schumann Mike Resech
Stakeholder Representatives	Capital Development Board (CDB) University of Illinois, Urbana/Champaign, Facilities (UIUC) Liberal Arts and Sciences (LAS)	Kirk Fernandes Jim Spese, Melvyn Skvarla, Donna McClure Matthew Tomaszewski
Advisory Agency	Illinois Historic Preservation Agency (IHPA)	Mike Jackson
With Thanks to	Allied Windows Building Blocks USDA Forest Products Laboratory Marvin Windows Monray Storm Windows / AWS Restoration Works Re-View Roessler Construction Huff Home Specialties	Dave Martin Todd Zeller Mike Wiemann, Daniel Lindner Dan Smith Gregg Murtha / Richard Basler Gail Wallace Todd Maxwell Tim Roessler Mike Couch

Section 2 Introduction

1 Lincoln Hall was built in 1910 – 1928 on the quadrangle of the University of Illinois' Urbana/Champaign campus. Based on its age and architecture, it is eligible for the National Register. The rehabilitation of this building is being funded jointly by the State of Illinois through the Capital Development Board and the University of Illinois, Urbana Champaign., and as such, it must comply with State legislation. This places the project under the purview of the Illinois Historic Preservation Agency, which has indicated that the project will comply with the Secretary of the Interior's Standards for Rehabilitation. In IHPA's May 29, 2007 letter, they indicated that the proposed design would have no adverse affect, provided the windows were restored.

2 According to the Secretary of the Interior's Standards for Rehabilitation, the recommended approach is:

> ***"Identifying, retaining, and preserving windows--and their functional and decorative features--that are important in defining the overall historic character of the building. Such features can include frames, sash, muntins, glazing, sills, heads, hoodmolds, panelled or decorated jambs and moldings, and interior and exterior shutters and blinds. Conducting an in-depth survey of the conditions of existing windows early in rehabilitation planning so that repair and upgrading methods and possible replacement options can be fully explored."***

3 Bailey Edward Design, the historic preservation architect on the OWP/P team, undertook a survey of the existing windows early, to quantify the extent of deterioration of the existing window members, the sizes of the openings, and the extent of repairs required, including hardware replacement. That survey revealed that the majority of windows were operable, were without much rot or wracking, and had the original hardware intact.

4 The typical existing windows are one pane over one pane, double hung original windows. The sashes are of yellow pine, 2" thick, with single panes of glass. Counterweights to balance the operation of the sashes reside in a pulley pocket in the jamb. While historically the sashes were hung with sash cord, some sashes have been repaired with chain. The frames and sills are typically of yellow pine, but there are slate sills at public corridor windows in the 1928 addition.

5 Windows are always a complex issue when approaching an historic building, since they are both a character-defining element of an historic building, as well as an operational and energy issue for the building owner. UIUC Standards are to replace existing windows as part of any major capital construction project. This is to address energy issues in the long term, as well as maintenance costs.

6 Initially, the survey results were shared with a window restoration company to generate an estimate of cost for the repair of the window, including the upgrade of the single glazing to a hermetically sealed double glazed (HSDG) window system. The University had previously retrofitted a building on the quadrangle of similar age, scale and window size called the Noyes Lab. These preliminary capital costs for replacement as realized in the Noyes lab for replacement units were used to compare with the budget costs for replacement windows, but this did not provide a definitive answer. Since there were also still concerns regarding air infiltration, on-going painting of restored windows and other concerns, more investigative work was required.

7 As the design and implementation for the rehabilitation of Lincoln Hall proceeded, there was a great deal of discussion on the approach to the windows. There were a lot of strong opinions on both sides of the questions, and the decision was made to perform a study to quantify the results that could be achieved in any window option. The CDB and UIUC approved funding to undertake an impartial window study.

8 The following options were proposed among those contributing to the discussion:
8.1 Benchmark the existing window

8.2 Test a replacement aluminum clad window
8.3 Test an existing window restored
8.4 Test an existing window unrestored with a storm window.

9 These options were tested for air infiltration. The U-Value and Solar Heat Gain Coefficient (SHGC) for each option was computer modeled by an independent testing agency. The results are appended to this study.

10 Other criteria were then developed to complete the analysis so that a decision could be made. An effort was made to develop objective criteria for analysis that would encompass performance, aesthetic and cost factors for each option. It should be noted that the assessment of some criteria will be subjective by nature.

11 The criteria developed were lifecycle costs (initial cost, operating cost, maintenance costs, and differential durability) ease of operations (of the window), ease of maintenance, historical considerations (Retention of historic fabric, reversibility, and appearance) and sustainability (avoided impact/diversion from landfill). These criteria were developed, and are presented in definition form with comparisons in Section III Scoring Criteria. Each option is later included in Section IV Evaluation Matrix.

Section 3 Methodology

1 The methodology was to select a set of windows that were primarily in similar condition, in the same orientation, easy to access, and in an area with the least impact on University operations. Several options were discussed. The chosen windows were on the west corridor, main floor, south end, in the 1928 part of the building. They were indicative of the typical sash and frame dimensions found on both the 1928 and the 1910 portions of the building, and of level of deterioration typically found. Four existing windows were in similar condition; all faced west, abutted a public corridor, and could be serviced off the loading lane.

1.1 **Opening Number One** is an unrestored window in an existing exterior wall and received a Monray Storm. The glazing for the Monray storm was 3/16" clear glass. No repair work or painting was done to the wall or the original window, but this work would be done if this option was selected. The new storm was attached to the exterior of the existing window, installed and caulked per manufacturer's recommendations.

1.2 **Opening Number Two** is an unrestored window in an existing exterior wall and received an Allied HOL-OP Storm. The glazing for the Allied storm was 1/8" "Energy Advantage" Low-E glass by Pilkington, tempered. No repair work or painting was done to the wall or the original window, but this work would be done if this option was selected. The new storm was attached to the exterior of the existing window, installed and caulked per manufacturer's recommendations.

1.3 **Opening Number Three** removed the original sash and frame of the existing window, including the pulley pocket. A new Marvin double hung aluminum clad window was installed, with an upgraded wall. The glazing for the Marvin Window was Marvin standard LoE2-272, Argon content: 90%, Spacer: Cardinal IG XL Edge stainless steel, LoE surface: #2 surface. (See appendix G section 1 for full specifications.) The design of the window complied with UIUC standards for replacement windows, which calls to match the stile and rail profiles, brick mold and sash lugs to the greatest extent possible. The pulley pocket void was filled by insulation. The existing interior sill was removed and relocated farther into the room to allow for the additional thickness of the upgraded wall, consisting of 3 ½" of steel studs and polyicynene insulation, and 5/8" drywall. Interior wood trim remains, as well as an exposed exterior brick lintel angle.

1.4 **Opening Number Four** received a restored window and an upgraded wall. The sashes were removed to the restoration workshop, where they were routered out to provide sufficient depth of reveal to take a hermetically sealed double glazed (HSDG) window unit, and for continuous weatherstripping. The existing window was boarded up in the interval. The existing frame was stripped, sanded, primed and painted on site, and the hardware and counterweights were adjusted to accommodate the additional weight for the double glazing. The existing interior sill was removed and relocated farther into the room to allow for the additional thickness of the upgraded wall, consisting of 3 ½" of steel studs and polyicynene insulation, and 5/8" drywall. The glazing for the restored window as installed was 1/2" OA Thick Annealed IG Outboard Lite: 1/8" Pilkington Energy Advantage Annealed (#2 Surface) Inboard Lite: 1/8" Clear Annealed and the Spacer: ¼" Bronze Low Profile Aluminum (3/8" Sightlines).

2 The rationale for testing the windows in an upgraded wall (or not) lay in the mechanics of the testing. The installation of a new window or restoration of an existing window involved improving the seal of the wall to the window. By testing the window within an upgraded wall, it was possible to get window results that reflected the proposed design. Since the upgraded wall had an air barrier, the testing measurements did not include how much air actually passed through the masonry, air that had nothing to do with the performance of the window. Initially, the storm windows were proposed for the restored window as a protection for paint, but it was decided to test them as a simpler fix to the existing unrestored windows. Given the timing of the decision, there was not an opportunity to upgrade the wall at those locations. All windows met the standard test pressure of 1.57 psf. Neither of the openings in the unimproved wall could meet the commercial test criteria for infiltration because of the wall construction. At the thermally improved wall openings, only the Marvin window installation met the commercial test pressure of 6.24 psf. The restored window did not. This difference could be

attributed to the fact that at the replacement windows the pulley pockets was filled. This was not done at the restored or storm window options.

3 The openings that were used were photographically documented (See Appendix B) and drawings and specifications were prepared. (See Appendix A) Since the University had a preferred aluminum clad window manufacturer that could provide a window per UIUC standards, and since the design team could source only two commercial storm window companies of sufficient quality, the team worked directly with these three manufacturers to provide windows for installation mock-ups.

4 A contractor, Roessler Construction, was hired to perform carpentry and coordination work for the mock-up. This contractor removed the designated historic window for restoration (See Appendix C) and shipped it to Re-View, the selected window restoration contractor for the mock-up. The aluminum clad window and the two storms were ordered. (Note: two storms were tested because there were two different types of storm windows available: double hung, counterweighted, and single hung, not counterweighted.) Once the historic window was completed, and the new Marvin, Monray and Allied windows were fabricated, the mock-up work began on site.

5 ReView was hired to install the restored window and the new Marvin Window. (See Appendix for photo documentation.) This work occurred five weeks after the initial removal. Following the installation of the windows, the interior furring, insulation and drywall work proceeded. Individual manufacturers installed their own storm windows.

6 Testing was performed using a third party testing agency: Architectural Testing. Site representatives created a framed enclosure for the windows, which held the plastic away from the actual window. Each window was first tested with the frame in place, with plastic over the exterior face of the window. This gave the amount of infiltration through the wall assembly, excluding the infiltration through the window. Then the exterior plastic was removed, which gave the reading through the window and wall. The difference between the two tests was the amount of infiltration through the window. See test result in appendix F.

7 For the existing windows with storms, the existing window was tested closed, with the storm window open and with plastic over the exterior face of the window. Once again, this gave the amount of infiltration through the wall assembly, excluding the infiltration through the window. Then the storm was closed, and the window was tested closed. This gave the infiltration through the storm. See test result in appendix F.

8 To afford a consistent calculation of the U-value for each option, Architectural Testing generated computer simulations of every aspect of the mock-ups. These results are included in appendix F. The Marvin window was simulated with Marvin standard LoE2-272, Argon content: 90%, Spacer: Cardinal IG XL Edge stainless steel, LoE surface: #2 surface. For the purposes of the calculation of the U value for the restored window, it was simulated with the correct glazing: LoE2-272, Argon content: 90%, Spacer: Cardinal IG XL Edge stainless steel, LoE surface: #2 surface, but the spacer was modeled narrower to meet the space limitations of the existing sash. The values derived were used in the generation of the energy model. It should be noted that composition of the HSDG unit does not affect the air infiltration test results.

9 The energy model created for the LEED rating process was used in assessing the difference between the unrestored window and wall, and the window options with an upgraded wall. This process rendered values for each of the options and for the baseline. In this way, the amount of energy savings attributable to the upgraded wall could be separated from that of the upgraded window option. See appendix H.

10 For the rest of the criteria, research was done to provide the data entered under the criterion headers listed in Section III Scoring Criteria. Each criterion was discussed at length, and the observations and assessments are itemized under Section IV Discussion. Finally, stakeholders were consulted to derive the scores included in the evaluation matrix.

Section 4 Scoring Criteria

1 Criteria – Overview:

1.1 The criteria listed were developed with the input by interested parties, namely the University of Illinois at Urbana Champaign, the Capital Development Board, the Illinois Historic Preservation Agency, window industry representatives, and the architectural team.

1.2 For the purposes of this study, the stated project duration of 50 years will be used. This was the design duration that the architectural team was tasked with at the inception of the project.

2 Life Cycle Costing Criteria

2.1 Life cycle cost has three components: the cost of creating, operating and repairing an object over its lifetime. Creating involves a capital (initial) cost, operating involves energy costs, and repairing involves maintenance costs. Due to the importance of these factors, these criteria are separated out and scored separately.

3 Initial Cost Criteria

3.1 The initial cost is the cost to build the solution. For the purposes of this window study, depending on the option, the initial costs include a) the cost to remove part (or all) of the window, plus the cost to install new, or b) the cost to restore the existing window. The number of windows is based on 08 80 88 Window Schedule for Costing in Appendix I, which lists the window opening number, the type, and the size. (This spreadsheet does not include openings where the window is either restored in both options, or replaced in both options.) All estimates are based on specification section 08 01 52 Wood Window Restoration, 08 52 50 Aluminum Clad Wood Windows, and 08 58 10 Aluminum Storm Windows were used to generate estimates by the contractors noted.

3.1.1 **Opening Number one** includes the cost to scrape/abate the existing paint, paint the existing window with an oil based primer and two top coats, replace any missing hardware, supply and install the new storm, and caulk.

3.1.2 **Opening Number two** includes the cost to scrape/abate the existing paint, paint the existing window with an oil based primer and two top coats, replace any missing hardware, supply and install the new storm, and caulk.

3.1.3 **Opening Number three** includes the cost to remove the existing window, scrape/abate the existing paint on the exterior brick ledge and any interior remaining trim, supply and installation of the replacement window, and caulk. It will possibly require the temporary protection of the opening, depending on construction sequencing.

3.1.4 **Opening Number four** includes the cost to remove and salvage the existing window, scrape/abate the existing paint on the exterior brick ledge and existing frame and trim, retrofit of the existing sashes including new HSDG unit, hardware as required, reinstallation, and caulk. It will likely require the temporary protection of the opening during the restoration of the window. For full description of this scope of work, see appendix A, specification section 08 01 52.

Table 2A – Capital Contractor Costs Summary by Option, Based on 433 Like Openings

Option	Information Source	Cost	Comments
Retrofit Storm Window	Allied	$ 284,249.00	
	Monray	$ 289,600.00	
		Average	**$ 286,924.50**
Replacement Window	Building Blocks	$ 1,370,000.00	
	Huff Home Specialties	$ 1,145,386.00	
		Average	**$1,257,693.00**
Restored Window	Restoration Works, Inc	$ 1,535,000.00	
	Re-View	$ 1,174,000.00	
		Average	**$1,354,500.00**
Salvage Cost	All options	$ 0	See Appendix I

Table 2B – Capital costs per Window

In all options, there are some windows that are anomalies. The table below calculates a per-window cost for each option, based on 433 windows.

Window Average Price	Information Source	Cost	Comments
Retrofit Storm Individual Window Cost	Average Estimate:	$ 286,924.50	
	Average Cost Per storm (433 windows)	$ 662.50	$ 286,924.50 / 433
Replacement Individual Window Cost	Average Estimate:	$1,141,193.00	
	Average Cost Per New (433 windows)	$ 2,904.50	$1,257,693.00 / 433
Restored Individual Window Cost	Average Estimate:	$1,354,500.00	
	Average Cost Per Restored (433 windows)	$ 3,128.00	$1,354,500.00 / 433

Operating Cost Criteria

3.2 The operating cost is the cost of the energy to heat/cool the air that infiltrates around the window sash and frame, and the cost of the energy to replace the heat loss due to the U-Value for the window, using a consistent cost of energy. The U-value for each option was modeled using Therm5.2 and Window 5.2. The glazing types were based on the UIUC standards (see Specification Appendix A). The values from U-value modeling for Transmissivity, Emissivity, and shading coefficient were used in the Energy model. A computer energy model was used to determine the energy costs, using the eQUEST 3.60.5200 modeling program, and cost data provided by the UIUC to OWP/P for the initial LEED energy study. The 50 year costs were calculated in excel, using a 4% cost of inflation.

Table 3 - Air Infiltration test results at 1.57 psf.

1	Item	Infiltration rate	Net Difference	% Improvement over baseline window (= difference over baseline value)
2	Monray Storm Open (= baseline)	0.47 cfm/ft2		
3	Monray Storm Closed	0.26 cfm/ft2	.21 cfm/ft2	$\frac{.47 - .26}{.47} = 44\%$
4	Allied Storm Open (= baseline)	0.22 cfm/ft2		
5	Allied Storm Closed	0.03 cfm/ft2	.19 cfm/ft2	$\frac{.22 - .03}{.22} = 86\%$
6	Replacement Marvin Window	0.01 cfm/ft2	.34 cfm/ft2	$\frac{.35 - .01}{.35} = 97\%$
7	Restored Existing Window	0.12 cfm/ft2	.23 cfm/ft2	$\frac{.35 - .12}{.35} = 65\%$

Note: Baseline window is the actual reading for the window over which the storm is placed.

** Since no testing of the existing window was done prior to replacement or refurbishment, the baseline for the two refurbishment windows consists of the average of the two existing windows, or (0.47 + 0.22)/2 = 0.35.*

Table 4 - U-Value Computer model results

1	Item	U-Value - Winter	U-Value - Summer	SGHC
2	Existing (Unrestored) Window	0.865 *	0.835 *	0.667 *
3	Monray Storm w/ existing window	0.442 *	0.442 *	0.596 *
4	Allied Storm w/ existing window	0.441 *	0.440 *	0.597 *
5	Replacement Marvin Window	0.322 *	0.283 *	0.329 *
6	Restored Existing Window	0.362 *	0.3530 *	0.320 *
7	Baseline 1910 wall*	.18505946 **		
8	Upgraded 1910 wall*	.061292448 **		
9	Baseline 1928 wall*	.20405505 **		
10	Upgraded 1928 wall*	.063242333 **		

* Calculated through Architectural Testing

** Calculated through energy model

Table 5 - UIUC Power costs*

1	Energy Source	UIUC Energy Rates*
2	Electricity	$0.068/kWh
3	Steam	$ 12.04 / MBTU
4	Chilled water	$13.96 MBTU

** As provided by UIUC.*

4.1. Energy Model Study

Table 6 - Annual Operating Costs over 50 Years

Item	Energy Cost	Cost Savings over Case 5 (Isolated Window Performance)	% Improvement on entire building performance Cost Savings over Case 5	50 Year Energy Costs Savings Using 4% annual inflation
Case I Baseline Unrestored window, not-upgraded wall	$204,730.00	-$27,758.00	-15.68%	
Case 2 Window with Storm, upgraded wall	$173,541.00	$3,431.00	1.94%	$548,183.79
Case 3 Replacement window with upgraded wall	$171,880.00	$5,092.00	2.88%	$813,568.02
Case 4 Restored Window with upgraded wall	$170,395.00	$6,577.00	3.72%	$1,050,832.07
Case 5 Unrestored window w/ upgraded wall	$176,972.00	$27,758.00	0.00%	

4 Differential Durability Criteria

4.1 The concept of differential durability is the qualitative evaluation of the object that exists, compared with the object that is being considered as the replacement, and an assessment of which will last longest. While the discussion below is of this as a concept, The concept itself is quantitatively evaluated within the Life Cycle Cost analysis based on maintenance.

4.1.1 **Opening Number one** entails:

4.1.1.1 Retention of the existing first growth wood double hung window and anticipation of the longevity of it.

4.1.1.2 Addition of an aluminum storm, and its anticipated durability.

4.1.1.3 Assessment of the finish over 50 years

4.1.2 **Opening Number two** entails:

4.1.2.1 retention of the existing first growth wood double hung window and anticipation of the longevity of it.

4.1.2.2 Addition of an aluminum storm, and its anticipated durability.

4.1.2.3 Assessment of the finish over 50 years

4.1.3 **Opening Number three** entails:

4.1.3.1 removal of the existing first growth wood double hung window.

4.1.3.2 Addition of an aluminum clad third growth wood window, and anticipation of the longevity of it.

4.1.3.3 Assessment of the finish over 50 years

4.1.4 **Opening Number four** entails:

4.1.4.1 retention of an existing double hung window and anticipation of the longevity of it.

4.1.4.2 Assessment of the finish over 50 years

5 Maintenance Cost Criteria

5.1 The life cycle cost is the cost of ongoing maintenance and major repairs to the windows: ongoing cleaning, painting, pulley cord or spring replacements, plus periodic HSDG unit replacement, over the designated life duration. Note: While cleaning windows is not a University cost, it is considered here for completeness of the study. Once again, the stated project duration of 50 years was used.

5.1.1 **Opening Number one** includes cleaning of four faces of glass, periodic caulking, and perhaps occasional replacement of the hidden spring counterbalance system of the storm. There could be one paint cycle for the interior window, and at the end of 50 years, the finish on the aluminum storm would be diminished. See Appendix G.

5.1.2 **Opening Number two** includes periodic caulking. There could be one paint cycle for the interior window, and at the end of 50 years, the finish on the aluminum storm would be diminished. See Appendix G.

5.1.3 **Opening Number three** includes periodic caulking, and replacement of the HSDG unit. Depending on the model of the window, this may or may not include the sash replacement. At the end of 50 years, the finish on the aluminum cladding would be diminished. See Appendix G.

5.1.4 **Opening Number four** includes periodic caulking, and replacement of the HSDG unit. There will be 6 paint cycles for the exterior, based on painting every 8 years.

Table 7 - Maintenance Cost Calculations

Item Description Maintenance Costs	Unit of Measure	# Units	Maintenance Description	Maintenance Annual Cost, $/Unit	Escalated Cost to 2008	One Time Cost	Frequency	Comments	**Annual Cost**
Repair (cord, spring, etc.)	/wsf	16873	minor repairs	$0.13	$0.20	$3,396.55	Annually	* Means Life Cycle Costing for Facilities, 2003	**$3,396.55**
Exterior Painting	/lf	12565.2	scraping and painting	$2.00	$2.99	$12,568.16	Every 8 years	* Means Life Cycle Costing for Facilities, 2003	**$1,571.02**
Interior Painting	/lf	12565.2	scraping and varnishing	$2.00	$2.99	$25,130.33	Every 16 years	* Means Life Cycle Costing for Facilities, 2003	**$1,570.65**
Caulking	/lf	12565.2	cut out and replace	$2.11	$2.95	$37,044.59	Every 16 years	* 2006 Means bldg constr cost data 07920 line	**$2,315.29**
Access	/wsf	59175	Provide access for Painting, Caulking		$0.00	$193,305.00	Every 8 years (Caulking)	*2008 McCabe Equipement rental Champaign	**$24,163.13**
Cleaning	/wsf	16873	wash and squeegee dry	$0.29	$0.43	$16,873.45	Annually	* Means Life Cycle Costing for Facilities, 2003	**$16,873.45**
HSDG Replacement	/sf	16873	remove and replace	$25.50	$35.63	$601,183.62	2.5% over 20 years	bldg constr cost data 08800 line 2500 p274	**$751.48**

Table 8 - Maintenance Costs by Option Summary

Annual costs by Maintenance Item	**Monray**		**Allied**	**Marvin**	**Restored**
Repair (cord, spring, etc.)*	$6,793.09		$3,396.55	$3,396.55	$3,396.55
Exterior Painting	$1,571.02		$1,571.02		$1,571.02
Interior Painting	$1,570.65		$1,570.65	$1,570.65	$1,570.65
Caulking	$2,315.29		$2,315.29	$2,315.29	$2,315.29
Access	$24,163.13		$24,163.13	$24,163.13	$24,163.13
Cleaning**	$33,746.91		$33,746.91	$16,873.45	$16,873.45
HSDG Replacement	-		-	$751.48	$751.48
Total	**$70,160.08**		**$66,763.53**	**$49,070.54**	**$50,641.56**
50 year costs	**$11,209,740.61**		**$10,667,061.47**	**$7,840,184.95**	**$8,091,192.74**

*** Monray has a spring for servicing and the existing window has a pulley cord. Allied has no spring, and the existing has a pulley cord. Marvin has a spring. Existing restored has a pulley cord.**

*** There is an assumption that all four faces of the storm / window will be cleaned. This is not common practice. Further, the UIUC does not wash windows as part of their maintenance.**

6 Ease of Maintenance and Repair Criteria

6.1 This criterion encompasses the ease with which the design of the window accommodates cleaning, maintenance, and repairs. It is an attempt to discuss the aspects of the cost of maintenance and repair which cannot be reflected in the straight numbers taken from R S Means.

6.1.1 **Opening Number one** encompasses :

6.1.1.1 The ease with which the storm can be removed for cleaning the glass between the primary window (the existing window) and the secondary glazing (storm).

6.1.1.2 The ease with which the glazing can be replaced if broken.

6.1.1.3 The ease with which the spring counterbalance can be repaired if it fails.

6.1.1.4 The ease of refinishing the storm when the finish fails.

6.1.1.5 The ease of caulking replacement.

6.1.2 **Opening Number two** encompasses:
- 6.1.2.1 The ease with which the storm can be removed for cleaning the glass between the primary window (the existing window) and the secondary glazing (storm).
- 6.1.2.2 The ease with which the glazing can be replaced if broken.
- 6.1.2.3 The ease of refinishing the storm when the finish fails.
- 6.1.2.4 The ease of caulking replacement.

6.1.3 **Opening Number three** encompasses:
- 6.1.3.1 The ease to perform cyclical cleaning on the glazing.
- 6.1.3.2 The ease with which the existing HSDG unit can be repaired if the seal fails.
- 6.1.3.3 The ease with which the internal spring system to counter balance the sashes can be repaired
- 6.1.3.4 The ease of repair of water damage/rot.
- 6.1.3.5 The ease of refinishing the aluminum cladding when the finish fails.
- 6.1.3.6 The ease of caulking replacement.

6.1.4 **Opening Number four** encompasses:
- 6.1.4.1 The ease to perform cyclical cleaning on the glazing.
- 6.1.4.2 The ease with which the existing HSDG unit can be repaired if the seal fails.
- 6.1.4.3 The ease with which the pulley and cord system to counter balance the sashes can be repaired
- 6.1.4.4 The ease of repair of water damage/rot.
- 6.1.4.5 The ease of repainting when the paint fails.
- 6.1.4.6 The ease of caulking replacement.

7 Ease of Operation Criteria

7.1 This criterion entails the ease with which the sash is physically operated. A committee of stakeholders convened to operate the windows to assess this aspect. Their observations were used to input the values into the evaluation table.

7.1.1 **Opening Number one** includes the operation of the storm and the existing sash. This was evaluated by the stakeholders who physically manipulated the installed windows the score in the matrix is their assessment.

7.1.2 **Opening Number two** includes the operation of the storm and the existing sash. This was evaluated by the stakeholders who physically manipulated the installed windows the score in the matrix is their assessment.

7.1.3 **Opening Number three** includes the operation of the new window. This was evaluated by the stakeholders who physically manipulated the installed windows the score in the matrix is their assessment.

7.1.4 **Opening Number four** includes the operation of the restored window. This was evaluated by the stakeholders who physically manipulated the installed windows the score in the matrix is their assessment.

8 Historic considerations

8.1 Historic considerations include two criteria: Retention of Historic Material / Reversibility and Historic Appearance, as outlined below.

9 Retention of Historic Material / Reversibility Criteria

9.1 The concept of reversibility is a requirement of the Secretary of the Interior's Standards for rehabilitation, as adjudicated by IHPA. Any work that is done to historical fabric should be able to be undone. This criterion rates the options, noting which option retains the most historic fabric, and that entails reversible procedures.

9.1.1 **Opening Number one** retains all the historic fabric, and places a storm to the exterior, which can be removed in the future (reversed).

9.1.2 **Opening Number two** retains all the historic fabric, and places a storm to the exterior, which can be removed in the future (reversed).

9.1.3 **Opening Number three** removes most of the historic window fabric, and is not reversible.

9.1.4 **Opening Number four** retains the historic fabric except for the original glazing, and an amount of wood that is lost due to routering out the frame to accommodate a new HSGD.

10 Historical Appearance Criteria

10.1 This criterion rates the option which retains the most historical appearance, a concept which is promoted within the Secretary of the Interior's Standards for rehabilitation, as adjudicated by IHPA.

10.1.1 **Opening Number one** adds a layer of storm window that hides the historic appearance, but the number of lights and the basic configuration is retained. The interior sill and wood framework will require adjustment to the new wall system.

10.1.2 **Opening Number two** adds a layer of storm window that hides the historic appearance, but the number of lights and the basic configuration is retained. The interior sill and wood framework will require adjustment to the new wall system.

10.1.3 **Opening Number three** provides a replacement aluminum clad double hung window which replicates the historic appearance of the stile, rail, profiles, brick mold, and sash lugs and configuration. The interior sill and wood framework will require adjustment to the new wall system.

10.1.4 **Opening Number four** retains the entire historic window, and so is the most historically accurate option. The interior sill and wood framework will require adjustment to the new wall system.

11 Sustainability Criteria:

11.1 Given that this project is targeted to obtain LEED Gold Certification, it is important to consider the sustainable aspects of the decision for the windows. Discussed below is the Avoided Impact / Landfill Diversion criterion. Other aspects, such as differential durability, is discussed under and reflected in Maintenance Costs.

12 Avoided Impact / Landfill Diversion

12.1 Sustainability is comprised of a number of different components related to avoided impact/landfill diversion, and the carbon footprint. Combined, these concepts focus on reducing the amount of energy the solution requires. The individual criteria are listed below, and scored separately. This is an important criteria, given that this is a mandated LEED (Gold targeted) project.

12.2 **Avoided Impact:** All material that exists contains energy, or the amount of energy (effort) that is used during the life cycle of the commodity, including manufacturing, transporting and disposing of the commodity. This concept is embedded in the LEED criteria for MR credit 2.1, which is being pursued under the requirement to obtain a LEED gold rating for this project. Where an option expends less of this energy, it is considered an avoided impact. The best solution based on this criterion would be the one which avoids the expenditure of the most amount of energy.

12.2.1 **Opening Number one** adds a new storm window, which includes aluminum extraction, transportation of raw materials, production of the glass, manufacture of the window frames, transportation of the finished product, and installation labor of the storm window. This option has a greater impact than option 4, but has more avoided impact than Option 3.

12.2.2 **Opening Number two** adds a new storm window, which includes aluminum extraction, transportation of raw materials, production of the glass, manufacture of the window frames, transportation of the finished product, and installation labor of the storm window. This option has a greater impact than option 4, but has more avoided impact than Option 3.

12.2.3 **Opening Number three** adds a new aluminum clad wood window, which includes aluminum extraction, harvesting of forests, transportation of raw materials, production

of the glass, manufacture of the windows, transportation of the finished product, labor to demolish the existing window, installation of the new window, and transportation of the old window to the landfill/recycling facility. This has the greatest impact of all options.

12.2.4 **Opening Number four** retains the existing window. This option adds the production of the glass, the transportation of the existing sashes to the restoration workshop and back, the labor to restore the window and frame and transportation of one pane of glass to the landfill. This is the greatest avoided impact of all options.

12.3 **Diversion from Landfill:** Construction waste takes up 60% of all landfills on the planet. Construction waste is difficult to decompose, and takes up valuable land that could be used for agriculture or other development. Diverting waste from the landfill is a benefit to communities, and is a requirement to obtain the LEED point MR 2.1 for this project to obtain LEED gold status.

12.3.1 **Opening Number one** diverts all the wood and glass of the existing windows from the landfill.

12.3.2 **Opening Number two** diverts all the wood and glass of the existing windows from the landfill.

12.3.3 **Opening Number three** surpluses all the existing wood to the landfill. Under LEED gold points pursuit, the glass and wood will be separated, and will be recycled as part of the LEED requirement. For the wood to be recycled, the lead paint must be abated.

12.3.4 **Opening Number four** diverts all the wood of the existing windows from going to the landfill. The glass will be recycled as part of the LEED requirement.

12.4 **Salvage:** It was proposed for each of the first three options that the windows could be sold for salvage. While there could be a market to resell them, salvagers stated that there is not sufficient commercial value to purchase them. (See appendix I.) They would be willing to accept them for resale at no purchase price, and this could still provide landfill diversion, and save on tipping fees at the landfill. This would require an assessment of the transportation cost, the energy impact of the transportation, and the need to abate the lead paint before the wood can be salvaged, against tip fee reduction and the goodness of landfill diversion.
The glass cannot be salvaged out of the sash for re-use because it has become very brittle at this age, but it can be recycled.

13 Evaluating Criteria:

13.1 The criteria above are scored in the evaluation matrix (see section V). The scores can be assigned from a low of 0 to a high of 5, with 5 being the best. Each criterion is evaluated separately.

13.2 Based on consensus during a review meeting, the weighting of the criteria were established at Life Cycle Costing (including Ease of Operation, Ease of Maintenance and Repair, and Differential Durability) 40%, Historic Considerations 30%, and Sustainability (including landfill Diversion and Avoided Impact) 30%.

Section 5 Scoring Criteria Discussion

1 Criteria Discussion – Overview:

1.1 The criteria discussion is an area where diverse opinions are expressed, coming from the University of Illinois at Urbana Champaign, the Capital Development Board, and the architectural team. In most cases, it is attempted to note from which point of view the opinion comes.

2 Initial Cost Discussion

2.1 **Option 1 – Storm: (Openings number 1 & 2)** Direct takeoff was requested of Allied Windows. Response is included in Appendix H.
Direct takeoff was requested of Monray Windows Response is included in Appendix H.

2.2 **Option 2 – Replace (Opening #3)** Direct takeoff was requested of Building Blocks. Response is included in Appendix H.
Direct takeoff was requested of Huff Home Specialties. Response is included in Appendix H.

2.3 **Option 3 – Restore (Opening #4)** Direct takeoff was requested of Restoration Works. Response is included in Appendix H.
Direct takeoff was requested of ReView, based on their experience with the mock up. Response is included in Appendix H.

2.4 **Salvage Option**:
There is no sourced location for the surplused windows caused by Option 2 replacement to provide offset income against the initial cost. See Appendix

3 Operating Cost Discussion

3.1 To calculate the energy consumption, the energy model used for the LEED certification process was re-run for each option, using U Value, Tvis, air infiltration, and solar heat gain coefficient. The energy consumption was then multiplied by the energy cost for 2007, as provided by UIUC. These values were in turn escalated over the 50 year duration.

Table 9 - % Improvement, Based On The Option As A Percent Of The Overall Performance.

Item		% Improvement
Case 2 Window with Storm, upgraded wall		2%
Case 3 Replacement window with upgraded wall		3%
Case 4 Restored Window with upgraded wall		4%
Wall Only		14%

*The per cent improvement refers to the overall improvement to the operation of the building based on the energy model.

4 Differential Durability Discussion

4.1 The concept of differential durability is the evaluation of the object that exists, compared with the object that is being considered as the replacement.

4.1.1 Opening Number one

4.1.1.1 The exterior finish on the existing window is protected from the elements. The interior finish will require upkeep every 16 years.

4.1.1.2 The aluminum finish on the storm window will deteriorate over ten years. Per Appendix G, Monray manufacturer information indicates that there will be 5? E units of fading, 8 points of chalking, and a 10% loss of surface, based on 70% Kynar, AAMA 2605. If 50% Kynar is used, AAMA 2604, the performance would only be half that.

4.1.2 Opening Number two

4.1.2.1 The exterior finish on the existing window is protected from the elements. The interior finish will require upkeep every 16 years.

4.1.2.2 The aluminum finish on the storm window will deteriorate over ten years. Per Appendix G, Monray manufacturer information indicates that there will be 5? E units of fading, 8 points of chalking, and a 10% loss of surface, based on 70% Kynar, AAMA 2605. If 50% Kynar is used, AAMA 2604, the performance would only be half that.

4.1.3 Opening Number three

4.1.3.1 The aluminum finish on the aluminum clad window will be faded in ten years. Per Appendix G, Monray manufacturer information indicates that there will be 5? E units of fading, 8 points of chalking, and a 10% loss of surface, based on 70% Kynar, AAMA 2605. According to Valspar, "by specification, 70% Fluoropon will only have 1 tenth film loss every ten years. If the product is applied at 1.2 mils minimum, this tells you that at the very worst conditions, 4 tenths of film would still be on the aluminum substrate after 80 years." For the [purposes of this report, after 50 years, the loss would be 5/10 of the film, or down to .7 mils.

4.1.3.2 The new growth wood of the sash is not as durable as that of the existing old growth wood. See Appendix I for Forest Products' Lab recorded opinion. While it will be protected by the aluminum cladding, the "frame corner seals constructed using sealant are prone to debonding from prolonged contact with moisture, and from thermal, structural and transportation movements". This makes it more susceptible to rot. See Appendix J.

4.1.4 Opening Number four

4.1.4.1 The finish on the existing window will require upkeep every 8 years.

4.1.4.2 This first growth wood window is inherently more durable. At the end of 50 years, this first-growth lumber can still be repaired.

5 Maintenance Cost Discussion

5.1 All options have similar amounts of maintenance, such as caulking, some cyclical painting, small repairs, window washing etc. The cost data was pulled from R S Means data, which is effective to compare the overall costs for maintenance. The subtleties of the differences between the options for the cost of, for example, a counterweight replacement, will be evaluated under Ease of Maintenance Discussion. In this way, the differences can be assessed without tampering with standardized numbers.

5.2 The differences in maintenance costs among the options are as noted:

5.2.1 **Opening Number one** – Monray Storm: Due to storms operating separately from the existing windows, there is twice the number of glass faces to clean. While it is more difficult to clean, given the additional panes of glass, the cost represented is held at 2x the costs for Openings 3 & 4. This option will require interior painting on a sixteen year

cycle. Because the exterior face of the existing window is protected by the storm, it will require painting only every 16 years (versus the 8 year cycle of exposed exterior wood).

5.2.2 **Opening Number two** – Allied Storm: Due to storms operating separately from the existing windows, there is twice the number of glass faces to clean. While it is more difficult to clean, given the additional panes of glass, the cost represented is held at 2x the costs for Openings 3 & 4. Also, compared with Opening 1 – Monray, which has dual operation of the sashes, Opening 2 – Allied, has a fixed upper sash. This will add to the difficulty to clean the exterior face of the existing upper sash, but this has not been quantified. This option will require interior painting on a sixteen year cycle. Because the exterior face of the existing window is protected by the storm, it will require painting only every 16 years (versus the 8 year cycle of exposed exterior wood).

5.2.3 **Opening Number three** – Marvin Replacement: The Marvin window will require only interior painting. This has been quantified as ½ of the restored, but the fact that there is still an exterior brick shelf angle that will require painting has not been quantified. The difficulty of replacing HSDG units on the Marvin is more difficult than the restored option because it is an exterior stop, but this has not been quantified. The difficulty of replacing the balance spring on the Marvin is more difficult than the restored option because the entire double sash of the Marvin must be removed to access it, but this has not been quantified. . This option will only require interior painting on a sixteen year cycle.

5.2.4 **Opening Number four** – Restored: This option requires more painting than any other option. The interior painting is on a sixteen year cycle and the exterior painting in on an eight year cycle. The difficulty of replacing HSDG units on the restored option is simple due to the existing interior wood glass stop. The repair of a pulley cord is simple on the restored option: both sashes are brought to the midpoint and supported on a temporary support. The cord is removed simultaneous to feeding in the new cord, and requires one person.

6 Ease of Maintenance and Repair Discussion

6.1 This criterion encompasses the ease with which the design of the window accommodates cleaning, maintenance, and repairs. As noted above, all options have similar amounts of maintenance, such as caulking, some cyclical painting, small repairs, window washing etc. As opposed to the costs of the maintenance, there are subtleties in the differences between the options for the difficulty of, for example, a counterweight replacement. This will be evaluated here, to express the differences among the options, without tampering with standardized numbers.

6.1.1 **Opening Number one**

6.1.1.1 Window cleaning requires cleaning of four faces, as opposed to two for the options 3 and 4. The MonRay window has removable sashes from the interior.

6.1.1.2 The glass can be replaced on the existing window using a removable interior wood glass stop. The glass for the new storm window can be removed using the removable interior sash stop, removing the sash to the interior.

6.1.1.3 The MonRay window has a spring counter balance operation, with a screw to access and replace the spring. This repair is seldom required.

6.1.1.4 The aluminum finish on the storm window will deteriorate over ten years. Per Appendix G, Monray manufacturer information indicates that there will be 5? E units of fading, 8 points of chalking, and a 10% loss of surface, based on 70% Kynar , AAMA 2605. If 50% Kynar is used, AAMA 2604, the performance would only be half that. At the point at which the finish has deteriorated, it is possible to refinish the windows, but it cannot be done on site, and is expensive. It is UIUC's anecdotal experience that aluminum sashes last longer than 20 years.

6.1.2 **Opening Number two**

6.1.2.1 Window cleaning requires cleaning of four faces, as opposed to two for the options 3 and 4. The Allied window has a top fixed sash, which depends on the existing window being operable to clean it. Therefore the top sash of the interior existing window must be cleaned from the exterior.

6.1.2.2 The glass can be replaced on the existing window using a removable interior stop. The glass for the new storm window can be removed using the removable interior stop, removing the sash to the interior.

6.1.2.3 The Allied window has a fixed upper sash, and a non-spring balanced lower sash.

6.1.2.4 The aluminum finish on the storm window will deteriorate over ten years. Per Appendix G, Monray manufacturer information indicates that there will be 5? E units of fading, 8 points of chalking, and a 10% loss of surface, based on 70% Kynar , AAMA 2605. If 50% Kynar is used, AAMA 2604, the performance would only be half that. At the point at which the finish has deteriorated, it is possible to refinish the windows, but it cannot be done on site, and is expensive. It is UIUC's anecdotal experience that aluminum sashes last longer than 20 years.

6.1.3 **Opening Number three**

6.1.3.1 Window cleaning requires cleaning of two faces, as opposed to four for the options 1 and 2. Both sashes are operable to assist in access and a removable screen.

6.1.3.2 The glass can be replaced on the aluminum clad window using a removable exterior stop. According to the manufacturer, this is not historically the way it is done. It is usually cheaper for labor to fabricate a new sash, and change it out.

6.1.3.3 The Marvin window has a spring counter balance operation, with a screw to access and replace the spring. If the spring mechanism fails, it can be replaced using an access panel in the jamb. To access this panel, both sashes must be removed to the interior, and the spring replaced. It is a two person job, based on the size of the windows.

6.1.3.4 The aluminum frame is mechanically fastened to a third-growth wood interior sash. Should any rot occur on the wood sash, it can not be repaired as easily as an all-wood window. When the aluminum-clad wood swells, prior to full rot, it can warp and wrack, preventing its proper operation. While the all-wood sashes can still be patched using an epoxy repair or Dutchman, the repair to the new sash is complicated by the aluminum that does not repair well with traditional techniques.

6.1.3.5 The aluminum finish on the storm window will deteriorate over ten years. Per Appendix G, Monray manufacturer information indicates that there will be 5? E units of fading, 8 points of chalking, and a 10% loss of surface, based on 70% Kynar , AAMA 2605. If 50% Kynar is used, AAMA 2604, the performance would only be half that. According to Valspar, "by specification, 70% Fluoropon will only have 1 tenth film loss every ten years. If the product is applied at 1.2 mils minimum, this tells you that at the very worst conditions, 4 tenths of film would still be on the aluminum substrate after 80 years." For the [purposes of this report, after 50 years, the loss would be 5/10 of the film, or down to .7 mils. At the point at which the finish has deteriorated, it is possible to refinish the windows, but it cannot be done on site, and is expensive.

6.1.4 **Opening Number four**

6.1.4.1 Window cleaning requires deaning of two faces, as opposed to four for the options 1 and 2. Both sashes are operable to assist in access.

6.1.4.2 The HSDG unit can be replaced in the existing window using a removable interior wood stop. In UIUC's experience, this has not been done, due to the weight of the sash.

6.1.4.3 The existing window has a sash cord and pulley balance operation, with an access panel in the jamb above the lower sash to access it. To access this

panel, the top sash can be lowered, and the sash cord replaced. It is possible to perform this as a one person job, but in UIUC's operation, this has traditionally been done by two people.

6.1.4.4 The existing frame and sash is first-growth wood, but is more exposed than the clad wood of Opening three. It is more durable than third-growth wood. See Appendix J. Should any rot occur on the wood sash, it can easily be repaired.

6.1.4.5 Over the 50 year study duration, the paint finish will deteriorate and require maintenance every eight years. It is a simple operation to refinish the paint, although it does require access.

7 Ease of Operation Discussion

7.1 This section consists of evaluation of the options based on the how easy it is to raise and lower the units. The following observations were provided by the consultant:

7.1.1 **Opening Number one** - Monray Storm:

7.1.1.1 Requires the operation of the inner (unrestored) window, and then the exterior spring weighted storm. This makes it about 2x more effort to operate. The existing window unrestored will be more difficult to operate than the restored window, but this has not been quantified.

7.1.2 **Opening Number two** – Allied Storm:

7.1.2.1 Requires the operation of the inner (unrestored) window, and then the exterior spring weighted storm. This makes it about 2x more effort to operate. The existing window unrestored will be more difficult to operate than the restored window, but this has not been quantified.

7.1.3 **Opening Number three** – Marvin Window:

7.1.3.1 The Marvin window is a single unit to operate. It is a new window and operates smoothly.

7.1.4 **Opening Number four** – Restored:

7.1.4.1 The restored window is a single unit to operate. It operates as if new, and operates smoothly.

8 Historic considerations

8.1 Historic considerations include two criteria: Retention of Historic Material / Reversibility and Historic Appearance.

9 Retention of Historic Material / Reversibility Discussion

9.1 The concept of reversibility is a critical aspect of restoration and preservation work. Any work that is done to an historical object should be able to be undone, without leaving (or removing) any material permanently. This criterion rates the option that retains the most historical fabric, and that entails reversible procedures.

9.1.1 **Opening Number one** retains all the historic fabric, and places a storm to the exterior, which can be removed in the future (reversed).

9.1.2 **Opening Number two** retains all the historic fabric, and places a storm to the exterior, which can be removed in the future (reversed).

9.1.3 **Opening Number three** removes most of the historic window fabric, and is not reversible.

9.1.4 **Opening Number four** retains the historic fabric except for the original glazing. While routering out the frame is not reversible, it is a minor change, and is a widely accepted treatment to reuse windows in lieu of replacing them.

10 Historical Appearance Discussion

10.1 This criterion rates the option which retains the most historical appearance.

10.1.1 **Opening Number one** Monray Storm

10.1.1.1 Adds a layer of storm window that obscures the historic appearance.

10.1.1.2 Parting rail obscures the existing parting rail location.

10.1.1.3 In the full project, the location of the parting rail can be adjusted to minimize this effect.

10.1.1.4 The sill and interior wood framework will require adjustment to the new wall system.

10.1.1.5 Two layers of glass will reflect differently.

10.1.2 **Opening Number two** Allied Storm

10.1.2.1 Adds a layer of storm window that obscures the historic appearance.

10.1.2.2 Parting rail obscures the existing parting rail location. In the full project, the location of the parting rail can be adjusted to minimize this effect.

10.1.2.3 The sill and interior wood framework will require adjustment to the new wall system.

10.1.2.4 Two layers of glass will reflect differently.

10.1.3 **Opening Number three** Marvin Replacement Window

10.1.3.1 Replicates the historic appearance. In the experience of UIUC, the details can be well matched. From the view of a preservationist, the stile (vertical member) does not continue to the lowest point of the sash. The rail interrupts it, and a sash lug is applied to the underside of the rail, identifying it as not historic.

10.1.3.2 The sill and interior wood framework will require adjustment to the new wall system.

10.1.3.3 The HSGD unit with the double layers of glass will reflect differently.

10.1.3.4 Since the sash and frame are thicker, there is less glazing area available. The window design reduces the available glazing by 3 %,

10.1.4 **Opening Number four** Restored Window

10.1.4.1 This option claims the most historic appearance of the options from the exterior.

10.1.4.2 Double-glazing will cause different reflections to that of the original glass.

10.1.4.3 The sill and interior wood framework will require adjustment to the new wall system. The HSGD unit with a double layer of glass will reflect differently.

11 Avoided Impact Discussion

11.1 All material that exists contains an amount of energy (effort) that was required to extract raw materials from the environment, to refine raw materials, to fabricate the item from the raw materials, to transport the finished item to the job site, and the energy to install it. Avoided impact calculates the cost of energy that would be avoided if that option were not selected. The higher the energy cost, the lower the score on the option. For simplicity, while caulking is part of this energy cost, it is a consistent portion among all options and will not be calculated.

11.1.1 **Opening Number one** includes the energy of the aluminum extraction and refinement, manufacture of the glass, production of the new storm window, transportation of finished window to the jobsite, and installation labor.

11.1.2 **Opening Number two** includes the energy of the aluminum extraction and refinement, production of the glass and new storm window, transportation of finished window the jobsite, and installation labor for glass.

11.1.3 **Opening Number three** includes the energy of the aluminum extraction and refinement, production of the glass and new aluminum clad wood window, the energy of forestry, milling and kiln drying of the wood, transportation of finished window to the jobsite, and installation labor. Further, typical maintenance practices for aluminum clad wood windows are to replace the sashes in lieu of utilizing the removable stop, since is requires less labor. Therefore there is more embodied energy going to the landfill for repairs (6 1/4% over 50 years).

11.1.4 **Opening Number four** includes the embodied energy of the restoration labor, manufacture of the glass, transportation to and from the workshop, and installation labor at the jobsite.

12 Diversion from Landfill Discussion

12.1 Construction waste takes up 60% of all landfills on the planet. This construction waste is difficult to decompose, and takes up valuable land that could be used for agriculture or other development. Diverting waste from the landfill is a benefit to communities, and is a goal of LEED projects.

12.1.1 **Opening Number one** diverts all the wood and glass of the existing windows from the landfill.

12.1.2 **Opening Number two** diverts all the wood and glass from the landfill.

12.1.3 **Opening Number three** surpluses all the existing wood and glass. The glass could be recycled as part of the LEED requirement, but the wood would have to be remediated for lead paint to be recycled. Sashes can be diverted from the landfill to a window recycler, but based on their large size and simple design, there is not much demand for them, and therefore they would not be purchased. Turning over the windows to a recycler would still reduce land fill, and could reduce costs due to lower transportation and tip fees.

12.1.4 **Opening Number four** diverts all the wood of the existing windows from going to the landfill. The glass could be recycled as part of the LEED requirement.

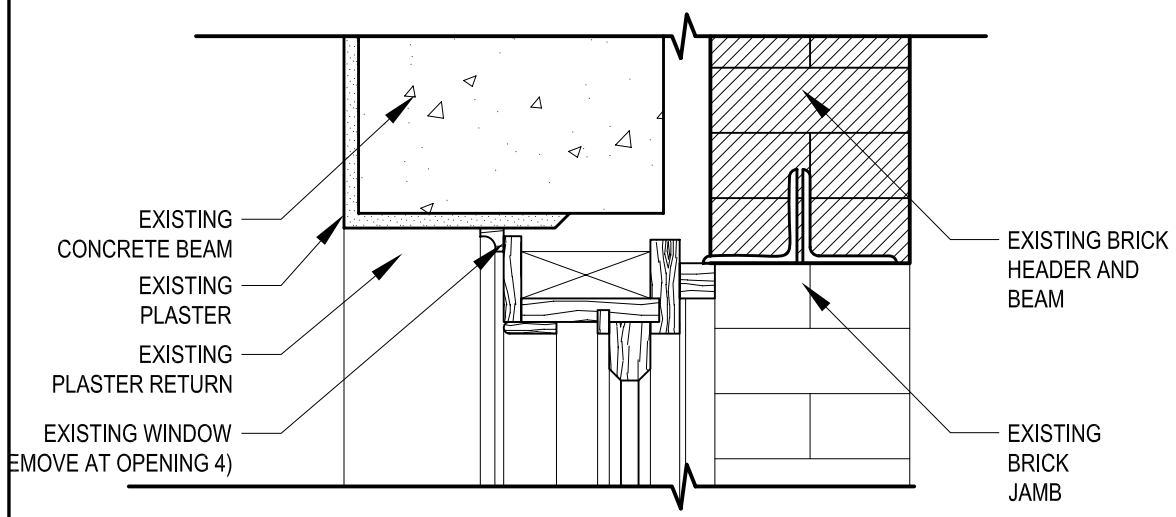
Section 6 Evaluation Matrix

12.2 Through a discussion process at a stakeholder's meeting, participants agreed to an allocation of scores at 40% Life Cycle Costing, 30% Historic Consideration, and 30% Sustainability.

Table 10 - Evaluation Matrix

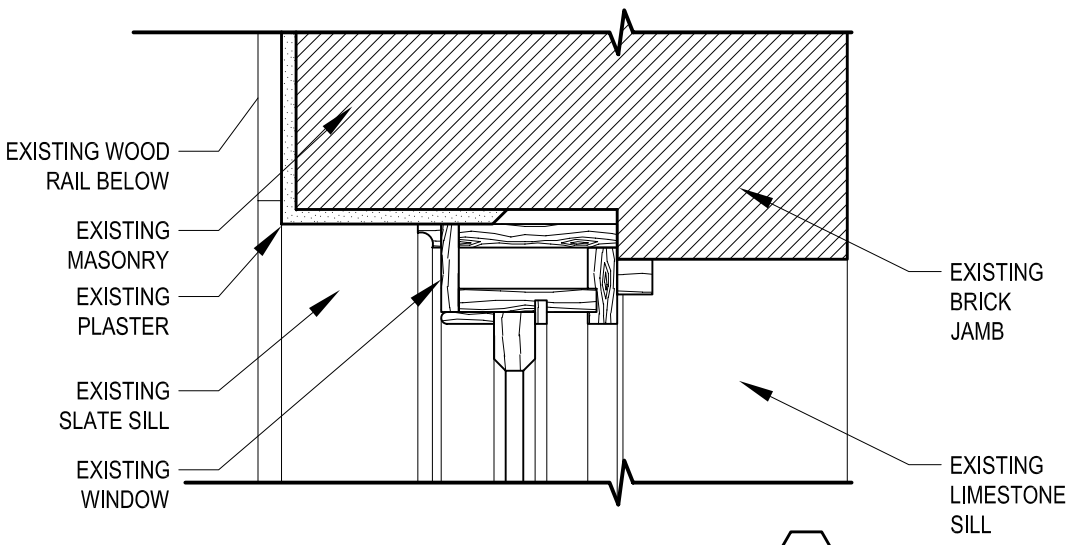
Scoring Criteria	Opening 1 Test Opening 4	Opening 2 Test Opening 3	Opening 3 Test Opening 2	Opening 4 Test Opening 1
	Existing window with Monray Storm	Existing window with Allied Storm	Marvin double hung aluminum clad window, upgraded wall	Restored window, upgraded wall
Life Cycle Cost	-	-	-	-
• Initial Cost				
• Operating Cost				
• Differential Durability				
• Maintenance Cost				
Ease of Maintenance & Repair				
Ease of Operation				
Historic Considerations:	-	-	-	-
• Retention of Historic Material / Reversibility				
• Historic Appearance				
Sustainability	-	-	-	-
• Avoided Impact / Landfill Diversion				
Total				

A Drawings and Specifications



2 EXISTING HEAD DETAIL OPENING 2

1"=1'-0"



4 EXISTING JAMB DETAIL OPENING 2

1"=1'-0"

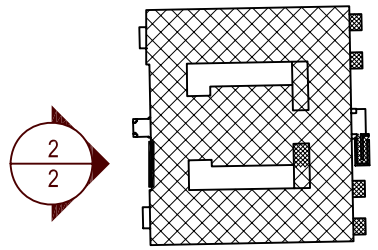
1 EXISTING WINDOW - NO WORK

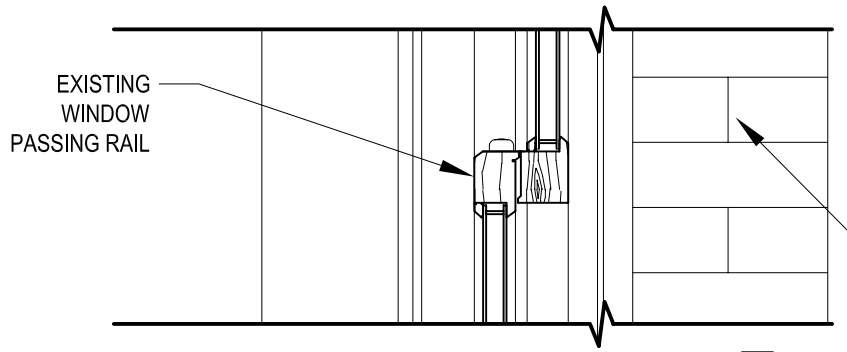
2 EXISTING WINDOW - TEST

3 REMOVE AND SALVAGE EXISTING WINDOW - NEW REPLACEMENT ALUMINUM CLAD WINDOW, TEST.

4 REMOVE AND SALVAGE EXISTING WINDOW - RESTORE AND REINSTALL, TEST.
INSTALL ALUMINUM STORM WINDOW, TEST.

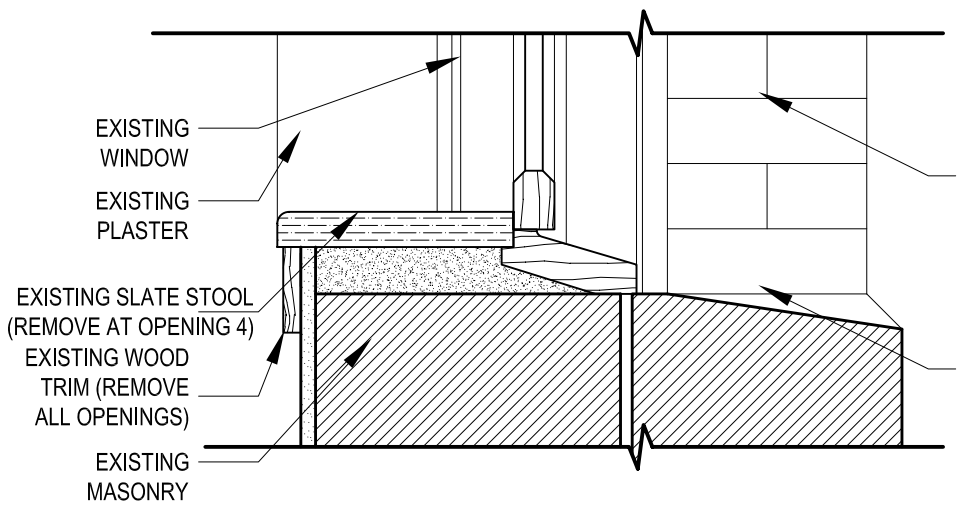
KEY PLAN





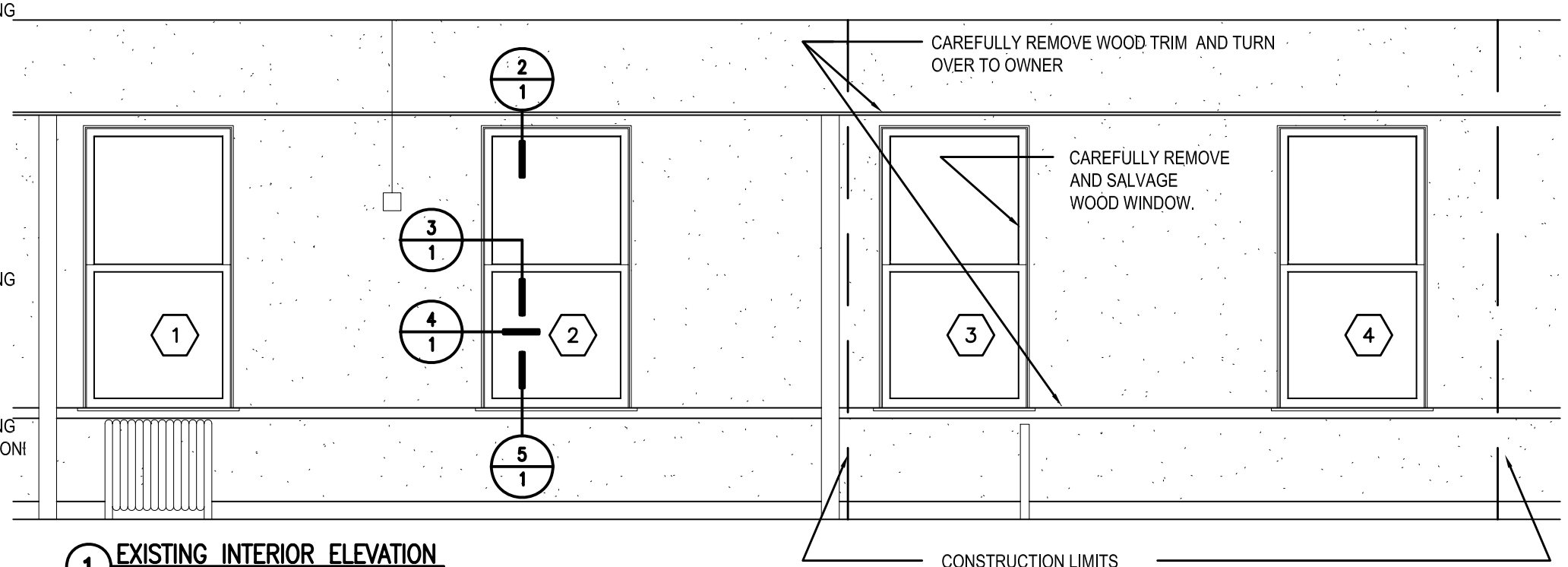
3 EXISTING PARTING RAIL DETAIL OPENING 2

1"=1'-0"



5 EXISTING SILL DETAIL OPENING 2

1"=1'-0"



1 EXISTING INTERIOR ELEVATION

1/4"=1'-0"

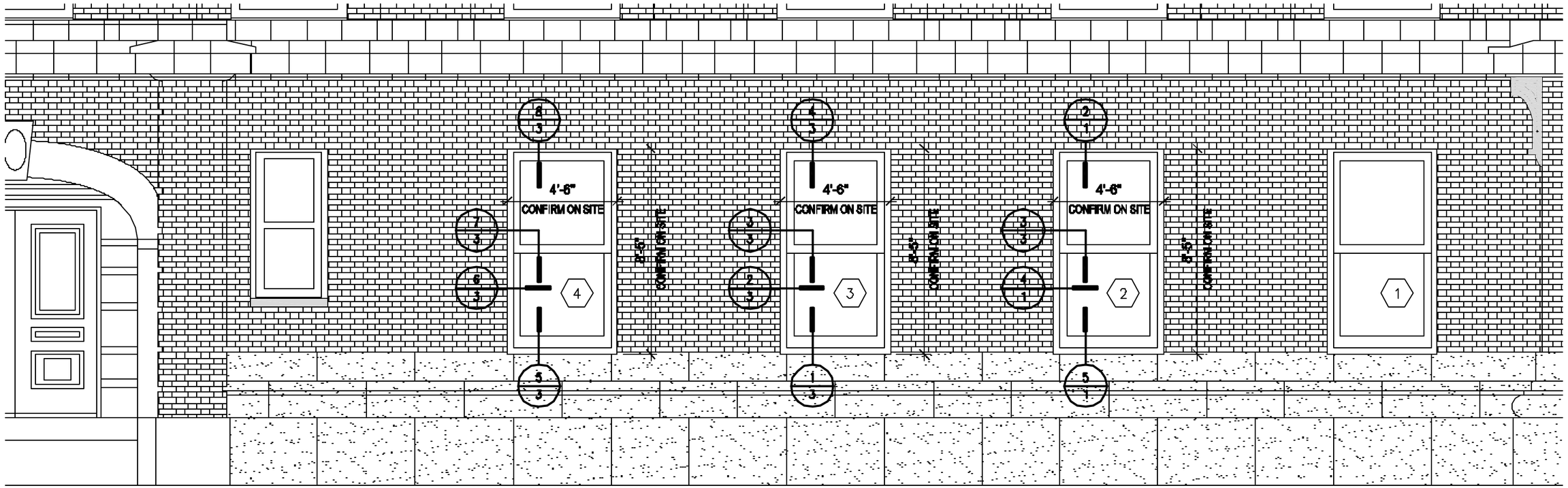
architecture
BAILEY EDWARD

WINDOW MOCK-UP

LINCOLN HALL

JANUARY 4, 2008

SHEET #: 1



2 EXTERIOR ELEVATION
1/8"-1'-0"

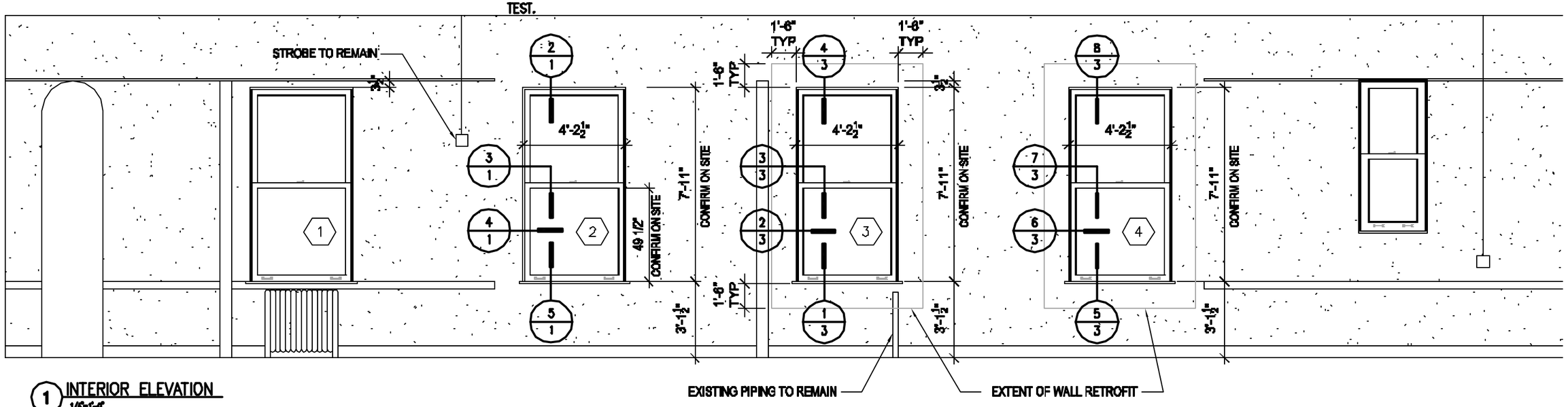
4A– RESTORE WINDOW. RETROFIT INTERIOR WALL. TEST.

4B– ADD ALUMINUM STORM WINDOW. TEST.

3– REMOVE AND SALVAGE EXISTING WINDOW. RETROFIT INTERIOR WALL. INSTALL NEW ALUMINUM CLAD WINDOW. TEST.

2– EXISTING WINDOW. NO WORK. TEST.

1– NO WORK.



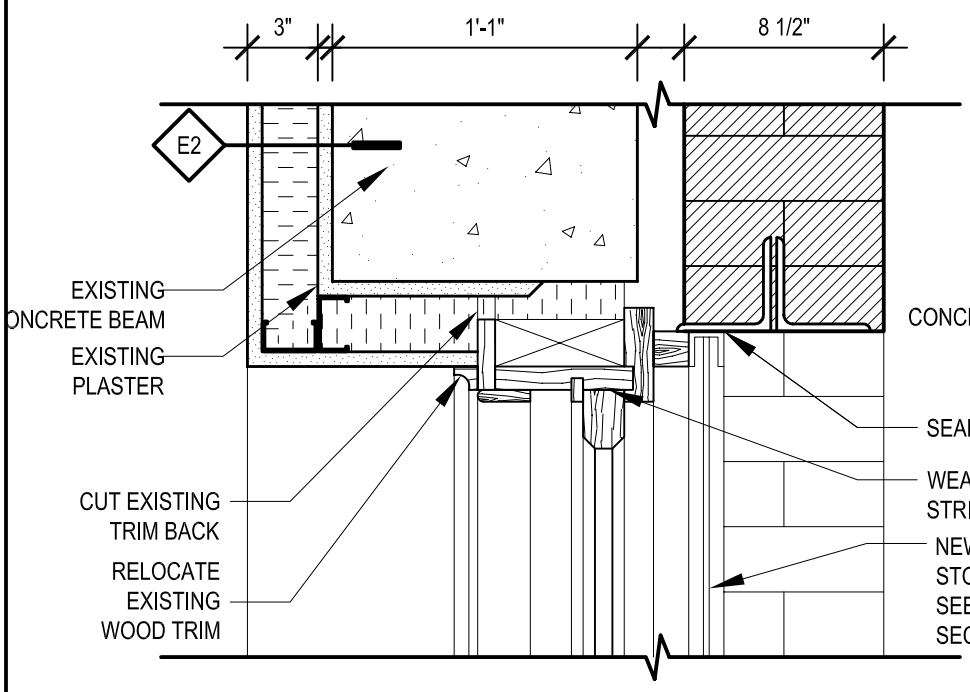
1 INTERIOR ELEVATION
1/8"-1'-0"

BAILEY EDWARD architecture

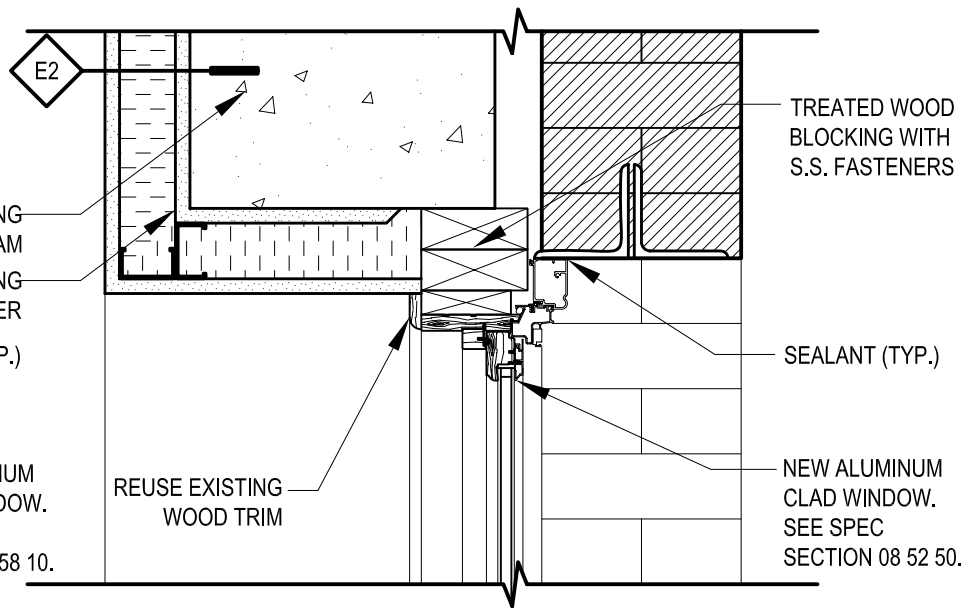
KEY PLAN

WINDOW MOCK-UP

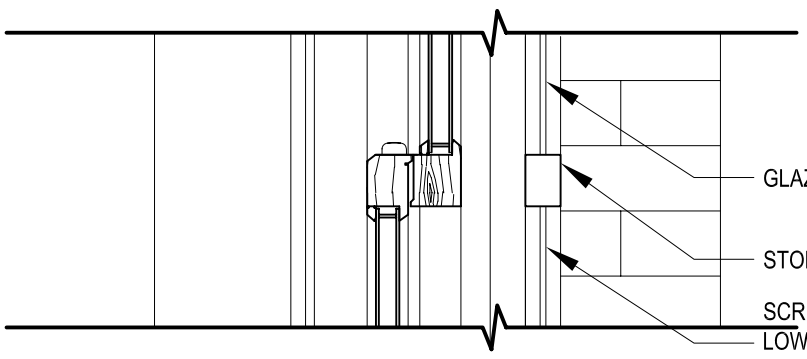
LINCOLN HALL
JANUARY 4, 2008
SHEET #: 2



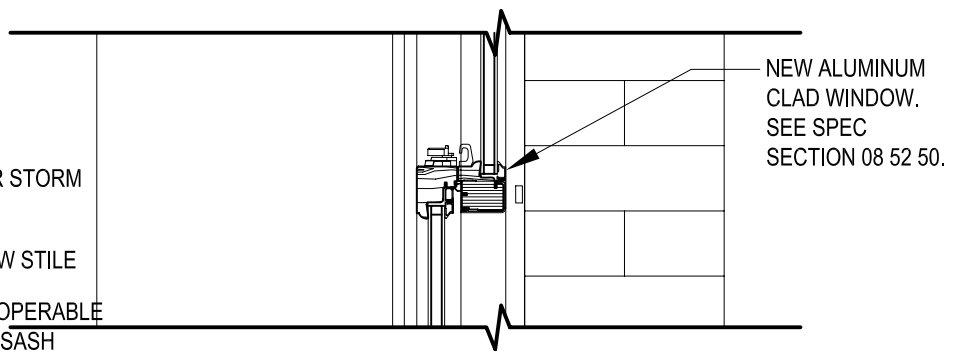
8/3 EXISTING WINDOW HEAD OPENING – RESTORED 4
1 1/2"=1'-0"



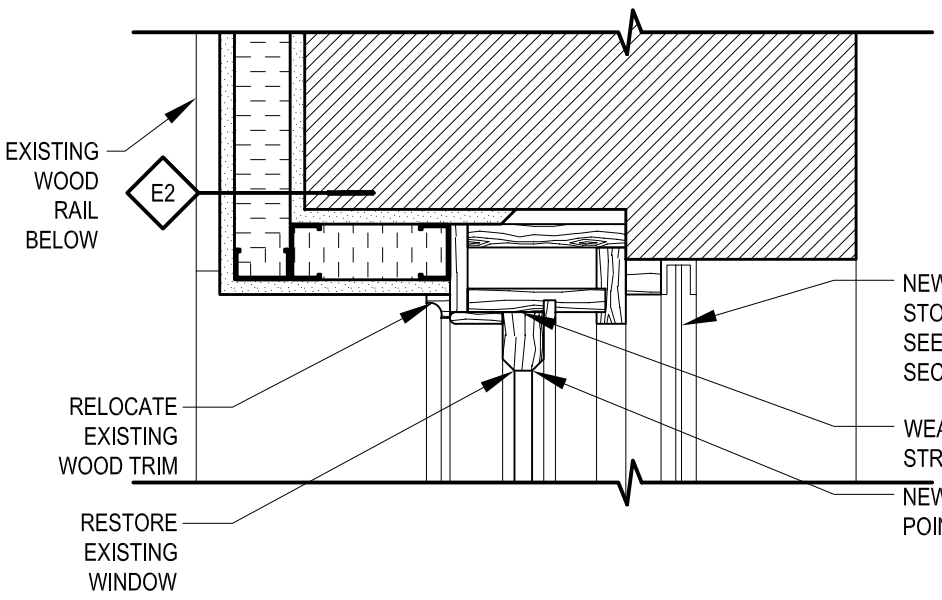
4/3 DOUBLE HUNG ALUMINUM CLAD WOOD WINDOW HEAD DETAIL OPENING 3
1 1/2"=1'-0"



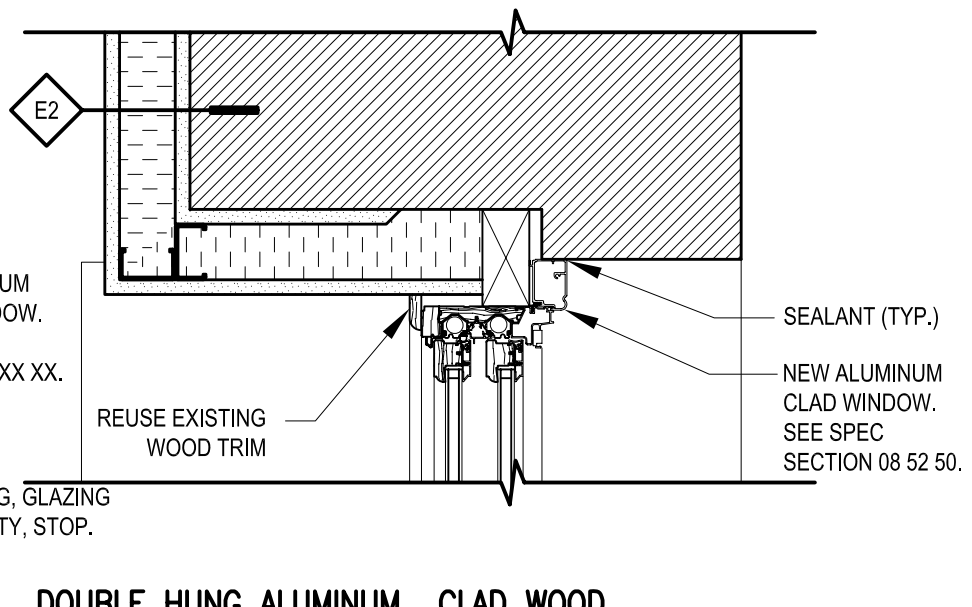
7/3 EXISTING WINDOW HEAD OPENING – RESTORED 4
1 1/2"=1'-0"



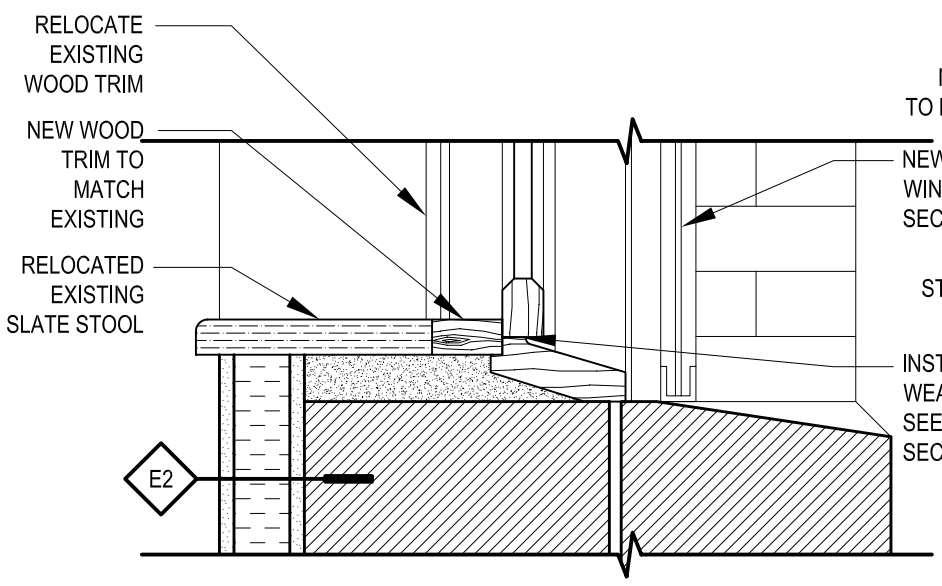
3/3 DOUBLE HUNG ALUMINUM CLAD WOOD WINDOW PARTING RAIL DETAIL OPENING 3
1 1/2"=1'-0"



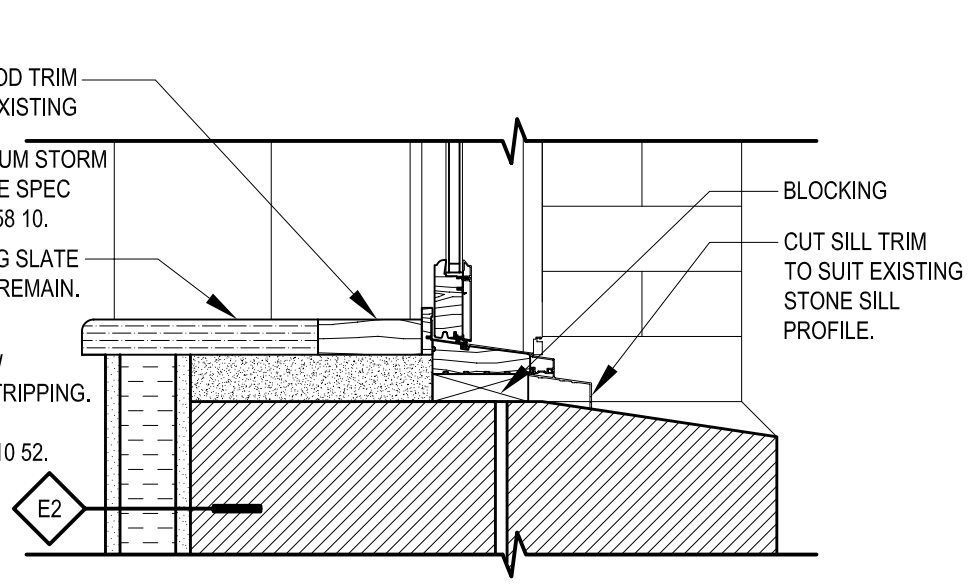
6/3 EXISTING WINDOW JAMB OPENING – RESTORED 4
1 1/2"=1'-0"



2/3 DOUBLE HUNG ALUMINUM CLAD WOOD WINDOW JAMB DETAIL OPENING 3
1 1/2"=1'-0"



5/3 EXISTING WINDOW SILL OPENING – RESTORED 4
1 1/2"=1'-0"



1/3 DOUBLE HUNG ALUMINUM CLAD WOOD WINDOW SILL DETAIL OPENING 3
1 1/2"=1'-0"

WINDOW MOCK-UP

architecture
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E2 5/8" GWB
1 5/8" METAL STUDS
EXPANDING FOAM INSULATION

LINCOLN HALL
JANUARY 4, 2008
SHEET #: 3

PART 1 – GENERAL

1.1 This Section includes opening number 4 as shown on Drawing 2.

A. Base Bid: General Contractor to Provide:
1. Removal of existing window and boarding up of existing window opening.
2. Installation of gypsum wall board systems.

B. Base Bid: Wood Restoration / Window Restoration Contractor to Provide:
1. Restoration of one existing window, including double glazed unit retrofit.
2. Installation of one existing restored window.

1.1 RELATED WORK

C. Specified elsewhere:

1. 06 10 53 Carpentry

2. 08 58 10 Storm Window

3. 09 29 00 Gypsum Board Systems

1.5 DELIVERY, STORAGE, & HANDLING

A. Store windows in a dry location, under cover, and protected from the weather.

1.6 PROJECT CONDITIONS

A. Protection: Use all necessary means to protect interior of building from all damage caused by precipitation and other environmental conditions during work of the Section.

B. Safety: The Owner has had glazing putty on the existing frames tested, and has found that existing glazing compound contains 20% asbestos. Take all necessary precautions to ensure health and safety of all persons engaged in removing and disposing of paint or other substances containing lead or asbestos and handle and dispose of all residues generated from removal to avoid contamination of buildings, soils, bodies of water, water table atmosphere, and other environmental elements and in compliance with all applicable laws and regulations.

1.7 QUALITY ASSURANCE

A. Glazing Standards: Comply with recommendations of GANA's "Glazing Manual" and "Sealant Manual," unless more stringent requirements are indicated.

B. Tempered Glass Certification Program: Provide tempered glass units permanently marked on spacers or at least on one component pane of units with the appropriate certification label of the inspecting agency indicated below:
1. Certification of Tempered Glass

C. Acceptable Restoration Contractors:
   1. Re-View
      1235 Saline Street
      North Kansas City, MO 64116

1.8 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run Concurrent with, other warranties made by the Contractor under requirement of the Contract Documents.

B. Special Warranty: Submit a written warranty, executed by restoration contractor, agreeing to repair or replace components that fail in materials or for a period of two years. Failures include, but are not limited to, the following:
   1. Structural failures, including excessive deflection, water leakage, air infiltration, or condensation.
   2. Faulty operation of doors.
   3. Deterioration of finishes and other materials beyond normal weathering.

C. Warranty Period for Insulating Glass: Ten years from date of Project Completion.

D. Warranty Period for general materials and workmanship is one year.

PART 2 – PRODUCTS

2.1 MANUFACTURERS / RESTORATION CONTRACTORS

A. Available manufacturers: Subject to compliance with requirements. Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Replacement Window / Sash parts or frames:
      a. Re-View - North Kansas City, MO

   2. Wood Consolidant:

      a. Liquid Wood by Abatron, Inc.
      b. Flexible Epoxy Consolidant by Conserve Epoxy
      c. PRG-JP-146 by PRG Inc. Rockville MD.

   3. Structural Adhesive Putty:

      a. Wood Epoxy by Abatron, Inc.
      b. Flex-Tech HV by Advanced Repair Technologies
      c. PRG-JP-146 by PRG Inc. Rockville MD

2.2 MATERIALS

A. General: Comply with NWWDA I.S. 2.

B. Windows:

1. Stile and Rail replacements parts shall be milled from clear western pine. Thickness shall be to match existing dimensions, kiln dried to a moisture content of 6- 12% at the time of fabrication and treated with a water repellent preservative in accordance with ANSI/NWWDA I.S.4. Window corners shall be mortised and tenoned and nailed.

2. All profiles shall be Custom profiles to match existing.

4. Finish:

a. Exterior: Two coat of oil based stain blocker primer. Two coats of acrylic latex satin finish.

b. Interior: Two coats of oil based stain. Varnish finish.

2.3 GLAZING

A. General: Insulating glass assembled as directed by the door manufacturer in compliance with IGCC class CBA, tested in accordance with ASTM E774. Provide units with a dual seal. Glass Types: Low profile with low profile IG spacer.
   1. Glass specification:
      a. Thickness of each Lite: 1/8”
      b. Glass: LoE2-272, LoE surface: #2 surface
      c. Spacer: Cardinal IG XL Edge stainless steel,.
   2. Air Space Width: 3/8” Argon content: 90%

B. Glazing Method:
   1. Insulating glass.

C. Glazing Compound: Organic blend of soya, linseed and mineral oil; knife grade compound for face glazing of door transoms. Products:
   1. ‘33’ Glazing; DAP, Inc.

2.4 HARDWARE

A. Replacement Hardware: Provide new hardware to match existing original hardware as close as possible.

B Restoration of Existing Hardware: Bead blast existing hardware to original metal substrate. Provide clear coat protective coating.

2.5 ACCESSORIES

A. Wood Consolidant: Liquid two (2) part system consisting of resin and hardener used to restore and reinforce wood by impregnation with resin that hardens after penetrating. Consolidant shall impregnate the wood fibers and harden into a water-resistant, distortion-free, high-strength mass capable of being sawed, planed, routed, carved, drilled, sanded, glued, and painted.

B. Structural Adhesive Putty: A light adhesive putty system consisting of two (2) components: resin paste and hardener paste. After mixing, blend should harden into a lighter-than-water, non-shrinking, tough adhesive mass with high dimensional stability, chemical, water, heat and weather resistance. Shall have no-slump paste consistency.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine opening before installation. Verify that window opening is square. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Masonry surfaces shall be dry and free of construction debris.

2. Wood frame walls shall be dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (75mm) of corner.

3. Coordinate window installation with wall flashings and other built-in components.

3.2 REFURBISH EXISTING WINDOW:

A. Strip and remove all paint from existing window.
B. Apply waterproof urethane glue to all joints with a hypodermic needle. Square each frame.
C. Replace deteriorated components with identical wood species for those components such as rails or stiles.
D. Use Wood Consolidant and Structural Adhesive Putty on exterior surfaces to repair checks, gouges, and cracks in original wood material.
E. Use wood putty to match interior finish or stain for repairing checks, gouges, or cracks on interior surfaces.
F. Glaze the sash with ½" insulated glass. Glaze tempered insulated glass in a bed of silicone. Apply silicone to wood glazing bead (species to match existing) milled to match the slope of the existing glazing putty. Fix glazing bead into position with mechanical fasteners.

3.5 ADJUSTING

A. Adjust operating panel and hardware to provide a tight fit at contact points and weather stripping for smooth operation and a weather-tight closure. Lubricate hardware and moving parts.

3.6 CLEANING

A. Clean exterior surfaces immediately after installation. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealants, dirt, and other substances.

B. Clean glass of factory-glazed units immediately after installing windows. Wash and polish glass on both faces before Project Completion. Comply with manufacturer's recommendations for final cleaning and maintenance. Remove nonpermanent labels from glass surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08 01 52

PART 1 GENERAL

1.01 SECTION INCLUDES

A. BASE BID: Window restoration contractor shall install window provided for opening number 2. Aluminum-clad wood double hung windows complete with hardware, glazing, weather strip, insect screen, jamb extensions, with anchors, trim, attachments, and accessories provided by others. Window restoration contractor to provide all additional and miscellaneous extensions, blocking, stops and trim as needed for a complete replacement project.

1.02 RELATED DOCUMENTS

A. SECTION 01 54 00 Construction Aids

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. E 283: Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
   2. E 330: Standard Test Method for Structural Performance of Exterior Windows, Curtains Walls, and Doors by Uniform Static Air Pressure Difference.
   3. E 547: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
   4. E 774: Specification for Sealed Insulated Glass Units.
   5. C 1036: Standard Specification for Flat Glass.

B. WDMA I.S.4: Industry Standard for Water Repellent Preservative Treatment for Millwork.

C. American Architectural Manufactures Association / Window and Door Manufactures Association (AAMA / WDMA): ANSI / AAMA / NWWDA 101 / I.S.2-97 Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors. and 101 / I.S.2 / NAFS-02 Voluntary Performance Specification for Windows, Skylights and Glass Doors:

D. Window and Door Manufacturers Association (WMDA): 101 / I.S.2 WDMA Hallmark Certification Program.

E. Sealed Insulating Glass Manufactures Association / Insulating Glass Certification Council (SIGMA / IGCC).

F. American Architectural Manufacturers Association (AAMA): 2605: Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

G. National Fenestration Rating Council (NFRC): 101: Procedure for Determining Fenestration Product Thermal Properties.

1.04 DESIGN AND PERFORMANCE REQUIREMENTS:

A. Definitions
   1. H-C: Hung Commercial

   2. Performance grade number, included as part of the AAMA/NWWDA product designation code, is actual design pressure in pounds force per square foot (pascals) used to determine structural test pressure and water test pressure.

3. Structural test pressure, for uniform load structural test, is equivalent to 150 percent of design pressure.

4. Minimum test size is smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

B. General: Provide wood windows capable to match or exceed test results dated with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below.

1. Minimum size required by AAMA/NWWDA 101/I.S.2.

C. AAMA/NWWDA Performance Requirements: Provide wood windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.

1. Performance Class: HC
2. Performance Grade: 30.

D. Structural Performance: Provide wood windows capable of withstanding positive and negative pressures of 45 psf, acting normal to the plane of the window. Structural tests shall be conducted in accordance with ASTM E 330.

1. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or ¾ inch (19 mm), whichever is less, at design pressure based on structural computations.

E. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.

1. Maximum Rate: 0.3 cfm/sq. ft (5 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft (300 Pa).

F. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure of 6.24 psf, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.

1. Test Pressure: 15 Percent of positive design pressure, but not less than 2.86 lbf/sq. ft (140 Pa) or more than 12 lbf/sq. ft (580 Pa).

G. Double Hung windows: Comply with requirements of AAMA/NWWDA 101/I.S.2.

1.05 DELIVERY

A. Deliver in original packaging and protect from weather.

1.06 STORAGE AND HANDLING

A. Store window units in an upright position in a clean and dry storage area above ground and protect from weather under provisions of Section 01620.

1.09 WARRANTY

A. Windows shall be warranted to be free from defects in manufacturing, materials, and workmanship for a period of ten (10) years from purchase date.

B. Insulating glass shall be warranted against visible obstruction thru the glass caused by a failure of the insulating glass air seal for a period of twenty (20) years from the date of original purchase.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Description: Clad double hung, windows as manufactured by:
   1. Ultimate Magnum, Marvin Windows and Doors, Warroad, Minnesota.

2.02 ALUMINUM CLAD WOOD WINDOW MATERIALS

A. Frame: clear vertical grain douglas fir or douglas fir finger jointed core with clear vertical grain douglas fir veneer; Finger jointed clear sill. Kiln dried to a moisture content no greater than twelve (12) percent at the time of fabrication. Water repellent preservative treated in accordance with WDMA I.S.4. Exterior extruded aluminum clad 0.050 inch (1.27 mm) thick minimum. Finger jointed wood is only allowed on non-visible parts.

B. Aluminum Extrusions and Rolled Aluminum for Cladding: Manufacturer's standard formed sheet or extruded-aluminum cladding, mechanically bonded to exterior exposed wood members. Provide aluminum alloy and temper recommended by wood window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000 psi (150-MPa) ultimate tensile strength, and not less than 16,000-psi (110-MPa) minimum yield strength.

C. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   2. High-Performance Organic Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating: Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers written instructions.
      a. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2005.
      b) Color and Gloss: Match Architect's sample.

D. Glazing: Select quality complying with ASTM C 1036. Insulating glass SIGMA/IGCC certified to performance level CBA when tested in accordance with ASTM E 774.
   1. Glazing method: Insulated glass
   2. Glass Types:
      a. Marvin standard LoE2-272, LoE surface: #2 surface.
   3. Spacer: Cardinal IG XL Edge stainless steel, Argon content: 90%

4. Glazing seal: Silicone bedding on interior; acrylic foam adhesive tape on exterior.

E. Finish:
1. Exterior: Aluminum clad. Fluoropolymer modified acrylic topcoat applied over primer. Meets or exceeds AAMA 2605 requirements. All brick molds and loose exterior trim to be finished to match.
2. Interior: Stained finish to match existing at stained finish locations.

F. Hardware:
1. Double Hung window unit:
   a. Balance system: shall be spiral spring or coil spring block and tackle with nylon cord and fiber filled nylon clutch. Meets or exceeds AAMA 902 requirements.
   b. Jamb carrier: shall be vinyl extrusion with wood and aluminum inserts. Color: Beige.
   c. Sash lifts: Reuse existing, two lifts per sash.

G. Weather-strip:
1. Double Hung and Single Hung window units:
   a. Continuous leaf weather strip at head jamb parting stop; foam filled bulb weather-strip at check rail; foam filled bulb weather strip along vertical sash edge; bulb weather-strip at bottom rail. Color: Beige.

H. Jamb Extension: Field installed jamb extension for wall thickness indicated or required. Finish: Match interior finish.

I. Insect Screens: Factory installed full screen over lower sash. Screen cloth, 18 by 16 mesh: Charcoal aluminum wire. Aluminum frame finish: Custom color to match rest of window.

2.03 ACCESSORIES AND TRIM

A. Installation Accessories:
1. Exterior Lugs: provide removable exterior sash lugs to match existing. Sash lugs shall be mounted such that there is no visible gap between the edge of the lug and the edge of the jamb.

B. Aluminum Extrusions:
1. Profile: Brick mold casing, flat casing, various special casings and stops, custom casing, Frame expander, Jamb extender, Mullion cover, Mullion expander, as indicated on drawings. Finish: Fluoropolymer modified acrylic topcoat applied over primer. Meets or exceeds AAMA 2605 requirements. Custom color to match rest of window components.

C. Wood Blocking and Trim:
1. Provide all additional and miscellaneous extensions, exterior lugs, blocking, stops and trim as needed for a complete replacement project.
2. For all finish wood trim and casings match original profile
3. Match finish of interior sash.

2.04 ELASTOMERIC JOINT SEALANT
A. One-Part Silicone Sealant (1-SCS): Low-Modulus Nonacid-Curing Silicone Sealant : For joints between brickmold and masonry.

B. Products: Provide one of the following :
   a. 790; Dow Corning.
   b. Silpruf; GE Silicones.
   c. Omniseal; Sonneborn Building Products Div., Degussa.
C. Type and Grade: S (single component) and NS (nonsag).
D. Class: 25.
E. Additional Movement Capability: 50 percent movement in extension and 50 percent movement in compression for a total of 100 percent movement.
F. Use Related to Exposure: NT (non-traffic).
G. Stain-Test-Response Characteristics: Non-staining to porous substrates per ASTM C 1248.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; and other conditions affecting performance of work.

   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets for weathertight construction.

D. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contract with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 10.1/I.S.2

E. Install sealant and related backing materials where indicated or required by the window manufacturer within the window assembly, and at the perimeter of the assembly.

F. Leave window units closed and locked.

G. Provide exterior window trim at wall louver, as indicated.

3.3 ADJUSTING

A. Adjust operating sashes, screens, hardware, and accessories for a tight fir at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.4 PROTECTION AND CLEANING

A. Protect window surfaces from contract with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

3.5 FIELD TESTING

A. Windows shall be field-tested by architectural testing.

END OF SECTION 08 52 50

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Base Bid:

1. Wood Window Restoration Contractor to install storm window.

2. Removable single hung storm window with screen, for exterior application to be supplied by Allied Windows.

B. RELATED SECTIONS

1. Section 07 92 00 - Sealants.

2. Section 08 01 52 –Wood Window Resotation

C. REFERENCES

1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 1998.

2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels; 1998.

D. SUBMITTALS

1. Procedures: Furnish submittals in accordance with general requirements specified in Section 01 33 23 – Shop Drawings, Product Data and Samples. All submittals shall be made to the Architect.

2. Product Data: Manufacturer's data sheets for specified products showing compliance with specified requirements; include installation instructions.

3. Shop Drawings: Show dimensions, layout, profiles and product components; details of anchoring and fastening; sealants and weatherstripping; and recorded field measurements.

4. Finish Samples: Submit color samples, for approval by Architect, that represent the allowable range of finish established from production material specified.

5. Component Samples: If requested by Architect, submit samples of anchors, fasteners, hardware, assembled corner sections and other materials and components.

6. Operation and Maintenance Data: Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

7. Executed warranty documents specified.

E. DELIVERY, STORAGE AND HANDLING

1. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

2. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

3. Store inside, if possible, in a clean, well-drained area free of dust and corrosive fumes.

   a. Stack vertically or on edge so that water cannot accumulate on or within materials. Use non-staining wood or plastic shims between components to provide water drainage and air circulation.

   b. Cover materials with tarpaulins or plastic hung on frames to provide air circulation.

   c. Keep water away from stored assemblies.

F. WARRANTY

1. Manufacturer's Warranty: Submit manufacturer's standard warranty document executed by authorized company official, against defects in materials and workmanship for period of 5 years from the date of Substantial Completion. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

2. PRODUCTS

A. MANUFACTURER

1. Acceptable Manufacturers:

   a. Allied Window, Inc., www.alliedwindow.com 800-445-5411

      i. Product Type 1: Allied One-Lite AOL-A with invisible clips.

   b. MonRay Window, Inc., www.monray.com 800-544-3646

      i. Product Type 1: Monray Exterior Storm Windows.

B. STORM WINDOWS

1. Storm Windows - General: Provide units that fit existing windows without gaps of more than 1/8 inch (3 mm) in each unit.

   c. Verify actual measurements of openings by field measurement before fabrication; show recorded measurements on shop drawings.

   d. Allow for out-of-square and irregular conditions.

   e. Verify frame and sill conditions of each opening before fabrication; provide appropriate fabrication details to suit existing conditions.

3. Removable Panel Storm Windows: Exterior mounted, aluminum framed removable panel(s) in aluminum master frame; panels removable to interior, without hardware on outside; Allied Window Historic One Lite (HOL).
   a. Frame and Sash Sightline: 2-1/8 inch (54 mm) maximum.
   b. Frame Thickness: 3/8 inch (9.5 mm).
   c. Style: Fixed top panel and operable bottom sash with exterior half screen, in aluminum master frame, with glass/screen assembly removable to interior; 1/2 inch (12.7 mm) build-out to ensure adequate spacing for operation of prime window upper sash; operable bottom sash with heavy duty spring loaded latches

that engage at multiple sash positions for ventilation and full width bottom rail lift handle.

d. Removable Panels: Easily removable, held in place with cam-action clips providing positive seal between master frame and panel frame; with full width bottom rail lift handle.

C. COMPONENTS

1. Master Frame and Panel and Sash Frame Members: Extruded aluminum with wall thickness not less than 0.062 inches (1.6 mm); miter corners and join with corner keys.

a. Aluminum: 6063-T5 alloy and temper with minimum ultimate strength of 22,000 psi (152 MPa) and yield strength of 16,000 psi (110 MPa).

b. Corner Keys: Extruded aluminum.

c. Sill Expander: Where necessary to fit existing sloping sill, provide H-shaped member below master frame with weep holes.

d. Finish: Manufacturer's paint finish Fluoropolymer; 70 percent Kynar 500 or Hylar 5000 resin coating complying with AAMA 2604; custom color to match historic color.

4. Screens: Extruded aluminum frame of same type of construction and finish as panel frames; screen cloth held in place with vinyl splines.
   a. Frame Dimensions: 3/8 inch (9.5 mm) thick by 1-1/16 inches (27 mm) wide.
   b. Screen Cloth: Aluminum wire, 18 by 16 mesh; charcoal color.

5. Fasteners: Zinc plated, cadmium plated or other non-corrosive metal compatible with aluminum.

6. Hardware: Nylon or zinc die-cast.

7. Type: Annealed float glass with Low-E pyrolytic hard coating.
   a. Thickness: 1/8 inch (3 mm).

8. Glazing Gaskets: Removable and reusable virgin vinyl glazing splines with neatly mitered corners.

9. Weatherstripping: Pile type for operating units. Tracks lined with Stan-pro number 525-160, with Schlegel number 301-2432-500 at meeting rail.

3. EXECUTION

A. EXAMINATION

1. Verify that openings are within allowable dimensional tolerances, plumb, level, and clean, provide solid anchoring surface, and are in accordance with approved shop drawings.

2. Do not install windows until unsatisfactory conditions are corrected.

B. INSTALLATION

1. Install in accordance with manufacturer's instructions, including product data, technical bulletins, catalog installation instructions, and carton instructions.

2. Install storm windows straight, plumb and level, securely fastened, and without distortion.

3. Adjust as required for proper operation of operable units.

C. PROTECTION

1. Protect installed products until completion of project.

2. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

B Existing Windows Photographs

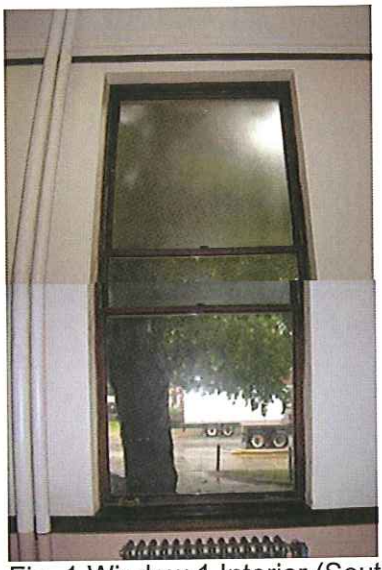


Fig. 1 Window 1 Interior (South)

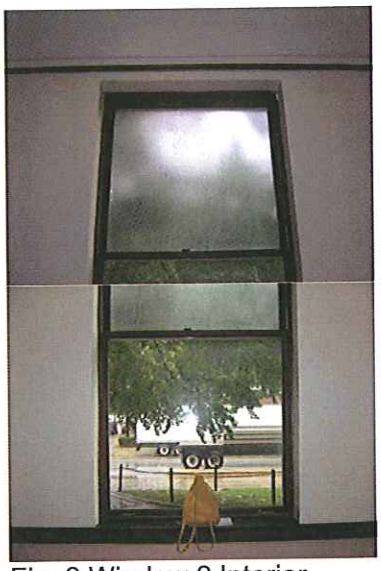


Fig. 2 Window 2 Interior

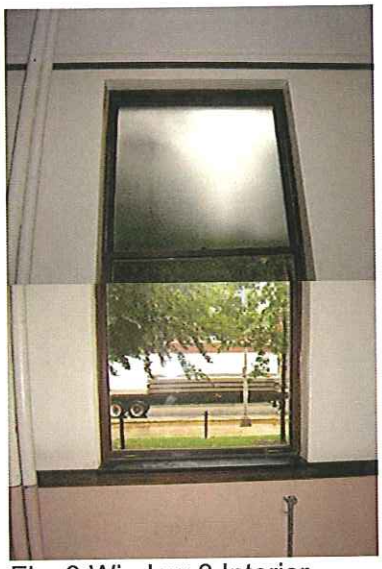


Fig. 3 Window 3 Interior

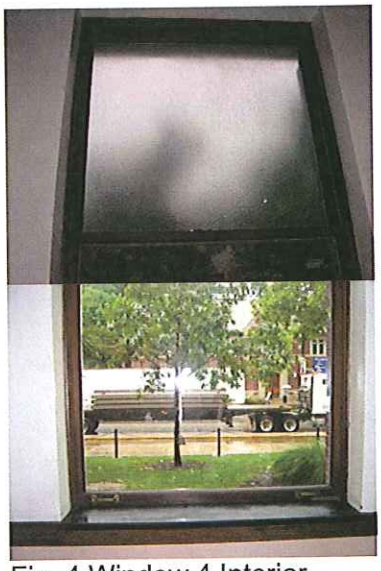


Fig. 4 Window 4 Interior

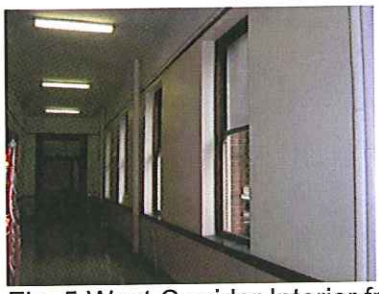


Fig. 5 West Corridor Interior from the North

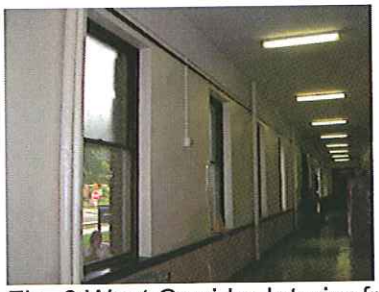


Fig. 6 West Corridor Interior from the South

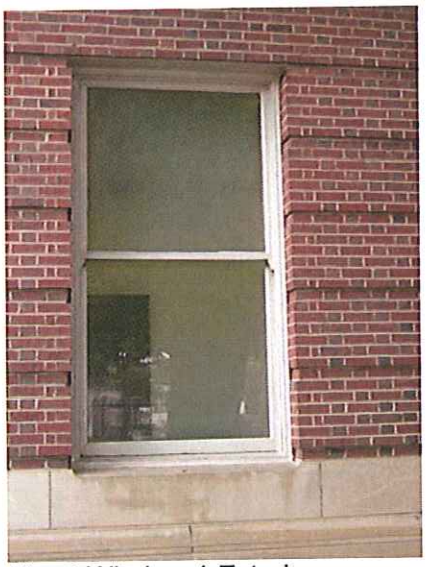


Fig. 7 Window 1 Exterior

Figure 8 Window 2 Exterior

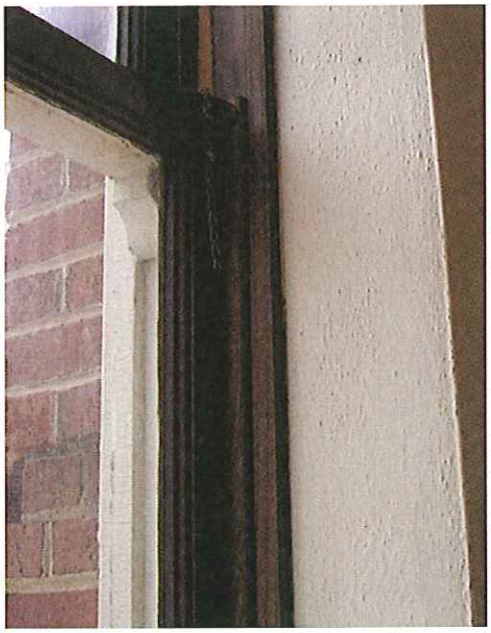
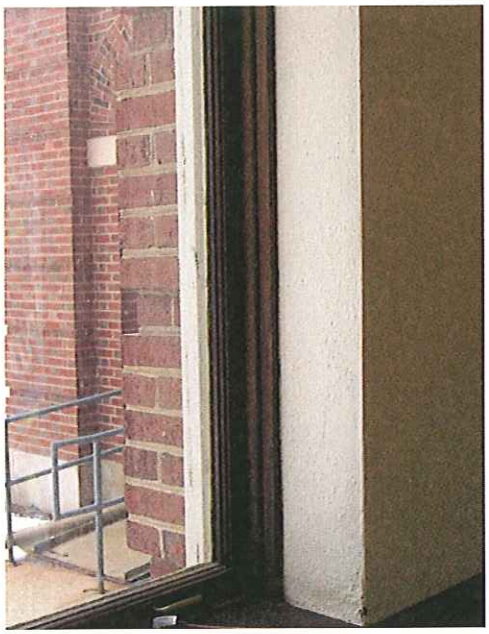
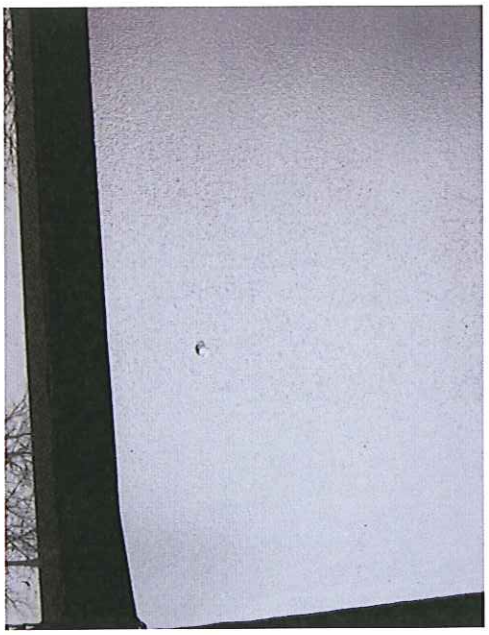
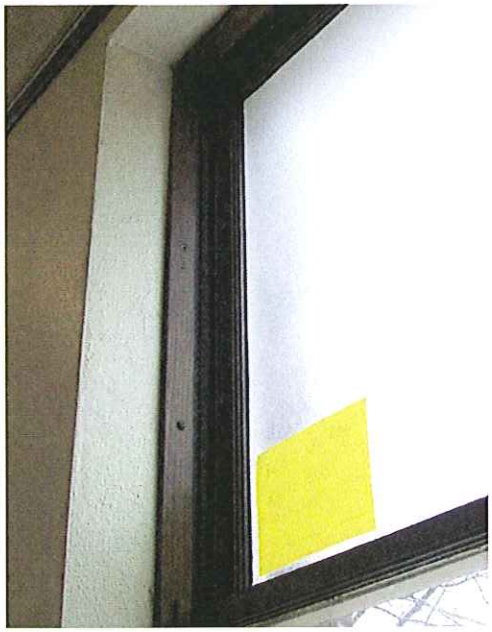
Fig. 9 Window 3 Exterior

Fig 10 Window 4 Exterior

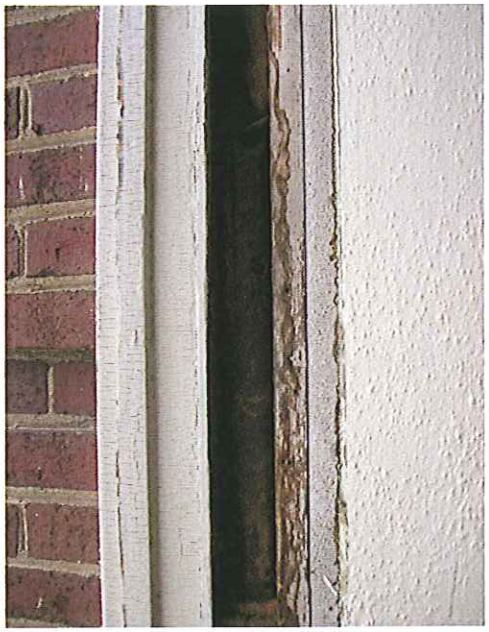
Fig. 11 Windows from the north - Exterior

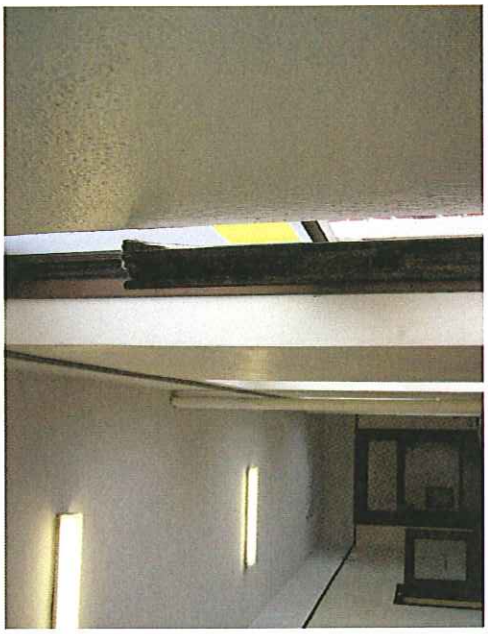
Section 7

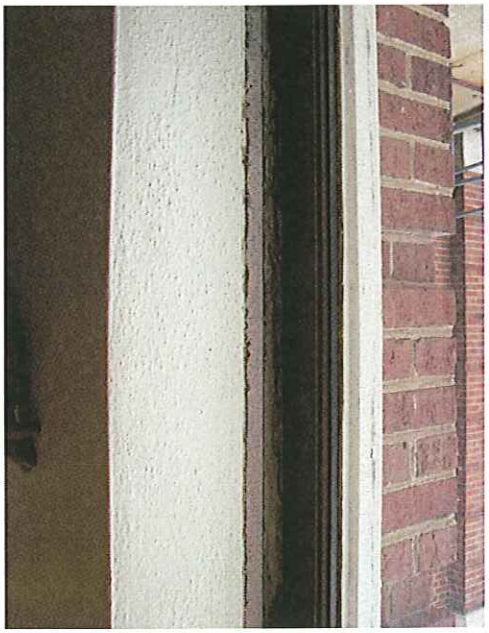
C Window Removal Photographs

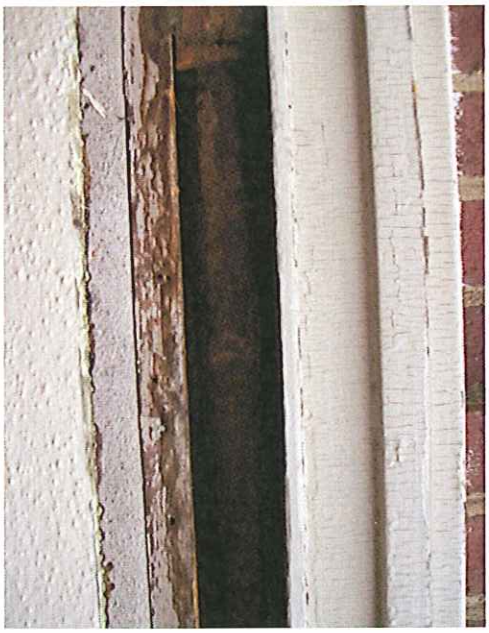







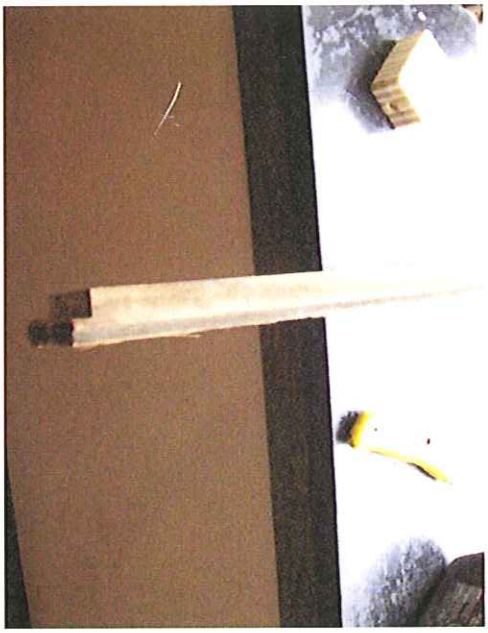
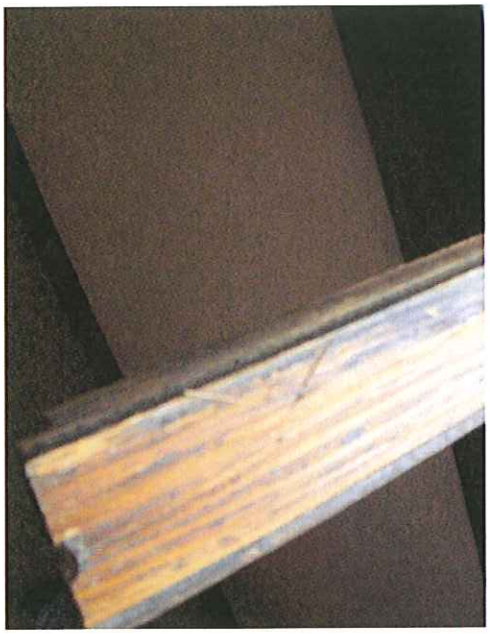





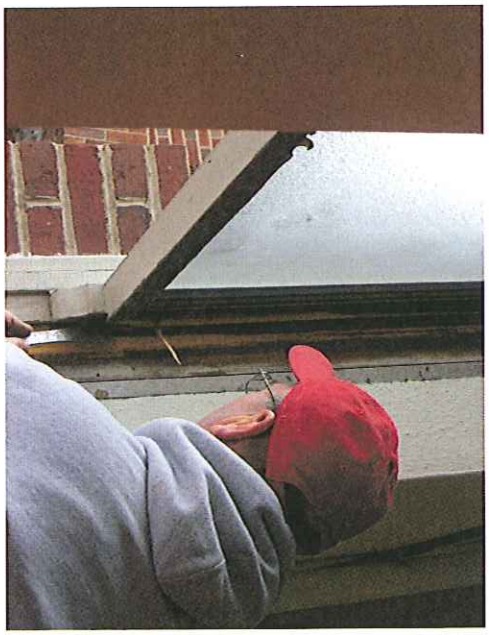


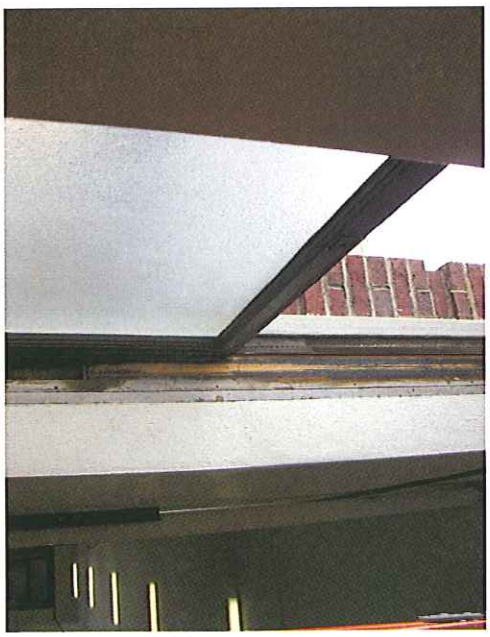










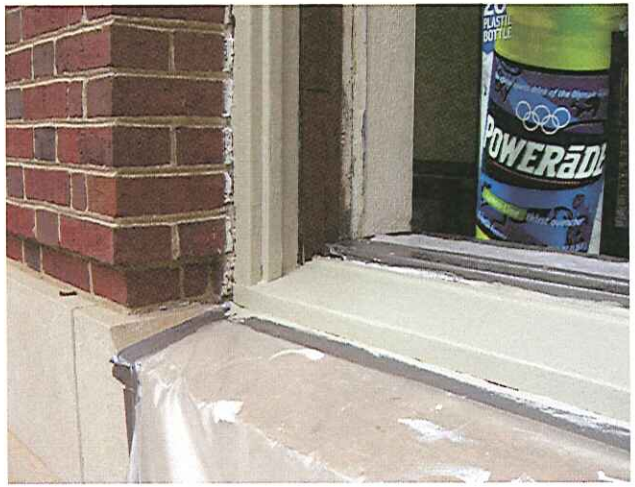

Section 7

D Installation Photographs





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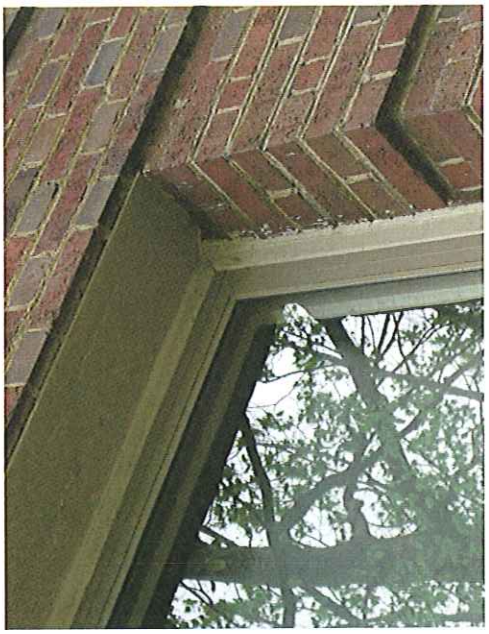
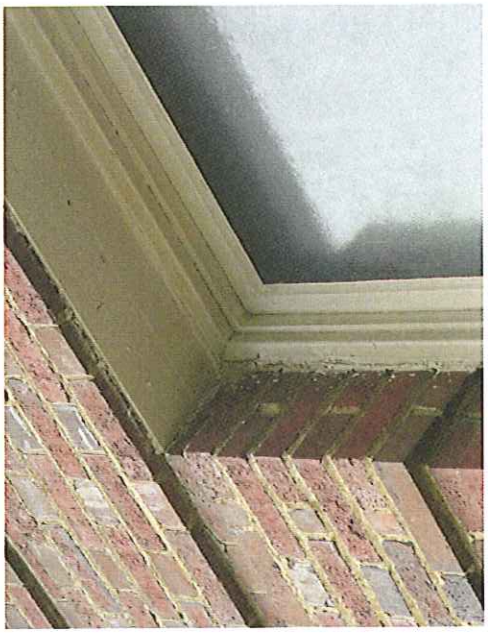
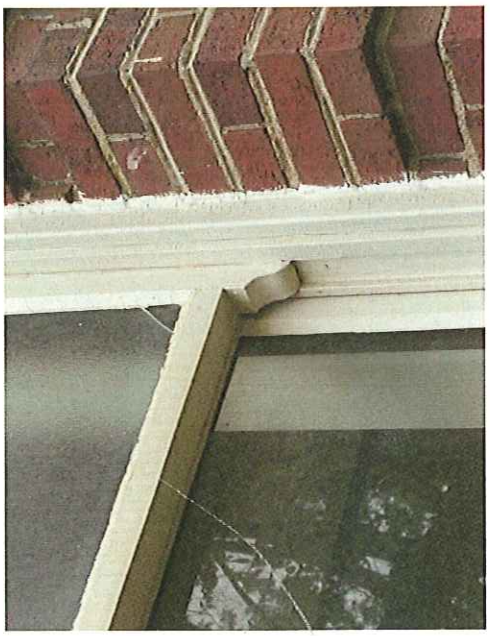
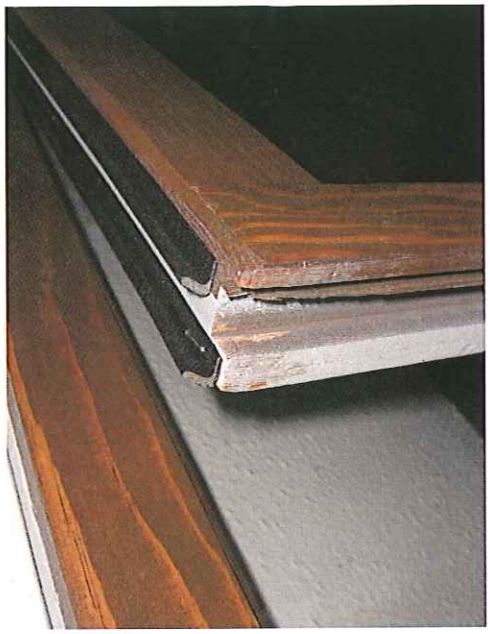
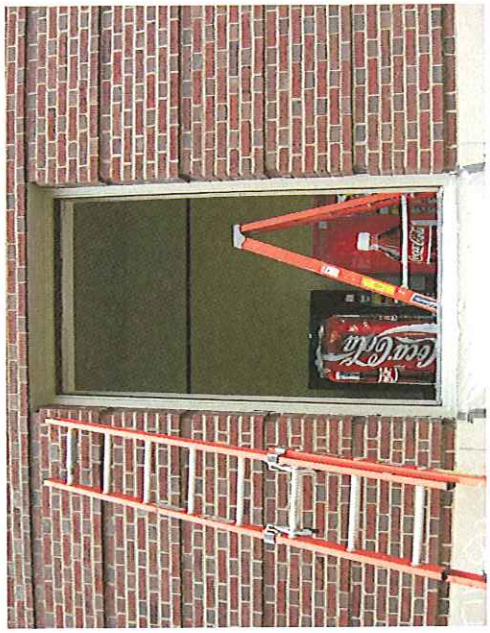
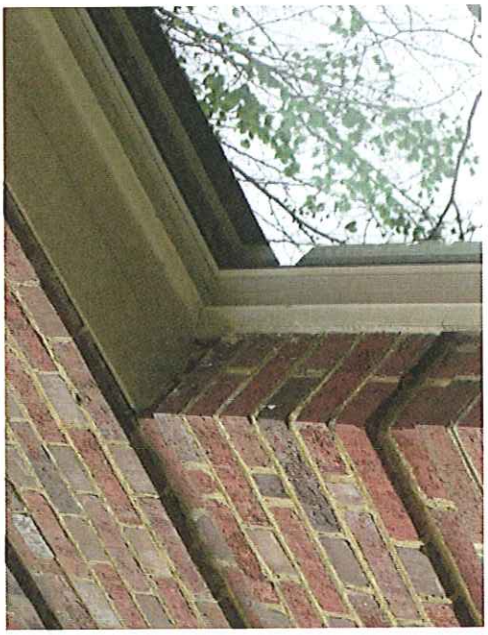
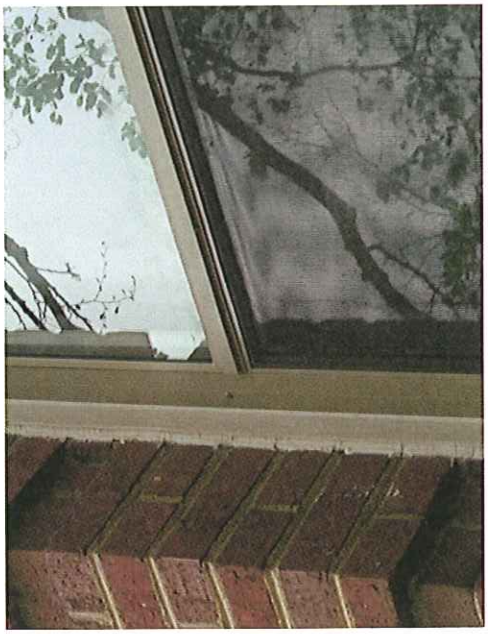
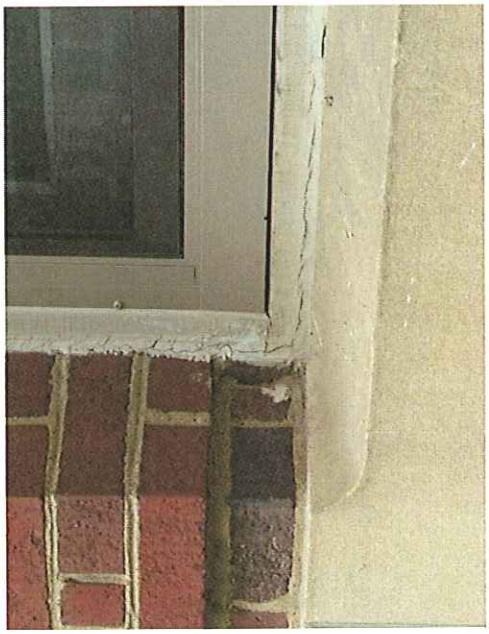



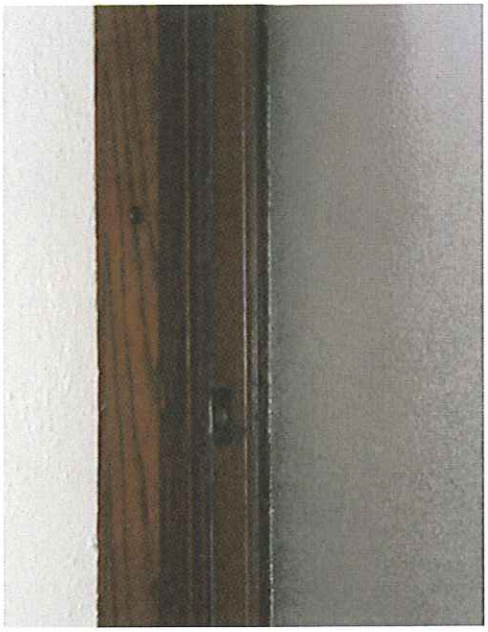


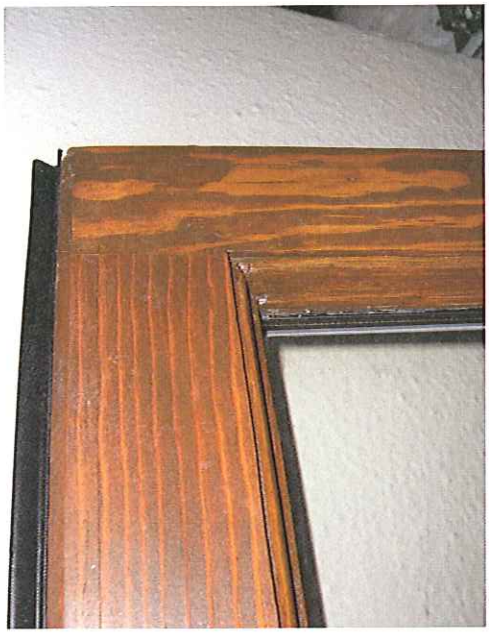
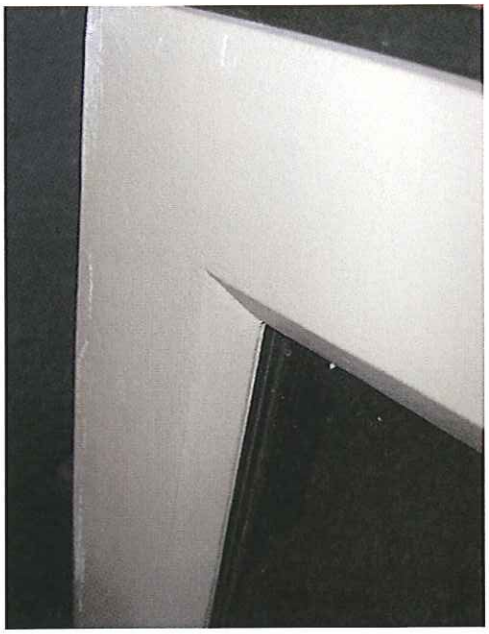
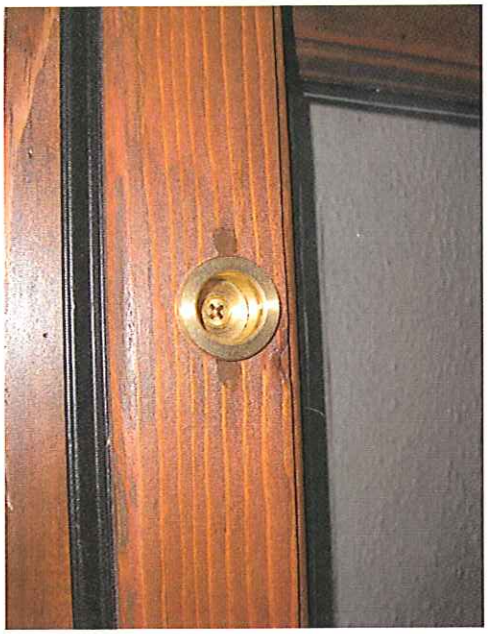


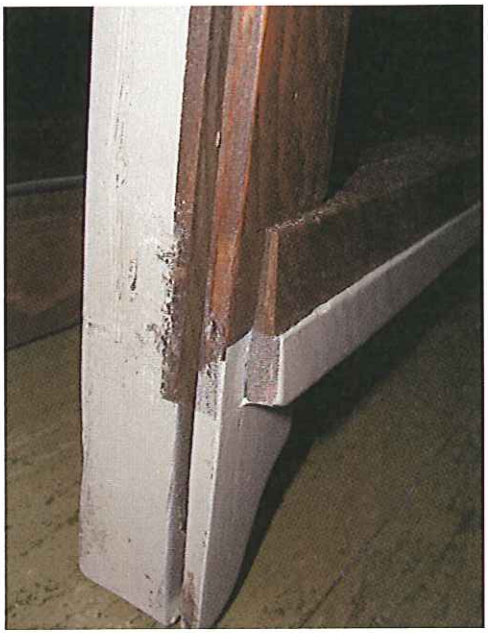



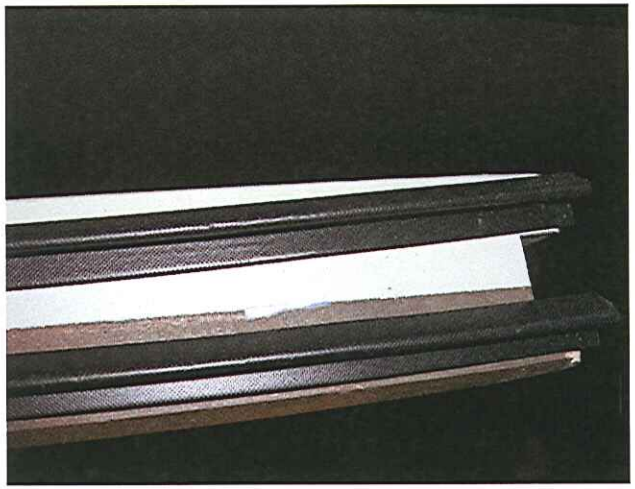


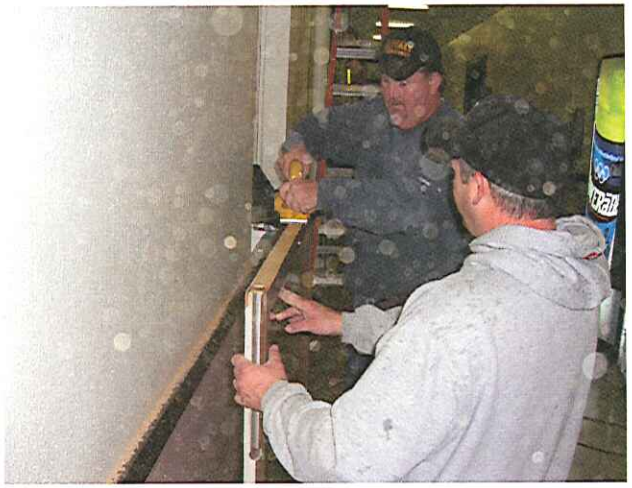





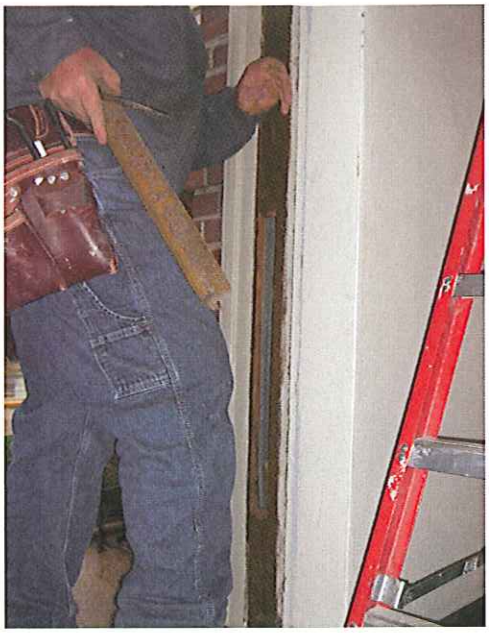




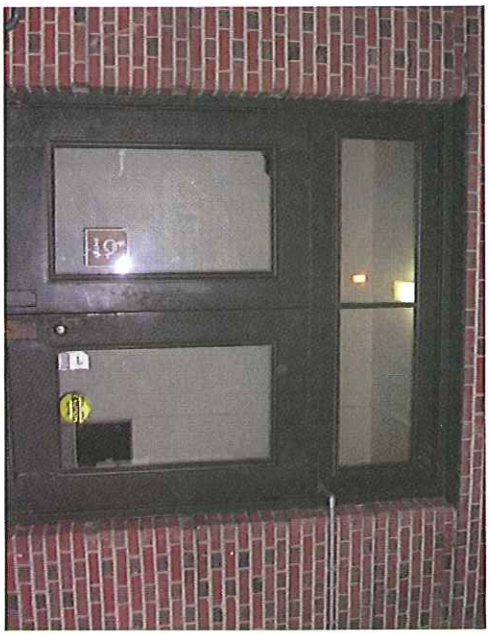
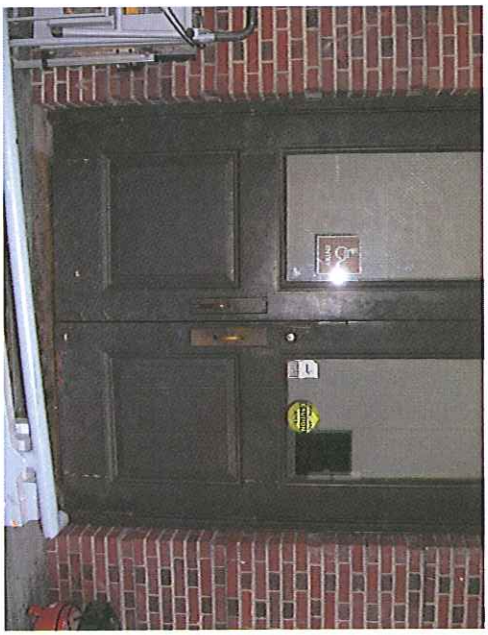
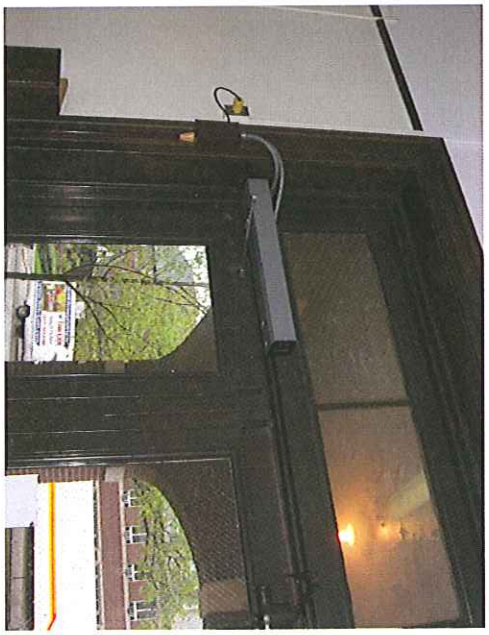


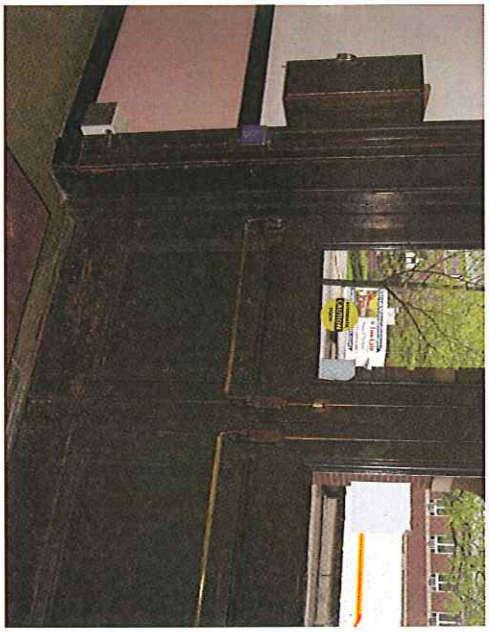



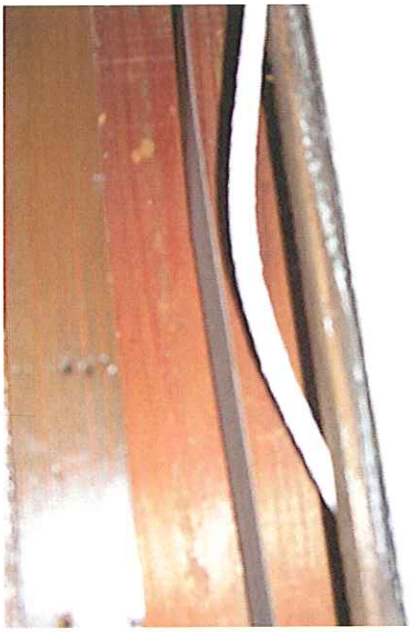



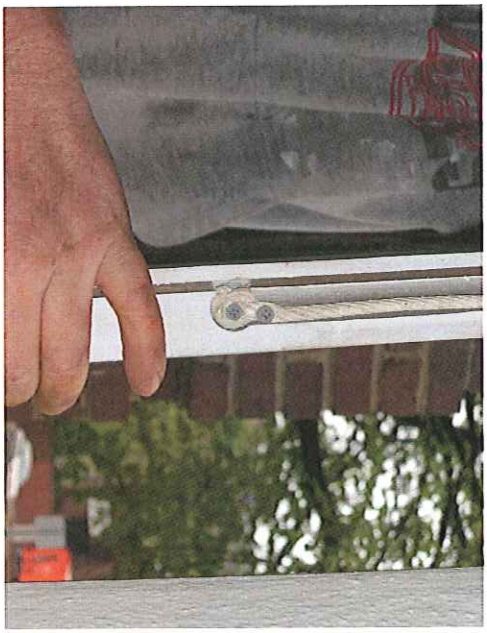


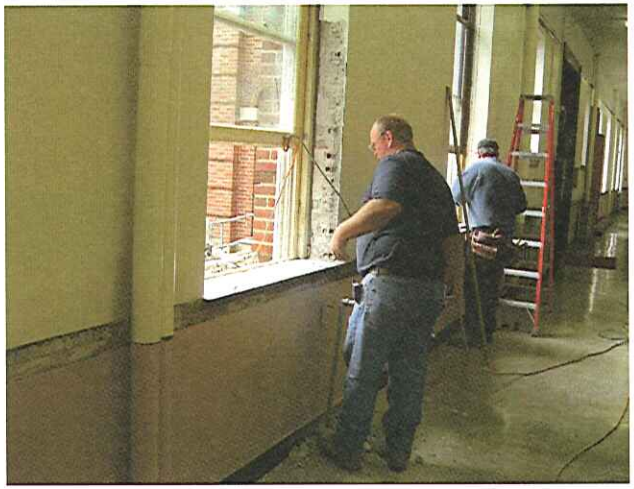


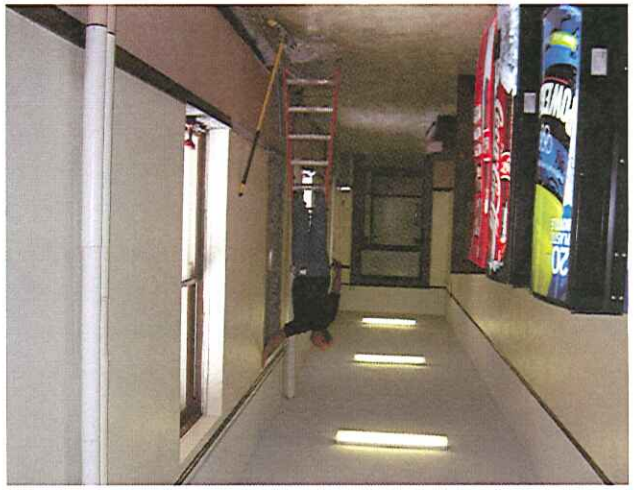




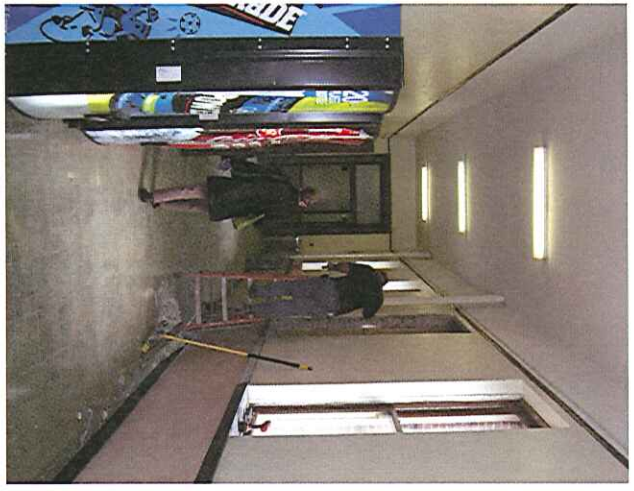


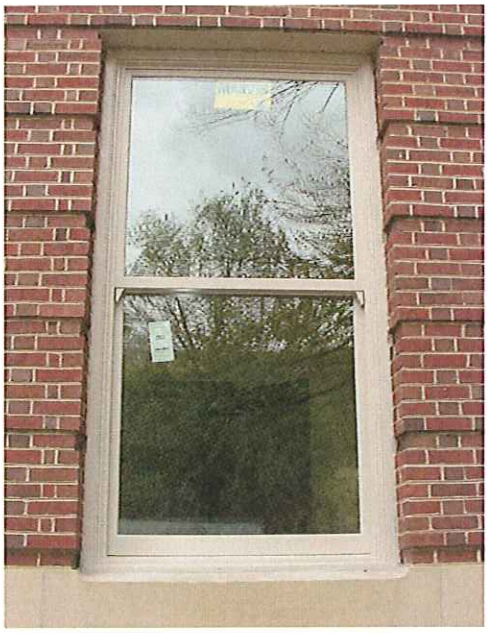


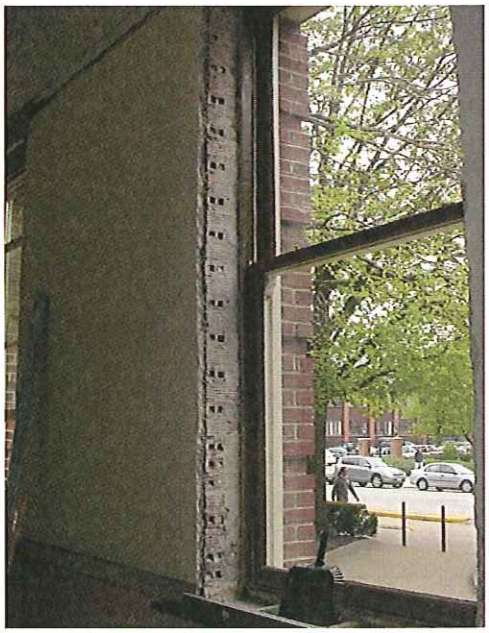
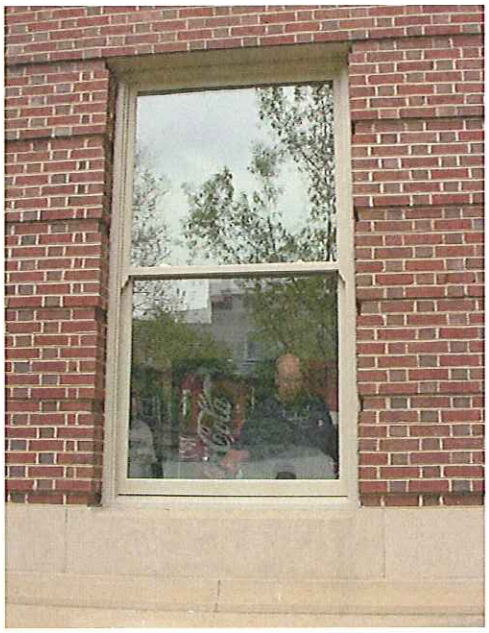






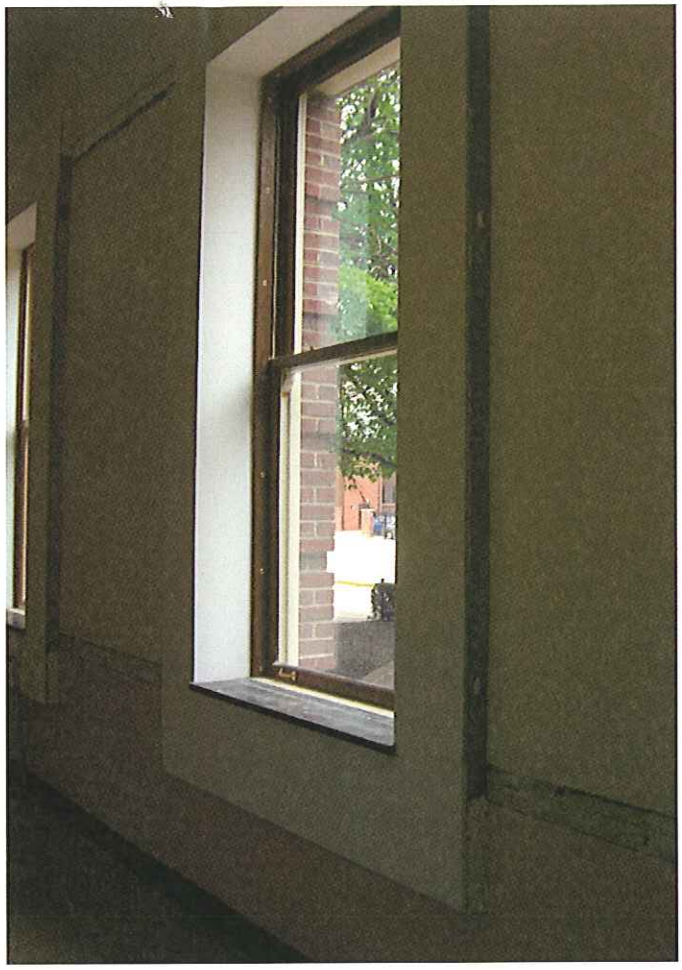


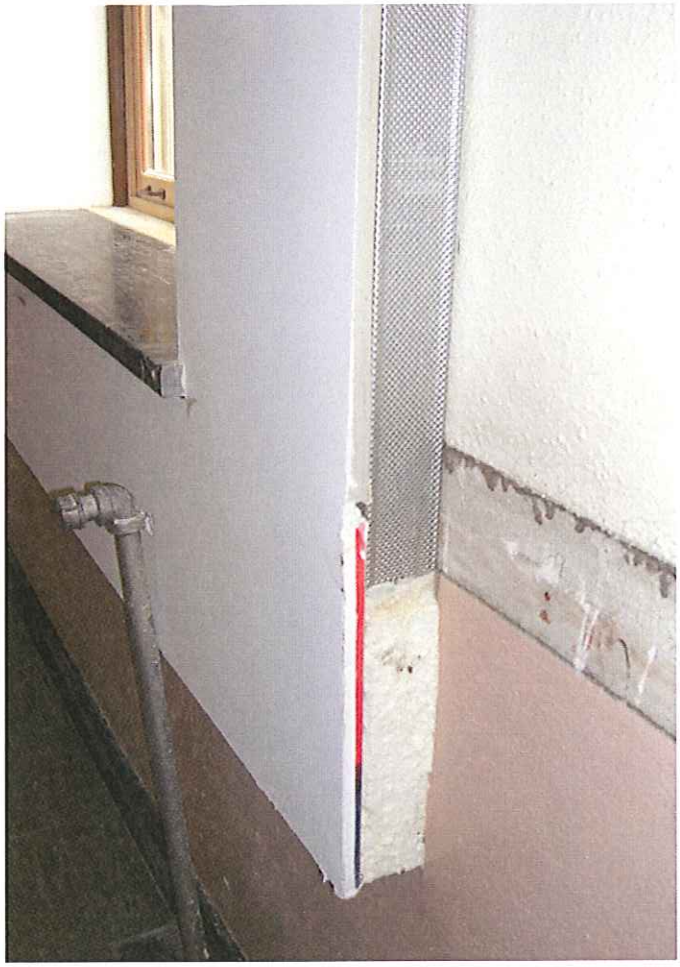



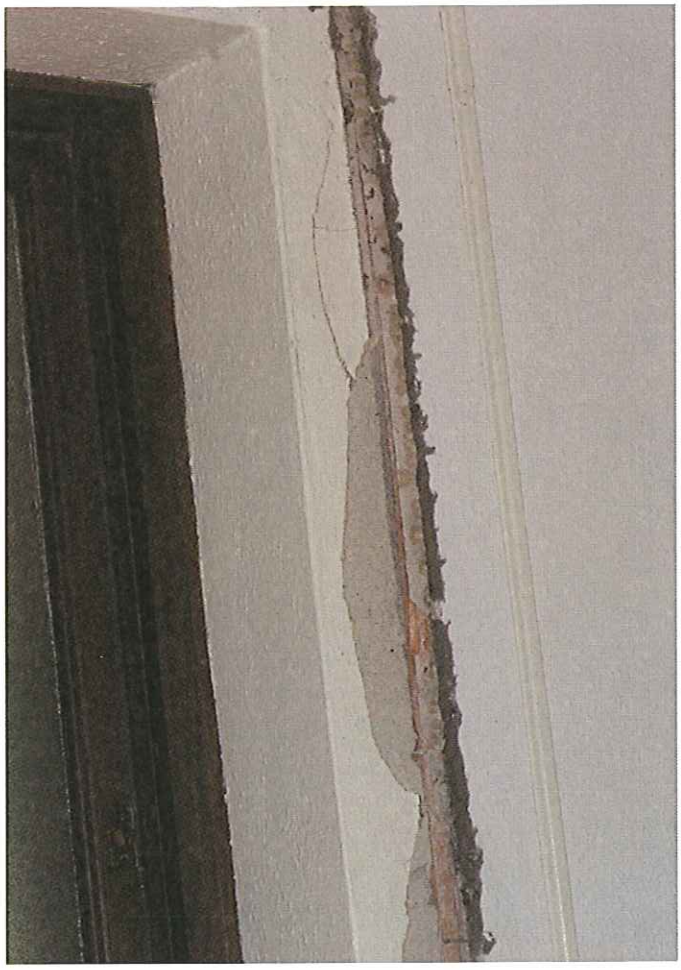



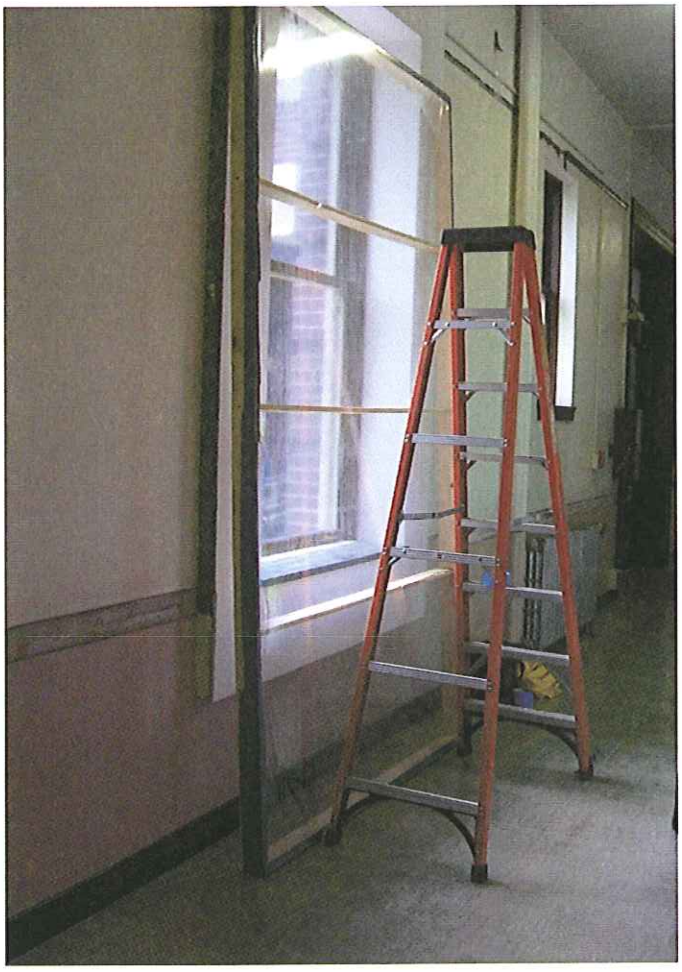

Section 7

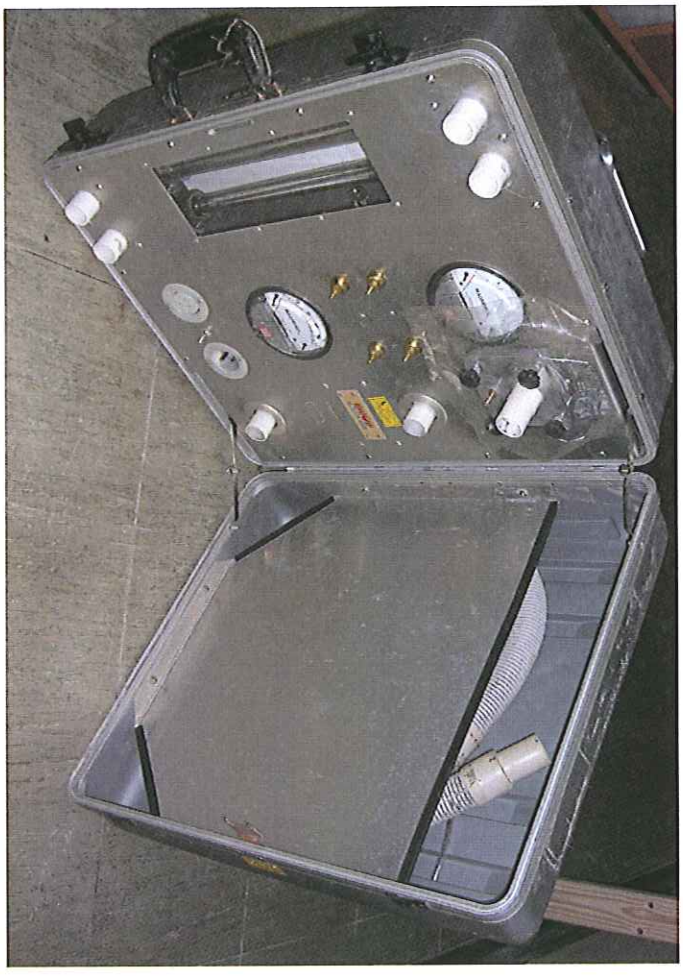
E Testing Photographs

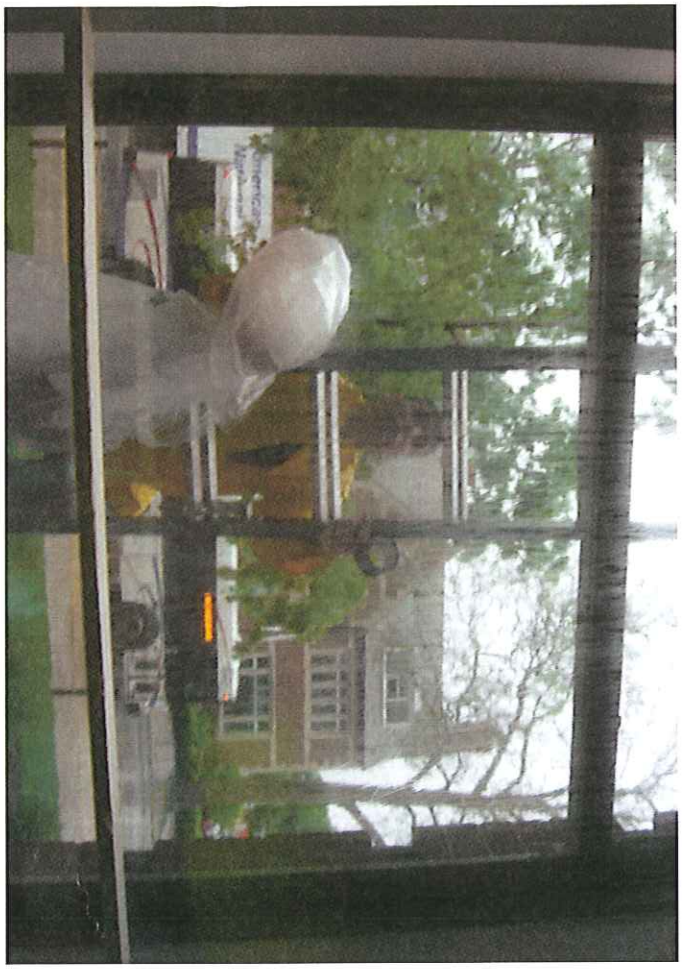


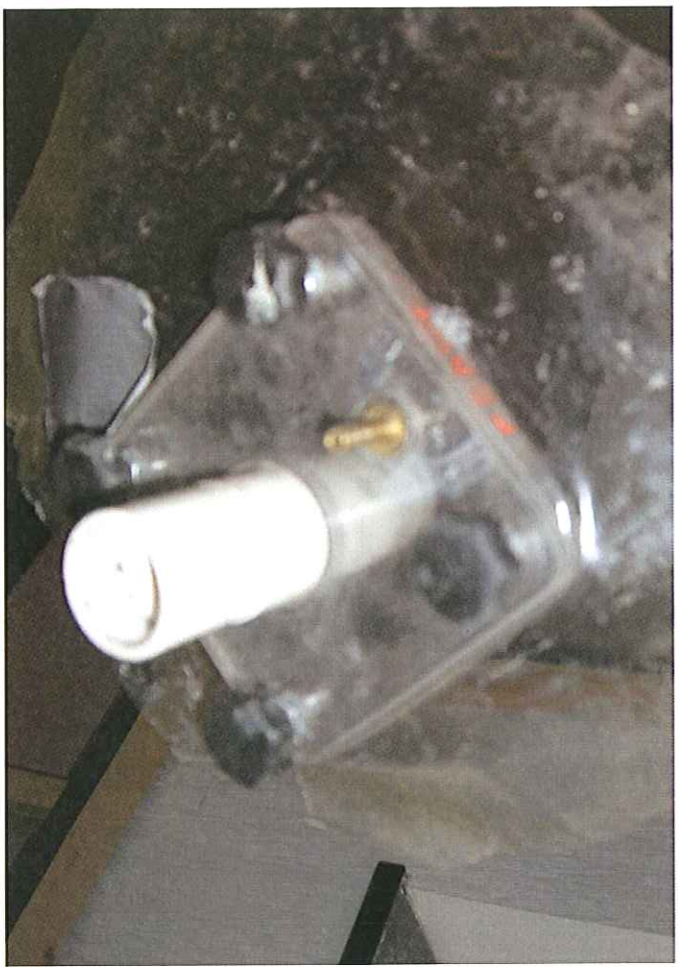


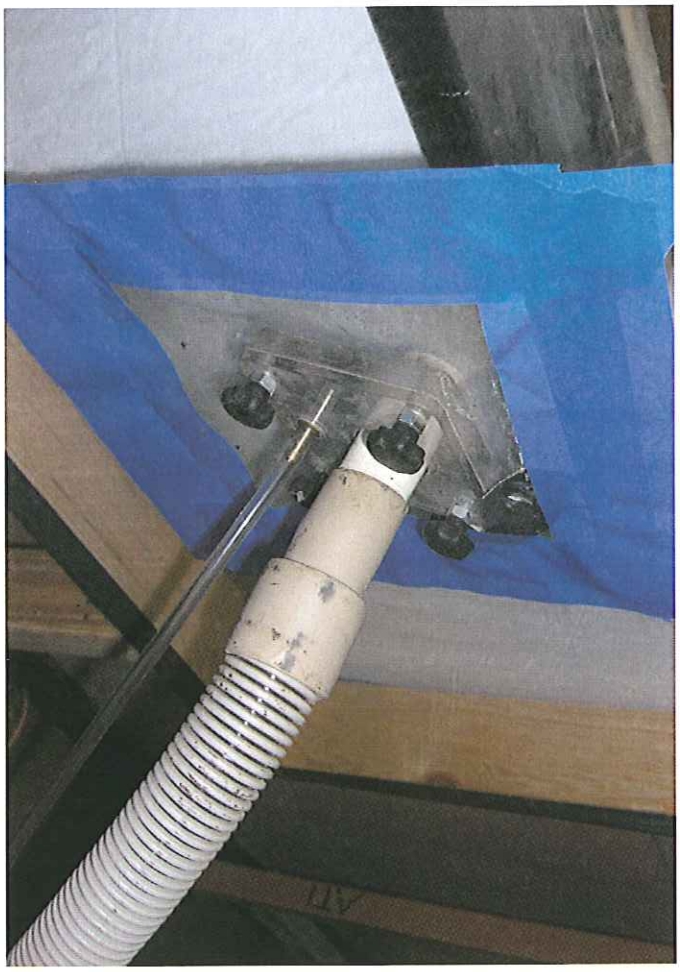


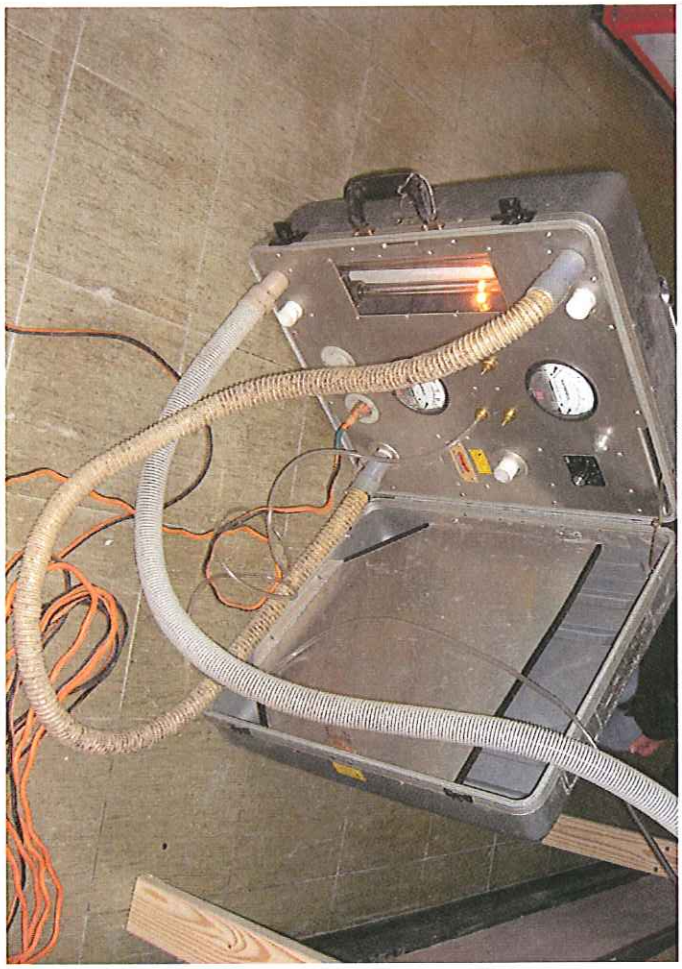


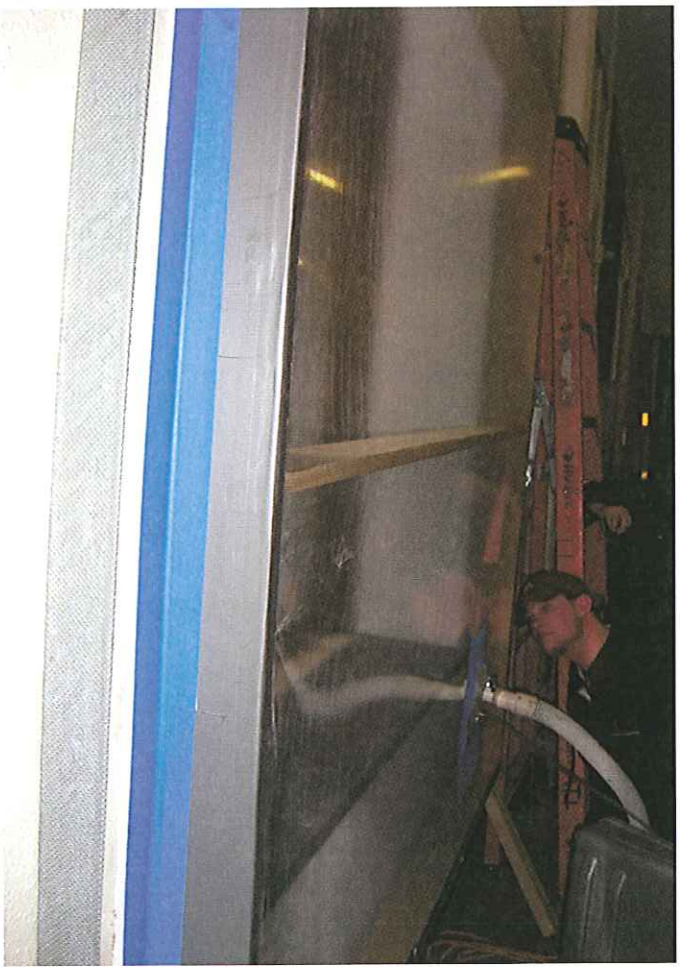


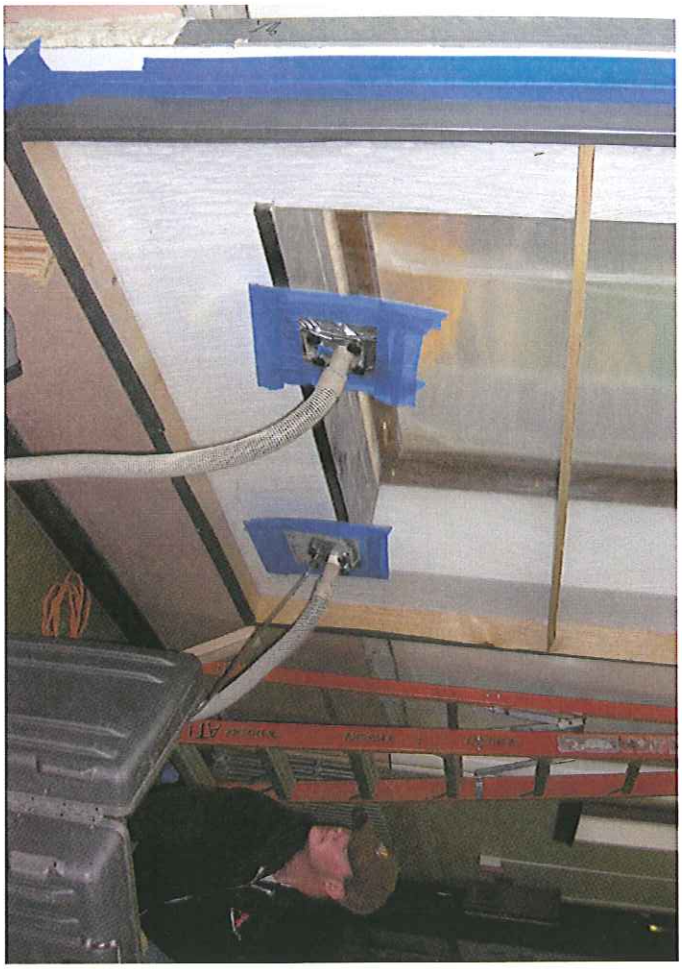


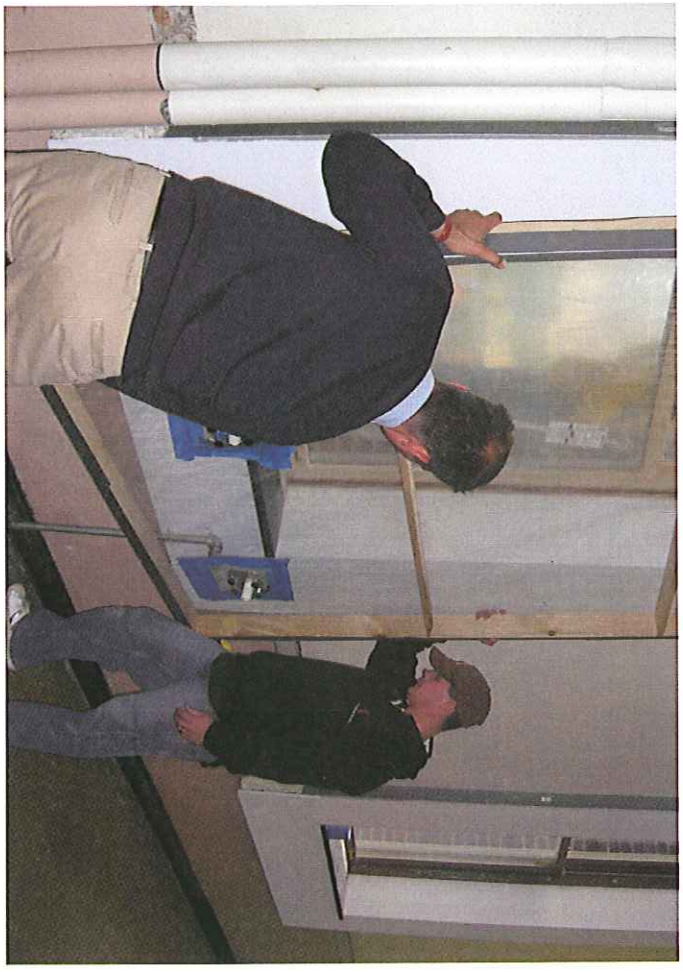


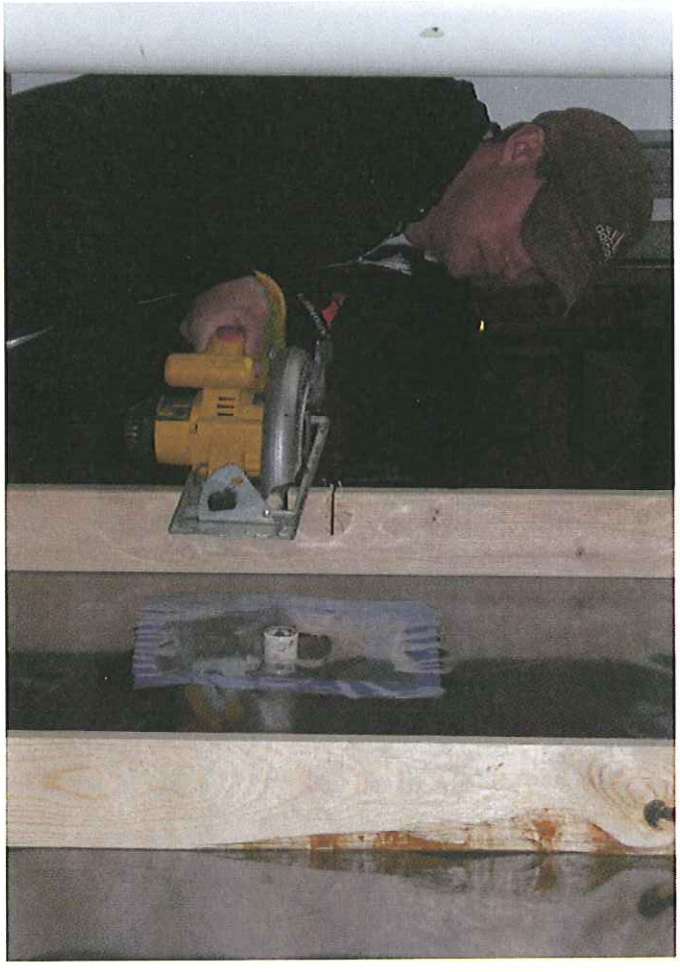


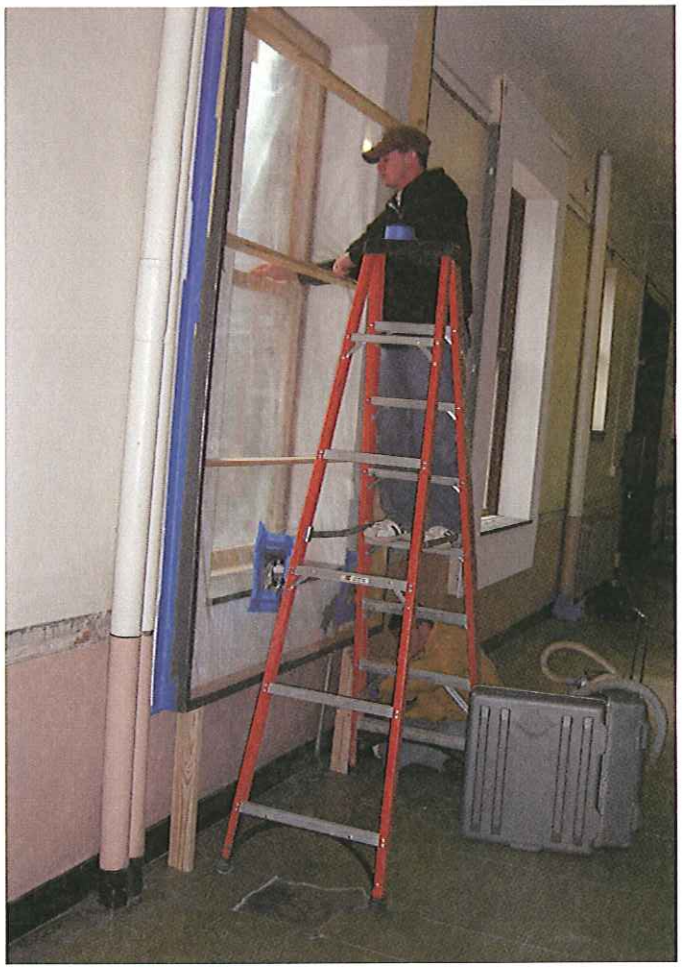


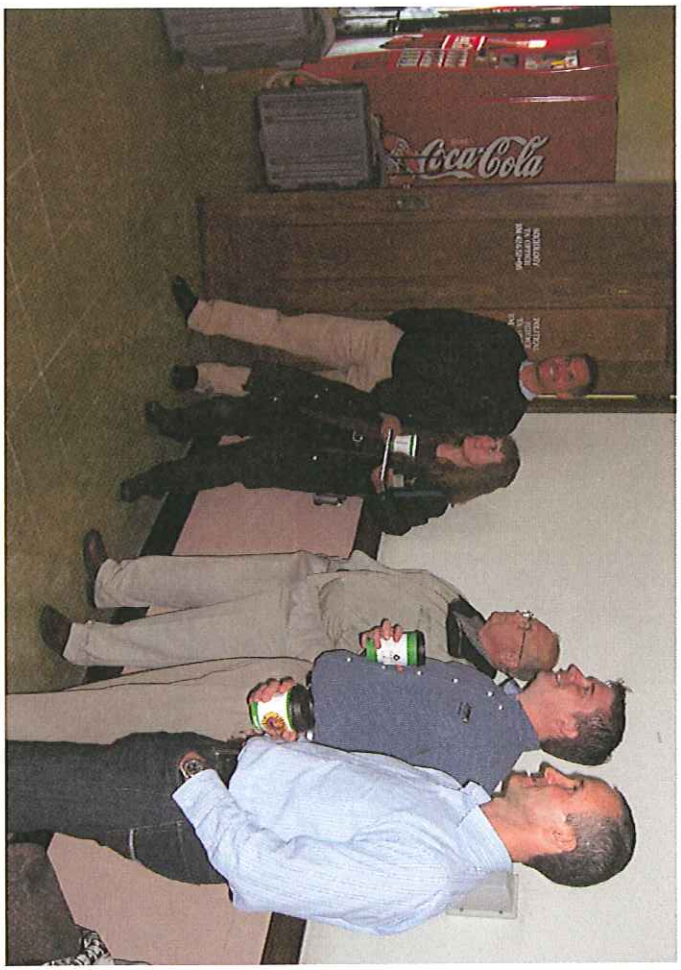








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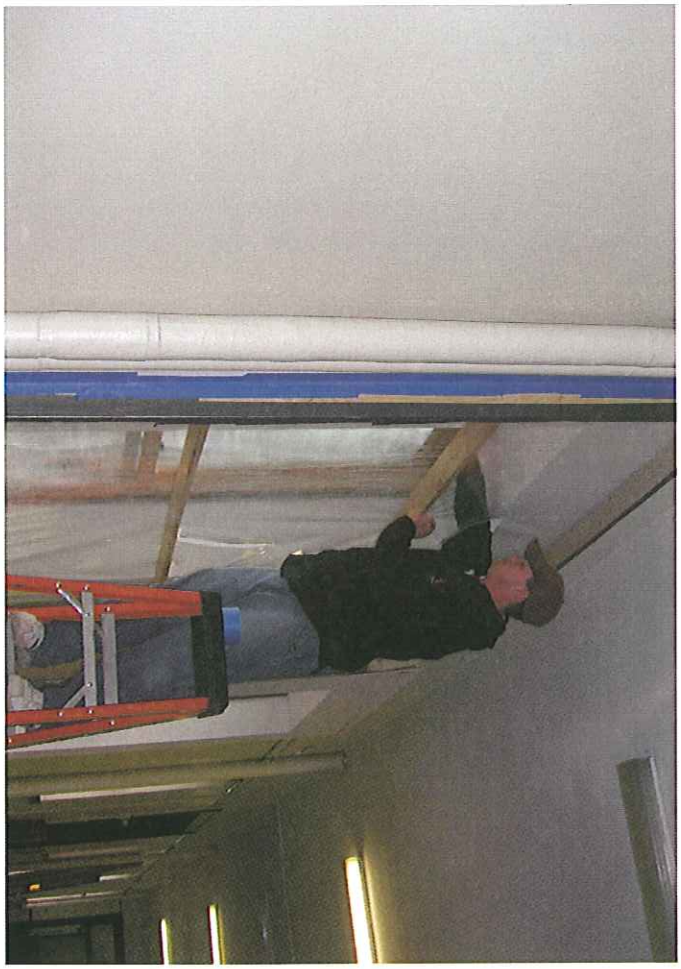

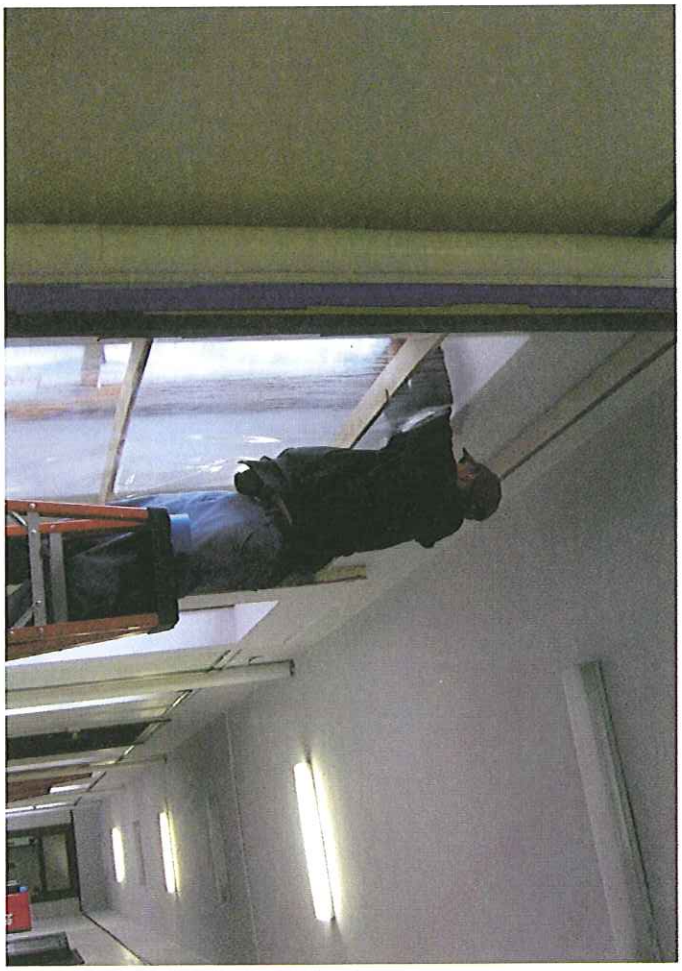

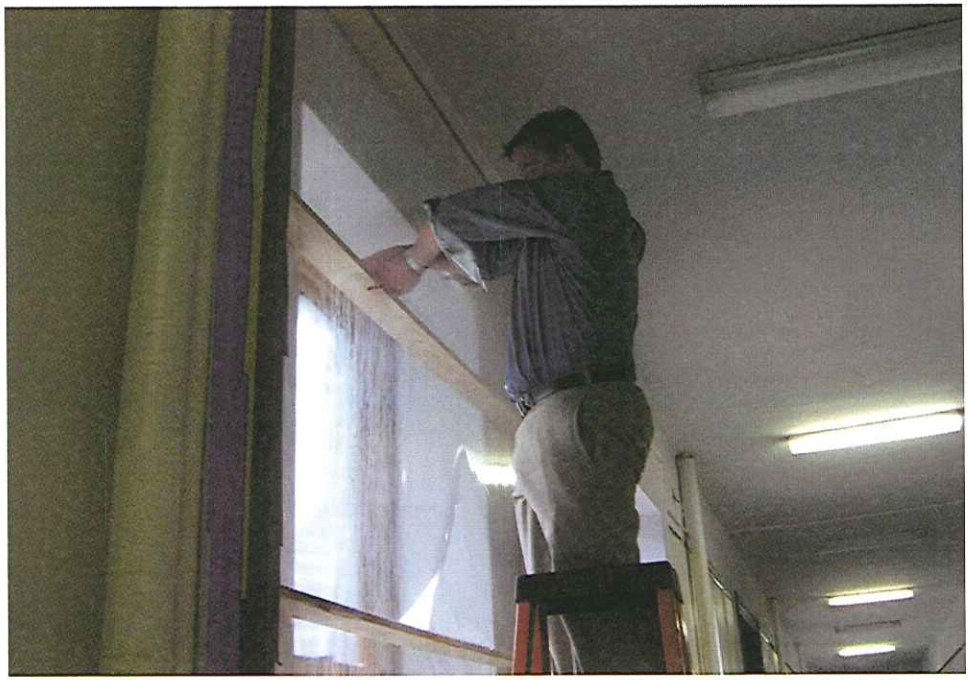

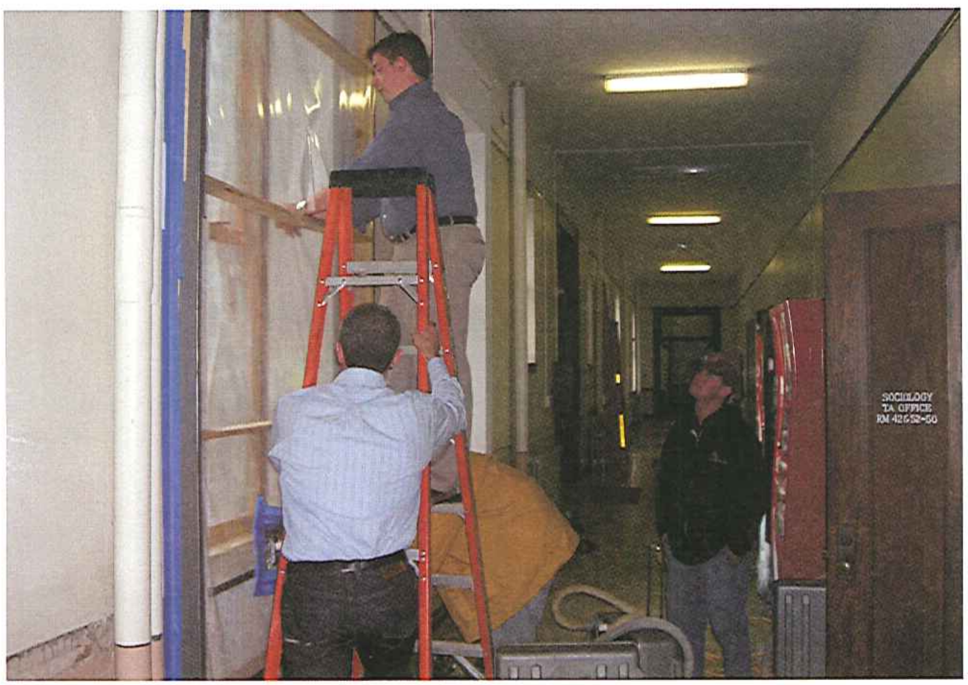
SOCIOLOGY
TA OFFICE

Section 7

F Testing Data

1 Infiltration Testing

2 U-Value Simulation

Architectural Testing

FIELD TEST REPORT

Rendered to:

BAILEY EDWARD DESIGN

PROJECT: **Lincoln Hall UIUC**
Champaign, Illinois

Report No.:	**83157.01-601-43**
Set-Up Date:	**05/19/08**
Test Date:	**05/19/08**
Report Date:	**06/02/08**
Revision 2:	**07/22/08**

9608 South Franklin Drive
Franklin, WI 53132
phone: 414-421-6100
fax: 414-421-6575
www.archtest.com

Architectural Testing

FIELD TEST REPORT

Rendered to:

BAILEY EDWARD DESIGN
35 East Wacker Drive, Suite 2800
Chicago, Illinois 60601

Report No.:	83157.01-601-43
Set-Up Date:	05/19/08
Test Date:	05/19/08
Report Date:	06/02/08
Revision 2:	07/22/08

Project Identification: Lincoln Hall UIUC
Champaign, Illinois

Project Summary: Architectural Testing, Inc. was contracted to perform on-site testing at the above referenced project. Air infiltration tests were conducted on four (4) specimens consisting of two (2) wood double hung windows with modified interior openings and two (2) wood double hung windows with exterior storm windows. Testing was conducted for comparison purposes, there was no pass or fail criteria provided.

Test Methods: Tests were conducted in accordance with the following:

AAMA 502-02, *Voluntary Specification for Field Testing of Windows and Sliding Glass Doors.*

ASTM E 783, *Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.*

Pre-Test Inspection:

A visual inspection of the designated test areas were performed prior to testing. The test specimens were compared to other adjacent windows on the project. No obvious deficiencies or anomalies were observed. The test specimens were operated, closed, and locked prior to testing.

Test Procedure:

The perimeter of the chambers for Specimens #1 and #2 were attached and sealed to the interior perimeter of the built out surrounds of the openings. The perimeter of the chambers for Specimens #3 and #4 were attached and sealed to the interior plaster perimeter. The chamber was equipped with a centrifugal blower/vacuum pump, air flow meter, and a pressure sensing device to maintain the desired air pressure differential across the assembly. Air infiltration tests were conducted at 1.57 psf and 6.24 psf pressure differential. Due to the desire of testing the wall cavity as well as the windows themselves, Specimens #1, #3, and #4 did not obtain the appropriate pressure while testing at 6.24 psf because of the high volume of air infiltration. The tests at 1.57 psf will be more accurate for comparison than the tests recorded at 6.24 psf; the 6.24 psf readings are for informational purposes only.

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Franklin, WI 53132
phone: 414-421-6100
fax: 414-421-6575
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Performance Criteria: Provided by Bailey Edward Design.

Allowable Air Infiltration at 1.57 psf: - undefined, for comparison purposes only

Allowable Air Infiltration at 6.24 psf: - undefined, for comparison purposes only

TEST RESULTS
Date: 05/19/08
Ambient Exterior Air Temperature: 64 °F

General Note: *All locations referenced are as viewed from the interior unless otherwise noted.*

Test Specimen #1:

Manufacturer: Not Available
Description: Original wood double hung window with modified interior wall condition (opening #4).
Overall Size: 4'-5 ⅜" wide by 8'-4 ⅝" high
Location: West elevation, 1st floor, entrance hallway, 6th window unit from the South

Title of Test	Test Results	Allowable
Air Infiltration @ 1.57 psf	Net = 4.50 cfm Rate = 0.12 cfm/ft^2	N/A N/A
Air Infiltration @ 6.24 psf*	Net = 8.90 cfm Rate = 0.24 cfm/ft^2 See Note #1	N/A N/A

**Note #1: After the exterior tare bag was removed, the infiltration exceeded what the equipment could measure; therefore the 6.24 psf was not achieved. The tare reading was taken at 6.24 psf, but the total reading after the tare bag was removed and was taken at 5.73 psf.*

Test Specimen #2:

Manufacturer: Marvin Windows & Doors
Description: Wood double hung window with modified interior wall conditions (opening #3).
Overall Size: 4'-5 ⅜" wide by 8'-4 ⅝" high
Location: West elevation, 1st floor, entrance hallway, 5th window unit from the South

Title of Test	Test Results	Allowable
Air Infiltration @ 1.57 psf	Net = 0.20 cfm Rate = 0.01 cfm/ft^2	N/A N/A
Air Infiltration @ 6.24 psf	Net = 1.55 cfm Rate = 0.04 cfm/ft^2	N/A N/A

Test Results: (Continued)

Test Specimen #3:

Manufacturer: Not Available
Description: Original wood double hung window with exterior Allied storm window (opening #2).
Overall Size: 4'-5 ½" wide by 8'-4 ⅛" high
Location: West elevation, 1st floor, entrance hallway, 4th window unit from the South

Title of Test	Test Results	Allowable
Air Infiltration	Net = 17.60 cfm	N/A
@ 1.57 psf	Rate = 0.47 cfm/ft^2	N/A
With storm window open		
Air Infiltration	Net = 6.00 cfm	N/A
@ 6.24 psf*	Rate = 0.16 cfm/ft^2	N/A
With storm window open	See Note #2	

**Note #2: After the exterior tare bag was removed, the infiltration exceeded what the equipment could measure; therefore the 6.24 psf was not achieved. The tare reading was taken at 6.24 psf, but the total reading after the tare bag was removed was taken at 3.65 psf.*

Title of Test	Test Results	Allowable
Air Infiltration	Net = 9.50 cfm	N/A
@ 1.57 psf	Rate = 0.26 cfm/ft^2	N/A
With storm window closed		
Air Infiltration	Net = 3.10 cfm	N/A
@ 6.24 psf*	Rate = 0.08 cfm/ft^2	N/A
With storm window closed	See Note #3	

**Note #3: After the exterior tare bag was removed, the infiltration exceeded what the equipment could measure; therefore the 6.24 psf was not achieved. The tare reading was taken at 6.24 psf, but the total reading after the tare bag was removed and was taken at 4.43 psf.*

Test Specimen #4:

Manufacturer: Not Available
Description: Original wood double hung window with exterior Monray storm window (opening #1).
Overall Size: 4'-5 ⅝" wide by 8'-4 ⅛" high
Location: West elevation, 1st floor, entrance hallway, 3rd window unit from the South

Test Results: (Continued)

Test Specimen #4: (Continued)

Title of Test	Test Results	Allowable
Air Infiltration	Net = 8.30 cfm	N/A
@ 1.57 psf	Rate = 0.22 cfm/ft^2	N/A
With storm window open		
Air Infiltration	Net = 4.40 cfm	N/A
@ 6.24 psf*	Rate = 0.12 cfm/ft^2	N/A
With storm window open	See Note #4	

**Note #4: After the exterior tare bag was removed, the infiltration exceeded what the equipment could measure; therefore the 6.24 psf was not achieved. The tare reading was taken at 6.24 psf, but the total reading after the tare bag was removed and was taken at 4.69 psf.*

Title of Test	Test Results	Allowable
Air Infiltration	Net = 1.20 cfm	N/A
@ 1.57 psf	Rate = 0.03 cfm/ft^2	N/A
With storm window closed		
Air Infiltration	Net = 0.50 cfm	N/A
@ 6.24 psf*	Rate = 0.01 cfm/ft^2	N/A
With storm window closed	See Note #5	

**Note #5: After the exterior tare bag was removed, the infiltration exceeded what the equipment could measure; therefore the 6.24 psf was not achieved. The tare reading was taken at 6.24 psf, but the total reading after the tare bag was removed and was taken at 5.20 psf.*

Witnesses: The following representatives witnessed all or part of the testing.

Richard Basler	Mon-Ray/AWS
Todd Zeller	Building Blocks
Matthew Tomaszewski	LAS/UIUC
Susan Turner	Bailey Edward
Donna McClure	UIUC
Dan Smith	Marvin Windows and Doors
Arlen Fisher	Architectural Testing, Inc.
Dave Schumann	Architectural Testing, Inc.

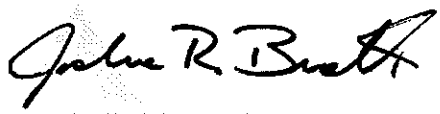
This report is prepared for the convenience of our customer and endeavors to provide accurate and timely project information. It contains a summary of observations made by a qualified representative of Architectural Testing. This report is intended to help in your Quality Assurance Program, but it does not represent a continuous nor exhaustive evaluation. The statements made herein do not constitute approval, disapproval, certification or acceptance of performance or materials.

Detailed drawings, data sheets, a copy of this report, or other pertinent project documentation will be retained by Architectural Testing for a period of four years from the original test date. At the end of this retention period, such materials shall be discarded without notice and the service life of this report will expire. Results obtained are tested values and were secured by using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimen(s) tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing.

For ARCHITECTURAL TESTING, INC:

Digitally Signed by: David Schumann

Dave C. Schumann
Senior Technician



Digitally Signed by: Joshua R. Brandt

Joshua R. Brandt
Senior Project Manager

DCS:jrb

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	06/02/08	N/A	Original report issue
0	07/22/08	Pages 2 through 4	Added the 6.24 psf air test results

Susan Turner

From: Resech, Michael [mresech@archtest.com]
Sent: Tuesday, January 06, 2009 11:37 AM
To: Susan Turner
Subject: Infiltration Testing

Susan,

Per our earlier discussions regarding air infiltration testing, you are correct in your assertion. The type of glazing (clear or coated) and gap fill (air or argon) will not affect the results obtained from your infiltration testing. Using clear glazing and air fill is allowable for both the NFRC 400 and ASTM E283 test methods. These methods test the amount of air that is infiltrating or exfiltrating the unit, as long as the glazing techniques are consistent, the specific glazing infill is irrelevant.

Thank you,
Michael P. Resech
Project Manager
Architectural Testing, Inc.
Phone: 651.636.3835
Fax: 651.636.3843
Email: mresech@archtest.com

Architectural Testing

THERMAL PERFORMANCE
COMPUTER SIMULATION REPORT

Rendered to:

BAILEY EDWARD DESIGN

Project: Lincoln Hall, UIUC
TYPE: Vertical Slider (Double Hung)

Report No.:	**83792.02-201-45**
Original Report Date:	**06/13/08**
Revision Report Date:	**12/17/08**
Expiration Date:	**06/13/12**

849 Western Avenue North
St. Paul, MN 55117
phone: 651-636-3835
fax: 651-636-3843
www.archtest.com

Architectural Testing

THERMAL PERFORMANCE
COMPUTER SIMULATION REPORT

Rendered to:

BAILEY EDWARD DESIGN
24 East Wacker Drive, Tower Floor 28
Chicago, Illinois 60601

Report No.:	83792.02-201-45
Simulation Date:	06/13/08
Original Report Date:	06/13/08
Revision Report Date:	12/17/08
Expiration Date:	06/13/12

Project Summary: Architectural Testing, Inc. was contracted to conduct a computer model thermal analysis of the Lincoln Hall window repair or replacement. Architectural Testing, Inc. utilized the THERM 5.2 and WINDOW 5.2 computer software developed by Lawrence Berkeley Laboratory. Simulations were conducted to determine a U-Factor, Solar Heat Gain Coefficient (SHGC), dew point, and conduct an interior surface temperature analysis at two sets of environmental conditions.

Modeling Conditions:

	Winter	Summer*
Exterior Air Temperature	-10 °F	80 °F
Exterior Wind Velocity	15 mph (Perpendicular Flow)	15 mph (Perpendicular Flow)
Interior Air Temperature	70 °F	75 °F

*Standard NFRC Direct Solar Radiation of 248.2 BTU-hr/Ft^2 was used for Summer conditions.

Test Results Summary:

Unit	Winter U-Factor**	Summer U-Factor**	SHGC**
Existing Wood Double Hung No Changes	0.865	0.835	0.667
With Monray Storm and Upgrade Wall	0.442	0.442	0.596
With Allied Storm and Upgrade Wall	0.441	0.440	0.597
New Aluminum-Clad Wood Double Hung Upgrade Wall	0.322	0.283	0.329
Restored Wood Double Hung Upgrade Wall with Energy Advantage	0.441	0.465	0.497
Restored Wood Double Hung Upgrade Wall with LowE 272	0.362	0.353	0.320

**U-Factor (Btu/hr/ft^2/F) and SHGC calculations do not include building envelope.

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phone: 651-636-3835
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Estimated Interior Dew Point Temperature:

Interior Temperature	Relative Humidity	Calculated Dew Point Temperature
Winter 70 °F	30 %	37.1 °F
Summer 75 °F	50 %	55.5 °F

Interior Temperature Results:

Cross-Section	Edge of Glass Temperature		Glass Siteline Temperature		Coldest Sash Temperature		Coldest Frame Temperature	
	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Existing Wood Double Hung								
Sill	8.5	78.9	12.1	78.7	32.6	77.4	43.5	76.7
Interlock	8.1	78.9	11.3	78.7	30.4	78.0	---	---
Head	8.5	78.6	12.7	78.6	36.1	77.1	46.2	76.5
Upper Jamb	8.8	78.9	12.5	78.6	36.3	77.1	47.6	76.4
Lower Jamb	8.7	78.9	12.4	78.6	37.0	77.1	46.6	76.5
Existing Wood Double Hung with Monray Storm and Upgraded Wall								
Sill	34.9	77.5	36.9	77.3	43.0	76.9	50.9	76.2
Interlock	35.2	77.4	43.0	76.9	46.8	76.6	---	---
Head	36.5	77.4	37.8	77.2	49.9	76.4	53.1	76.1
Upper Jamb	36.4	77.4	37.7	77.2	49.6	76.4	51.7	76.2
Lower Jamb	36.9	77.4	37.7	77.2	51.2	76.3	50.7	76.2
Existing Wood Double Hung with Allied Storm and Upgraded Wall								
Sill	34.8	77.5	36.8	77.3	42.8	76.9	50.9	76.3
Interlock	36.0	77.4	43.7	76.8	47.3	76.6	---	---
Head	37.1	77.3	38.8	77.2	50.1	76.4	52.9	76.1
Upper Jamb	37.0	77.3	38.2	77.2	49.8	76.4	51.5	76.2
Lower Jamb	36.4	77.3	38.0	77.2	51.3	76.3	50.7	76.3
New Aluminum-Clad Wood Double Hung with Cardinal LowE 272								
Sill	45.4	76.2	36.3	76.9	43.1	76.2	49.1	75.7
Interlock	40.1	76.1	30.9	76.5	37.2	75.4	---	---
Head	44.2	76.2	35.8	76.9	38.4	76.2	43.8	75.7
Upper Jamb	44.9	76.1	36.5	76.9	43.1	76.2	38.6	75.4
Lower Jamb	45.1	76.2	36.9	76.9	41.8	76.2	39.2	75.9

*Note: All temperatures reported in °F

Interior Temperature Results (Continued):

Cross-Section	Edge of Glass Temperature		Glass Siteline Temperature		Coldest Sash Temperature		Coldest Frame Temperature	
	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Restored Wood Double Hung with Pilkington Energy Advantage								
Sill	34.5	77.4	24.3	77.9	25.7	76.3	42.4	75.8
Interlock	36.0	77.2	25.5	77.6	34.8	75.4	---	---
Head	34.3	77.4	24.6	77.9	26.2	76.2	42.7	75.2
Upper Jamb	35.6	77.3	24.2	77.9	25.9	76.3	46.0	75.4
Lower Jamb	35.7	77.3	24.3	77.9	25.9	76.3	38.4	75.7
Restored Wood Double Hung with Cardinal LowE 272								
Sill	40.5	76.5	30.7	77.3	34.4	76.2	44.9	75.8
Interlock	42.0	76.3	32.3	76.9	36.5	75.4	---	---
Head	40.4	76.6	31.1	77.3	32.2	76.1	42.6	75.2
Upper Jamb	41.7	76.4	31.1	77.3	32.1	76.2	46.2	75.4
Lower Jamb	41.8	76.6	31.0	77.3	32.1	76.2	38.5	75.6

*Note: All temperatures reported in °F

Simulation Specimen Description:

Model: Lincoln Hall, UIUC
Type: Vertical Slider (Double Hung)
Size: 54 in. wide x 101 in. high

Existing Wall: Solid masonry consisting of four wythes of brick and mortar.1/2" thick plaster was applied directly to the interior of the brick and fully wrapped the head and jambs. Plaster at the sill was terminated by a 1-1/2" thick slate stool and interior wood trim was applied to finish the opening.

Upgrade Wall: Solid masonry consisting of four wythes of brick and mortar. 5/8" thick plaster was applied directly to the interior of the brick. A furring wall consisting of steel studs with fiber batt infill was applied to the interior plaster. A second layer of 1/2" plaster was used to cap the wall and fully wrapped the head and jambs. Plaster at the sill was terminated by a 3" wide wood extension with 1-1/2" thick slate stool and wood trim was applied to finish the opening.

Glazing Description:

New Aluminum-Clad Wood Window
3/4" OA:
0.125" Cardinal 272 LowE, e=0.042 Surface 2
0.50" Gap, Argon 90% fill - XL Edge Stainless Steel Spacer
0.125" Clear

Restored Window Option 1
1/2" OA:
0.125" Pilkington Advantage LowE, e=0.156 Surface 2
0.25" Air 100% fill - Aluminum Spacer
0.125" Clear

Restored Window Option 2
1/2" OA:
0.125" Cardinal 272 LowE, e=0.042 Surface 2
0.25" Gap, Argon 90% fill - XL Edge Stainless Steel Spacer
0.125" Clear

Existing Window with Storm:
DS Clear Glass Storm Window
3.5" to 6.34" nominal air gap width
Single Pane DS Clear Glass

Existing Window:
Single Pane DS Clear Glass

Modeling Assumptions:

1. Models were constructed at ideal conditions.
2. All simulations were completed using supplied AutoCAD drawings.
3. Rounding was conducted in accordance with NFRC 601.

References:

THERM 5.2 Program:
This software was developed by the Lawrence Berkeley Laboratory. The program calculates heat loss through frame and edge-of-glass components using finite difference analysis. The program solves for temperature and heat flow distribution throughout the cross section. The temperature distribution can then be used to determine overall heat loss, total and component U-factors, and local temperatures at points of interest.

WINDOW 5.2 Program:
This software was developed by the Lawrence Berkeley Laboratory. The program calculates U-factor and temperatures for the center-of-glazing by using two-dimensional heat flow analysis.

An electronic assembly drawing, simulation data, and a copy of this report will be retained by Architectural Testing for a period of four years. The above results are the exclusive property of the client so named herein and are applicable to the sample simulated. This report does not constitute an opinion or endorsement by this laboratory. This report may not be reproduced except in full without the approval of Architectural Testing.

For ARCHITECTURAL TESTING, INC.:

SIMULATED BY:

Digitally Signed by: Armeya R. Saroufiem

Armeya R. Saroufiem
Simulation Technician

REVIEWED BY:

Digitally Signed by: Michael Resech

Michael P. Resech
Project Manager

ARS: ars
83792.02-201-45

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix A: Drawings (6)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
01-R0	06/13/08	All	Original report issue. Work requested by Mrs. Susan Turner of Bailey Edward Design.
02-R0	12/17/08	All	Revised report issue. Report revised to update glass configurations and add SHGC values. Work requested by Mrs. Susan Turner of Bailey Edward Design.

G Manufacturers' Data

1 Marvin Aluminum Clad Window
2 Allied Storm Windows
3 Monray Storm Window

MARVIN
Windows and Doors

December 3rd 2008

Building Blocks Inc.
At: Todd Zeller
3250 N Kedzie Ave
Chicago, IL 60612-2501

Re: Lincoln Hall @ University of Illinois Urbana-Champaign
Profile No: 668008

Dear Todd,

Thank you for your business and representing Marvin Windows and Doors on this project. The following is information in meeting your request. Please reference attached documents for specific details.

Manufacturer: Cardinal IG Fargo, ND http://www.cardinalcorp.com/
Glass: Marvin standard LoE2-272
Argon content: 90%
Spacer: Cardinal IG XL Edge stainless steel
LoE surface: #2 surface

It is Marvin Windows and Doors goal to be your best total solution for windows and doors. Offering product and design flexibility to meet customer requirements is paramount in being a part of the solution. We are committed and focused to performing as a partner on the Lincoln Hall project. If you have any questions, concerns or wish to discuss this in detail please contact me.

Sincerely,

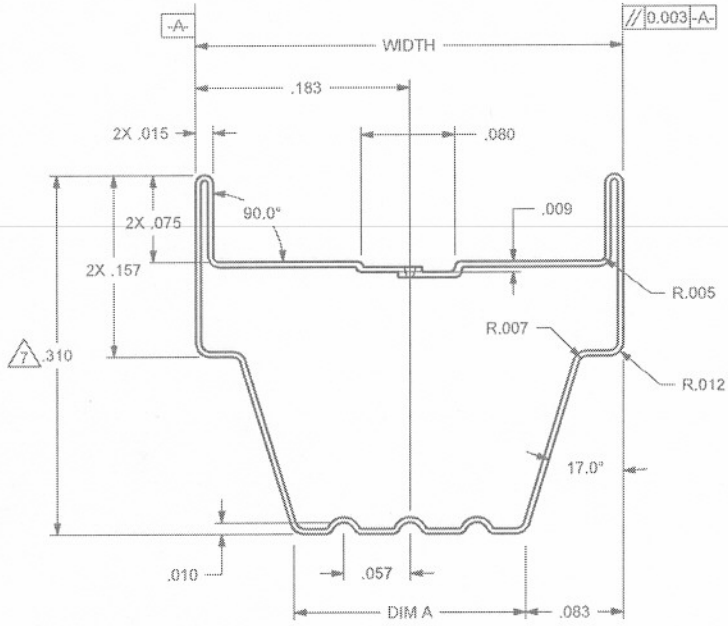
Tim Kuehn CSI, CCCA
Commercial Specialist
Marvin Windows and Doors Architectural Division
888-323-7114
timk@marvin.com

Cc: Mike Laufman CDT Architectural Division Manager
Dan Smith CSI, CDT, LEED AP Commercial Sales Representative

DRAFT DOCUMENT
NOT APPROVED FOR PRODUCTION

CONCEPT: ☐ DEVELOP: ☐

SIGNATURE & DATE REQUIRED FOR CONCEPT TO DEVELOPMENT



.008" WALL THICKNESS

SIZE	WIDTH	DIM A	PART NO
11.5	.432	.265	***
13.0	.492	.325	***
14.5	.550	.383	***
16.0	.610	.438	***

.0045" WALL THICKNESS

SIZE	WIDTH	DIM A	PART NO
6.5	.236	.069	***
7.0	.256	.072	***
7.5	.275	.104	***
8.0	.295	.128	15440100
9.8	.366	.199	15440110
11.5	.432	.265	15440120
13.0	.492	.325	15440130
14.5	.550	.383	15440140
16.0	.610	.438	***

NOTES:
1. FOR GENERAL SPECIFICATIONS, REFER TO DOC 00003952
2. MATERIAL: 201 STAINLESS STEEL, 0.0045 ± 0.00025, .008 ± .00025 WALL THICKNESS, ANNEALED, 1 CBA FINISH
3. LASER STITCH WELD 33 PULSE PER INCH, NO EXTERIOR FLASH, NO THROUGH BURNS
4. SPACER MUST BE CLEAN AND FREE OF DIRT AND OILS
5. FOR ASSEMBLY DRAWINGS, REFER TO DOC 00017348 (MARVIN) AND 00016864 (INTEGRITY AND INFINITY)
6. THESE PART NUMBERS ARE FOR MARVIN INTERNAL USE IN EDI DATA DEVELOPMENT ONLY
7. 7.0 SPACER DIMENSION IS .330

REV	DESCRIPTION / REQUESTER	ECN NO	DATE	REV BY
13.0	ADDED ADDITIONAL SPACERS, UPDATED NOTE 2 ADDED NOTE 7	8727	5/14/08	CDH
12.2	UPDATED STANDARDS/APPVD FOR PILOT/RELEASE	7815	03/05/08	MAP
11.0	UPDATED TO LATEST SOFTWARE VERSION	6968	11/20/06	AWM

UNSPECIFIED TOLERANCES	
DECIMALS: XX: ± .03 XXX:± .012	ANGLE DEG: ± .5°
LINEAL (L/L): + NA - NA	FAB (F/L): ± NA
MATERIAL: NA	

MARVIN Windows and Doors

RESEARCH & DEVELOPMENT
WARROAD, MN, USA, (218) 386-4021
00030644 VER 0.8

PRODUCT CATEGORY:	CARDINAL IG			
UNIT TYPE:	GLASS AND GLAZING			
DWG TYPE:	COMPONENT PROFILE			
DESCRIPTION:	RIBBED FLAT BACK SPACER			
CHK: KRM 8/8/08	SIZE: B	CLASS: MISC	DWG NO: 00016931	
APP: JTK 8/8/08	SCALE: 10:1	DATE: 07/21/00	DWG BY: TAH	SHEET: 1 OF 1

SPECIFICATIONS
"HOL-OP"
HISTORIC ONE LITE - OPERATING

APPLICATION: EXTERIOR INSTALLATION: - BOTTOM OPERABLE-LOWER SCREEN STANDARD

PART 1 – GENERAL

1.1 SCOPE. All aluminum windows of the types and sizes shown in the plans and/or as called for in this specification shall be furnished with all necessary hardware, fasteners and miscellaneous equipment as herein specified and shall be manufactured by Allied Window, Inc. Quality standards shall be as described within these specifications.

PART 2 – MATERIALS

2.1 ALLOYS. Aluminum shall be of commercial quality and of proper alloy for window construction free from defects impairing strength and durability. All straight extruded sections shall be of 6063-T5 alloy and temper and shall have a minimum ultimate tensile strength of 22,000 P.S.I. and a yield of 16,000 P.S.I.

2.2 WINDOW MEMBERS. Master frame members shall be of extruded aluminum with a 3/8" x 1 3/8" dimension. All extrusions shall be of sufficient strength to perform as designed. Sash members shall be of extruded aluminum with a 3/8" x 1" dimension. Frame and sash members shall have a nominal structural wall thickness of not less than .062". All corner keys shall be of extruded aluminum. Build-out channels (1/2" x 5/8") shall be provided at head and jambs to assure full operation of top sash of wood prime window.

2.3 FASTENERS. All screws and other miscellaneous fastening devices incorporated shall be zinc plated, cadmium plated or other non-corrosive metals compatible with aluminum.

2.4 HARDWARE. All insert clips shall be nylon, or zinc die cast.

2.5 WEATHERSTRIPPING. Operating track jamb members shall be lined with pile weatherstripping equal to Stan-pro #525-160.

PART 3 – CONSTRUCTION

3.1 ASSEMBLY. All windows shall be assembled in a secure and workmanlike manner. The master frame and insert frame(s) shall be of mitered head and sill. Frame rails and stiles shall be neatly joined together using extruded aluminum corner keys staked in place.

3.2 SASH. The operable bottom sash shall be removable and be equipped with a full bottom rail lift handle. Heavy-duty spring loaded latches shall be provided for variable sash positions for ventilation.

3.3 SILL EXPANDER. Sill expander shall be of "H" type with minimal wall thickness of .062: and .125" web thickness, and modified to permit weepage.

PART 4 – FINISH

The exposed surfaces of all aluminum members shall be clean and free from serious surface blemishes. Standard finishes shall be electrostatically applied baked acrylic enamel in white, beige, black or bronze. Painted finish shall meet AAMA 603.6. Optional custom color finish to be two-part polyurethane paint (air dried). Clear anodized, bronze anodized and Kynar finishes are available under appropriate circumstances.

PART 5 – SCREEN

Extruded screen insert frame(s) (3/8" x 1 1/16") with extruded aluminum corner keys shall be provided. Standard screen cloth is charcoal aluminum 18 x 16 mesh securely held in frame with vinyl spline (fiberglass, black aluminum, bright aluminum, or bronze screen wire optional).

PART 6 – GLASS AND GLAZING

6.1 GLASS. Glass shall be not less than "B" quality. Standard factory glazing shall be "DSB" (1/8"). Optional use of 5/32", 3/16", or tempered glass shall be dictated by size of panels, code requirements, or project specifications.

6.2 GLAZING MATERIAL. Glass shall be held in place with removable and reusable vinyl glazing splines. Vinyl shall be manufactured from virgin polyvinyl chloride. All corners shall be neatly mitered.

PART 7 – INSTALLATION

The installer shall securely fasten windows in place to a straight, plumb and level condition, without distortion of the windows and shall make final adjustments for proper operation in accordance with the manufacturer's instructions.

PART 8 – WARRANTY

Manufacturer shall provide a five (5) year warranty against faulty materials, paint and workmanship.

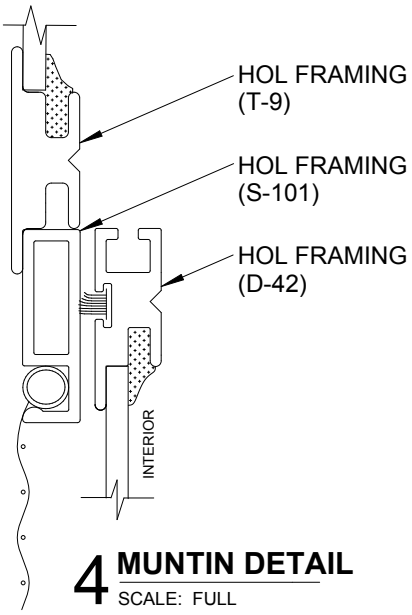
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

For More Information Contact:

ALLIED WINDOW, INC.
11111 Canal Road
Cincinnati, Ohio 45241
(800) 445-5411
(513) 559-1212
(513) 559-1883 (Fax)

WEBSITE
www.alliedwindow.com
www.invisiblestorms.com

E-MAIL ADDRESS
info@alliedwindow.com



4 MUNTIN DETAIL
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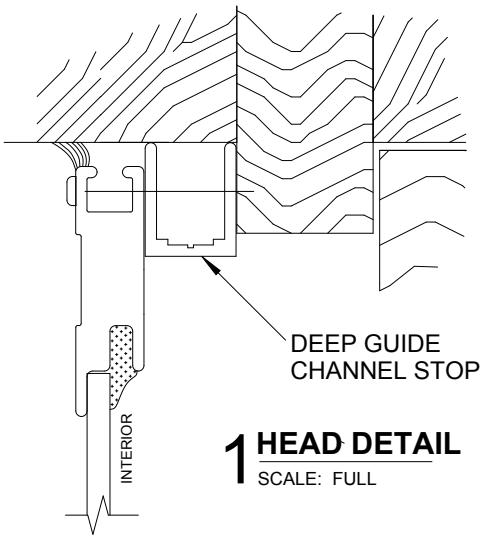

1 HEAD DETAIL
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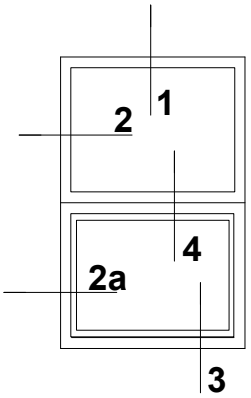

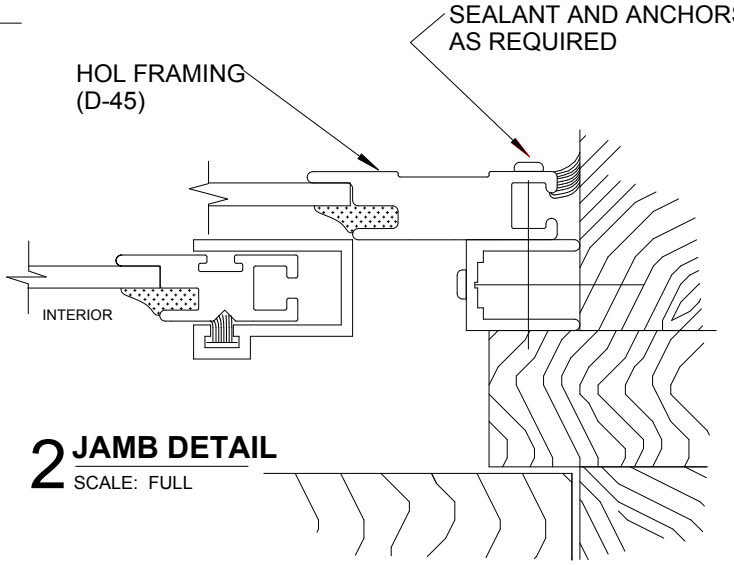

2 JAMB DETAIL
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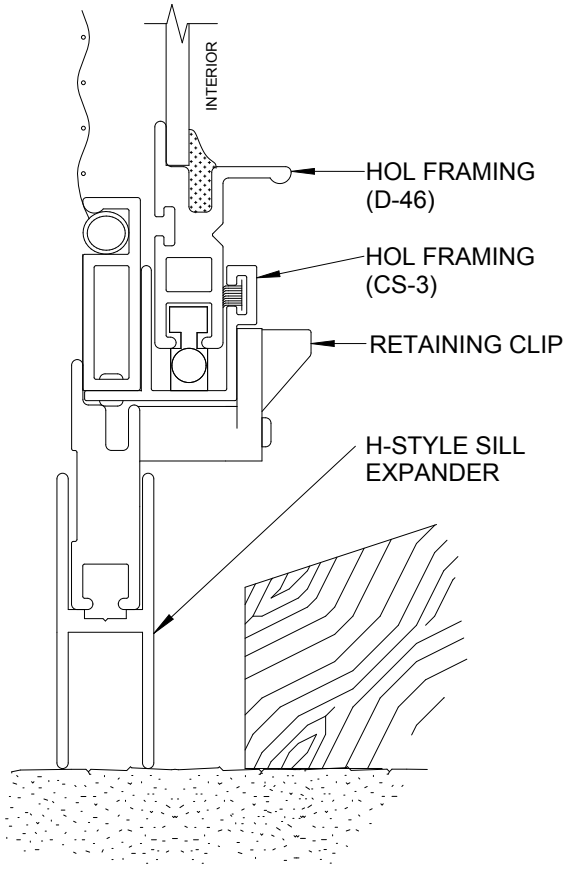

3 SILL DETAIL
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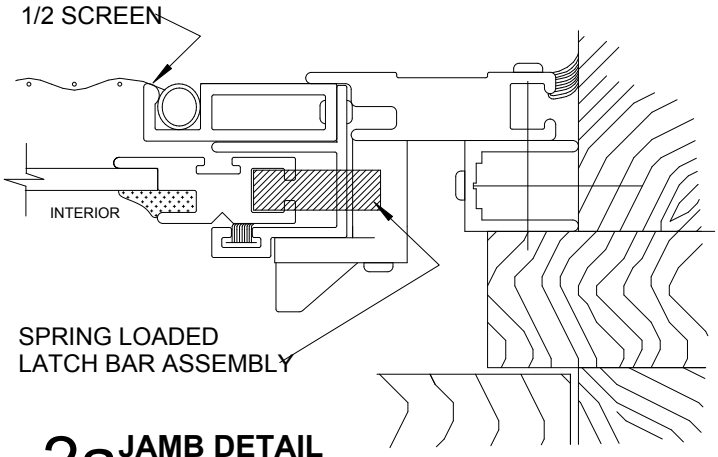


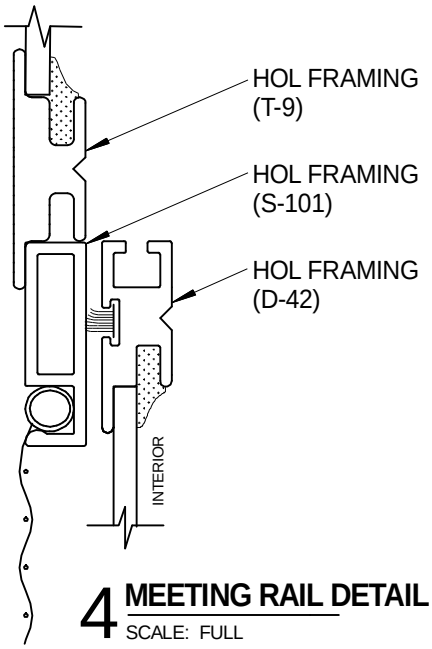
2a JAMB DETAIL
SCALE: FULL

Graphic Scale
0" 1/2" 1"

PRODUCT
HISTORIC ONE LITE - OPERATING • HOL-OP
WITH SCREEN

DWG. NO.
H-6

Allied Window
Performance Panels™
11111 CANAL ROAD • CINCINNATI, OH 45241 • PH: 800-445-5411, 513-559-1212 • FAX: 513-559-1883 • www.alliedwindow.com • info@alliedwindow.com



4 **MEETING RAIL DETAIL**
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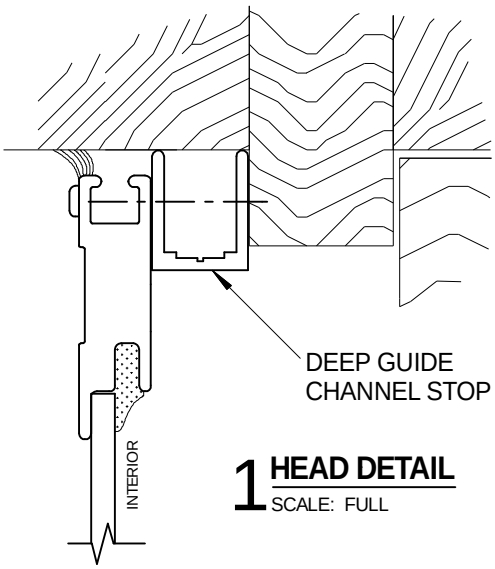

1 **HEAD DETAIL**
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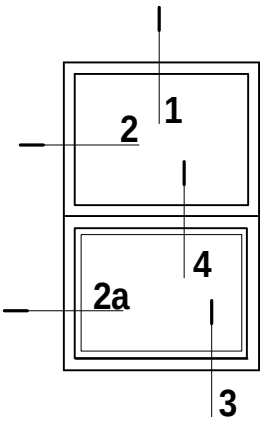

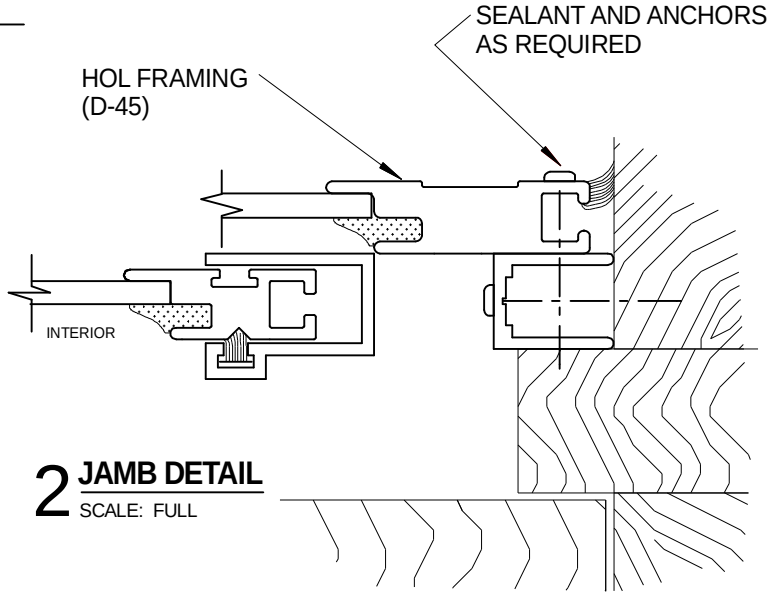

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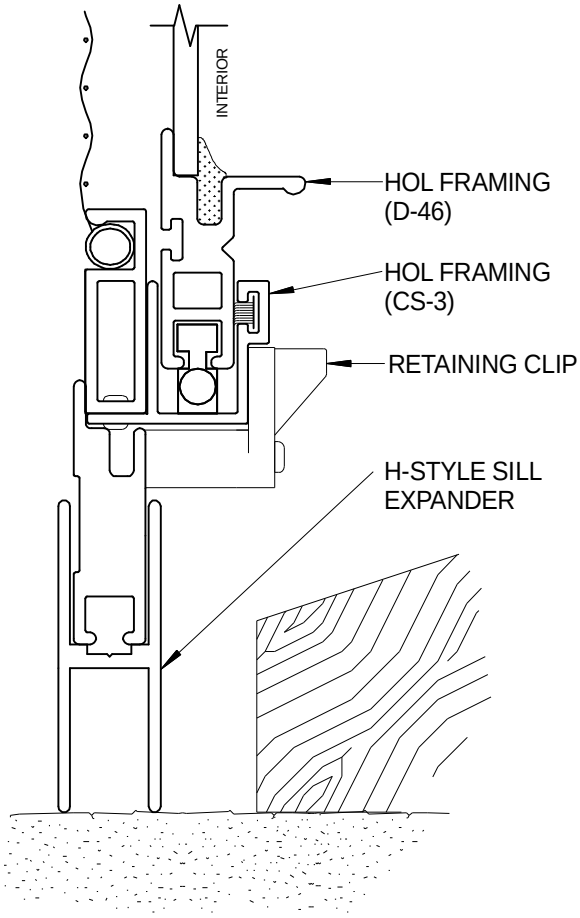

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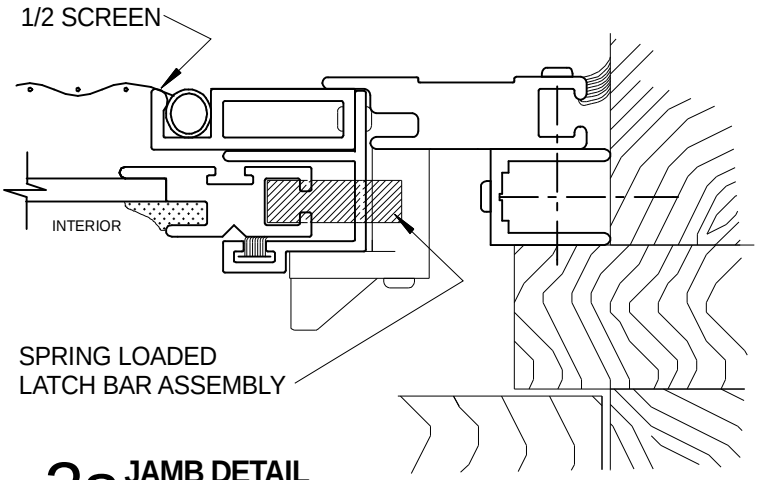

2a **JAMB DETAIL**
SCALE: FULL

Graphic Scale
0" 1/2" 1"

PRODUCT
HISTORIC ONE LITE - OPERATING • HOL-OP
WITH SCREEN

DWG. NO.
H-6

Allied Window
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ARCHITECTURAL SPECIFICATIONS

Section 08580 or 08593
2004 Master Format Section 08 51 69 or 08 56 73

Mon-Ray 500 & 600 Series
High Performance Aluminum Storm Windows

PART 1 GENERAL

1.00 SCOPE

A. This is a high performance acoustical storm window Specification. The Specification provides the Bidders with rigid standards for product materials, workmanship and performance that must be complied with in every respect.

B. It is the intent of this Specification to provide the Owner with proper product materials, workmanship, design, application, performance, installation and warranty coverage. The Specification describes specific test requirements, system performance, quality assurance tests, and product material requirements required to meet the Owner's desired acoustical performance level.

1.01 WORK INCLUDED

A. Furnish and install high performance acoustical aluminum storm windows, complete with hardware, and related components as shown in drawings and specified in this Section.

B. All storm windows are to be Mon-Ray Series 500 or 600 as manufactured by Mon-Ray, Inc. Other manufacturers requesting approval to bid their product will be viewed as alternate bids and must submit a request for approval 10 days prior to bid for consideration.

1.02 REFERENCES

A. ANSI/AAMA 1002.10-93 "Voluntary Specifications for Insulating Storm Products for Windows and Sliding Glass Doors
B. ASTM E 283 "Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors"
C. ASTM E 330 "Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference"
D. ASTM E 331 "Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Air Pressure Difference"
E. AAMA 502 "Voluntary Specification for Field Testing of Windows and Sliding Glass Doors"
F. ASTM E 90 "Laboratory Measurement of Airborne Sound Transmission of Building Partitions"
G. ASTM E 413 "Determination of Sound Transmission Class (STC)"

1.03 SYSTEM PERFORMANCE

A. Test Unit Size: Test units shall be the sizes listed below. Sill of the test buck shall have a 13 degree slope to the exterior. (See Appendix "A" for test buck details)

1. Fixed panel and removable panel storm windows: 4"0" wide x 4"0" high
2. Horizontal sliding storm windows: 6'0" wide x 4'0" high
3. Vertical sliding storm windows: 3' 8" wide x 5' 2" high

B. Air Leakage Test: The storm window shall be subjected to an air leakage test in accordance with ASTM-E 283. Window units tested by an Independent Laboratory shall be glazed with 1/8" clear annealed glass. Air leakage shall meet the following performance requirements. **Revised 2/2/07**

1. Air leakage for fixed panel storm windows shall not exceed 0.15 CFM per square foot of window area at both a positive (infiltration) and negative (exfiltration) static pressure of 1.56 PSF at 25 mph wind. Weep holes shall not be sealed during the air leakage test.

2. With the storm sash in the closed position, air leakage in removable panel, horizontal and vertical sliding windows shall not exceed 0.50 CFM per lineal foot of sash crack at both positive and negative static pressure 1.56 PSF at 25 mph wind . Weep holes shall not be sealed during the air leakage test.

C. Uniform Structural Load Test: With storm sash closed position, the window shall be tested in accordance with ASTM E 330. Apply a minimum exterior positive and negative load of:

30.0 PSF at 108 mph wind = Class 20
37.5 PSF at 121 mph wind = Class 25
45.0 PSF at 132 mph wind = Class 30
52.5 PSF at 143 mph wind = Class 35

for fixed panel, removable panel, horizontal and vertical sliding storm windows. Each load shall be maintained for 10 seconds. At the conclusion of the test, there shall be no glass breakage, damage to fasteners, hardware or any other damage causing the storm window to be inoperable.

D. Water Resistance Test: With storm sash in the closed position, the window shall be subjected to a water resistance test in accordance with ASTM E 331. When a positive static pressure of:

2.0 PSF at 28 mph wind = Class 20
2.5 PSF at 31 mph wind = Class 25
3.0 PSF at 34 mph wind = Class 30
3.5 PSF at 37 mph wind = Class 35

has been stabilized, 5 gallons of water per hour per square foot of window area shall be applied to the exterior face of the window, for a continuous period of 3 minutes. No water shall run over the interior edge of the sloped test buck sill.

E. Concentrated Load and Glass Adherence Tests: A concentrated load equal to the weight of the sash, but not less than 15 pounds, acting parallel to the plane of the glass in a direction tending to pull the sash rails off the glass and applied alternately for three minutes at the center of all sash rails of the glazed sash shall not cause the sash rails to deflect more than 1/8" each.

F. Safety Drop Test: When the glazed lower sash of a vertical sliding storm window is allowed to "free fall" the maximum distance provided for by the latch positions, it shall automatically stop every two inches in the next lower latch position.

G. Glass and Screen Insert Squareness Test: Take a measurement of the distance between diagonally opposite pairs of corners of an insert with a steel rule. The difference between these measurements shall not be more than 1/4".

H. Acoustical Performance: An acoustical test report shall state that the secondary glazing window to be furnished has been tested by it self in accordance with ASTM E90-90. The STC rating of the storm window shall tested as either "solo", the storm window alone or "tandem", with a prime window and a storm window.

1.04 SUBMITTALS

A. Shop Drawings: Submit drawings under provisions of Section 01300. Include dimensions, relationships to construction of adjacent work, component anchorage, type of caulking, window locations, installation methods and installation materials. Dimensions of all windows and components will be the responsibility of the successful Bidder.

B. Samples: Submit appropriate color Samples for Architects review and approval.

C. Test Reports: Submit Independent Laboratory Test Reports verifying windows meet the specified requirements for sound transmission, air leakage, water resistance, uniform structural load, and deglazing.

D. Certificates: Furnish an affidavit in triplicate from the Window Manufacturer, certifying that materials used on this Project conform to these Specifications and are identical in all appropriate respects to the storm windows identified in the Independent Laboratory Test Reports.

1.05 QUALITY ASSURANCE

A. Qualifications: Fabrication shall be by a Window Manufacturer who can furnish evidence to the Owner that it is, and has been for not less than five (5) consecutive years, regularly engaged in the manufacturing of aluminum window units similar in design and performance to those specified for this Project.

B. Pre-award Installation:

1. Provide a complete installation of one (1) window as specified and selected by the Owner. Window mock-up to be completed within seven (7) days of the bid opening date. This window and installation shall be for the review of the product and installation. The Owner at his discretion may have the window tested by an Independent Test laboratory to verify compliance of the product with these Specifications.

   The cost for pre-award testing, by the Independent Laboratory shall be paid by Owner. Any deficiencies discovered on the window by the testing and the Bidder at no cost to the Owner will correct deficiencies in any similar models used in the project.

C. Post Installation Field Testing:

1. Window field-testing will be in accordance with AAMA 502-90 using Test Method B. After installation and before final payment, up to two percent (2%), but not less than two (2) window units may be randomly selected by the Owner and subjected to an air leakage and water resistance tests. Air leakage and water resistance test results shall meet the specified requirements per AAMA 502-90. If any randomly tested window fails, the Successful Bidder shall make necessary corrections until satisfactory results are achieved and make corrections to all other window units installed as part of this Project.

   All costs associated with the Post Installation Field Testing and required repairs or replacements shall be borne by the Successful Bidder. These tests may be performed by either the Window Manufacturer's technical service personnel using accurately calibrated and approved air leakage testing equipment, or by an approved Independent Test Laboratory. All tests shall be conducted in the presence of the Owner, or the Owner's Representative.

D. Reference List:

1. The Bidder shall furnish with its bid a Reference List from the Window Manufacturer containing not less than ten (10) completed projects with window units of similar to the window units specified for this Project. At least five (5) of the referenced projects shall be at least three (3) years old. As part of the bid evaluation to determine life cycle cost and best value for the Owner, consideration will be given as to age, longevity, performance and extended product life of these installations. The Reference List shall include the name, address and phone number of the project, and the date the project was completed.

2. If an installation sub-contractor is used, the subcontractor must furnish a list of at least five (5) projects similar in scope to this project with the base bid.

3. The Owner or Owners Representative has the right to deem the bidder as "non-responsible" or "non-qualified", based upon inspection of any projects performed by the bidder as a contractor, sub-contractor or manufacturer, if the products or workmanship is determined to be unacceptable by the Owner or Owners Representative.

1.06 WARRANTY

A. Product Warranty: The successful Bidder shall furnish a positively written, non-prorated and fully transferable warranty from the Window Manufacturer against defects in materials and workmanship of the storm window units, under normal use, for a period of ten (10) years from the date of acceptance of the installed storm window units by the Owner. The warranty shall state that the Window Manufacturer shall provide all materials required to repair or replace defective materials or workmanship. The warranty shall further state that parts used to manufacture the storm window units, or suitable replacements, shall be available throughout the warranty period.

B. Installation Warranty: The Successful Bidder shall furnish a written warranty against defects in the installation workmanship and materials for a period of three (3) years from the date of acceptance by the Owner. Installation warranty work will be performed at no cost to the Owner.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Mon-Ray, Inc. (Manufacturer of Mon-Ray 500 or 600 Series Acoustical Storm Windows)
801 Boone Ave. No
Minneapolis, MN 55427-4432
Phone: (800) 544-3646 Fax: (763)-546-8977 Website: www.monray.com

B. Alternates: Under provisions of Section 01030.

2.02 MATERIALS

A. Aluminum: All frame, sash and screen members shall be accurately extruded aluminum prime alloy 6063-T6. The minimum nominal wall thickness of all frame, sash, expanders and panning members shall not be less than 0.050".

B. Glazing: Standard glazing for fixed panel, removable panel, horizontal and vertical sliding storm windows shall be 1/8" clear annealed float glass. The area per lite of glass shall not exceed 20 Square feet for 1/8" glass. Safety glazing shall be used as required by code and correctly labeled on glass. The glass shall be glazed into the sash with a one-piece wrap-around, flexible vinyl glazing channel. All corners shall be secured and neatly tucked. All glass shall be factory washed.

C. Weather-Strip: All weather-strip shall be silicone treated, UV stabilized polypropylene pile with an integral polypropylene fin running through the center. Weather-stripping shall be bonded to a non-shrinking backing, which shall slide into extruded ports in the aluminum storm frame.

D. Vinyl Track: All operating windows shall incorporate a vinyl track to eliminate metal to metal contact and reduce operating force. All horizontal sliding sashes shall operate smoothly in a weather tight vinyl track. All vertical sliding sashes shall operate in a vinyl track with predetermined processed ventilating positions. The vinyl tracks will be secured into the storm frame through the use of extruded ports.

E. Screens: All horizontal and vertical sliding storm window shall have a half screen mounted in the sash track of the storm frame. The screen shall be pre-bowed, extruded 6063-T6 tubular aluminum with a nominal wall thickness of 0.055". Mitered corners shall be joined neatly by means of solid T6 tempered aluminum corner gussets, securely peened within the screen frame extrusion. The screen cloth shall be fiberglass 18 x 14 mesh in a charcoal color and secured into screen frame with a vinyl spline. The screen inserts if removed will not affect the operation, efficiency or performance requirements of the storm window. NOTE: Fiberglass 18 x 16 mesh shall not be acceptable.

2.03 WINDOW TYPE AND OPERATION

A. Type: All windows shall be fixed panel, removable panel, horizontal sliding or vertical sliding aluminum acoustical storm windows with a frame depth of 7/8" for standard Mon-Ray products.

1. The 500 Series window shall have an frame expander design and mount cleanly into the existing storm window pocket against the blind stop or on the interior of the prime sash using a F channel frame expander.

2. The 600 Series window shall have a blind stop frame design to mount on the blind stop or casing.

All glass sash and screen inserts shall be easily removable to the interior for cleaning. The entire storm window shall be designed and constructed in a manner that allows for easy replacement of all parts, hardware and weather-stripping.

B. Non-operating Sash: All removable panels shall be held in place by an extruded aluminum turn button. Non-operating sash of horizontal and vertical sliding storm windows shall slide into an extruded weather-stripped sash pocket. Vertical non-operating sash shall be securely supported by two high impact nylon support blocks anchored into the storm window frame by non-magnetic stainless steel screws.

C. Operation: Operating sash and frame shall have a two-track, self storing sash and screen design. Operating surfaces to be completely separated from metal-to-metal contact. All horizontal sliding sash shall operate smoothly in a weather tight vinyl track. All vertical sliding sash shall operate in a vinyl track with predetermined processed ventilating positions. The vinyl tracks will be secured into the storm frame through the use of extruded ports. The vinyl track and spring loaded pin-locks shall provide a "ratchet action" design with automatic ventilation settings every two (2) inches. In the closed and fully open positions the operating sash shall lock in non-ratcheted, secure holes. The pin-locks shall engage automatically into predetermined ventilating positions processed into each of the side storm frames.

2.04 HARDWARE

A. All assembly and installation fasteners and screws incorporated in the storm window units and exterior panning shall be non-magnetic, stainless steel. All hardware parts shall be of aluminum, stainless steel, nylon, or other non-corrosive materials compatible with aluminum. NOTE: Wrought metal or plastic parts will not be acceptable.

B. All removable panel storm sash shall incorporate an extruded aluminum turn button installed with non magnetic stainless steel screws.

C. All horizontal sliding windows shall slide in extruded vinyl tracks, which shall be set in extruded ports in the master frame.

D. All vertical sliding sashes shall be equipped with two spring loaded stainless steel pin-lock assemblies. The pin-lock assemblies shall be located at the lower corners of the operating sash and automatically engage at each ventilation setting. Each pin-lock assembly shall consist of: One stainless steel plunger with a diameter of 3/16". One stainless steel knurl knob threaded into the plunger and extending 1/2" to the interior of the sash rail to allow for a firm and easy finger grip. One stainless steel compression spring. The spring and the plunger shall be concealed in an extruded channel within the sash rails to prevent moisture, dirt and debris from affecting the operation of the pin-lock assembly.

2.05 FABRICATION

A. Frame and Sash Construction:

1. Frame: All aluminum head, jamb and sill members for the master frame and all frame expanders shall have a minimum wall thickness of 0.050 ". All members to be extruded 6063-T6 aluminum assembled in a secure and workman like manner to assure lasting weather resistant construction. Frame joints shall be butt-type, neatly joined and secured by means of non-magnetic stainless steel screws anchored into integral screw ports. Vinyl weather-stripping and tracks shall be shaded from direct sunlight by the frame and sash members. The storm window shall be mounted by using four adjustable expanders, which securely slide over the master frame. All installation holes shall be pre-drilled the manufacturer.

2. Sash: All sash members shall be extruded 6063-T6 aluminum with a minimum wall thickness of 0.055 ". Mitered corners shall be joined by non-magnetic stainless steel corner keys, securely peened on the inside of the sash insert. All sharp corners of the sash shall be deburred and smoothed. Sash meeting rails shall interlock in the closed position. All removable panels and operating sash shall have a full-length extruded lift handle as part of the sash rail. The lift handle shall project 7/16" to the interior to allow adequate area to maintain a sure finger grip. Note: Weather-stripping applied to or installed on the operating sash will not be permitted.

B. Weep System: The sill expander shall have a minimum of two weep holes, uniformly positioned to allow for water to weep to the exterior of the storm window unit.

2.06 FINISHES

A. Organic (Painted Finish)

1. Finish all exposed areas of aluminum storm windows and components with a factory applied spray coating in accordance with Aluminum Association Designation:

*Description	AA Designation	AAMA Guide Specification
Siliconized polyester baked enamel	AA-M12-C41-RX1	AAMA 2603

2. Standard colors shall be one of the manufacturer's three standard Poly-Cron III painted finished: White, Bronze or Tan. The head of all assembly and installation screws shall be painted the same color as the master frame of the storm window.
3. Optional colors: Available in polyester enamel or Kynar paints to conform to AAMA 2603 or 2605. Computer matching capability. Color samples available upon request.

B. Anodic (Anodized Finish)

1. Finish all areas of aluminum storm windows and components with electrolitically deposited color in accordance with the following Aluminum Association Designation:

*AA Designations	Architectural Class	Description	AAMA Guide Specification
AA-M10-C22-A31/41	II/I	Clear Anodized	AAMA 607.1-77

2. Standard anodized color is 202 R1. Optional anodized finishes conform to AAMA 608.1, in the following colors: Clear 204 R1 and 215 R1, Champagne, Gold, Light Bronze, Medium Bronze, Dark Bronze, Deep Bronze and Black. Other custom anodized colors available upon request at an additional charge.

2.07 ACCESSORIES

A. Exterior panning: (Optional) - 500 Series Only All existing exterior wood brick-molding around the window openings as shown in the Project drawings shall be covered with 6063-T6 extruded panning. Head and jamb panning shall interlock into the storm window frame and be pre-assembled by the manufacturer. A sill expander panning shall be provided to accommodate sill variations. The panning corners shall be butt-joined, secured with stainless steel alignment clips and be back-sealed by the window manufacturer.

B. F-channel Expanders: (Optional) - 500 Series Only - Where project conditions warrant or thermal separation is desired, an F-channel expander is available. This expander installs on the same fashion as the U-channel expander, but has a 1/2" leg for anchorage.

C. H-mulls: (Optional) - 500 Series Only - This accessory allows two or more storm windows or panels to be installed either horizontally or vertically in a single opening.

D. Mullions and Transoms: (Optional) - 500 Series Only - Where two or more storm window frames adjoin each other horizontally or vertically, mullion or transom panning covers shall be used. Mull and transom covers shall incorporate a port for weather-sealing at the exterior.

PART 3 EXECUTION

3.01 EXAMINATION

A. Bidders are expected to visit the job-site and make a complete survey of the Project prior to bid. All storm window openings will be measured by the Bidder for proper sizing of the new storm windows. Failure to do so will not relieve the Successful Bidder from the need to furnish any and all materials, which may be required, in accordance with the Specifications, without any additional cost to the Owner.

B. Inspect openings before installation to assure surfaces are clean and dry. Verify that Storm opening and masonry openings are correct and the sill is level.

3.02 PREPARATION

A. Remove new storm window units from crating and packaging material. Verify that all parts and accessories are included. All storm window units and accessories shall be securely stored, upright and protected from the weather.

B. Remove old storm windows and accessories from the window opening. Scrape and remove existing sealant from the opening, which will interfere with the installation of new storm windows.

C. Install only aluminum tubing or preservative treated lumber, as required, for all blocking. All blocking shall be the full length of the head, jambs and sill.

3.03 INSTALLATION

A. Storm windows shall be installed in strict accordance with the Manufacturer's instructions and Shop Drawings.

B. Plumb and align storm window faces in a single plane with the existing window. Erect storm windows and accessories square and true, using blocking and anchors to maintain a permanent position.

C. Anchors should be not less than #8 non-magnetic, stainless steel screws. The length of the installation screws shall allow a minimum of one half (1/2) inch to penetrate into the window frame or blocking. Anchors must be adequate to handle thermal and building movement, and specified uniform load requirements.

D. Provide single-component or multi-component, low-modulus, non-sag sealant; comply with ASTM C920, Type S or M, Grade NS, Class 25

3.04 ADJUST AND CLEAN

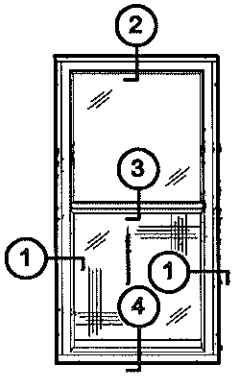
A. Operate installed storm windows to assure a proper installation has occurred. Make any appropriate adjustments.

B. Remove excess sealant, dirt, window labels and wipe dust off frame and glass.

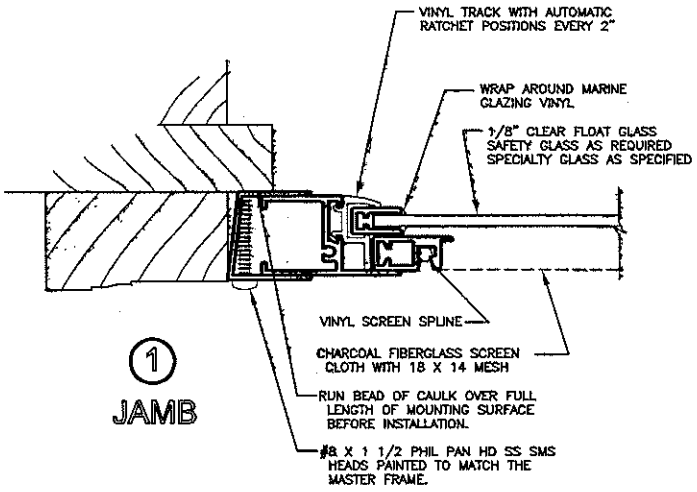
MON-RAY

Storm Windows & Doors

Mon-Ray, Inc.
Phone: (800) 544-3646
Fax: (763) 546-8977
www.monray.com



2-LITE DH



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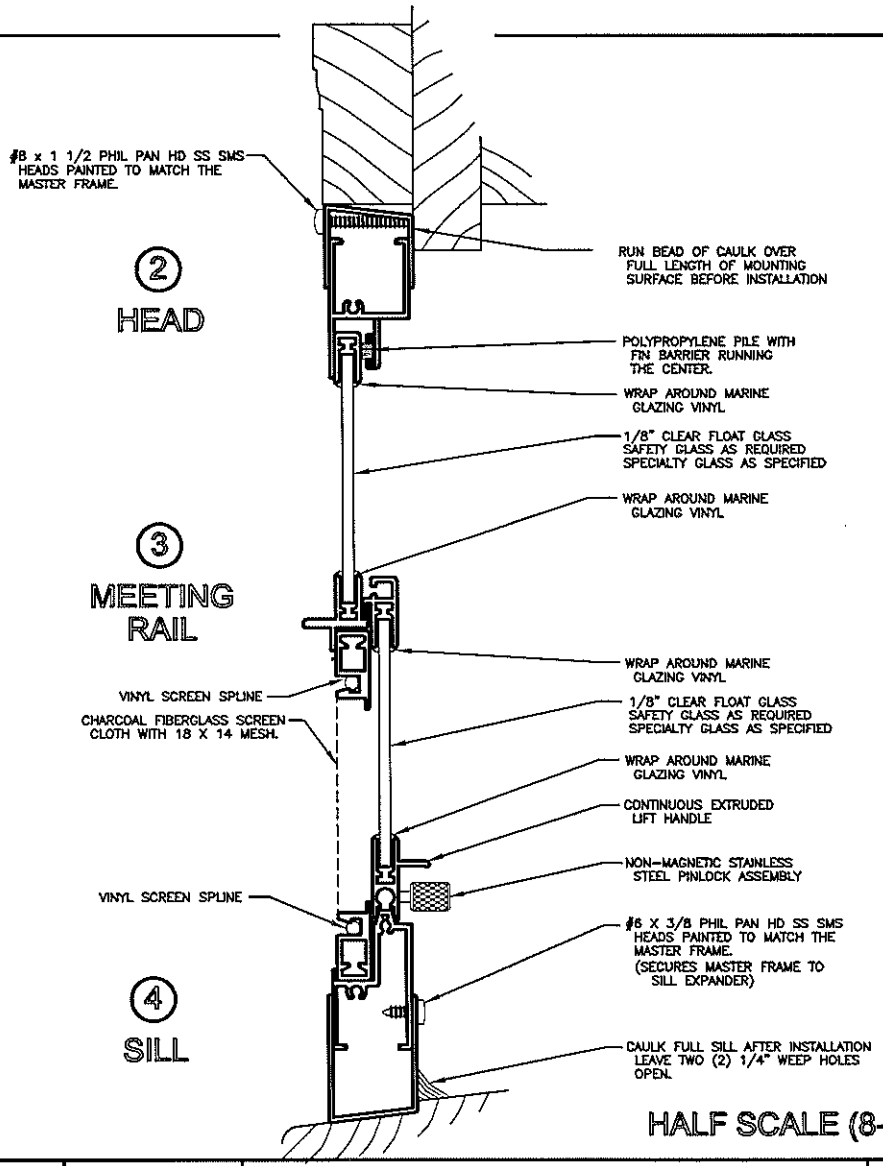

FULL SCALE (11 x 17)

HALF SCALE (8-1/2 x 11)

MON-RAY MODEL 500 SERIES 504 DOUBLE HUNG SHOWN	TYPICAL INSTALLATION	GLAZED WITH 1/8" CLEAR FLOAT GLASS	DRAWING MR-500-801

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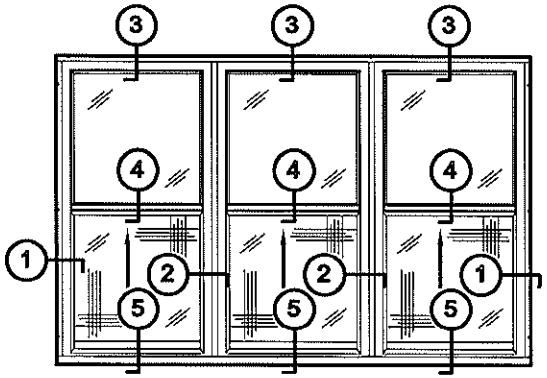
Storm Windows & Doors



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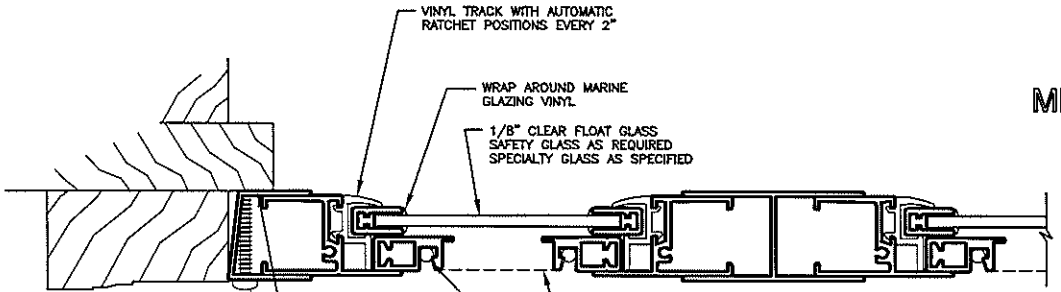
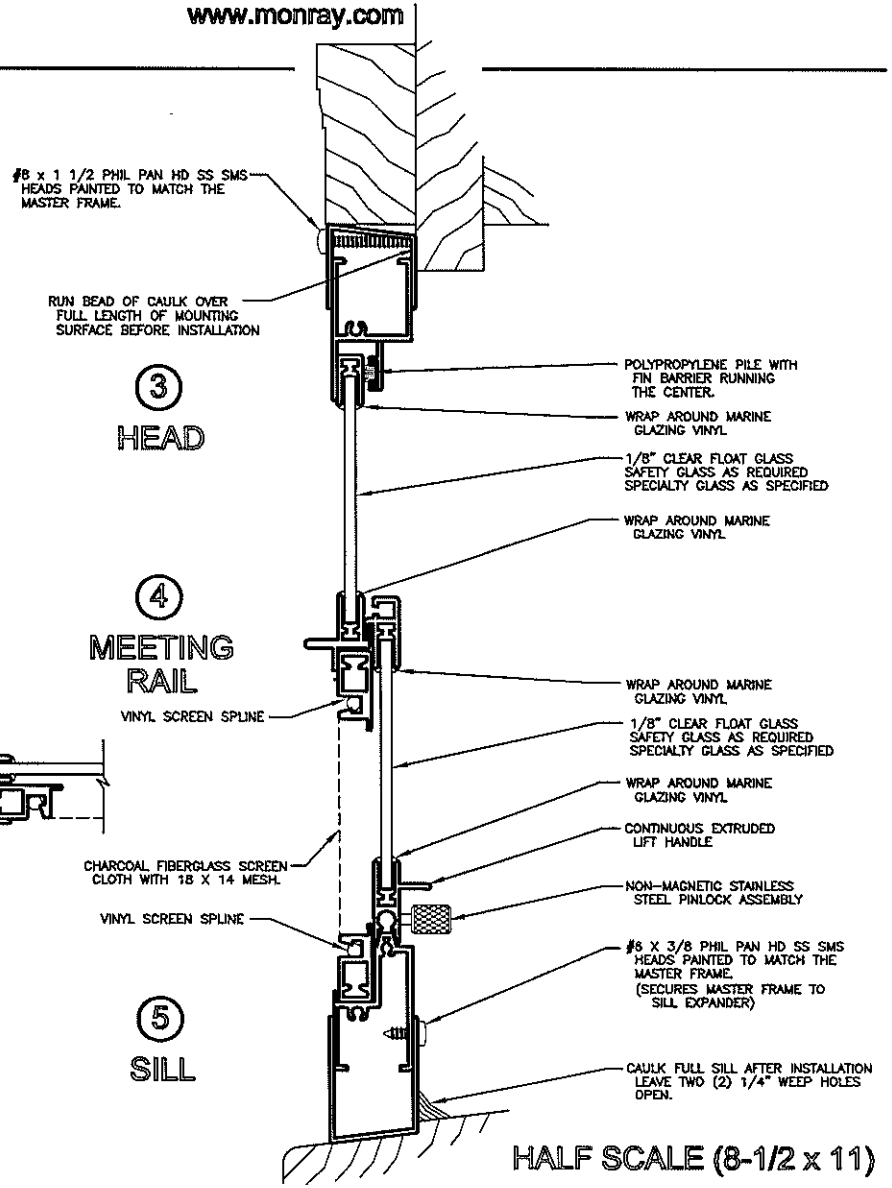


1 JAMB

2 MULLION



3 HEAD

4 MEETING RAIL

5 SILL

FULL SCALE (11 x 17)

HALF SCALE (8-1/2 x 11)

MON-RAY MODEL 500 SERIES - MULLION DOUBLE HUNG WITH 1854 H-MULL SHOWN	TYPICAL INSTALLATION	GLAZED WITH 1/8" CLEAR FLOAT GLASS	DRAWING MR-500-802

MON-RAY

Storm Windows & Doors

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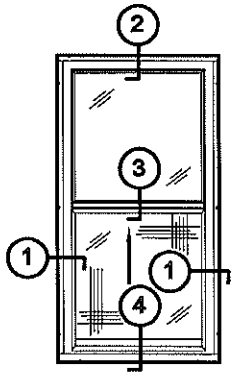

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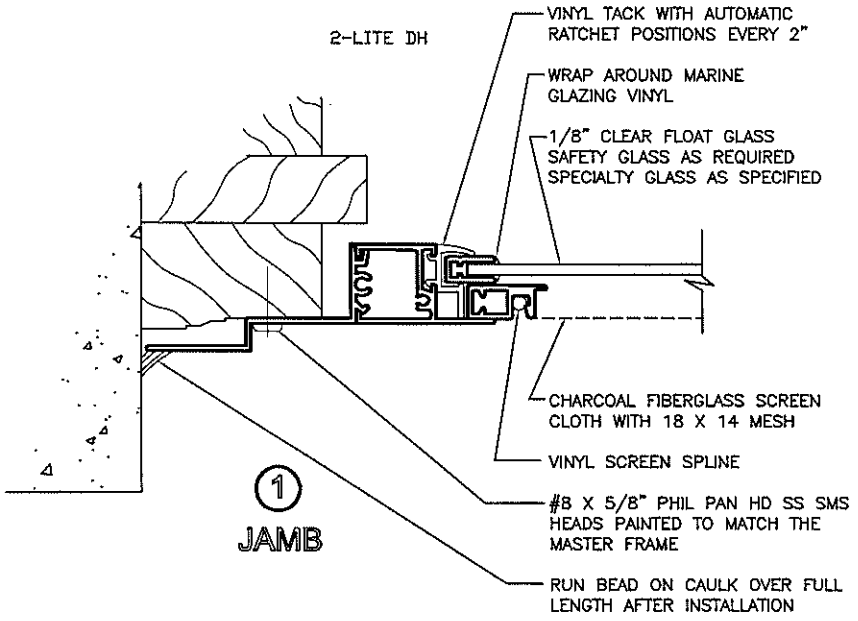

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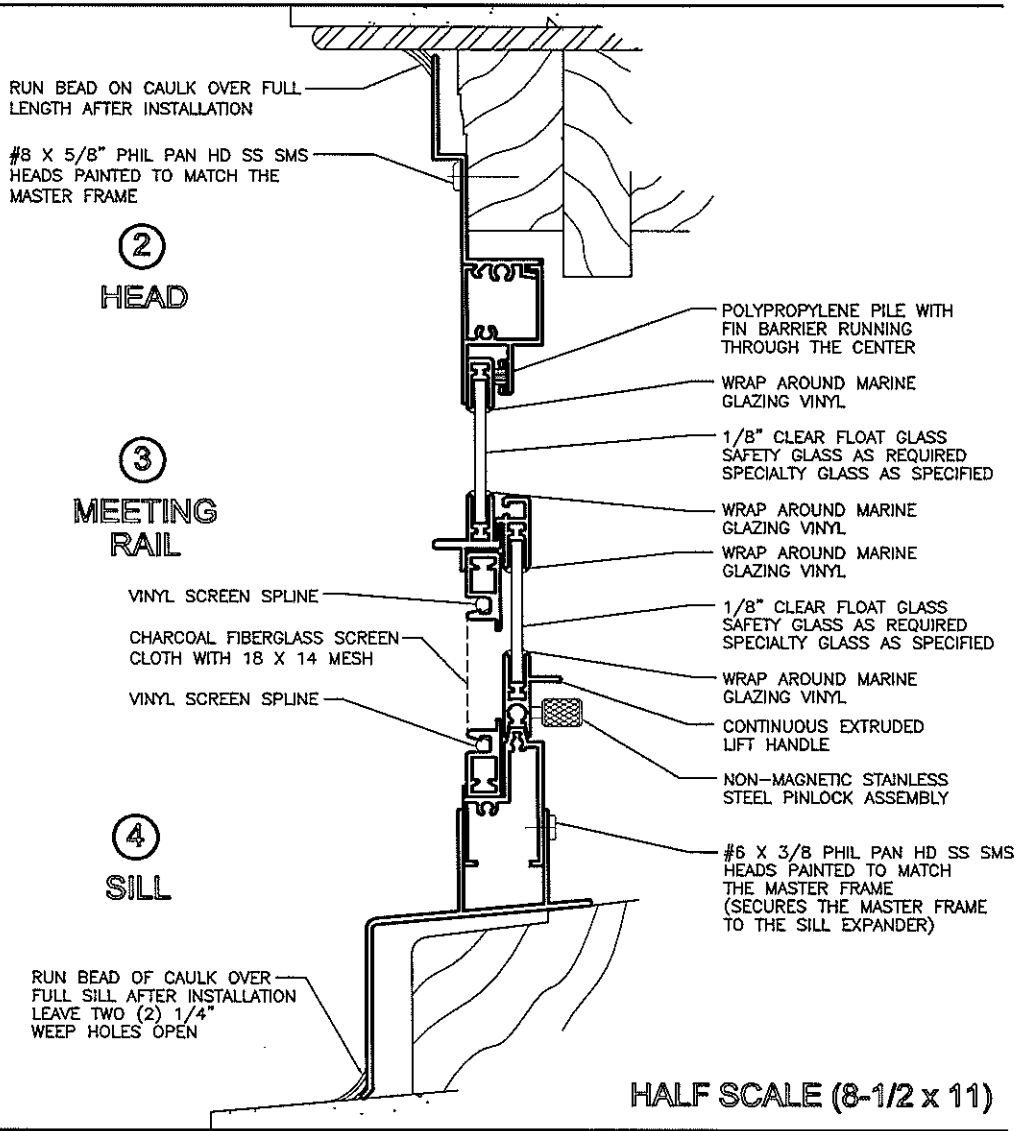


FULL SCALE (11 x 17)

HALF SCALE (8-1/2 x 11)

MON-RAY MODEL 500 SERIES - EXTERIOR PANNING TRIMS DOUBLE HUNG WITH 1875 PANNING SHOWN	TYPICAL INSTALLATION	GLAZED WITH 1/8" CLEAR FLOAT GLASS	DRAWING MR-500-805

H Energy Model

Case 1) Energy cost for the unrestored wall, windows

Case 2) Energy cost for the windows with storm,

Case 3) Energy cost for the replacement window,

Case 4) Energy cost for the restored window.

Case 5) Energy cost for the new walls and unrestored windows

Existing Conditions

1928 Existing Wall (Calculated U= 0.204 Btu/h-ft2-°F)						
Material	Thickness (ft)	Conductivity (Btu/h-ft-°F)	Density (lb/ft^3)	Specific Heat (Btu/h-°F)	R-Value ($h\text{-}ft^2\text{-}°F/Btu$)	Calculated R-Value
Face Brick 4in (BK05)	0.333	0.7576	130	0.22	n/a	0.43954593
Air Space (HF-B1)	n/a	n/a	n/a	n/a	0.91	0.91
Com Brick 4in (BK01)	0.333	0.4167	120	0.2	n/a	0.79913607
Com Brick 4in (BK01)	0.333	0.4167	120	0.2	n/a	0.79913607
Com Brick 4in (BK01)	0.333	0.4167	120	0.2	n/a	0.79913607
Gypsum LW Agg 3/4in (GP04)	0.063	0.133	45	0.2	n/a	0.47368421
						0.68 Inside Film Reistance
						4.90063835 Total R-Value
						0.20405505 U-Value

1910 Existing Wall (Calculated U= 0.185 Btu/h-ft2-°F)						
Material	Thickness (ft)	Conductivity (Btu/h-ft-°F)	Density (lb/ft^3)	Specific Heat (Btu/h-°F)	R-Value ($h\text{-}ft^2\text{-}°F/Btu$)	Calculated R-Value
Face Brick 4in (BK05)	0.333	0.7576	130	0.22	n/a	0.43954593
Air Space (HF-B1)	n/a	n/a	n/a	n/a	0.91	0.91
Com Brick 4in (BK01)	0.333	0.4167	120	0.2	n/a	0.79913607
Com Brick 4in (BK01)	0.333	0.4167	120	0.2	n/a	0.79913607
Com Brick 4in (BK01)	0.333	0.4167	120	0.2	n/a	0.79913607
ClayTile 4in (HF-C1)	0.166	0.33	70	0.2	n/a	0.5030303
Gypsum LW Agg 3/4in (GP04)	0.063	0.133	45	0.2	n/a	0.47368421
						0.68 Inside Film Reistance
						5.40366866 Total R-Value
						0.18505946 U-Value

Existing Slate Roof (Calculated U= 0.156 Btu/h-ft2-°F)						
Material	Thickness (ft)	Conductivity (Btu/h-ft-°F)	Density (lb/ft^3)	Specific Heat (Btu/h-°F)	R-Value ($h\text{-}ft^2\text{-}°F/Btu$)	Calculated R-Value
Slate 1/2in (SL01)	0.22	0.834	100	0.35	n/a	0.26378897
Felt 3/8in (HF-E3)	0.031	0.11	70	0.4	n/a	0.28181818
Plywd 3/4in (PW05)	0.063	0.0667	34	0.29	n/a	0.94452774
Air Space (HF-B1)	n/a	n/a	n/a	n/a	0.91	0.91
Conc LW 30lb 3in	0.25	0.0751	30	0.2	n/a	3.32889481
						0.68 Inside Film Reistance
						6.40902969 Total R-Value
						0.15602986 U-Value

Existing Low Sloping Roof (Calculated U= 0.149 Btu/h-ft2-°F)						
Material	Thickness (ft)	Conductivity (Btu/h-ft-°F)	Density (lb/ft^3)	Specific Heat (Btu/h-°F)	R-Value ($h\text{-}ft^2\text{-}°F/Btu$)	Calculated R-Value
EPDM Membrane	n/a	n/a	n/a	n/a	0.001	0.001
Roof Insulation 3/4 in	n/a	n/a	n/a	n/a	2.7	2.7
Conc LW 30lb 3in	0.25	0.0751	30	0.2	n/a	3.32889481
						0.68 Inside Film Reistance
						6.70989481 Total R-Value
						0.14903363 U-Value

Windows	
U	0.835
SHGC	0.95

Proposed Conditions

1928 New Wall (Calculated U= 0.063 Btu/h-ft2-°F)						
Material	Thickness (ft)	Conductivity (Btu/h-ft-°F)	Density (lb/ft^3)	Specific Heat (Btu/h-°F)	R-Value ($h\text{-}ft^2\text{-}°F/Btu$)	Calculated R-Value
Face Brick 4in (BK05)	0.333	0.7576	130	0.22	n/a	0.43954593
Air Space (HF-B1)	n/a	n/a	n/a	n/a	0.91	0.91
Com Brick 4in (BK01)	0.333	0.4167	120	0.2	n/a	0.79913607
Com Brick 4in (BK01)	0.333	0.4167	120	0.2	n/a	0.79913607
Com Brick 4in (BK01)	0.333	0.4167	120	0.2	n/a	0.79913607
Gypsum LW Agg 3/4in (GP04)	0.063	0.133	45	0.2	n/a	0.47368421
2 7/8 in Insulation	n/a	n/a	n/a	n/a	10.35	10.35
GypBd 5/8in (GP02)	0.052	0.0926	50	0.2	n/a	0.56155508
						0.68 Inside Film Reistance
						15.8121934 Total R-Value
						0.06324233 U-Value

1910 New Wall (Calculated U= 0.061 Btu/h-ft2-°F)						
Material	Thickness (ft)	Conductivity (Btu/h-ft-°F)	Density (lb/ft^3)	Specific Heat (Btu/h-°F)	R-Value ($h\text{-}ft^2\text{-}°F/Btu$)	Calculated R-Value
Face Brick 4in (BK05)	0.333	0.7576	130	0.22	n/a	0.43954593
Air Space (HF-B1)	n/a	n/a	n/a	n/a	0.91	0.91
Com Brick 4in (BK01)	0.333	0.4167	120	0.2	n/a	0.79913607
Com Brick 4in (BK01)	0.333	0.4167	120	0.2	n/a	0.79913607
Com Brick 4in (BK01)	0.333	0.4167	120	0.2	n/a	0.79913607
ClayTile 4in (HF-C1)	0.166	0.33	70	0.2	n/a	0.5030303
Gypsum LW Agg 3/4in (GP04)	0.063	0.133	45	0.2	n/a	0.47368421
2 7/8 in Insulation	n/a	n/a	n/a	n/a	10.35	10.35
GypBd 5/8in (GP02)	0.052	0.0926	50	0.2	n/a	0.56155508
						0.68 Inside Film Reistance
						16.3152237 Total R-Value
						0.06129245 U-Value

New Slate Roof (Calculated U= 0.049 Btu/h-ft2-°F)						
Material	Thickness (ft)	Conductivity (Btu/h-ft-°F)	Density (lb/ft^3)	Specific Heat (Btu/h-°F)	R-Value ($h\text{-}ft^2\text{-}°F/Btu$)	Calculated R-Value
Slate 1/2in (SL01)	0.22	0.834	100	0.35	n/a	0.26378897
Felt 3/8in (HF-E3)	0.031	0.11	70	0.4	n/a	0.28181818
Plywd 3/4in (PW05)	0.063	0.0667	34	0.29	n/a	0.94452774
Air Space (HF-B1)	n/a	n/a	n/a	n/a	0.91	0.91
Conc LW 30lb 3in	0.25	0.0751	30	0.2	n/a	3.32889481
Roof Insulaton 2.25 in	n/a	n/a	n/a	n/a	13.95	13.95
						0.68 Inside Film Reistance
						20.3590297 Total R-Value
						0.04911825 U-Value

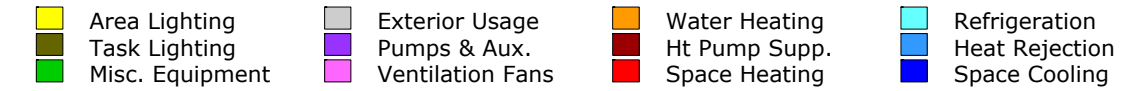
Existing Low Sloping Roof (Calculated U= 0.048 Btu/h-ft2-°F)						
Material	Thickness (ft)	Conductivity (Btu/h-ft-°F)	Density (lb/ft^3)	Specific Heat (Btu/h-°F)	R-Value ($h\text{-}ft^2\text{-}°F/Btu$)	Calculated R-Value
EPDM Membrane	n/a	n/a	n/a	n/a	0.001	0.001
Roof Insulation 3/4 in	n/a	n/a	n/a	n/a	2.7	2.7
Conc LW 30lb 3in	0.25	0.0751	30	0.2	n/a	3.32889481
Roof Insulaton 2.25 in	n/a	n/a	n/a	n/a	13.95	13.95
						0.68 Inside Film Reistance
						20.6598948 Total R-Value
						0.04840296 U-Value

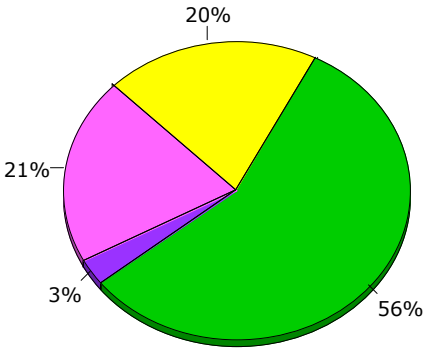
Windows	Case 1, 5	Case 2	Case 3	Case 4
Winter U	0.865	0.441	0.322	0.362
Summer U	0.825	0.44	0.283	0.353
SHGC	0.667	0.597	0.329	0.32

Case	Description	Cost	Cost Saving vs Case 5	Savings Compared to Original Windows
1	Original Walls & Original Windows	$204,730	($27,758)	-15.68%
2	New Walls & Original windows w/ Storm Windows	$173,541	$3,431	1.94%
3	New Walls & New Windows	$171,880	$5,092	2.88%
4	New Walls & Restored Windows	$170,395	$6,577	3.72%
5	New Walls & Orginal Windows	$176,972	$0	0.00%

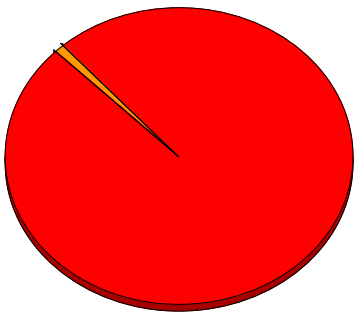
Annual Energy Consumption by Enduse

	Electricity kWh (x000)	Natural Gas Btu	Steam MBtu	Chilled Water MBtu
Space Cool	-	-	-	2,415.7
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	-	5,557.7	-
HP Supp.	-	-	-	-
Hot Water	-	-	53.2	-
Vent. Fans	312.5	-	-	-
Pumps & Aux.	43.6	-	-	-
Ext. Usage	-	-	-	-
Misc. Equip.	857.9	-	-	-
Task Lights	-	-	-	-
Area Lights	307.3	-	-	-
Total	1,521.3	-	5,610.9	2,415.7





Electricity



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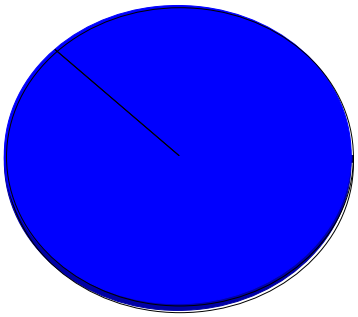
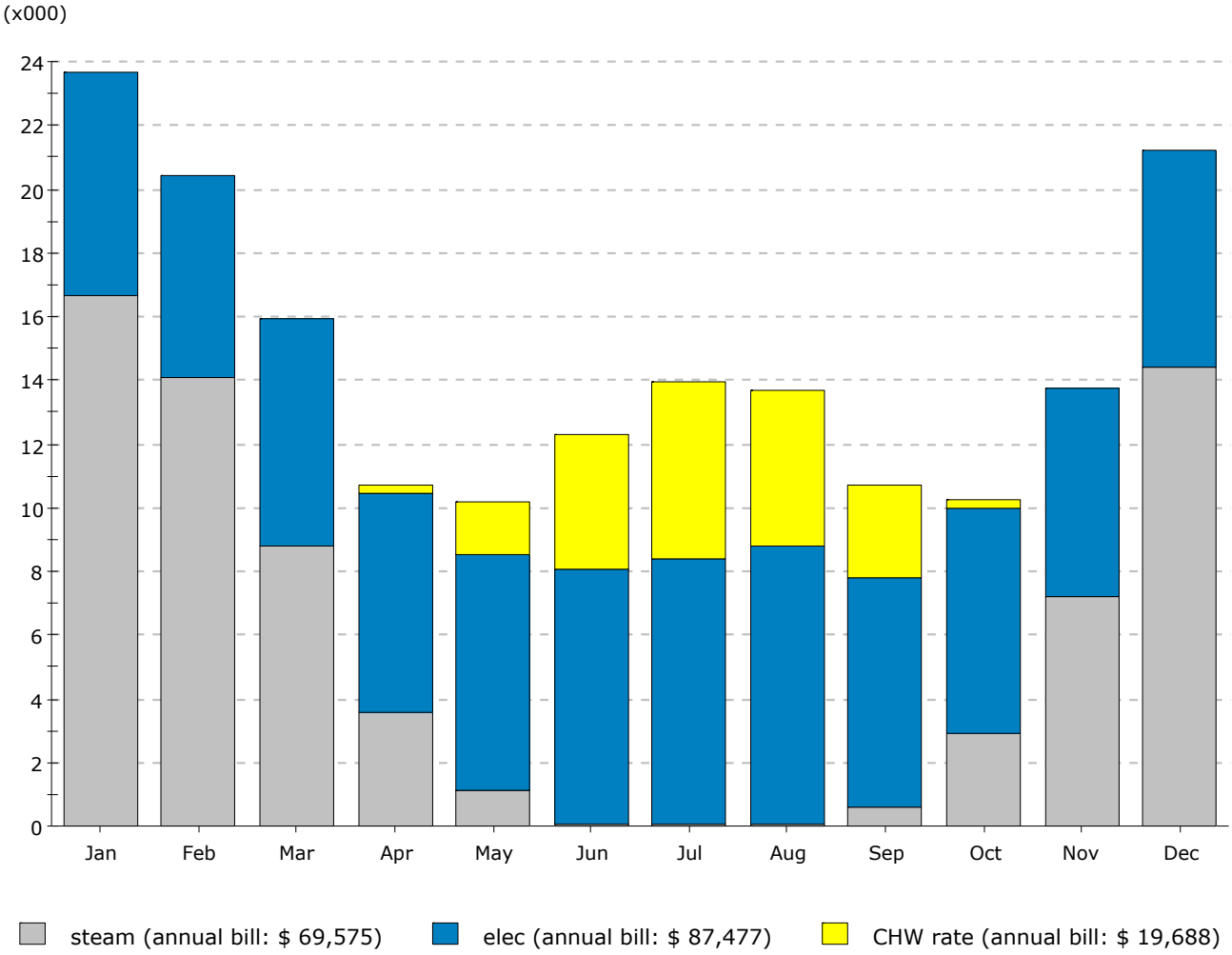


Chilled Water

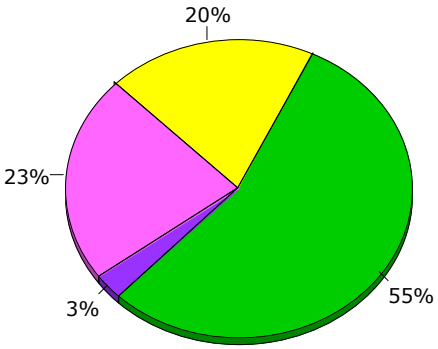
Monthly Utility Bills ($)



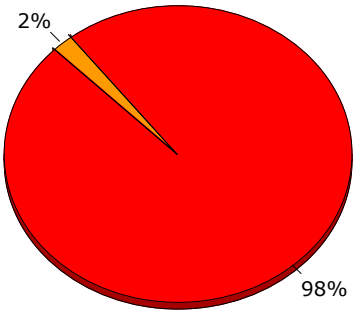
Total Annual Bill Across All Rates: $ 176,740

Annual Energy Consumption by Enduse

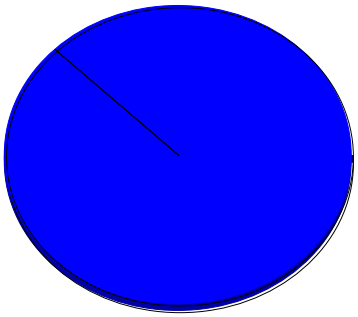
	Electricity kWh (x000)	Natural Gas Btu	Steam MBtu	Chilled Water MBtu
Space Cool	-	-	-	2,539.4
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	-	2,581.2	-
HP Supp.	-	-	-	-
Hot Water	-	-	53.2	-
Vent. Fans	356.1	-	-	-
Pumps & Aux.	43.0	-	-	-
Ext. Usage	-	-	-	-
Misc. Equip.	857.9	-	-	-
Task Lights	-	-	-	-
Area Lights	307.3	-	-	-
Total	1,564.3	-	2,634.4	2,539.4



Electricity

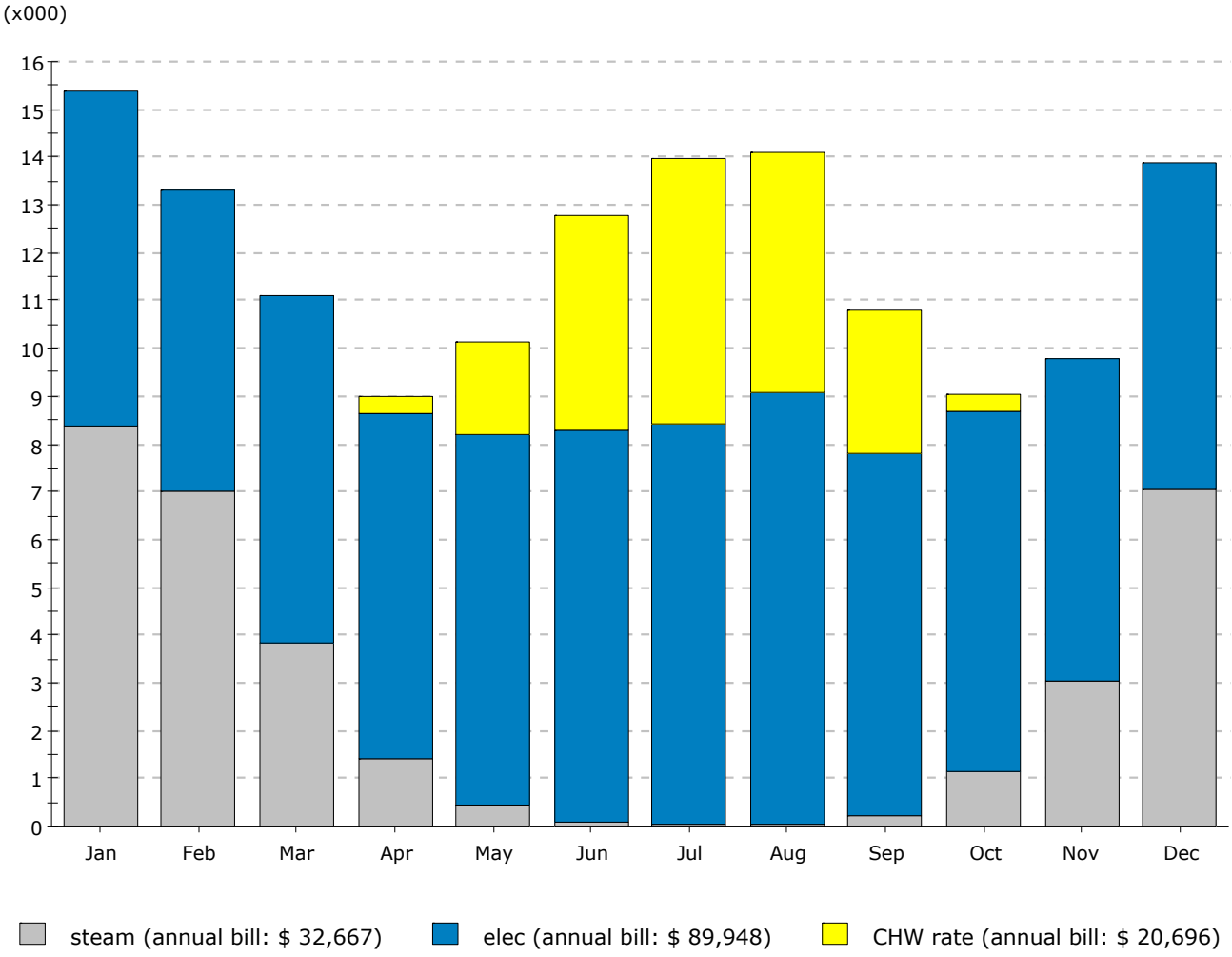


Steam



Chilled Water

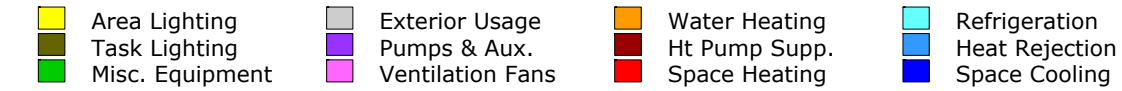
Monthly Utility Bills ($)

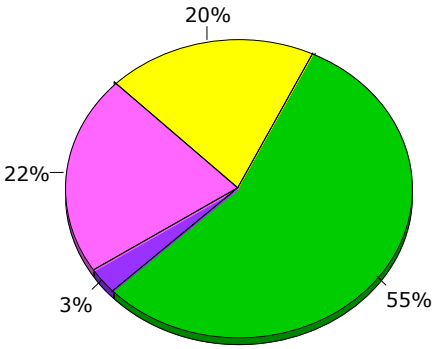


Total Annual Bill Across All Rates: $ 143,311

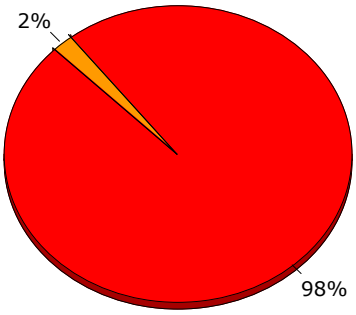
Annual Energy Consumption by Enduse

	Electricity kWh (x000)	Natural Gas Btu	Steam MBtu	Chilled Water MBtu
Space Cool	-	-	-	2,422.2
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	-	2,585.5	-
HP Supp.	-	-	-	-
Hot Water	-	-	53.2	-
Vent. Fans	340.9	-	-	-
Pumps & Aux.	43.1	-	-	-
Ext. Usage	-	-	-	-
Misc. Equip.	857.9	-	-	-
Task Lights	-	-	-	-
Area Lights	307.3	-	-	-
Total	1,549.2	-	2,638.7	2,422.2

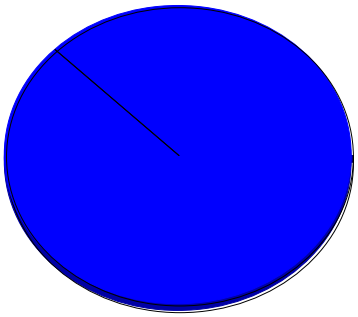




Electricity

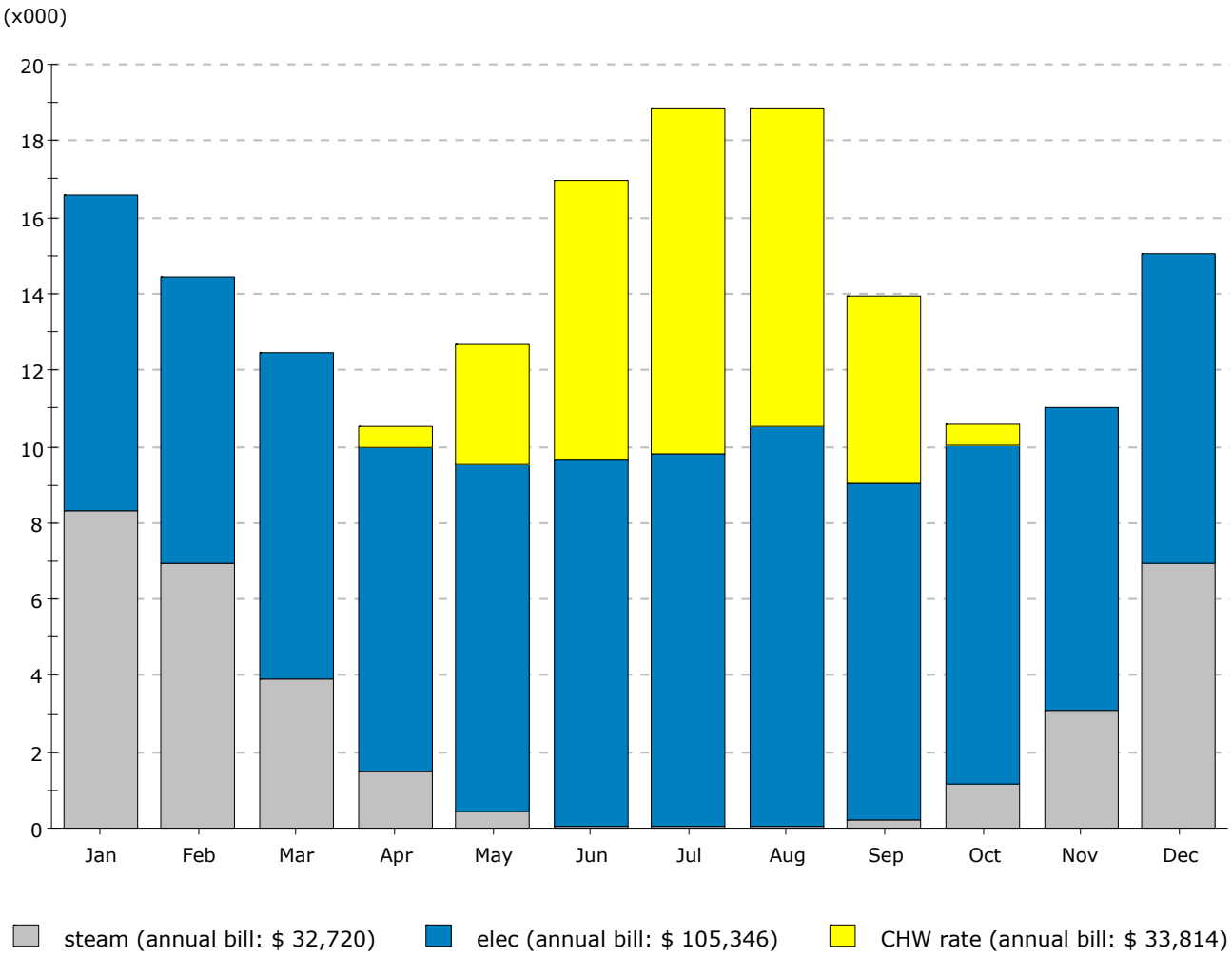


Steam



Chilled Water

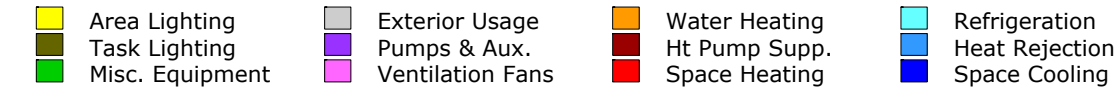
Monthly Utility Bills ($)

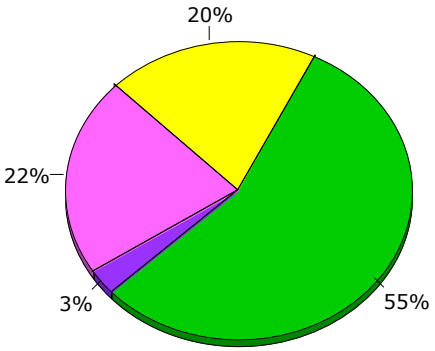


Total Annual Bill Across All Rates: $ 171,880

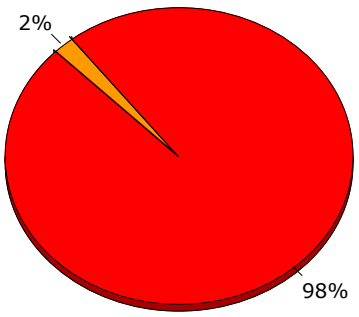
Annual Energy Consumption by Enduse

	Electricity kWh (x000)	Natural Gas Btu	Steam MBtu	Chilled Water MBtu
Space Cool	-	-	-	2,410.3
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	-	2,652.7	-
HP Supp.	-	-	-	-
Hot Water	-	-	53.2	-
Vent. Fans	338.2	-	-	-
Pumps & Aux.	43.1	-	-	-
Ext. Usage	-	-	-	-
Misc. Equip.	857.9	-	-	-
Task Lights	-	-	-	-
Area Lights	307.3	-	-	-
Total	1,546.6	-	2,705.9	2,410.3

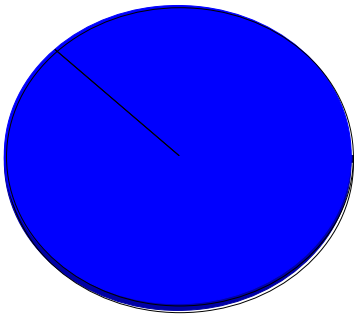




Electricity

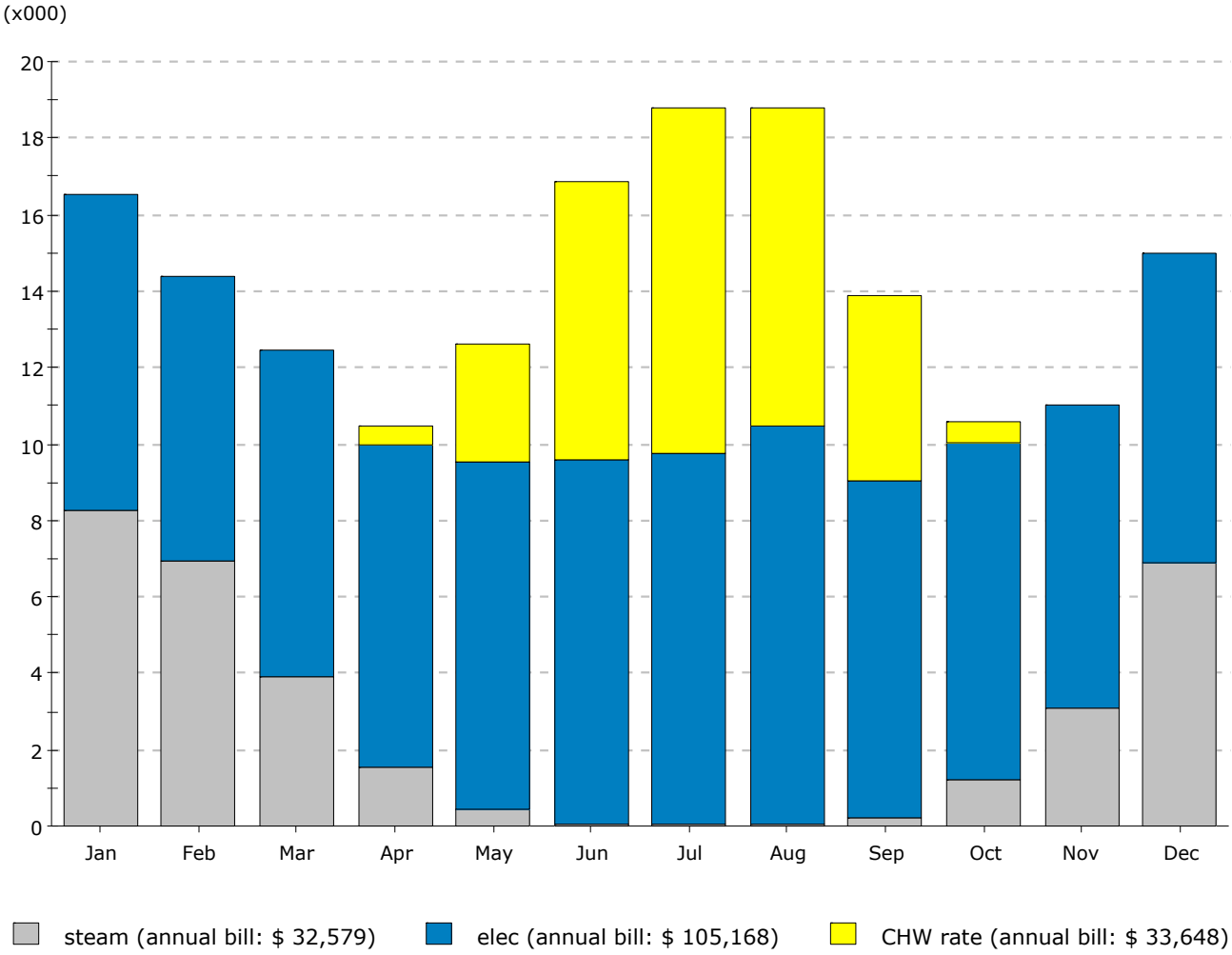


Steam



Chilled Water

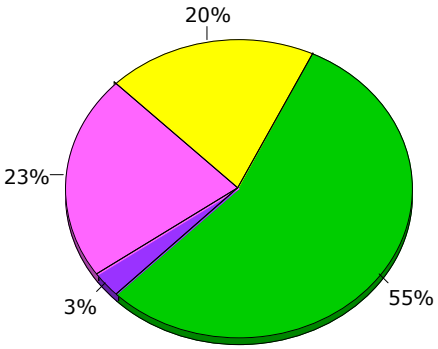
Monthly Utility Bills ($)



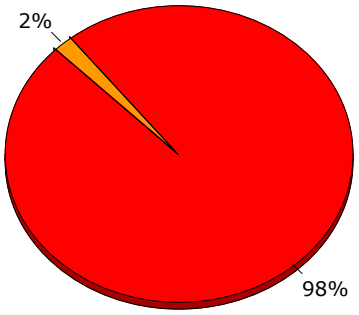
Total Annual Bill Across All Rates: $ 171,395

Annual Energy Consumption by Enduse

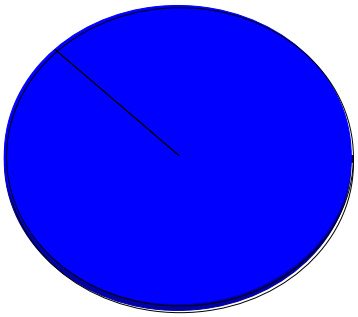
	Electricity kWh (x000)	Natural Gas Btu	Steam MBtu	Chilled Water MBtu
Space Cool	-	-	-	2,547.9
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	-	2,878.5	-
HP Supp.	-	-	-	-
Hot Water	-	-	53.2	-
Vent. Fans	352.1	-	-	-
Pumps & Aux.	43.1	-	-	-
Ext. Usage	-	-	-	-
Misc. Equip.	857.9	-	-	-
Task Lights	-	-	-	-
Area Lights	307.3	-	-	-
Total	1,560.4	-	2,931.8	2,547.9



Electricity

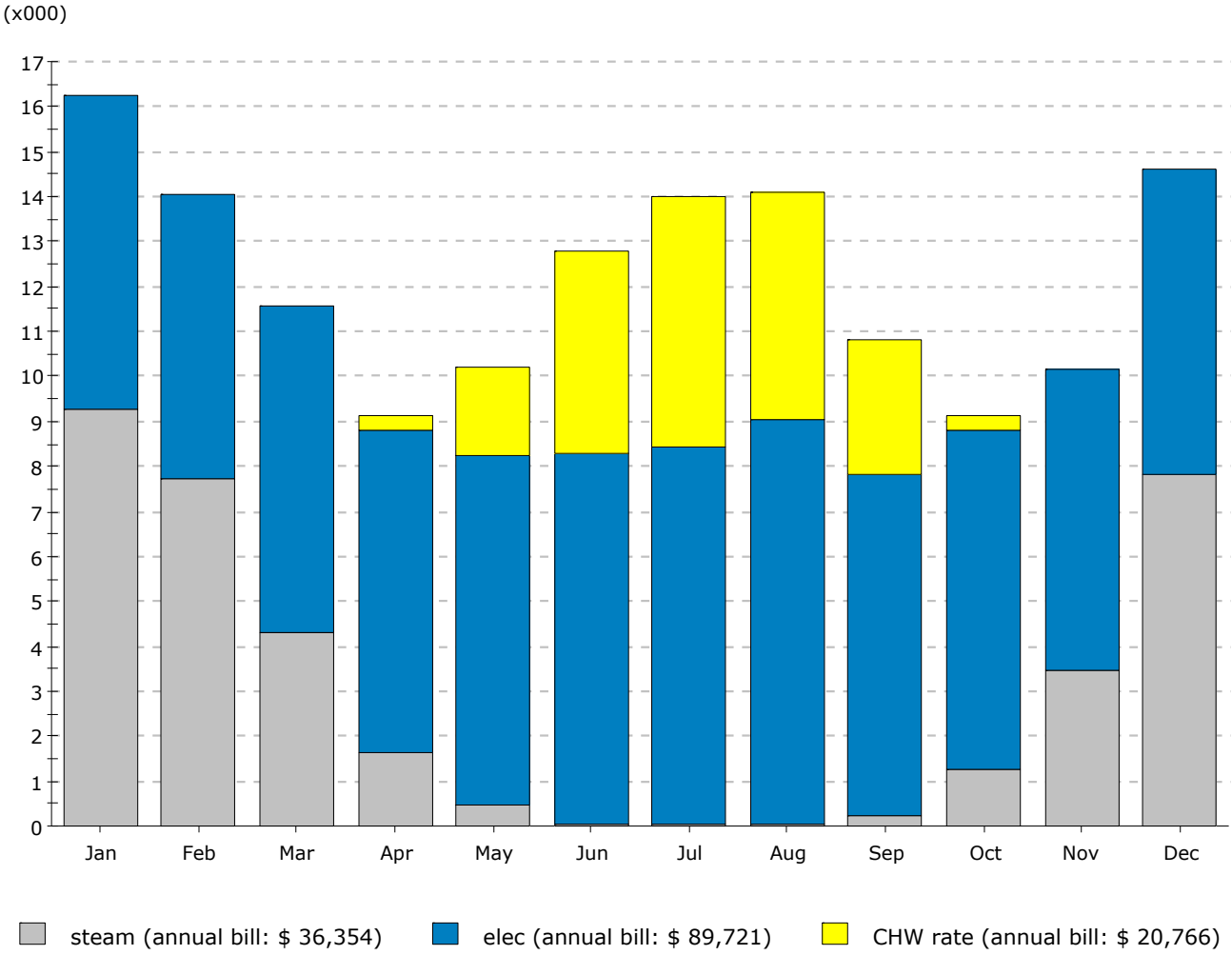


Steam



Chilled Water

Monthly Utility Bills ($)



Total Annual Bill Across All Rates: $ 146,841

I Cost Data Sources

Quotation #: 0

Proposal

ALLIED WINDOW, INC.
THE WINDOW PROFESSIONALS
11111 Canal Road
Cincinnati, OH 45241
(513) 559-1212
800-445-5411 · FAX: (513) 559-1883 · email: dmartin@alliedwindow.com

PROPOSAL SUBMITTED TO:	PHONE	DATE
BAILEY EDWARD ARCHITECTURE	**312-440-2300**	**10/15/2008**
STREET	FAX	Cel
35 E. WACKER DRIVE SUITE 2800	**312-440-2303**	
CITY, STATE & ZIP CODE	JOB NAME	
CHICAGO, IL 60601	**LINCOLN HALL -U, OF IL -BUDGET-REV.**	
CONTACT	JOB LOCATION	
SUSAN TURNER	**CHAMPAIGN-URBANA, IL**	

We hereby submit specifications and estimates for:

FABRICATE AND INSTALL (433) CUSTOM EXTERIOR STORM WINDOW UNITS

QUOTE INCLUDES:

-(431) OPERATING HISTORIC ONE LITES (HOL-OP)-TOP FIXED AND BOTTOM OPERABLE
* LOWER SCREEN WITH CHARCOAL ALUMINUM WIRE
* BUILD-OUT STOPS SHOWN IN (HOL-OP) DRAWING # H-6 ARE NOT REQUIRED

-STANDARD GLAZING TO BE (1/8") "Energy Advantage" LOW-E GLASS BY PILKINGTON
* TEMPERED (1/8") WHERE GLASS AREA EXCEEDS 20 sq. ft. OR REQ'D BY CODE

-INCLUDES MEASURING AND SHOP DRAWINGS
-ASSUMES THAT--- **INSTALLATION BOOM TRUCK TO BE PROVIDED BY OTHERS**

-Shipping Costs Included

GEN'L CONTR.- INSTALLED COST = $284,249

We Propose hereby to furnish material – complete in accordance with above specifications, for the sum of:

(See Above) Dollars **($284249.00)**

PER CONTRACT

BALANCE-NET (30) DAYS

All material is guaranteed to be as specified. All work to be completed in a workmanlike manner according to standard practices. Any alteration or deviation from above specifications involving extra costs will be executed only upon written orders, and will become an extra charge over and above the estimate period. All agreements contingent upon strikes, accidents or delays beyond our control. Owner to carry fire, tornado and other necessary insurance. Our workers are fully covered by Workmen's Compensation Insurance.

Authorized DAVE MARTIN

Dave Martin, Pres.

Note: This proposal may be withdrawn by us if not accepted within 30 days.

Acceptance of proposal - The above prices, specifications and conditions are satisfactory and are hereby accepted. You are authorized to do the work as specified. Payment will be made as outlined above.

SIGNATURE

SIGNATURE

DATE OF ACCEPTANCE

ARCHITECTURAL WINDOW SYSTEMS

BASLER GROUP
22948 Lochanora Drive Hawthorn Woods, Il. 60048
Phone: (847)373-4468 Fax:(847)726-9185

Date: 11/4/08

Attention: Susan Turner
Bailey Edward Architecture
35 E. Wacker Drive, Suite 2800
Chicago, Illinois 60601

We propose to furnish and install 433 Mon-Ray Exterior Storm Windows.
as described below, for the University of Illinois
located at Lincoln Hall, Champaign, Illinois
as per plans and specifications dated ----------
prepared by Bailey Edward Architecture and Mon-Ray Windows
for the sum of Two hundred, Eighty-nine thousand, six hundred dollars.
$289,600 .00

This proposal includes

This proposals includes labor, materials, equipment and storm windows by Mon-Ray, Mpls. Mn. Included are 3/16 clear glass, sash balances, tubular rails and clay colored painted finish. Typical window details are provided.
This proposal does not include bonds, permits, storage or cartage.

Terms of Payment: To be arranged. Commercial Window Installers.

This Proposal is hereby accepted: **Architectural Window Systems**

By:_____ **By:** Richard Basler

Title:_____ **Title:** V.P. Marketing and Sales

Date:_____ **Approved:**_____

DESIGN–TESTING–SALES–SERVICE–INSTALLATION

Huff Lumber Estimate - Mike Couch
October 16, 2008

Location	Qnty of Units	x	Hours =	Total Labor Hours/Location	x	Rate/Hour	+	Materials	Total
Ground & 1st Floor Units	126		8	1008		$ 42.49		$ 6,300.00	$ 49,129.92
2nd & 3rd Floor Units	248		11	2728		$ 42.49		$ 12,400.00	$ 128,312.72
Courtyard Units	52		16	832		$ 42.49		$ 2,600.00	$ 37,951.68
	426								

This budget estimate covers the following units:
(23) A, (20) AA, (8) B, (10)C, (89) D, (46)E, (36)F, (18) G, (22)K, (9)L, (24)M, (4)N, (45)P, (30)Q, (2)S, (3)T, (12)X, (5)Y (20)Z

Total Labor	$ 215,394.32
Marvin Units	$ 728,865.74
Manlift & Scaffold	$ 25,000.00
Superintendant	$ 72,000.00
G/C Profit	$ 104,126.01
TOTAL	$ 1,145,386.07

Carpenter Rate / Hr	$ 42.49
Materials per Hole	$ 50.00
G/C Profit Rate	10%

Building Blocks, Inc.
1621 W. Carroll St.
Chicago, IL 60612
Ph: (312) 243-9960
Fx: (312) 243-9009

BUDGET PROPOSAL

TO:	Susan Turner
COMPANY:	Bailey Edward Design
FAX:	(312) 440-2303
DATE:	January 5, 2009
FROM:	Todd Zeller
PROJECT:	Lincoln Hall, Urbana, IL

An updated budget number for demolition, installation, and materials based on 432 openings from your 12/31/08 spreadsheet for Lincoln Hall would be $1,350,000.00.

This includes the following:

Demolition and disposal of the existing windows
Blocking and shims for installation of new windows
New Marvin Ultimate Magnum Double Hungs
- **Standard** clad color
- Low e w/ argon glazing
- Bronze color sash locks & lifts
- Bare pine interior
- 4-9/16" jambs
- Exterior ogee lugs
- Custom brickmould casing
- Custom subsill

Installation using union labor

Submitted by,

Todd Zeller
Building Blocks, Inc.

re)view™
The Complete Restoration
of Historic Windows

1235 Saline Street
North Kansas City, MO 64116
ph. 816-741-2876
fx. 816-746-9331
www.re-view.biz

April 6, 2007
(Revised 7-17-08)
(Revised 11-10-08)

Budgetary Estimate for Lincoln Hall

To: Ms. Susan Turner **Phone: 312-440-2300 Ext. 16**
Bailey Edward Design, Inc. **Email: sturner@bedesign.com**

The following is a budgetary estimate for **HISTORICAL WOOD WINDOW RESTORATION** based upon PDF drawings, window survey and a Window Mock Up completed on 5/14/08.

1. Base Bid – First, Second, Third & Fourth Floors (Including Lightcourt)

For the Sum of: $ 1,174,000 Sales Tax not Inc.
Approx. 433 Window Openings

Re-View will perform the following restoration on the wood window sash at its restoration facility in North Kansas City.

- Re-View will remove all remaining lead-based paint and asbestos glazing from the window sash in the Re-View shop and dispose of according to State and Federal guidelines.
- Re-View will restore the sash by using liquid epoxies and epoxy fillers. Wood Dutchmen made from the same wood species will be used for those sections that cannot be practically restored with epoxies. Complete sections shall be replicated where damage is too great for restoration such as bowed bottom rails of the upper sash. All joints will be reglued for structural integrity. All sashes shall be hand sanded and prepared to finish by Re-View.
- Re-View will rout out the sash and to allow for ½" O.A. Low E insulated glass. Each sash shall be exterior stopped using exterior applied mahogany wood glazing beads matching the original glazing putty profile.
- Re-View will provide the restored sashes with new high performance exterior finish and stained / lacquered interior finish to match existing condition. Exterior finish shall consist of prime coat and two coat finish.
- Re-View will provide new checkrail locks designed for units with insulated glass. Where existing window lifts or pull down sockets are missing, we will provide

new hardware closely matching the original hardware as closely as possible. Re-View will bead blast the existing pulleys and clear coat protective finish.

- Re-View will provide new sash stop and parting stop for each window opening. Sash stop shall be furnished with sash adjusters in finish to match window hardware.
- Re-View shall be responsible for transporting refurbished to and from our restoration facility in Kansas City. Our estimate is based upon 12 deliveries back to the jobsite.
- Re-View will provide the additional weights required for rebalancing the restored sashes with insulating glass.
- Re-View will also provide any replacement exterior wood trim damaged beyond repair. All profiles to match original trim.

Field Work:

- Re-View will remove the existing wood sashes from openings, mark for proper location and ship to our facility in Kansas City.
- Re-View will provide temporary protection in each window opening while sashes are removed for restoration.
- Re-View will strip 100% of all paint down to bare wood on window sill and up each jamb a minimum of 2". Re-View will remove loose paint down to sound substrate on remaining window frame and exterior wood trim.
- Re-View will perform liquid wood and wood epoxy restoration work on window sill and frame.
- Re-View will install refurbished sashes into restored frames. Both upper and lower sash shall be fully operable.
- Re-View will fully weather-strip the window opening prior to reinstallation of refurbished sashes Both upper and lower sash will require added weights to be installed to offset the additional weight from the insulated glass conversion.
- Re-View will provide one prime coat and two coat finish to refurbished window frame on exterior and interior.
- Re-View will provide new exterior perimeter sealants where brickmould meets masonry.

Please Note: Re-View will not be responsible for:

- Ceiling tile / grid work removal for window access.
- Drapery or existing blind removal or reinstallation.
- Window air conditioner removal or reinstallation.
- Masonry modification or structural repair.

Please Note:

- Cost of Performance and Payment Bonds are not included in this proposal. Add 1.1% for cost of bonds. .

Please contact me at 816-741-2876 or my cell phone 816-985-4208 with questions.

Respectfully,
Re-View

Robert T. Maxwell

Todd Maxwell

Restoration Works, Inc.

1345 Stanford Dr. Kankakee, IL 60901 Ph (815) 937-0556 FAX (815) 937-4072

Oct. 28, 2009

Susan Turner, AIA, PMP
Bailey Edward Architects
35 E. Wacker Dr. Ste. 2800
Chicago, IL 60601

Dear Susan:

I did receive the new revised window list for Lincoln Hall on Oct. 20, 2008. I made some adjustments after reviewing it. I now have a window count of 433 windows. This is only slightly different than my original window count of 445 windows. I see that the window list is calling for new screens on 21 windows. I did not have that in my first budget estimate.

I have taken out 12 windows and have added in 21 screens. I am assuming that they are ½ screens. My new budget estimate is roughly the same at 1,535,000.00 using prevailing wages in the field and 1,635,000.00 using union labor. This of course is for a full restoration program.

Please call if you have any questions.

Sincerely,

Gail Wallace, President

08 80 88 Window Schedule for Costing

Note: Window # corresponds to Elevations A4.1 to A4.5. Windows which are anomalies (i.e. are restored in both options or replaced in both options) are not included in this list of windows. For the purposes of the study, this is the 'official' window count.

	Window #	Type	Restored Windows (Base Bid)	Replacement Windows (Alternate Bid)	Size
1	W1001	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
2	W1002	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
3	W1003	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
4	W1004	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
5	W1005	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
6	W1006	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
7	W1007	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
8	W1008	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
9	W1009	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
10	W1010	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
11	W1011	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
12	W1012	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
13	W1013	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
14	W1014	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
15	W1015	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
16	W1019	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
17	W1020	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
18	W1021	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
19	W1022	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
20	W1023	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
21	W1024	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
22	W1025	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
23	W1026	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
24	W1027	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
25	W1028	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
26	W1029	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
27	W1030	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
28	W1031	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
29	W1032	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
30	W1033	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
31	W1034	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
32	W1035	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
33	W1036	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
34	W1040	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
35	W1041	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
36	W1042	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
37	W1043	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
38	W1044	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
39	W1045	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
40	W1046	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
41	W1047	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
42	W1048	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
43	W1049	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
44	W1050	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
45	W1051	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
46	W1052	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
47	W1053	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
48	W1054	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
49	W1055	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
50	W1056	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"

	Window #	Type	Restored Windows (Base Bid)	Replacement Windows (Alternate Bid)	Size
51	W1057	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
52	W1058	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
53	W1059	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
54	W1060	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
55	W1061	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
56	W1062	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
57	W1063	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
58	W1064	N	Restore per 08 01 70	Replace per 08 52 50	3'4 x 5'11
59	W1065	N	Restore per 08 01 70	Replace per 08 52 50	3'4 x 5'11
60	W1068	N	Restore per 08 01 70	Replace per 08 52 50	3'4 x 5'11
61	W1070	L	Restore per 08 01 70	Replace per 08 52 50	4'6 x 8'7
62	W1071	L	Restore per 08 01 70	Replace per 08 52 50	4'6 x 8'7
63	W1072	L	Restore per 08 01 70	Replace per 08 52 50	4'6 x 8'7
64	W1073	L	Restore per 08 01 70	Replace per 08 52 50	4'6 x 8'7
65	W1074	0	Restore per 08 01 70	Replace per 08 52 50	3'2 x 6'4
66	W1076	0	Restore per 08 01 70	Replace per 08 52 50	3'2 x 6'4
67	W1077	L	Restore per 08 01 70	Replace per 08 52 50	4'6 x 8'7
68	W1078	L	Restore per 08 01 70	Replace per 08 52 50	4'6 x 8'7
69	W1079	L	Restore per 08 01 70	Replace per 08 52 50	4'6 x 8'7
70	W1080	L	Restore per 08 01 70	Replace per 08 52 50	4'6 x 8'7
71	W1082	N	Restore per 08 01 70	Replace per 08 52 50	3'4 x 5'11
72	W1085	N	Restore per 08 01 70	Replace per 08 52 50	3'4 x 5'11
73	W1087	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
74	W1088	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
75	W1089	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
76	W1090	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
77	W1091	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
78	W1092	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
79	W1093	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
80	W1094	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
81	W1095	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
82	W1096	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
83	W1097	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
84	W1098	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
85	W1099	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
86	W1100	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
87	W1101	Q	Restore per 08 01 70	Replace per 08 52 50	3'2" x 8'4"
88	W1102	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
89	W1103	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
90	W1104	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
91	W1105	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
92	W1106	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
93	W1107	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
94	W1108	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
95	W1109	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
96	W1110	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
97	W1114	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4
98	W1115	G	Restore per 08 01 70	Replace per 08 52 50	3'4 x 8'4"
99	W1116	F	Restore per 08 01 70	Replace per 08 52 50	3'2 x 8'4

	Window #	Type	Restored Windows (Base Bid)	Replacement Windows (Alternate Bid)	Size
100	W1117	C	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
101	W1118	C	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
102	W1119	C	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
103	W1120	C	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
104	W1121	C	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
105	W1122	B	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
106	W1123	B	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
107	W1124	B	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
108	W1125	B	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
109	W1126	B	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
110	W1140	B	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
111	W1141	B	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
112	W1142	B	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
113	W1143	B	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
114	W1144	B	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
115	W1145	C	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
116	W1146	C	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
117	W1147	C	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
118	W1148	C	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
119	W1149	C	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
120	W1150	Y	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
121	W1151	Y	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
122	W1155	T	Restore per 08 01 70	Replace per 08 52 50	3'5 x 5'6
123	W1164	T	Restore per 08 01 70	Replace per 08 52 50	3'5 x 5'6
124	W1165	T	Restore per 08 01 70	Replace per 08 52 50	3'5 x 5'6
125	W1166	Y	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
126	W1167	Y	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
127	W1168	Y	Restore per 08 01 70	Replace per 08 52 50	5'0 x 8'4
128	W2001	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
129	W2002	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
130	W2003	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
131	W2004	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
132	W2005	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
133	W2006	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
134	W2007	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
135	W2008	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
136	W2009	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
137	W2010	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
138	W2011	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
139	W2012	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
140	W2013	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
141	W2014	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
142	W2015	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
143	W2019	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
144	W2020	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
145	W2021	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
146	W2022	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
147	W2023	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
148	W2024	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4

	Window #	Type	Restored Windows (Base Bid)	Replacement Windows (Alternate Bid)	Size
149	W2025	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
150	W2026	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
151	W2027	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
152	W2028	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
153	W2029	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
154	W2030	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
155	W2031	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
156	W2032	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
157	W2033	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
158	W2034	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
159	W2035	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
160	W2036	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
161	W2037	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
162	W2038	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
163	W2039	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
164	W2040	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
165	W2041	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
166	W2042	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
167	W2043	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
168	W2044	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
169	W2045	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
170	W2046	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
171	W2047	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
172	W2048	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
173	W2049	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
174	W2050	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
175	W2051	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
176	W2052	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
177	W2053	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
178	W2054	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
179	W2055	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
180	W2056	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
181	W2057	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
182	W2058	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
183	W2059	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
184	W2060	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
185	W2061	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
186	W2062	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
187	W2063	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
188	W2064	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
189	W2065	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
190	W2066	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
191	W2067	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
192	W2068	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
193	W2069	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
194	W2070	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
195	W2071	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
196	W2072	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
197	W2073	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
198	W2074	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4

	Window #	Type	Restored Windows (Base Bid)	Replacement Windows (Alternate Bid)	Size
199	W2075	K	Restore per 08 01 70	Restore per 05 55 55	4'9 x 9'4
200	W2076	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
201	W2077	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
202	W2078	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
203	W2079	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
204	W2080	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
205	W2081	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
206	W2082	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
207	W2083	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
208	W2084	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
209	W2085	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
210	W2086	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
211	W2087	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
212	W2088	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
213	W2089	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
214	W2090	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
215	W2091	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
216	W2092	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
217	W2093	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
218	W2094	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
219	W2095	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
220	W2096	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
221	W2097	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
222	W2098	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
223	W2099	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
224	W2100	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
225	W2101	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
226	W2102	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
227	W2103	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
228	W2104	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
229	W2105	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
230	W2106	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
231	W2107	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
232	W2108	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
233	W2109	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
234	W2110	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
235	W2111	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
236	W2112	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
237	W2113	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
238	W2114	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
239	W2115	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
240	W2116	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
241	W2117	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
242	W2118	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
243	W2119	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
244	W2120	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
245	W2121	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
246	W2122	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
247	W2123	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
248	W2124	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4

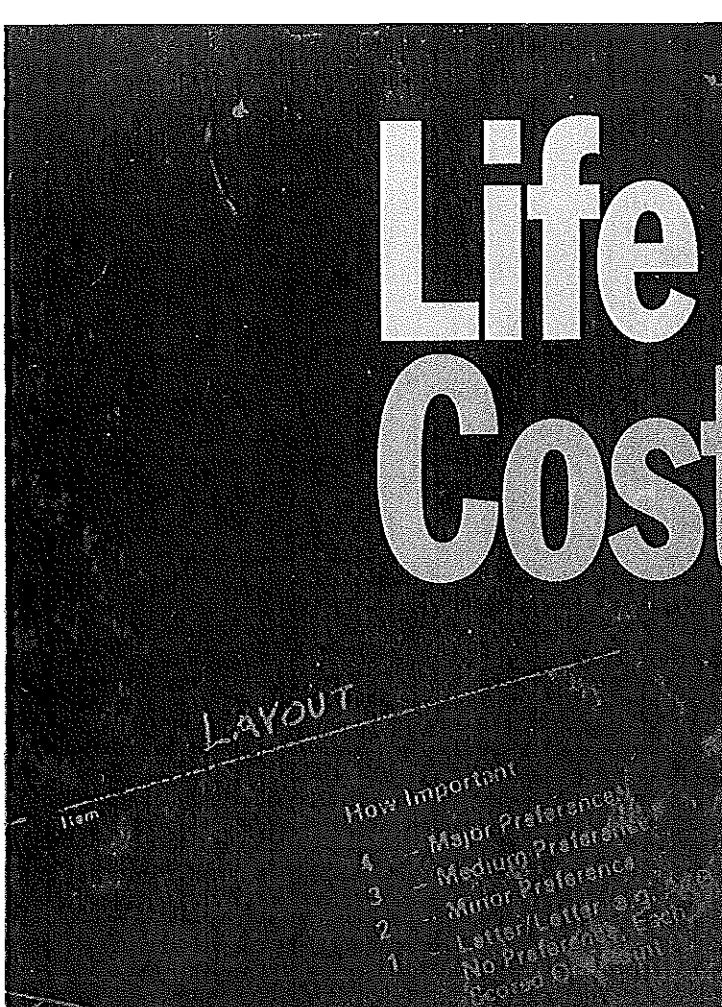
	Window #	Type	Restored Windows (Base Bid)	Replacement Windows (Alternate Bid)	Size
249	W2125	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
250	W2126	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
251	W2140	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
252	W2141	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
253	W2142	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
254	W2143	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
255	W2144	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
256	W2145	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
257	W2146	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
258	W2147	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
259	W2148	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
260	W2149	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
261	W2150	X	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
262	W2151	X	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
263	W2152	X	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
264	W164A	S	Restore per 08 01 70	Provide new per 08 52 50	3'9 x 8'4
265	W2166	X	Restore per 08 01 70	Provide new per 08 52 50	5'0 x 9'4
266	W2167	X	Restore per 08 01 70	Provide new per 08 52 50	5'0 x 9'4
267	W2168	X	Restore per 08 01 70	Provide new per 08 52 50	5'0 x 9'4
268	W3001	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
269	W3002	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
270	W3003	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
271	W3004	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
272	W3005	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
273	W3006	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
274	W3007	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
275	W3008	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
276	W3009	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
277	W3010	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
278	W3011	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
279	W3012	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
280	W3013	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
281	W3014	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
282	W3015	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
283	W3016	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
284	W3017	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
285	W3018	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
286	W3019	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
287	W3020	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
288	W3021	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
289	W3022	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
290	W3023	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
291	W3024	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
292	W3025	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
293	W3026	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
294	W3027	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
295	W3028	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
296	W3029	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
297	W3030	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
298	W3031	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4

	Window #	Type	Restored Windows (Base Bid)	Replacement Windows (Alternate Bid)	Size
299	W3032	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
300	W3033	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
301	W3034	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
302	W3035	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
303	W3036	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
304	W3037	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
305	W3038	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
306	W3039	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
307	W3040	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
308	W3041	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
309	W3042	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
310	W3043	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
311	W3044	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
312	W3045	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
313	W3046	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
314	W3047	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
315	W3048	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
316	W3049	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
317	W3050	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
318	W3051	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
319	W3052	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
320	W3053	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
321	W3054	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
322	W3055	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
323	W3056	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
324	W3057	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
325	W3058	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
326	W3059	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
327	W3060	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
328	W3061	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
329	W3062	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
330	W3063	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
331	W3064	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
332	W3065	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
333	W3066	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
334	W3067	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
335	W3068	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
336	W3069	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
337	W3070	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
338	W3071	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
339	W3072	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
340	W3073	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
341	W3074	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
342	W3075	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
343	W3076	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
344	W3077	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
345	W3078	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
346	W3079	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
347	W3080	K	Restore per 08 01 70	Replace per 08 52 50	4'9 x 9'4
348	W3081	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7

	Window #	Type	Restored Windows (Base Bid)	Replacement Windows (Alternate Bid)	Size
349	W3082	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
350	W3083	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
351	W3084	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
352	W3085	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
353	W3086	M	Restore per 08 01 70	Replace per 08 52 50	3'7 x 9'7
354	W3087	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
355	W3088	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
356	W3089	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
357	W3090	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
358	W3091	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
359	W3092	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
360	W3093	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
361	W3094	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
362	W3095	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
363	W3096	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
364	W3097	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
365	W3098	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
366	W3099	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
367	W3100	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
368	W3101	P	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
369	W3102	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
370	W3103	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
371	W3104	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
372	W3105	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
373	W3106	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
374	W3107	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
375	W3108	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
376	W3109	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
377	W3110	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
378	W3111	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
379	W3112	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
380	W3113	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
381	W3114	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
382	W3115	E	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
383	W3116	D	Restore per 08 01 70	Replace per 08 52 50	3'6 x 9'4
384	W3117	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
385	W3118	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
386	W3119	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
387	W3120	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
388	W3121	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
389	W3122	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
390	W3123	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
391	W3124	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
392	W3125	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
393	W3126	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
394	W3132	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
395	W3133	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
396	W3134	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
397	W3140	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
398	W3141	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4

	Window #	Type	Restored Windows (Base Bid)	Replacement Windows (Alternate Bid)	Size
399	W3142	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
400	W3143	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
401	W3144	A	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
402	W3145	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
403	W3146	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
404	W3147	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
405	W3148	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
406	W3149	Z	Restore per 08 01 70	Replace per 08 52 50	6'2 x 9'4
407	W3150	X	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
408	W3151	X	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
409	W3152	X	Restore per 08 01 70	Replace per 08 52 50	5'0 x 9'4
410	W3166	X	Restore per 08 01 70	Provide new per 08 52 50	5'0 x 9'4
411	W3167	X	Restore per 08 01 70	Provide new per 08 52 50	5'0 x 9'4
412	W3168	X	Restore per 08 01 70	Provide new per 08 52 50	5'0 x 9'4
413	W4128	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
414	W4129	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
415	W4130	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
416	W4131	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
417	W4132	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
418	W4133	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
419	W4134	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
420	W4135	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
421	W4136	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
422	W4137	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
423	W4138	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
424	W4139	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
425	W4140	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
426	W4141	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
427	W4142	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
428	W4143	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
429	W4144	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
430	W4145	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
431	W4146	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
432	W4147	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9
433	W4148	AA	Restore per 08 01 70, and provide new screen	Replace per 08 52 50	4'0 x 5'9

Life Cycle Costing for Facilities



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Alphonse J. Dell'Isola, PE, CVS
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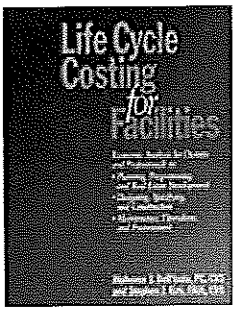
Life Cycle Costing for Facilities
by Alphonse Dell'Isola and Dr. Steven Kirk



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Susan Turner

From: kirkassociates@aol.com
Sent: Tuesday, July 22, 2008 4:35 AM
To: Susan Turner
Subject: Re: Lincoln Hall Window Painting

Dear Susan:

Thanks for your e-mail.

Painting is usuallu $0.50 to $0.75 per SF of surface area. Depending on the effort to paint the fraimes I might suggest $1.00 to $2.00 per linear foor of window frame depending on the number of coats. So a window that is 3' x 7' would be 20 LF or $20 to $40 per window. I don't have the book with me but perhaps the cost of $400 includes repair to the frame as well as painting.

Hope this helps..

Sincerely,
Steve

-----Original Message-----
From: Susan Turner <sturner@bedesign.com>
To: kirkassociates@aol.com
Sent: Mon, 21 Jul 2008 5:45 pm
Subject: Lincoln Hall Window Painting

Hi Kirk

I am working through my spreadsheet for the windows at Lincoln Hall. There does not appear to be a line item for the maintenance and repair of windows in terms of painting the frames periodically. (I am looking in the 260 page area.)

Currently the frames are repainted every 16 years at UIUC. They indicate that it is $400 per window. This would end up with a single paint job at $220,000.

Would you have a different number?

☺
Susan

Susan D. Turner, AIA, PMP
BAILEY EDWARD architecture
35 E Wacker Driv e, Suite 2800
Chicago, Illinois 60601
p 312.440.2300 x216
f 312.440.2303
www.bedesign.com

Susan Turner

From: jeremiah goss [jeremiahgoss@gmail.com]
Sent: Wednesday, July 16, 2008 11:12 AM
To: Susan Turner
Subject: Re: Fw: Lincoln Hall Renovation

Thank you for seeking us out and attempting to recycle these building materials. Unfortunately, since these are simply clear glass sashes there is not a market for resale. The situation would be different if they contained leaded or stained glass. However, most local contractors and homeowners donate their sashes to us so that we can be a source for locals seeking panes of glass for home repairs and furniture repairs. Since the demand for this glass is so small it is not possible for us to pay for each window, store it, and resell it for a profit. Let us know if you would like to make a donation in order to cut down on the material you pay to dispose of while giving it a new life for free. We look forward to hearing from you.

Jeremiah

On Tue, Jul 15, 2008 at 11:23 AM, Doc Keys <docgkeys@yahoo.com> wrote:

--- On **Mon, 7/14/08, Susan Turner <*sturner@bedesign.com*>** wrote:

> From: Susan Turner <sturner@bedesign.com>
> Subject: Lincoln Hall Renovation
> To: docgkeys@yahoo.com
> Date: Monday, July 14, 2008, 8:43 PM
>
> Hi Doc
>
> I am working on a renovation of Lincoln Hall in Urbana Champaign. I was on your website Doc's Architectural Salvage and Reclamation. Since you are relatively close to Urbana Champaign, I was wondering if you could answer a question regarding the local market.
>
> One aspect of the scope of work is to address the windows, with one option replacing the existing windows with new. This would end up with salvage material of the exterior frame material, and the sashes. Many are 5' x 8', and many are 3' x 8'. They are all one-over-one, 1910 or 1927 yellow clear pine, 990 sashes, or about 500 windows. Could you tell me if there is any salvage value to them?
>
> Thanks!
>
> Susan
>
> Susan D. Turner, AIA, PMP
> **BAILEY EDWARD** architecture
> 35 E Wacker Drive, Suite 2800
> Chicago, Illinois 60601
> p 312.440.2300 x216

Lincoln Hall Renovation
UIUC Schedule of Operations and Maintenance costs
Data provided by UIUC Facilities

Annual Costs:

Item Description Maintenance Costs	Unit of Measure	# Units	Maintenance Description	Maintenance Annual Cost, $/Unit	One Time Cost	Frequency	Comments
Repair (cord, spring, etc.)	ea.	433	minor repairs	$0.00	$0.00	Ongoing	UIUC backcharges for repairs
Exterior Painting	ea.	433	scraping and painting	$400.00	$173,200.00	Every 11 years	UIUC Cost
Interior Painting	ea.	433	scraping and varnishing	$250.00	$108,250.00	Every 25 years	
Caulking*	/lf	11005.8	cut out and replace	$4.05	$44,573.63	Included in Exterior Painting Price	Applies only to caulking-ony work, every 11 years
Access	ea.	0	Provide access for Painting, Caulking	$0.00	$0.00	Included in Exterior Painting Price	
Cleaning	/wsf	14871	wash and squeegee dry	$0.29	$0.00	UIUC does not clean windows	If required, window washing is back-charged
HSDG Replacement	/sf	14871	remove and replace	$25.50	$0.00	0	UIUC does not experience failures

Annual costs by Maintenance Item	**Monray**		**Allied**	**Marvin**	**Restored**	
Repair (cord, spring, etc.) [1]	$0.00		$0.00	$0.00	$0.00	UIUC doesn't have an annual cost - they are flow-through work orders.
Exterior Painting	$173,200.00		$173,200.00	$0.00	$173,200.00	Every 11 years on windows requiring
Interior Painting	$108,250.00		$108,250.00	$108,250.00	$108,250.00	Estimated every 25 years with an interior space remodel
Caulking and Access	$0.00		$0.00	$44,573.63	$0.00	Included in painting number and cycle Except for Marvin (no Painting)
Cleaning	$0.00		$0.00	$0.00	$0.00	UIUC does not clean windows
HSDG Replacement	$0.00		$0.00	$0.00	$0.00	UIUC doesn't have an annual cost - they are flow-through work orders.
Annual Costs	**$0.00**		**$0.00**	**$0.00**	**$0.00**	No Annual Costs
50 year costs	**$3,339,658.65**		**$3,339,658.65**	**$1,645,100.18**	**$3,339,658.65**	

Lincoln Hall Window Maintenance
UIUC Maintenance Frequencies

Inflation 4.00%

Maintenance Costs Per Year

Year		Monray Storm Windows	Allied Storm Windows	Marvin Replacement Windows	Restored Windows	Ext Painting 11 yr cycle Esc @ 3%/Yr	Int Painting 25 yr cycle Esc @ 3%/Yr	Caulking & Access 11 yr cycle Esc @ 3%/Yr
2008	Today	$ -	$ -	$ -	$ -	$ 173,200	$ 108,250	$ 44,574
2009	1	$ -	$ -	$ -	$ -	$ 180,128	$ 112,580	$ 46,357
2010	2	$ -	$ -	$ -	$ -	$ 187,333	$ 117,083	$ 48,211
2011	3	$ -	$ -	$ -	$ -	$ 194,826	$ 121,767	$ 50,139
2012	4	$ -	$ -	$ -	$ -	$ 202,620	$ 126,637	$ 52,145
2013	5	$ -	$ -	$ -	$ -	$ 210,724	$ 131,703	$ 54,231
2014	6	$ -	$ -	$ -	$ -	$ 219,153	$ 136,971	$ 56,400
2015	7	$ -	$ -	$ -	$ -	$ 227,919	$ 142,450	$ 58,656
2016	8	$ -	$ -	$ -	$ -	$ 237,036	$ 148,148	$ 61,002
2017	9	$ -	$ -	$ -	$ -	$ 246,518	$ 154,074	$ 63,442
2018	10	$ -	$ -	$ -	$ -	$ 256,378	$ 160,236	$ 65,980
2019	11	$ 266,633	$ 266,633	$ 68,619	$ 266,633	$ 266,633	$ 166,646	$ 68,619
2020	12	-	-	-	-	$ 277,299	$ 173,312	$ 71,364
2021	13	-	-	-	-	$ 288,391	$ 180,244	$ 74,218
2022	14	-	-	-	-	$ 299,926	$ 187,454	$ 77,187
2023	15	-	-	-	-	$ 311,923	$ 194,952	$ 80,275
2024	16	-	-	-	-	$ 324,400	$ 202,750	$ 83,486
2025	17	-	-	-	-	$ 337,376	$ 210,860	$ 86,825
2026	18	-	-	-	-	$ 350,871	$ 219,295	$ 90,298
2027	19	-	-	-	-	$ 364,906	$ 228,066	$ 93,910
2028	20	-	-	-	-	$ 379,503	$ 237,189	$ 97,666
2029	21	-	-	-	-	$ 394,683	$ 246,677	$ 101,573
2030	22	$ 410,470	$ 410,470	$ 105,636	$ 410,470	$ 410,470	$ 256,544	$ 105,636
2031	23	- -	- -	- -	- -	$ 426,889	$ 266,805	$ 109,861
2032	24	- -	- -	- -	- -	$ 443,964	$ 277,478	$ 114,256
2033	25	$ 288,577	$ 288,577	$ 288,577	$ 288,577	$ 461,723	$ 288,577	$ 118,826
2034	26	- -	- -	- -	- -	$ 480,192	$ 300,120	$ 123,579
2035	27	- -	- -	- -	- -	$ 499,399	$ 312,125	$ 128,522
2036	28	- -	- -	- -	- -	$ 519,375	$ 324,610	$ 133,663
2037	29	- -	- -	- -	- -	$ 540,150	$ 337,594	$ 139,010
2038	30	- -	- -	- -	- -	$ 561,756	$ 351,098	$ 144,570
2039	31	- -	- -	- -	- -	$ 584,227	$ 365,142	$ 150,353
2040	32	- -	- -	- -	- -	$ 607,596	$ 379,747	$ 156,367
2041	33	$ 631,900	$ 631,900	$ 162,622	$ 631,900	$ 631,900	$ 394,937	$ 162,622
2042	34	- -	- -	- -	- -	$ 657,176	$ 410,735	$ 169,126
2043	35	- -	- -	- -	- -	$ 683,463	$ 427,164	$ 175,891
2044	36	- -	- -	- -	- -	$ 710,801	$ 444,251	$ 182,927
2045	37	- -	- -	- -	- -	$ 739,233	$ 462,021	$ 190,244
2046	38	- -	- -	- -	- -	$ 768,802	$ 480,502	$ 197,854
2047	39	- -	- -	- -	- -	$ 799,555	$ 499,722	$ 205,768
2048	40	- -	- -	- -	- -	$ 831,537	$ 519,710	$ 213,999
2049	41	- -	- -	- -	- -	$ 864,798	$ 540,499	$ 222,559
2050	42	- -	- -	- -	- -	$ 899,390	$ 562,119	$ 231,461
2051	43	- -	- -	- -	- -	$ 935,366	$ 584,604	$ 240,720
2052	44	$ 972,780	$ 972,780	$ 250,348	$ 972,780	$ 972,780	$ 607,988	$ 250,348
2053	45	- -	- -	- -	- -	$ 1,011,692	$ 632,307	$ 260,362
2054	46	- -	- -	- -	- -	$ 1,052,159	$ 657,600	$ 270,777
2055	47	- -	- -	- -	- -	$ 1,094,246	$ 683,904	$ 281,608
2056	48	- -	- -	- -	- -	$ 1,138,015	$ 711,260	$ 292,872
2057	49	- -	- -	- -	- -	$ 1,183,536	$ 739,710	$ 304,587
2058	50	$ 769,298	$ 769,298	$ 769,298	$ 769,298	$ 1,230,878	$ 769,298	$ 316,771
Total Maintenance		$ 3,339,659	$ 3,339,659	$ 1,645,100	$ 3,339,659			

For energy costs for these options, please see page 11, Table 6 of the main report.

Window openings - Lincoln Hall October 13, 2008
Dimensions, area, number take-offs

Opening	Quantity	Dimensions W	H	SF	SF TOTAL	LF	LF TOTAL
A	23	60	112	46.7	1073	28.7	659.3
B	10	60	100	41.7	417	26.7	266.7
C	10	60	100	41.7	417	26.7	266.7
D	82	42	112	32.7	2679	25.7	2104.7
E	41	42	112	32.7	1339	25.7	1052.3
F	36	38	100	26.4	950	23.0	828.0
G	18	40	100	27.8	500	23.3	420.0
K	22	57	112	44.3	975	28.2	619.7
L	8	54	102	38.3	306	26.0	208.0
M	24	43	115	34.3	824	26.3	632.0
N	5	40	71	19.7	99	18.5	92.5
O	2	38	76	20.1	40	19.0	38.0
P	60	42	112	32.7	1960	25.7	1540.0
Q	30	38	100	26.4	792	23.0	690.0
S	1	45	100	31.3	31	24.2	24.2
T	3	41	66	18.8	56	17.8	53.5
X	12	60	112	46.7	560	28.7	344.0
Y	5	60	100	41.7	208	26.7	133.3
Z	20	74	112	57.6	1151	31.0	620.0
AA	21	49	69	23.5	493	19.7	413.0
Total	**433**				**14871 SF**		**11005.8 LF**

Area:	**Main Ext. walls**		**N Court**	**S Court**		
North	8775	North	4590	North	4590	
South	8775	South	4590	South	4590	
East	10192.5	East	1440	East	1440	
West	10192.5	West	0.0	West	0.0	**TOTAL**
	37935		10620		10620.0	**59175**

J USDA Forest Products Laboratory Research

design

Architecture, Planning and Consultation

BAILEY EDWARD DESIGN
900 North Franklin #604
Chicago, Illinois 60610

Identified By
Center for Wood Anatomy Research
USDA, Forest Service
Forest Products Laboratory
One Gifford Pinchot Dr.
Madison, WI 53726

Lincoln Hall wood samples
1928 sample - yellow pine (Pinus sp.) Mike Wiemann
1910 sample - yellow pine (Pinus sp.) Aug. 8, 2007

☒ Transmittal
☐ Memorandum
☐ RFI Response
☐ Phone Record
☐

Bailey Edward Design
35 E Wacker Drive, 28th Tower Floor
Chicago Illinois 606010
#312-440-2300 (2303 fax)

Transmitted Via: USPS
Address: One Gifford Pinchot Drive
Madison, Wisconsin 53726
(608) 231-9200

To	Name	Company	# Copies	
☒	Alex Wiedenhoeft	Forest Products Laboratory	2	Wood Sample

From: Susan Turner **Date:** 7/13/07

Project: CDB UIUC Lincoln Hall Renovations

Message / Remarks:

Hi Alex

Enclosed please find two samples from existing historic windows from a building called Lincoln Hall on the University of Illinois Urbana/Champaign capon. We are working on this project as the preservation architects, and would like to identify the species of the two types of wood from the two periods of windows. If you could please identify the species, I would appreciate it. I do not require the return of the samples. (But if you could take a couple of digital pictures of the testing, you in the lab etc, so I can include this step in the paper I am planning for the Association of Preservation Technology, I would really appreciate it. We would credit you and the lab with your work, of course!

Could you please contact me at either 312-440-2300 x216, or at sturner@bedesign.com to let me know how long this will take, and what other services you do that would be helpful to my restoration work.

Thanks so much!

Susan

Susan Turner, R.A., AIA, PMP

Susan Turner

From: Daniel L. Lindner [dlindner@wisc.edu]
Sent: Saturday, July 19, 2008 1:32 AM
To: Susan Turner
Subject: [NEWSENDER] - Re: Lincoln Hall Wood Windows - Message is from an unknown sender

Dear Susan,

Sorry for not getting back sooner, it's been a busy week. I've only been able to look into the literature briefly, but I can pass along a couple references that may help. In my personal experience as a researcher who studies wood decay and wood decay fungi, the heartwood of trees is typically more decay resistant. Because old-growth trees possess significantly more (and
older) heartwood than trees being harvested today, it seems likely that old-growth yellow pine would have superior durability relative to recently harvested wood.

Here is a good review on heartwood durability:
Taylor AM, Gartner BL and Morrell JJ. 2002.
Heartwood formation and natural durability - a review. Wood and Fiber Science 34:587.

Here is a paper showing that in red cedar decay resistance is greatest in the oldest heartwood, thus suggesting that "products made from the wood of younger trees will be less resistant to decay than similar products made from the wood of old
trees":
Nault J. 1988. Radial distribution of
thujaplicins in old growth and second growth western red cedar (Thuja plicata Donn). Wood Science and Technology 22:73-80.

Hopefully this will start you out. Feel free to email if you have further questions or need any other information.

Yours,
Daniel

>----- Forwarded by Daniel L Lindner/NRS/USDAFS on 07/18/2008 04:33 PM
>-----
>
> "Susan Turner"
> <sturner@bedesign
> .com> To
> <dlindner@fs.fed.us>
> 07/15/2008 03:32 cc
> PM
> Subject
> Lincoln Hall Wood Windows
>
>
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>
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>
>
>Hi Dan
>
>Thanks for taking the time to speak with me this afternoon. As I
>mentioned, Forest products lab did the species identification of the
>existing 1910 and 1927 windows as yellow pine. We are preparing an
>exhaustive study on the factors affecting the decision to replace,
>restore, or storm the existing windows.

>
>One of the categories of criteria is the durability of any given solution.
>One comparative aspect between the replace and the restore option is
>the durability of the wood. Could you please provide comment and / or
>references that cite the durability of old growth yellow pine lumber
>versus new wood as would be used in a new aluminum clad window?
>
>Thanks so much for your assistance.
>
>Regards,
>Susan
>
>
>
>Susan D. Turner, AIA, PMP
>BAILEY EDWARD architecture
>35 E Wacker Drive, Suite 2800
>Chicago, Illinois 60601
>p 312.440.2300 x216
>f 312.440.2303
>www.bedesign.com
>
>
>ü Please consider the environment before printing this e-mail.

--
Daniel L. Lindner
USDA-Forest Service
Madison Field Office of the Northern Research Station Center for Forest Mycology Research
One Gifford Pinchot Dr.
Madison, WI 53726-2398
Tel. 608-231-9511

K Color Chronology Results

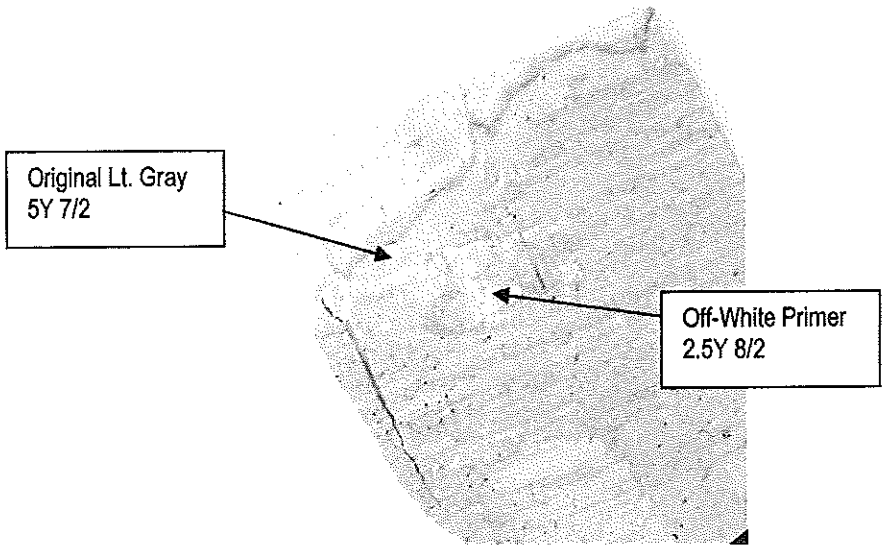
Location: Exterior
Sample: 1

Area: Window Frame
Substrate: Wood

Layer	Color	Media	Munsell	Notes
	Off-White	Primer	2.5Y 8/2	Remnant
1	Lt. Gray	Paint	5Y 7/2	*Original
2	Gray	Paint	5PB 6/1	
3	Off-White	Paint		
4	Lt. Tan			
5	Lt. Gray			
6	Lt. Gray			

*Paint layer is followed by a dirt layer

Photomicrograph Sample 1



Note: The original paint scheme appears to be a Light Gray (Munsell 5Y 7/2) over an Off-White (Munsell 2.5Y 8/2) primer. A Medium Gray (Munsell 5PB 6/1) immediately follows the Light Gray.

Susan Turner

From: Anthony Kartsonas [tkartsonas@sbcglobal.net]
Sent: Monday, August 27, 2007 10:08 AM
To: Susan Turner
Subject: Lincoln Hall/Exterior Paint Color

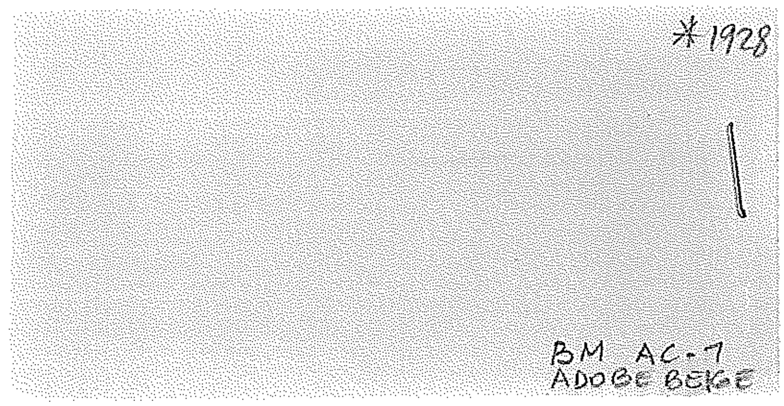
If 1910 window sample.

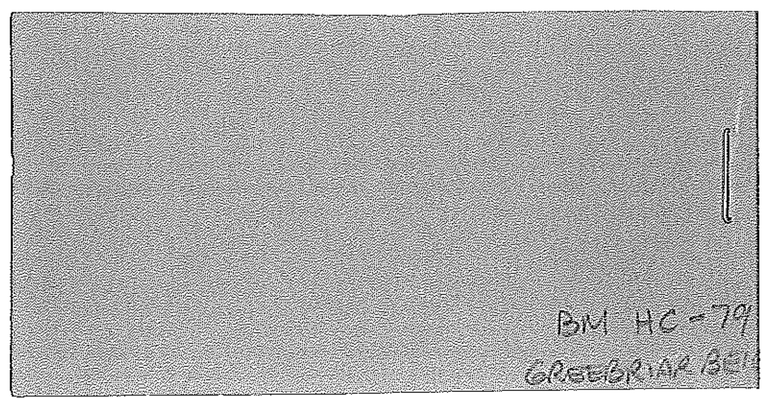
Hi Susan,
Please find attached a revised sheet on the exterior window color. I did not recall whether you needed the color immediately after the darker gray or the second one after it. I have listed both. A close match to each in Benjamin Moore is the following:

10YR 8/2	AC-7 / Adobe Beige
2.5Y 7/2	HC-79 / Greenbriar Beige

If you have any questions, please call me.

Thanks,
Tony





IF 1929 this would be paint on them similar to this.

I IHPA Illinois Historic Preservation Agency Comments

Illinois Historic
Preservation Agency

One Old State Capitol Plaza • Springfield, Illinois 62701-1507 TTY (217) 524-7128

ARCHITECTURAL REVIEW COMMENTS

Project Name: **Lincoln Hall**
702 S. Wright St.
Champaign, IL

Project Type: 707

Review Documents: **Windows Research Report**

Preliminary Findings, Report dated Oct 20, 2008
Operations and Maintenance Cost Study - U of I Oct 13, 2008
Operations and Maintenance Cost Study – Industry Standard, Oct 13, 2008

From: Mike Jackson, FAIA
Chief Architect
Preservation Services

Date: November 3, 2008

The research report covers three design treatments for the windows on the significant facades of Lincoln Hall. The treatments that retain the original windows and add new exterior storm windows or restore and retrofit existing sash with new insulated glazing both meet the Secretary of the Interior's Standards for Rehabilitation. The proposed replacement of the windows with new metal clad replacement windows does not meet the Standards.

Study Protocol

The Capital Development Board, U of I, and Bailey Edwards Design (and partners) are all to be complemented on the thoroughness and technical proficiency of this study. The issue of window treatments for historic buildings is nationally important and this study will add substantial information to many others who are engaged in this same process. Illinois is fortunate to be in a region that has several excellent window restoration companies as well as access to high performance storm windows and replacement window manufacturers. The use of Life Cycle Assessment (LCA) methodology as the best measure of true performance is a design and technical tool that is at the forefront of sustainable and preservation design. The study's technical components on energy performance modeling meet the high standards of new LCA tools. The study's Operations and Maintenance performance modeling has followed contemporary industry standards as well as the University's actual performance models.

This part of the study has also identified several predictive performance models for which there is no current defined industry standard. Future window studies will gain from the important research data as well as the few missing items.

IPHA solicited comments on the Sept 13 version of the report from the National Park Service, Landmarks Illinois and a peer architect with another university facilities office. These IHPA comments have been developed with input these reviewers. They were all highly impressed with the detailed effort. The following quote from one of the reviewers is particularly appropriate: "I especially commend the effort to maintain objectivity and to take in to account additional considerations that are not normally part of window studies."

Technical comments:

Windows included in the Study.

The window treatment protocol for the building can also be based upon the relative significance of the windows based upon their "public visibility." The IHPA is not opposed to allowing a different treatment option for the interior courtyard windows of the building as opposed to the main exterior windows. The study focused on the appropriate treatment to the highly significant windows on the primary elevations of the building.

Testing measures:

The IHPA has no specific comments about the testing protocols and methods that were used. Whatever other options might have been undertaken are not needed to use this study as it was intended.

Life Cycle Assessment

The concluding materials of this study are based upon 50-year predicted performance summaries, which add immensely to the value of this effort. The following performance factors are ones that we and our peer reviewers have identified as needing explanations. We are not necessarily requesting that the final study tables be changed, only that the variable performance modeling periods be identified for others who would use the base-line data.

1) Window Cleaning. The assumption that storm windows need to be cleaned on all four faces at the same time cycle is not a common practice in window cleaning. The exterior cleaning of windows should be the same cost for storms, replacement or restored sash for most cleaning cycles. It is only on a long-term cycle that the cleaning of the interior faces of storm windows is a likely addition cost.
2) Exterior Painting Cycle for storm windows. The assumption that the exterior woodwork of windows needs to be painted on an eleven year is not a common or expected practice for windows protected by storms. The only wood that is exposed to weathering is a small area of the exterior brick mould and frame. Most of the window is protected from substantial weathering and has a much longer painting cycle than eleven years.
3) Exterior painting cycle for restored windows. The assumption that repainting requires an eleven year first cycle does not seem to be based upon the quality of the restored finish system and the historical service life

of painted wood windows on the campus. If the University was painting exterior woodwork on an eleven year cycle there would be 9 coats of paint on the windows, when the paint analysis showed far fewer. The University's real paint cycle is probably a 20 year number not an eleven year number.

4) Caulking and access. The eight-year cycle for this activity seems extremely high, as new caulking compounds are now made with a 50 year warranty. (The study noted that this was likely to change.)
5) Life expectancy performance of replacement windows. The study assumes that the clad wood replacement window will require virtually no maintenance over the 50 year life cycle. The potential total failure of the spring balances (20 yr life-cycle) is not part of the analysis. The life expectancy of the wood/clad window system does not seem to have any service life factor other than the manufacturer's warranty of 10/20 years. A future testing protocol for the life expectancy of this assembly is an item that is beyond the scope of this study but one that the window industry needs to address.
6) Insulated glass units. The industry standard rate for failure seems to be quite low compared to the anecdotal information we are receiving about the failure rate of insulated glass units. The performance factor over a fifty year period is another item that is largely in control of the contemporary industry.
7) None of the contemporary life cycle assessment tools give much of a quantifiable method of stating that "materials that have already lasted a hundred years have a proven durability and will likely last another hundred years with proper maintenance." The lack of durability factors for existing materials such as old-growth wood is a contemporary cultural deficiency that is beyond the range of this study.

Historic Appearance

The effort to put together a final evaluation matrix that tries to quantify the "apples and oranges" of energy, maintenance and historic authenticity is one that has rarely been put to a mathematical test. This "cross platform" comparison is also going on in the development of green building rating standards, with quite a few negative comments about the impossibility of making comparisons based upon such an unquantifiable item as "authenticity." We will allow the study authors to decide if they want to pursue this. They have developed a matrix, but have not tried to place any values on the various items within each category. Based upon the efforts to do this within green rating standards, this becomes a highly subjective item. For the purposes of learning from the relative weighted categories used in green rating systems, I would suggest the following:

Energy Efficiency 40%

This is the most objective number of the analysis and the one with the most important long term sustainability value. In a preservation-based analysis, the embodied energy would also be included in this replacement option as well as the operating energy.

Operations and Maintenance 30%

The objectivity of the numbers is offset by the uncertain performance factors for some new material and assemblies, as noted above.

Historic Preservation 30%

Retention, Reversibility, Historic appearance, Embodied energy These values are difficult to quantify, but by giving this category only 30% weight the highest values go to the operational costs.

Note: There is much less of a change of character for buildings with single light sash than there is for multi-light sash when storm windows are added.

KAN HARRISON'S COPY

Illinois Historic Preservation Agency

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Voice (217) 782-4836

www.illinois-history.gov

Champaign County
Urbana
Rehabilitation, Lincoln Hall
702 S. Wright St. (Bldg. #27)
CDB-830-010-327
IHPA Log #027042507

DON'T KNOW WHETHER YOU RECEIVED A COPY OF THIS OR NOT.
MS 06/24/2007

May 29, 2007

Kirk Fernandes
Capital Development Board
Wm. G. Stratton Bldg., 3rd Floor
Springfield, IL 62706

Dear Mr. Fernandes:

We have reviewed the revised minutes to the March 27, 2007 on-site meeting to discuss the rehabilitation of Lincoln Hall on the University of Illinois at Urbana-Champaign Campus. This building is considered to be eligible for the National Register of Historic Places and, as such, is protected by the Illinois State Agency Historic Resources Preservation Act (20 ILCS 3420).

We concur that the minutes are an accurate representation of the meeting and site inspection. At this point, it is our opinion that the project will constitute a "no adverse affect" to the historic structure provided that the following conditions are met:

1. The stage curtain should be retained or documented to IL HABS standards.
2. The wood windows shall be retained and repaired.
3. Character defining features in hallways and classrooms shall be retained and repaired.

We look forward to working with you as the design progresses to ensure appropriate revisions to the project.

Sincerely,

Anne E. Haaker

Anne E. Haaker
Deputy State Historic
Preservation Officer

Cc: Melvyn Skvarla, University of Illinois at Urbana-Champaign
Susan Turner, Bailey Edward Design