Refurbishing vs. Replacing Commercial Windows:

Why, When, and How

WESSLING
ARCHITECTS

Course Description

Refurbishing vs. Replacing Commercial Windows: Why, When, and How

This case study based program explores the factors and data used to evaluate whether replacing or refurbishing commercial windows is the best option, from both functional and financial perspectives. It incorporates project/property reviews including costs; air infiltration test data, pre and post repairs (performed by a third party testing company); scope of work demonstrations and/or reviews; videos of key testing performed pre- and post-repairs; and hands-on examination of key materials, and/or tools used in each project.

As an AIA Registered Provider, Window Services:

- Certifies that this course, entitled "Refurbishing vs. Replacing Commercial Windows: Why, When and How" is approved by AIA.
- Agrees not to promote or market our company's products or services during the educational portion of this program.
- Will report the LUs each participant earns as a result of completing this course to AIA CES.
- Will provide a Certificate of Completion to each participant upon request.

Learning Objectives

1. Identify the four basic components of window efficacy to assess the overall condition and refurbishability of windows on any given property.

2. Evaluate if/when it makes sense to refurbish each of the three basic window types: hung windows, sliding windows, and compression windows.

Learning Objectives

3. Identify the common problems owners experience with each window type and outline the scope of work involved in addressing any of those issues.

4. Describe the steps involved in compiling & providing data-driven information to building owners that addresses both the financial and functional feasibility of refurbishing their windows.

Refurbishing vs. Replacing:

Four Primary Considerations

1. Financial *(based on a commercial grade 3' x 5' double-hung window)*

   Average price to refurbish: $388 per window* (including operating hardware, general reconditioning, and two low-e DSB insulated glass units)

   Average price to replace: $1425

   Putnam Square Quote:

   - 25% of quote to replace windows
   - Windows work better than they have in years
   - Residents are thrilled
   - WSI staff was great to work with

* *Open Shop Rate Pricing. Prevailing wage rate estimate for identical scope is $469.*

Refurbishing vs. Replacing:

Four Primary Considerations

2. Reduced disruption for residents

   Average time to refurbish: One–two hours (including operating hardware, general reconditioning, and new glass units as needed)

   Average time to replace: Five-six hours (includes removing replacing trim, repainting, etc)

3. Extended life cycle of the window
4. Environmental
   A. Improved energy efficiency
   B. Eliminated waste

Refurbishability

The extent to which you can cost effectively extend the life cycle of an existing window by improving its energy efficiency, functionality, and/or aesthetics.

(As defined by Window Services, January 2013)

Anatomy of a Window

Refurbishing vs. Replacing:

4 Components of Window Efficacy

1. Frame and Sash
   A. Frame/sash composition
   B. Thermal barrier
   C. Installation method and perimeter sealant
   D. Structural integrity/condition

Refurbishing vs. Replacing:

4 Components of Window Efficacy

2. Operating hardware

   A. Balances – AAMA Classifications & Warranty

      Class 1 – MAFR cannot exceed 70%

      Class 2 – MAFR cannot exceed 60%

      Class 3 – MAFR cannot exceed 50%

      Class 4 - MAFR cannot exceed 40%

      Class 5 - MAFR cannot exceed 30%

   B. Hinges, locking hardware, tilt latches, balance or tilt shoes, stops and rollers, etc.

Refurbishing vs. Replacing:

4 Components of Window Efficacy

3. Glass
   A. R value of existing glass unit
   B. Glazing method and quality

Refurbishing vs. Replacing:

4 Components of Window Efficacy

4. Weather stripping
   - A. Two primary types: Compression sealed & sliding sealed
   - B. Effective functionality considerations
     1. Condition/existence of weather stripping
     2. Is it functioning as designed
        - a. Debris precluding proper compression
        - b. Quality of original window installation (plumb)
        - c. Building settling over time

Refurbishability

1. Hung Windows
2. Sliding Windows
3. Compression Windows

1. Common Problems
2. Refurbishing Solutions

Hung Windows

Common Problems:

1. Safety
   a. Guillotine effect
   b. Locking/building security
   c. Windows falling in
2. Hard to open/close
3. Air infiltration/water penetration
4. Failed or under-performing glass

Hung Windows

Solutions:

1. Replace failed balances with AAMA Class 5 balances
2. Replace weather stripping
3. Re-caulk frame to building envelope
4. Replace locking/tilting hardware
5. Repair interlocks
6. Replace failed or under-performing glass units
7. Improve glazing methods

Sliding Windows

Common Problems:

1. Air infiltration/water penetration
2. Safety
    a. Locking/building security
3. Hard to open/close
4. Failed or under-performing glass

Sliding Windows

Solutions:

1. Replace weather stripping
2. Replace locking hardware
3. Replace rollers
4. Clean and lubricate tracks
5. Re-caulk frame to building envelope
6. Replace failed or under-performing glass units
7. Improve glazing methods

Compression Windows

Common Problems:

1. Air infiltration/water penetration
2. Safety
   a. Locking/building security
   b. Overextension/dropping
3. Broken hardware (roto-arms & cranks)
4. Failed or under-performing glass

Compression Windows

Solutions:

1. Replace and/or add additional weather stripping
2. Replace locking hardware
3. Replace roto-arms and operators
4. Re-caulk frame to building envelope
5. Replace failed or under performing glass units
6. Improve glazing methods

Test Case #1:

Boston Bay Apartments, Dorchester, MA

- Property & window descriptions
- Issues with windows
- Planned scope
- Testing procedure
- Test results (video & data):
  - Air infiltration rates
  - Operating forces
- Scope modifications
- Project pricing

Test Case #1: Boston Bay Apartments, Dorchester, MA

Interior Test Chamber

Test Case #1: Boston Bay Apartments, Dorchester, MA
Digital Manometer (DG-700)

Test Case #1: Boston Bay Apartments, Dorchester, MA

Pre and Post Repair Test Results Table

Air Infiltration (ASTME E783) & Operating Force Data

Test Date: January 26, 2015

		Specimen Number:	1		2			3	
			Before Repairs	After Repairs	Before Repairs	After Repairs	After Repairs*	Before Repairs	After Repairs
Testing	Specifications	a) Pressure differential, psf:	1.57	1.57	1.57	1.57	1.57	1.57	1.57
		b) Pressure differential, Pa:	75	75	75	75	75	75	75
		d) Specimen, total square feet:	11.2	11.2	14	14	14	11.2	11.2
Measured Results	Air Flow	e) Total, cfm:	34.2	19	47.3	21.2	20.3	44.6	19.1
		f) Extraneous, cfm:	17.2	17.2	13.8	13.8	13.8	14.1	14.1
		g) Specimen, cfm (g=e-f):	17	1.8	33.5	7.4	6.5	33.4	5
	Rate	h) Total, cfm/sf (h=e/d):	3.05	1.7	3.38	1.51	1.45	3.98	1.78
		i) Specimen, cfm/sf (i=g/d):	1.52	0.16	2.39	0.53	0.46	2.98	0.45
		j) Reduction in cfm/sf Air Infiltration %	89%		77%		81%	85%	
	Force Gauge Readings	Operating Required to Open / Close the Window	Pre Repair Up/Down	Post Repair Up/Down	Pre Repair Up/Down	Post Repair Up/Down		Pre Repair Up/Down	Post Repair Up/Down
			39 / 37	17 / 15	43 / 33	12 / 12		40 / 35	13 / 12

Per testing completed by Building Enclosure Associates

Test Case #1: Boston Bay Apartments, Dorchester, MA

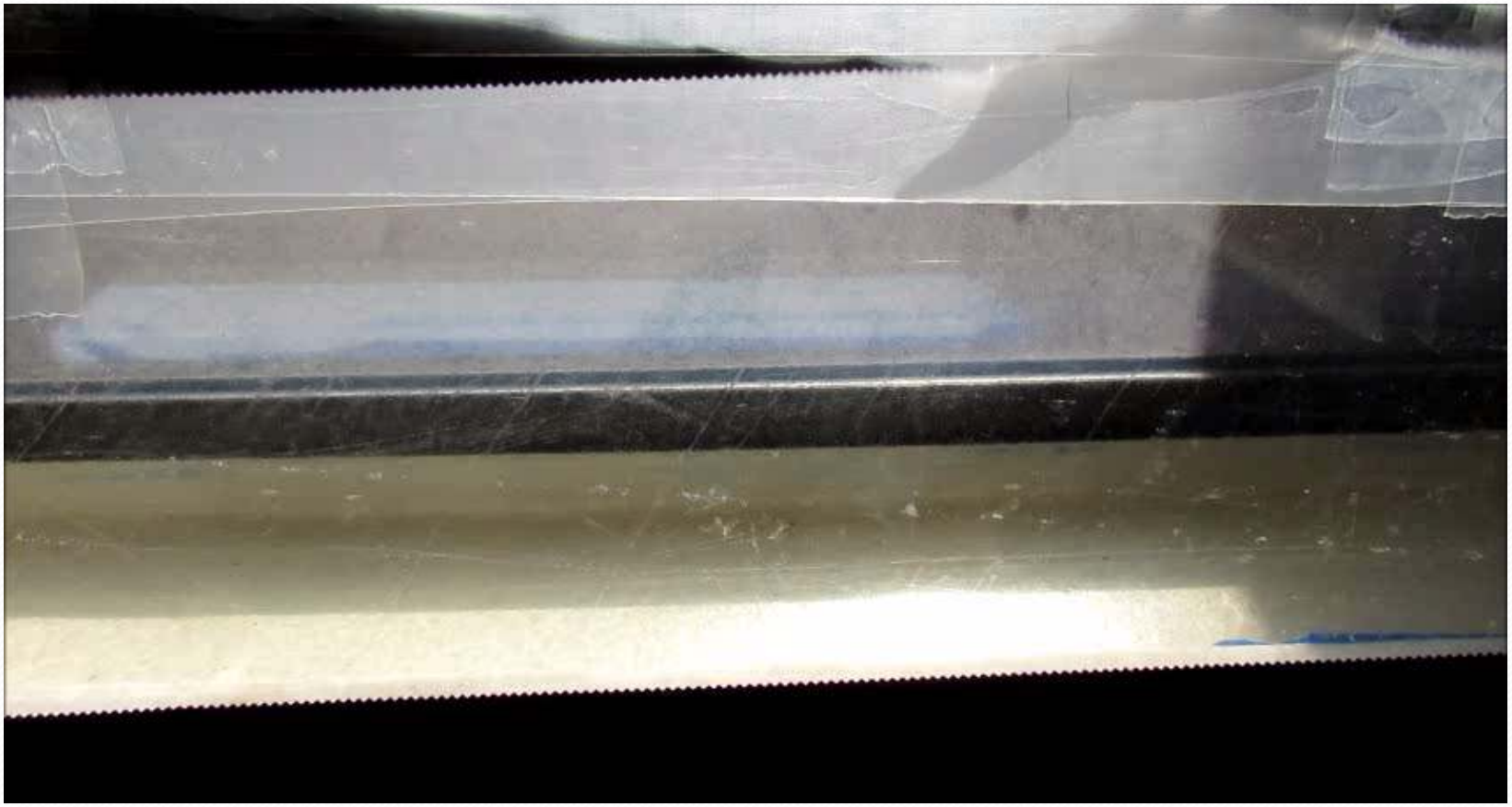
Pre-Repair Smoke Test at Meeting Rail

Test Case #1: Boston Bay Apartments, Dorchester, MA

Post-Repair Smoke Test at Meeting Rail

Test Case #1: Boston Bay Apartments, Dorchester, MA

Pre-Repair Smoke Tests at Sill



Test Case #1: Boston Bay Apartments, Dorchester, MA

Post-Repair Smoke Test at Sill

Force Gauge Reading

Test Case #1: Boston Bay Apartments, Dorchester, MA

Force Gauge Reading - Up

Test Case #1: Boston Bay Apartments, Dorchester, MA

Force Gauge Test Down

Test Case #1: Boston Bay Apartments, Dorchester, MA

Comparison Table

Refurbishing vs. Replacing 846 Commercial Grade Double Hung Windows

846 Total Windows	Cost Per Window	Total Project Cost	Time per Window	Total Project Duration*	Operat-ing Forces Up/ Down	Air Infiltration Rates
Replace	$1213	$1,026,198	6 hours	181 days	17/17**	.30 cfm psf
Refurbish	$379	$320,634	2.75 hours	83 days	14/13	.35 cfm psf
Deltas	$834	$705,564	3.25 hours	98 days	3/4	(.05 cfm psf)

*Project Duration based on 7 hours on-site/day with 4 mech. crew

** Up/down operating forces of new windows based on average weight of sash and class two balances being installed in the new windows.

Test Case #2:

Cambridge High-Rise Apartments

- Property & window descriptions
- Issues with windows
- Planned scope
- Testing procedure
- Test results:
  - Air infiltration rates
  - Operating forces
- Scope modifications
- Project pricing

Test Case 2: High-Rise Apartments, Cambridge, MA

Exterior Chamber

Test Case 2: High-rise Apartments, Cambridge, MA

Interior Chamber and Equipment

Test Case # 2: High-rise Apartments, Cambridge, MA

Cavity Insulation: Jamb & Sill

Test Case # 2: High-rise Apartments, Cambridge, MA

Test Case #2
Cambridge High-Rise Apartments
Pre and Post Repair Test Results Table
Air Infiltration (ASTM E783) & Operating Force Data

Test Date: April 30, 2015

		Specimen Number:	**1**		**2**	
			Before Repairs	**After Repairs**	**Before Repairs**	**After Repairs**
Testing	**Specifications**	a) Pressure differential, psf:	1.57	1.57	1.57	1.57
		b) Pressure differential, Pa:	75	75	75	75
		d) Specimen, total square feet:	15.4	15.4	15.4	15.4
Measured Results	**Air Flow**	e) Total, cfm:	35	22	58	33
		f) Extraneous, cfm:	33	21	51	32
		g) Specimen, cfm (g=e-f):	2	1	7	1
	Rate	h) Total, cfm/sf (h=e/d):				
		i) Specimen, cfm/sf (i=g/d):	0.13	0.06	0.45	0.06
		j) Reduction in cfm/sf Air Infiltration %	54%		87%	
	Force Gauge Readings	Operating Force Required to Open / Close the Window	Pre Repair Up / Down	Post Repair Up / Down	Pre Repair Up / Down	Post Repair Up / Down
			41 / 61	**11 / 8**	**30 / 42**	**12 / 11**

Per testing completed by ATI

Refurbishing vs. Replacing:

Comparison Table

Refurbishing vs. Replacing 1407 Commercial Grade Double Hung Windows in 714 Openings

1407 operable windows/ 714 openings	Cost per opening with one operable window (21)	Cost per opening with two operable windows (441)	Cost per opening with two operables & one fixed (252)	Total Project Cost	Time per opening with one operable window	Time per opening two operable windows	Time per opening with two operables and one fixed	Total Project Duration*	Operating Forces Up/ Down	Air Infiltra-tion Rates
Replace	$1425	$2850	$4275	$2,364,075	5 hours	6:25 hours	7:30 hours	175 days	Not know at this time	.30 cfm psf
Refurbish	$418	$604	$604	$414,498	2:50 hours	4:25 hours	4:25 hours	111 days	12 / 10	.06 cfm psf
Deltas	$1025	$2264	$3689	$1,949,577	2:10 hours	2 hours	3:05 hours	64 days	TBD	.24 cfm psf

*Project Duration based on 7 hours on-site/day with a four mechanic crew
** Up/down operating forces of new windows based on average weight of sash and class two balances being installed in the new windows.

Window Efficacy Scoring Chart

Factors	Existing Window	New Window	Refurbished Window
1. Frame Composition	2	2	2
2. Thermally Broken	2	2	2
3. Balance Type/Rating (or)	2	2	5
4. Roller Quality & Condition (or)	na	na	na
5. Hinge Quality & Condition	na	na	na
6. Glass	2	2	2
7. Glazing Condition	2	3	3
8. Weatherstripping	3	4	4
Window Efficacy Score	13	15	18

Average cost to purchase & install a new window: $1425

Average cost to refurbish an existing window: $388

Both estimates quoted above are based on a 3' x 5' commercial grade double-hung window.

Refurbishing vs. Replacing Commercial Windows

Q & A

Concluding Thoughts

Program Evaluation

Presenter Contact Info

Steve Wessling
Wessling Architects, Inc.
617-773-8150
swessling@wesslingarchitects.com
www.wesslingarchitects.com

Deb Coppins
John Paquette
Window Services, Inc.
508-429-2012
dcoppins@windowservicesinc.com
jpaquette@windowservicesinc.com
www.windowservicesinc.com