

## Historical Buildings A Holistic Approach to “Green”



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## The Issue

- How to maintain a building which may have been built prior to the installation of mechanical heat and air conditioning?
- Will the alterations do more harm than good?
- Energy is expensive – what is the best use of available funding?



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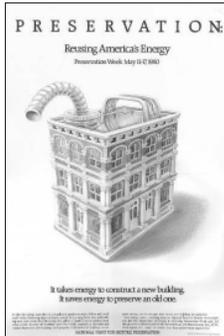
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## The Solution



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**Historic buildings were designed and built to be sustainable**

- Climate driven design
- Passive solar
- Day lighting
- Natural ventilation
- Built to last
- Durable & natural materials
- Ability to be maintained

Preservation Week Poster from 1980

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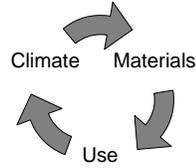
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## Decision Making & Building Science




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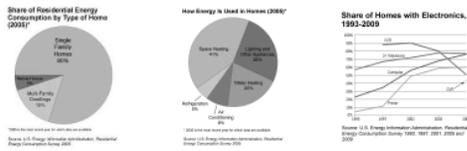
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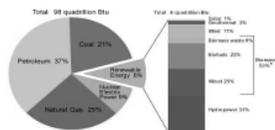
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## Residential Energy Usage



U.S. Energy Consumption by Energy Source, 2010




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## New York City Codes

### New York City Energy Conservation Code 2011

New York City Local Law 85 of 2009, which became effective July 1, 2010, established the New York City Energy Conservation Code (ECC) and ensured that the NYCECC was at least as stringent as the New York State ECC (2007 edition). When the 2010 NYSECC was released, Local Law 66 of 2010 was enacted to incorporate the new state code and became effective December 28, 2010.

The **ONLY** allowed exemptions are:

- National or State listed historic buildings
- Contributing buildings within a National or State Historic District
- Buildings certified as eligible for listing on the National or State registers
- City level designation does not qualify for exemptions

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## A Holistic Approach to Weatherization

Where one size doesn't fit all



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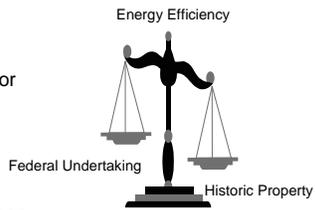
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## How Does Weatherization Fit into the Goals of the Project?

- What are the goals of the Housing Agency?
- Will weatherization procedures adversely impact/effect the exterior or interior of the building?
- Are we able to find a balance with both preservation and weatherization in mind?
- Have original elements been covered up? Have they been removed?



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## Achieving Weatherization Goals While Preserving Distinctive Features



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## Historic building features can:



Save Energy



Save the Earth



Save Money

## Refining those features will:



Improve Property Values



Improve Health



Add Local Jobs

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## Sustainability



**Historic buildings are often highly adaptable for new uses**



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## Waste & Demolition



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## Inherently Sustainable Features

- Floor Plan
- Exterior materials
- Roof overhangs
- Fireplace locations
- Window sizes
- Shutters
- Orientation



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## New England Climate



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## Southern Climate



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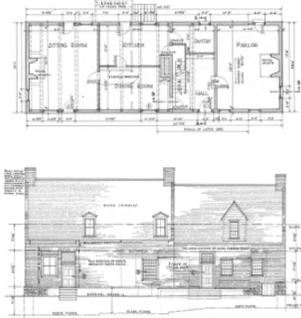
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## New York State Climate Humid Continental



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## Neighborhood Developments



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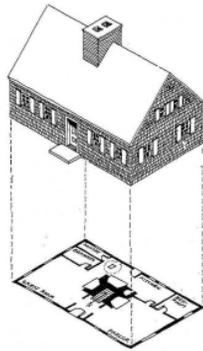
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## A Short Story of 200 Years



1804, Jefferson County, NY



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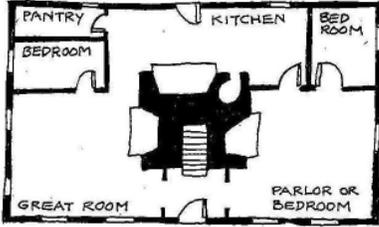
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1804



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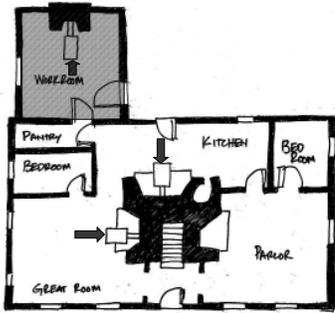
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1848



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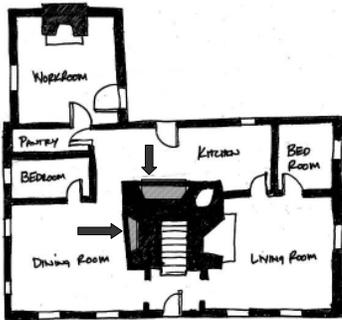
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1940



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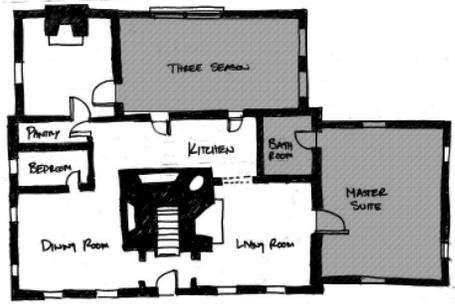
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1960



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1986-2012



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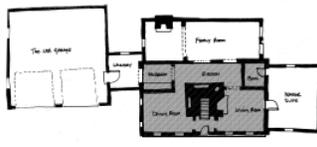
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### Energy Audit

- Identify the location of air infiltration
- Review past energy bills – 1-2 years
- Determine baseline for current use of home.
- Blower door test & infrared thermography
- Determine Inherently Sustainable Features



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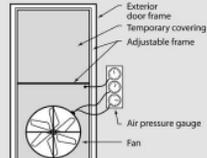
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## Blower Door Test

- A fan that mounts into the frame of an exterior door
- Fan pulls air out of the house, lowering the air pressure inside
- The higher outside air pressure then flows in through all unsealed cracks and openings.

### Diagnostic Tools

Testing the airtightness of a home using a special fan called a blower door can help to ensure that air sealing work is effective. Often, energy efficiency incentive programs, such as the DOE/ EPA Energy Saver Program, require a blower door test (usually performed in less than an hour) to confirm the tightness of the house.



US Department of Energy

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## Audit Results

- Implement improvements that will provide the most payback and the least compromise to the historic character of the building.



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## Minimal Alterations to Historic Buildings

- Chimneys
- Attic Insulation
- Seal ducts & pipes
- Weather-strip doors
- Add storm windows & doors
- Seal locations of air infiltration



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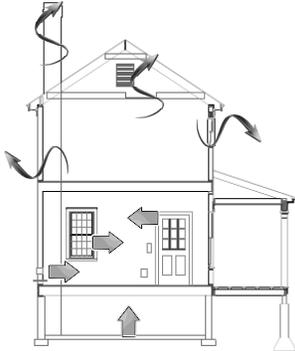
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## Common Air Leaks – Stack Effect

- CHIMNEY
- ATTIC HATCH
- WINDOWS
- OUTLETS
- UTILITY ENTRANCES
- DOORS/WINDOWS
- DRAINS
- CRACKS



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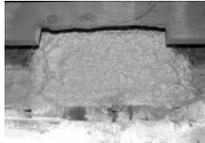
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## Air Infiltration

- Seal ducts
- Pipe and electrical penetrations.
- Foam inserts at electrical outlets
- Leaks around doors and windows



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## Air Infiltration - Doors



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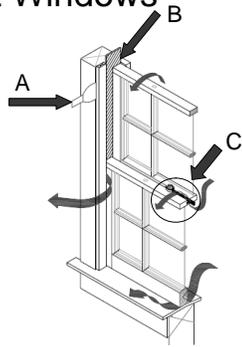
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## Air Infiltration at Windows

A Weather-stripping should be installed at the jambs, the sill, the head and at the meeting rails. Use a thin putty knife to slip behind the stop and lightly pry off.

B Spring bronze is a good choice for the jambs. The strip is nailed to the jamb channel along the interior side at the stop or parting bead.

C An interlocking strip is best for the meeting rails. When the window is closed, the strips close off any air gaps. The sash lock pulls the meeting rails tight.



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## Air Infiltration at Windows



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## Indoor Air Quality

- Homeowners are spending more time indoors.
- Tightening the envelope too much could lead to poor air quality and mold issues.
- Addition of a whole house air exchanger will aid in air quality issues, but is an additional use of energy.



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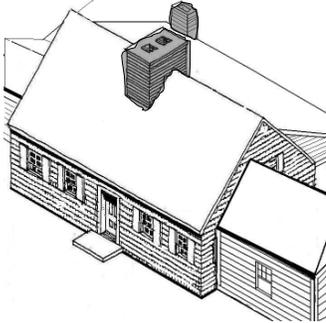
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## Chimney



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## Closing the Damper



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## Insulation



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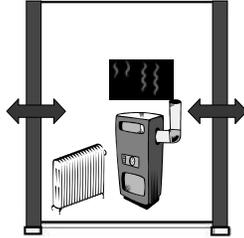
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## Building Science of Masonry Walls

- Historic bricks were fired at different temperatures, were made of different mixtures, and have different porosity levels.
- Buildings heated during the winter protect the exterior face of the masonry wall by reducing the possibility of water freezing in the outer layers of the wall.



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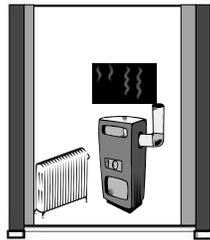
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## Building Science of Masonry Walls

- Adding insulation to masonry walls prolongs the drying rate.
- The wall will stay cold
- Increased freeze/thaw cycles
- Damage may occur to the brick – future \$\$ for repairs & repointing
- Look at the brick at non heated locations – if you see deterioration, the brick may act in a similar fashion if insulated.



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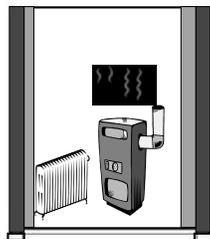
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## Building Science of Masonry Walls

- Exterior masonry walls can absorb water when it rains and insulation may slow the drying period.
- Such changes may damage the historic masonry, may damage the interior finishes, and cause deterioration to wood or steel structure within the wall.



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## Insulating Solid Masonry Walls

- Should be avoided when it involves the removal of important finishes or features or when the additional thickness alters the historic character of the interior.
- Use rigid insulation at basements.



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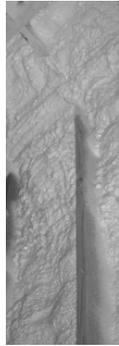
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## Spray Foam Insulation

- Since liquid foam insulation (closed & open cell) will adhere permanently to wood and masonry fabric, its use is not advised for listed or eligible buildings. (Not reversible)
- Pressure used for installation could cause damage to historic material including plaster keys & details
- Hides the condition of the structure. A leak in the roof will go undetected
- Doesn't allow for accessible locations for repairing or running new electrical, plumbing, or HVAC lines
- May trap moisture
- Long term effects of adding spray foam to historic masonry walls have not been adequately documented.



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## Insulating Wood Framed Walls

- Blow in wall insulation where no decorative plaster or stenciling is damaged.



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## Wall Insulation Concerns

- Does wall sheathing exist? Is exterior siding nailed directly to the studs? Platform or Balloon framed?
- If holes are drilled through exterior siding, holes must be filled with wooden plugs, sanded smooth, and primed and painted to match surrounding siding finish
- Recommended use of *borate only* grade of cellulose insulation. Cellulose treated with sulfates will react with moisture in the air and will form sulfuric acid which corrodes metal.



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## Insulation Concerns



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## Attic & Wall Insulation Concerns

- Installation of a moisture barrier is difficult without removing historic fabric
- Inspect for safety and moisture related issues, and address accordingly
- All kitchen and bath fans venting into attic must be vented outdoors through roof fittings
- Walls and attics may contain knob and tube wiring. If this still exists, it must be removed/updated prior to adding insulation.
- Existing insulation, such as vermiculite, may contain asbestos – Contractor Safety



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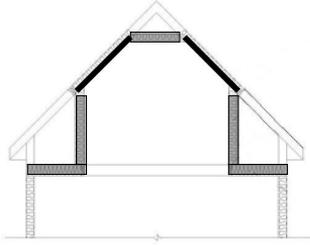
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## Eaves and Finished Spaces



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## Unfinished Attic Spaces



At eaves, install baffles, dams or other blocking devices

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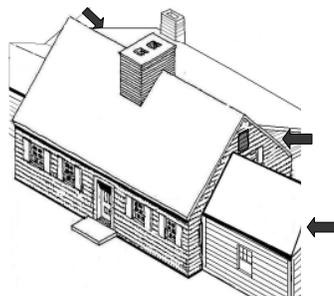
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## Attic Venting



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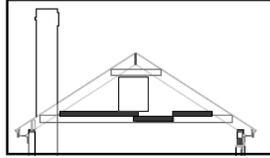
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## Attic Insulation

- Install insulation over the attic floor and over the attic hatch. Rigid insulation should be placed over the attic hatch
- Attic vents need to be clear for proper air movement and drying.
- If you must install new attic vents in the gable end, consider how this will alter the historic appearance of your building and avoid irreversible changes.



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## Attic Venting at Gables



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## Attic Venting at Gables



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## Deep Energy Retrofits



Never an appropriate treatment for historic buildings.

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## Moisture Migration & Mold



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## Basement Moisture



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## Heating & Cooling Systems

- The energy audit will determine the age of your system, its efficiency, and if it is properly sized for your building and your lifestyle



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## Heating & Cooling Systems

- Will new pipes need to be installed?
- New exhaust or fresh air piping at the roof or exterior wall?
- Use of a wood stove or insert?



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## Unconditioned Basements

- Install a moisture barrier over exposed dirt floors to prevent ground moisture from entering conditioned spaces.
- Seal ducts for heating and AC



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## Thermostats

- Installation and usage of a programmable thermostat
- Reduce building's heating costs by approximately 25%.



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## Energy Star Appliance Upgrades

- Refrigerators, washing machines and dishwashers.
- Available rebates at [www.energystar.gov](http://www.energystar.gov)



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## Cross Ventilation & Vegetation



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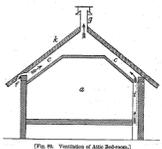
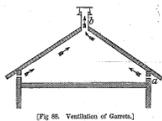
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## Cupolas & Ventilation



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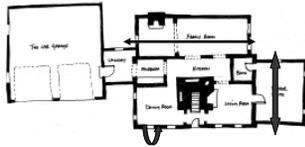
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## Summer Cooling

- Window & door screens
- Close windows and curtains to reduce solar gain during the day
- Open windows overnight to draw in cooler air
- Open both the bottom and top sashes to increase the cycle of cool and warm air.



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## Insulated Shades & Awnings

- Awnings should only be installed when compatible with the character of the building
- Interior shades are a cost effective alternative to controlling heat gain and loss
- Pleated shades provide air spaces which add insulation value. Lower at night during the winter season



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## Exterior & Interior Shutters



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## Exterior Storm Windows

- Salvaged storm windows can be repaired and reused as they are often the correct size and the cost is minimal.
- Some new storm windows offer clear, non tinted, low-e glass.
- Studies show that the use of an exterior storm window can equal the performance of a new double glazed replacement window.
- Use solves the issue of insulated glass seal failure found in new replacements.



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## Exterior Storm Windows

- Storm windows must be tight fitting to the existing opening – reduce the formation of condensation on the existing primary window
- Align with the meeting rail of the existing sash
- Match the color of the existing sash
- Caulked around the frame without closing off weep holes



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## Interior Storm Windows

•As long as a proposed measure does not diminish the historic character of a building or endanger historic materials, then it will meet the Standards.

•Gaskets must be used to ensure a tight fit to the existing opening – reduce the formation of condensation on the inside of the existing primary window



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## Windows



Windows come in all shapes, sizes, and types, and are some of the most important character defining features on historic buildings.

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## Historic Windows

- Originally built of old growth and dense wood.
- Glass was individual panes.
- Easily repaired
- Easily adapted to receive energy enhancements

### Common Issues:

- Sticky Windows / Loose Windows
- Replacing Glazing and Putty
- Sash Cords and Weights
- Cracked Paint



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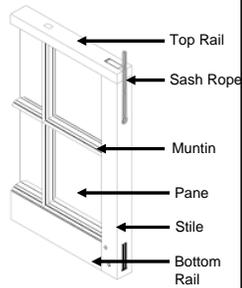
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## Sash Repair



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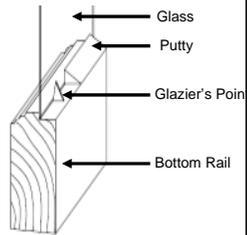
## Pane Replacement

### Pane Replacement:

- Remove existing damaged pane.
- Insert pane into existing sash, secure with glazing points
- Seal perimeter of pane with latex or oil based glazing compound, or vinyl glazing strips.

### Re-glazing:

- Lead paint and asbestos hazards



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## Lead Paint

### EPA RRP

- Built prior to 1978
- Lead compounds were used as they had excellent adhesion, drying, and covering abilities for such elements as window sash, window frames, trim, and siding.
- Disruption of more than 6 square feet by any contractor performing renovation, repair, and painting projects in homes, child care centers, and schools triggers RRP
- Preservation Brief 37 - A preferred approach, consistent with *The Secretary of the Interior's Standards*



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## Lead Hazard Control in Historic Buildings

- If Federal funds are involved in the project and it is eligible or listed on the National Register, treatment must comply with the Secretary of Interior's Standards.
- See Chapter 18: Lead Hazard Control and Historic Preservation
- Consult with the SHPO on different levels of treatment.
  1. Stabilization & removal of lead based paint
  2. Extensive repair with in kind or closely matching materials
  3. Replacement and Removal - Extensive review by SHPO and ACHP

[www.hud.gov/offices/lead/lbp/hudguidelines/Ch18.pdf](http://www.hud.gov/offices/lead/lbp/hudguidelines/Ch18.pdf)

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## Asbestos

- Used since the late 1800's as an ingredient for caulking and putties.
- Asbestos increases the viscosity of caulks, reduces the sag, and reinforces the matrix.
- Ranges from 5-25% of caulking, glazing, and patching compounds.



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## Asbestos & NYS Department of Labor

- Part 56 of Title 12 of the Official Compilation of Codes, Rules and Regulations of the State of New York (Cited as 12 NYCRR Part 56)

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# Historic Doors



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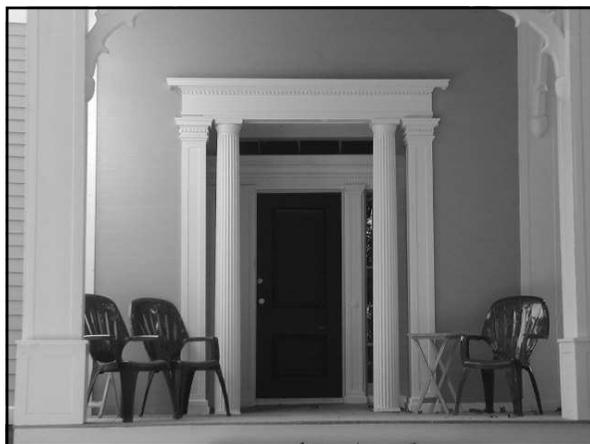
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## When is Replacement an Option?

- Severely deteriorated
- Lead paint & children
- Non-historic windows that have failed



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## Replacement Windows

- Proportions of the frame to sash
- Configuration of windowpanes and muntin profiles
- Material, including type of wood or metal and glass characteristics.



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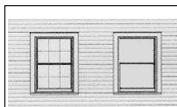
## Replacement

DO



Replacement of 6 over 6 in kind, keeping muntin pattern and size.

DON'T



Replacement with 1 over 1: Poor selection, no muntins change the design substantially and reduce the overall character of original windows and building.

DON'T



Replacement with smaller opening: Poor selection, wrong size and proportion to overall wall

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## Character Defining Features



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## Character Defining Doors & Windows



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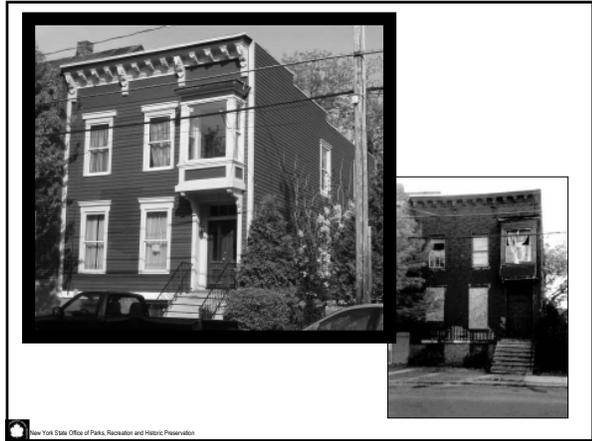
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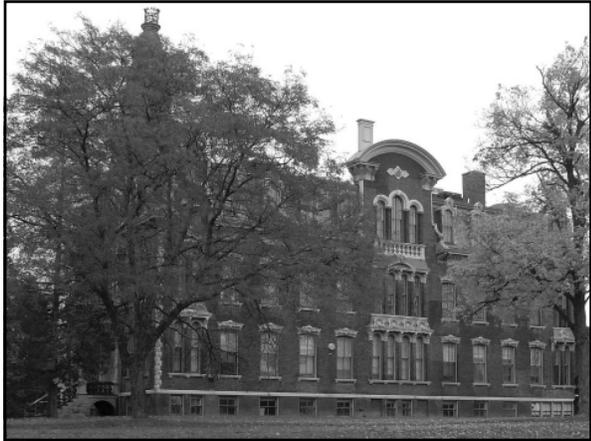
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## Electrical

- Fluorescent bulbs use 2/3 less energy than standard incandescent bulbs.
- Strip Fluorescent Fixtures:  
Garages, laundry rooms, closets and utility rooms.
- Use less electricity than traditional incandescent bulbs
- ENERGY STAR-qualified CFLs use about 2/3 the energy and last ten times longer than a comparable incandescent bulb
- Can fit into existing lighting fixtures



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## Lighting

- Turning off unnecessary lighting will save energy and money.
- Lighting Occupancy Sensors: Convenience of turning lights on automatically when someone enters the room



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## The Little Red Light

### Phantom loads:

- Computers, cable boxes, DVR, TV and other similar devices, even when turned off, consume energy.
- Chargers plugged into walls when not in use are still using energy.
- Consider plugging these devices into a power strip and using the power strip switch to turn off devices.



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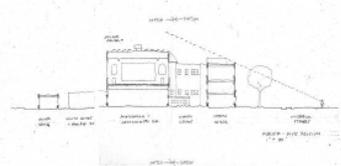
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## Solar Panels



- Visibility from public right-of-ways must be limited
- Orientation of panels can have a significant impact on visibility
- Best accommodated on buildings with flat roofs and parapets



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## SHPO Web Resources

SHPO Historic Preservation Office • 1019 Park, Voorhies & Stuyvesant • Page 1 of 2



[www.nysparks.com/shpo/](http://www.nysparks.com/shpo/)



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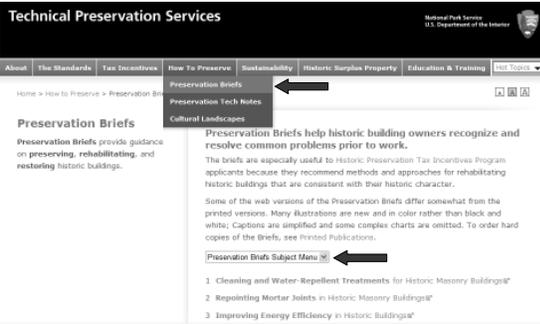
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## NPS Web Resources

[www.nps.gov/tps/](http://www.nps.gov/tps/)



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## NPS Web Resources

### Preservation Briefs

3. Improving Energy Efficiency in Historic Buildings
9. The Repair of Historic Wooden Windows
16. The Use of Substitute Materials on Historic Building Exteriors
37. Appropriate Methods for Reducing Lead-Paint Hazards in Historic Housing
39. Controlling Unwanted Moisture in Historic Buildings

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## Case Studies



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## Henry Street Settlement MAS Demonstration Project

- National Historic Landmark
- Landmark Preservation Commission Designation
- Circa 1830 Federal style
- Brick row house



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## Existing Conditions



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## Audit - Windows



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## Audit - Interiors



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## Audit - Air Infiltration



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## Audit Phase

Issues noted in interview with building owners:

- Top floors very warm
- High electrical bills
- High heating & cooling costs
- Lack of thermostats and controls
- Old steam boiler system
- Windows are not operable
- Staff have personal refrigerators, fans, printers, etc
- Too much light, too little light

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## Process - Brainstorming



What might we refine? Repair?

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## Inherently Sustainable Features & Goals

- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>• Masonry walls</li><li>• Large windows</li><li>• Tall ceilings</li><li>• Nearly flat roof – Solar?</li><li>• Rainwater collection?</li><li>• Natural shading at street</li></ul> | <ul style="list-style-type: none"><li>• Short Term Goals</li><li>• Costs to change from oil to gas/boiler</li><li>• Window Survey</li><li>• Passive shading options</li><li>• Efficient Lighting</li><li>• Weather-stripping</li><li>• Staff education</li></ul> |
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## Shading Options



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## Energy Efficiency Manual

MAS and the LPC are producing a manual, "Greening New York City's Landmarks: A Guide for Property Owners."

*"...improve the energy efficiency and sustainability of the city's landmark buildings while meeting preservation standards."*

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## WAP in Historic Districts

- 1290, 1325, 1326 Grand Concourse, Bronx
- Multi-family
- Windows are a character defining feature
- Windows had been altered previously in some cases



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## 1290 Grand Concourse



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## 1290 Grand Concourse



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## 1290 Grand Concourse



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## 1290 Grand Concourse



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## 1325 Grand Concourse



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## 1325 Grand Concourse



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# 1326 Grand Concourse



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# 1326 Grand Concourse



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# 1326 Grand Concourse



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### Audit - Exterior - Neighborhood



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### Audit - Exterior



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### Audit - Exterior



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## Audit - Windows



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## Audit - Interior



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## Audit Phase

- Determine Inherently Sustainable Features
- What can be refined or repaired?
- Audit

### Findings

- Original Interior Storms
- Second Empire style with highly ornate porch (shading)
- Large windows – operable
- Tall ceilings
- Paint can be removed
- Wall insulation installed

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## Measures

- Install interior and exterior storm windows
- Install exterior storm doors while retaining original doors. Weather-strip doors & windows
- Remove lead paint
- Insulate attic
- Repair cornice – water issues



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## Rehabilitation & Lead Abatement



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## Storm Doors



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# Cornice Repair



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