Preservation as a sustainability strategy

**STEWARDSHIP OF THE BUILT ENVIRONMENT**

**SUSTAINABILITY**

Defined by the Brundtland Commission (1988) as:

"...development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

And the Whole Building Design Guide further states:

"Sustainability begins with preservation."

**ARE WE ON THE RIGHT TRACK?**

"...we’re on the threshold of a new phase as growing numbers of people are concerned about the degradation of the environment and our relentless consumption of irreplaceable energy and natural resources. Preservation certainly isn’t the solution to these problems, but it can be—and should be—an important part of the solution."

– Richard Moe

NTHP President

**“THREE LEGGED STOOL”**

Preservation can be seen as the interconnection of all three legs

**SEE**

Social
Environment
Economics

**STEWARDSHIP OF THE BUILT ENVIRONMENT**

Stewardship of the built environment balances the needs of contemporary society and their impact on the built environment with their ultimate effects on the natural environment.
IMPORTANT POINT TO PONDER

“The greenest building is one that has already been built.”
—Carl Elefante

“THE GREENEST BUILDING…”

HOW CAN OLDER BUILDINGS BE GREEN?

Older and historic buildings possess inherent green qualities that are often underestimated, overlooked, or undervalued with regards to:

- Embodied energy
- Energy Utilization Index (EUI)
- Impacts of demolition/replacement
- Regional/climate-based design
- Low technology comfort mechanisms
- Original walkable communities

EMBODIED ENERGY

First discussed by the National Trust for Historic Preservation in the late 1970s and still a mainstay in their sustainability initiative today:

“The sum total of all the energy used to acquire raw materials, transform them into building materials, transport them to the building site, and construct the building.”

EMBODIED ENERGY: A CLOSER LOOK

- INITIAL embodied energy includes non-renewable energy used in the acquisition of raw materials, their processing, manufacturing, transportation to site, and construction. This energy has two components:
  - Direct energy: the energy used to transport building products to the site, and then to construct the building; and
  - Indirect energy: the energy used to acquire, process, and manufacture the building materials, including any transportation related to these activities.
- RECURRING embodied energy includes non-renewable energy consumed to maintain, repair, restore, refurbish or replace materials, components or systems during the life of the building.

Energy Utilization Index (EUI)

Many historic buildings are already energy efficient

<table>
<thead>
<tr>
<th>Year</th>
<th>Average energy consumption</th>
<th>Btu/sq. ft</th>
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<tbody>
<tr>
<td>Before 1920</td>
<td>80.127</td>
<td></td>
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<tr>
<td>1920 – 1945</td>
<td>90.234</td>
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<td>1946 – 1959</td>
<td>89.198</td>
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<td>1960 – 1969</td>
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<td>1970 – 1979</td>
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<td>1980 – 1989</td>
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<tr>
<td>1990 – 1999</td>
<td>88.834</td>
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<td>2000 – 2003</td>
<td>79.703</td>
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</table>

Source: Commercial Building Energy Consumption Survey, 2003
U.S. Department of Energy
IMPACT OF DEMOLITION/REPLACEMENT
- Actual recovery time of embodied energy costs
- Demolition cost/energy
- Materials flows

REGIONAL/CLIMATE-BASED DESIGN
- Design worked with factors commonly understood within the local climate
- Vernacular solutions
- Local materials

LOW TECHNOLOGY COMFORT MECHANISMS
- Thermal mass
- Passive thermal control
- Daylighting
- Convective Cooling

LOW TECHNOLOGY
- Thermal Mass
- Passive Thermal Control

DAYLIGHTING
- Let the light in

CONVECTIVE AIR FLOW
- Warm air rises
- Cross ventilation
**ORIGINAL WALKABLE COMMUNITIES**
- Source of New Urbanism precedents
- Source of Transit Oriented Development precedents

**SOCIAL AND ECONOMIC CONSIDERATIONS**
- Education and marketing
- LEED
- Building codes
- Secretary of the Interior Standards
- Economic Incentives
- Life cycle cost assessment
- Economic Analysis
- Community Revitalization: "Smart Growth"

**EDUCATION AND MARKETING**
- Project an enhanced image for preservation
- Dispel the "myths"
- Build relationships

**PROJECTING AN ENHANCED IMAGE FOR PRESERVATION**
- Move from iconic museums to vital communities

**BUILDING RELATIONSHIPS**
- Work proactively with public, oversight agencies and boards, and multiple stakeholders

**BUILDING RELATIONSHIPS**
- Acknowledge complexity but seek clarity and create collaborative models
COLLABORATIVE PARTNERSHIPS

- Public/private partnerships
- Joint operating agreements
- Inter-agency agreements

DISPELLING THE MYTHS

Win-Win solutions
- McDonald’s, Freeport, ME
- Rite Aid, Camden ME

LEED AND OTHER RATING SYSTEMS

In addition to LEED, other systems are in use.
- Become familiar with proactively engaging the scoring system
- Use as first step not the final solution
- Advise on new metrics development

BUILDING CODES

- Enhance awareness of opportunities and constraints for solutions
BUILDING CODES

- Form based codes: historic/vernacular precedents
- High performance building codes and smart codes: accommodate older and historic buildings
- IEBC alternate compliance: make code officials aware
- Reasonable accommodation versus exemptions: find solutions rather than denying the problem

SECRETARY OF THE INTERIOR STANDARDS

The basis for many local design guidelines needs to reconsider:
- Sustainable design issues
- Smart codes
- High performance building standards
- Interface with LEED and other performance metrics

SECRETARY OF THE INTERIOR STANDARDS

- Reassessment and evolution

LIFE CYCLE COST ASSESSMENT

The present value of all cash flows over the lifetime of a building:
- First cost
- Operating cost
- Maintenance cost
- Cyclical replacement cost
- Disposition cost
- Includes factors for time value of money

ECONOMIC ANALYSIS

In lieu of the more complex LCCA, simple payback analysis may be more readily understood by the public, practitioners, and public officials.

Simple payback: period of time needed to recover additional money spent based on energy savings alone.

Generally accepted simple payback period is 3-5 years.
**ECONOMIC INCENTIVES**

Even under current conditions, there are funding incentives:
- Community Development Block Grants (CDBG)
- Energy and Environmental Block Grants (EEBG)
- Historic Preservation Tax credits
- Historic Preservation Incentives
- Low Income Housing Tax Credits
- New Market Tax Credits
- Redevelopment opportunities

**COMMUNITY REVITALIZATION:**

- Main Street and beyond
- Walkable Communities
- LEED-ND
- Job Creation
- Local impacts

**Impact of Various Economic Activities**

<table>
<thead>
<tr>
<th>Economic Activity</th>
<th>Jobs</th>
<th>New Construction Buildings</th>
<th>Rehabilitation of Historic Buildings</th>
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<tbody>
<tr>
<td>Highway Construction</td>
<td>33.6</td>
<td>36.1</td>
<td>38.3</td>
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<tr>
<td>Household Income</td>
<td>$1,197,000</td>
<td>$1,223,000</td>
<td>$1,302,000</td>
</tr>
<tr>
<td>State Taxes</td>
<td>$101,000</td>
<td>$103,000</td>
<td>$110,000</td>
</tr>
<tr>
<td>Local Taxes</td>
<td>$85,000</td>
<td>$86,000</td>
<td>$92,000</td>
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</tbody>
</table>

**CASE STUDIES**

- G. H. Schettler House
- Big-D Construction Office
- Scowcroft Warehouse

**THANK YOU!**

Robert A. Young, PE, LEED ap

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URL: http://faculty.arch.utah.edu/young/

G. H. SCHETTLER HOUSE CASE STUDY
Stewardship of the Built Environment

May 27, 2009

G. H. SCHETTLER HOUSE CASE STUDY

Timeline
1904 Constructed
1936 Converted to five apartment units
1961 Resumed use as single family home
1979 Named as contributing building in the Avenues Historic District and listed on the National Register of Historic Places
1994 Purchased by current owner
2000 Rehabilitated back to single family home
2001 Historic Landmarks Commission Award
Utah Heritage Foundation Award
2008 Systems upgrades and replacements

G. H. SCHETTLER HOUSE CASE STUDY

Social
- Building conservation
- Neighborhood revitalization
- Enhance livability

Environmental
- Energy conservation
- Resource conservation
- Reduce/reuse/recycle
- Reduce exposure to contaminants

Economics
- Urban revitalization
- Innovative financing mechanism
- Rehabilitation tax credits
- Financially competitive

Goals
- Reduce Natural Resource Consumption/Increase Comfort
- Reduce Waste/Increase Recycled Content
- Reduce Hazardous Contamination
- Be Financially Competitive

First Floor–Before

Second Floor–Before
G. H. SCHETTLER HOUSE CASE STUDY

Process
- Physical Assessment/Archival Research
- Performance Programming
- Schematic Design
- Design Review
- Construction Documents
- Construction
- Occupation

Building Envelope

Physical Assessment

G. H. SCHETTLER HOUSE CASE STUDY

Character Defining Features

Physical Assessment

G. H. SCHETTLER HOUSE CASE STUDY

Building Chronology

Physical Assessment

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G. H. SCHETTLER HOUSE CASE STUDY

Recreated Original 1904 Floor Plans

Physical Assessment

Construction Documents

G. H. SCHETTLER HOUSE CASE STUDY

Construction

G. H. SCHETTLER HOUSE CASE STUDY

Construction

G. H. SCHETTLER HOUSE CASE STUDY

Construction

G. H. SCHETTLER HOUSE CASE STUDY

Construction
**G. H. SCHETTLER HOUSE CASE STUDY**

**Reduce Natural Resource Consumption/Increase Comfort**

Before Rehabilitation
- Heating Load: 135,075 Btuh
- Cooling Load: 48,077 Btuh

After Rehabilitation
- Heating Load: 85,564 Btuh (36.7% lower)
- Cooling Load: 37,275 Btuh (22.5% lower)

**Architectural**

- Brick construction
- Large/Tall windows

**Window upgrades**

**Mechanical Thermal Control**

**Plumbing**

**Electrical/Lighting**

**Architectural**

- Operable skylight in stairwell

**Architectural**

- Ceiling height
- Transoms
- Double-hung windows

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G. H. SCHETTLER HOUSE CASE STUDY

Architectural

Insulation upgrades

G. H. SCHETTLER HOUSE CASE STUDY

Architectural

Light colored roofing

G. H. SCHETTLER HOUSE CASE STUDY

Architectural

Light wall color

G. H. SCHETTLER HOUSE CASE STUDY

Mechanical Thermal Control

Central forced air furnace
Split system air-conditioning
Combustion air inlet

G. H. SCHETTLER HOUSE CASE STUDY

Mechanical Thermal Control

Two thermal zones
Programmable thermostats

G. H. SCHETTLER HOUSE CASE STUDY

Mechanical Thermal Control

Gas-fired fireplace inserts
Stewardship of the Built Environment

May 27, 2009

G. H. SCHETTLER HOUSE CASE STUDY

Mechanical Thermal Control
Paddle fan in kitchen

G. H. SCHETTLER HOUSE CASE STUDY

Mechanical Thermal Control
Attic ventilation fan
Ridge vents

G. H. SCHETTLER HOUSE CASE STUDY

Electrical/Lighting
Daylighting

G. H. SCHETTLER HOUSE CASE STUDY

Electrical/Lighting
Task lighting
Upgraded appliances

G. H. SCHETTLER HOUSE CASE STUDY

Electrical/Lighting
Programmable timers
Automated controls

G. H. SCHETTLER HOUSE CASE STUDY

Plumbing
Low flow water fixtures
Low water use appliances
DHW tank insulated
G. H. SCHETTLER HOUSE CASE STUDY

Reduce Waste/Increase Recycled Content

Reduce demand for new materials
Reuse existing materials
Reduce landfill pressure

Case 1: Rehabilitate Original House
New Materials Needed: 24.5 tons
Construction Waste: 22.8 tons
Total Material Stream: 47.3 tons
85.9% recycled content from original construction.

Case 2: Build New House in the Suburbs
New Materials Needed: 173.5 tons
Construction Waste: 8.9 tons
Total Material Stream: 182.4 tons ~4X Case 1
0% recycled content (no original construction to reuse).

Case 3: Demolish House and Rebuild Comparable New House (but not a “Monster House”)
New Materials Needed: 173.5 tons
Construction Waste: 178.3 tons
Total Material Stream: 351.8 tons ~7.4X Case 1
0% or only nominal recycled content from original construction.

G. H. SCHETTLER HOUSE CASE STUDY

Reduce Hazardous Contamination

Asbestos
Lead
Radon
Indoor air quality
Water quality

G. H. SCHETTLER HOUSE CASE STUDY

Be Financially Competitive

Project Cost: $215,000 $84/sf
Tax Credit: $41,800
Net Cost: $173,200 $68/sf
Overall Cost: $302,700 $119/sf

Note: Average cost for new construction locally was >$150/sf.

G. H. SCHETTLER HOUSE CASE STUDY

North Parlor

Before

After
G. H. SCHETTLER HOUSE CASE STUDY

Dining Room

Before After

G. H. SCHETTLER HOUSE CASE STUDY

Kitchen

Before After

G. H. SCHETTLER HOUSE CASE STUDY

Porch

Before After

G. H. SCHETTLER HOUSE CASE STUDY

Exterior

Before After

BIG-D CONSTRUCTION OFFICE CASE STUDY

Social
- Building conservation
- Neighborhood revitalization
- Enhance workplace productivity
- Health/Safety/Welfare

Environmental
- LEED Gold
- Reduce/reuse/recycle
- Reduce exposure to contaminants

Economics
- Urban revitalization
- Brownfield redevelopment
- Rehabilitation investment tax credits
- Innovative financing mechanism
- Economic feasibility

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BIG-D CONSTRUCTION OFFICE CASE STUDY

Timeline
1922  Constructed as factory for W. P. Fuller Paint Co.
1965  Building sold and continued use as light manufacturing and other uses (mostly unoccupied)
2003  Purchased by Big-D Construction Co.
2004  Rehabilitation Completed
2005  Historic Preservation Tax Credits
       Utah Heritage Foundation Award
       AIA Merit Award
       Associated Builders of Utah Award...
2006  LEED Gold

BIG-D CONSTRUCTION OFFICE CASE STUDY

Goals
- LEED Silver
- Demonstrate Successful Adaptive Reuse
- Promote Preservation of Existing Buildings
- Revitalize Neighborhood
- Demonstrate Economic Feasibility

BIG-D CONSTRUCTION OFFICE CASE STUDY

Floor Plans—Before

BIG-D CONSTRUCTION OFFICE CASE STUDY

Process
- Assessment and Research
- Programming
- Schematic Design
- Design Review
- Construction Documents
- Construction
- Commissioning
Stewardship of the Built Environment

BIG-D CONSTRUCTION OFFICE CASE STUDY

Building Interior
Physical Assessment

Exterior
Character Defining Features
Physical Assessment

BIG-D CONSTRUCTION OFFICE CASE STUDY

Interior
Character Defining Features
Physical Assessment

National Register of Historic Places Nomination
Research

BIG-D CONSTRUCTION OFFICE CASE STUDY

Floor Plans

Construction

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**BIG-D CONSTRUCTION OFFICE CASE STUDY**

**Construction**

**ROUGH CONSTRUCTION**

**FINISH CONSTRUCTION**

---

**BIG D CONSTRUCTION OFFICE CASE STUDY**

**Qualify for LEED Silver rating**
- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Materials & Resources
- Indoor Environmental Quality
- Innovation & Design Process

---

**BIG-D CONSTRUCTION OFFICE CASE STUDY**

**Sustainable Sites**

1: Site Selection
2: Brownfield redevelopment
3: Alternative transportation:
   - Public transit/
   - Light rail

---

**BIG-D CONSTRUCTION OFFICE CASE STUDY**

**Sustainable Sites**

4.1: Alternative transportation:
   - Bicycle storage and changing rooms
   - Car and van pool parking

---

**BIG-D CONSTRUCTION OFFICE CASE STUDY**

**Sustainable Sites**

7.1: Landscape and exterior designed to reduce heat islands: non-roof
7.2: Landscape and exterior designed to reduce heat islands: roof

---

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Sustainable Sites
8: Light Pollution Reduction

Water Efficiency
1.1: Water Efficient landscaping:
Xeriscaping adjoins parking lot and the building.

Energy & Atmosphere
Night Convective Cooling
Atrium is solar chimney
Daylighting

Energy & Atmosphere
Laminated glass replacement windows in the reconditioned original window sash.

Energy & Atmosphere
Lighting is controlled by occupancy sensors and daylighting dimmers.
BIG D CONSTRUCTION OFFICE CASE STUDY

8: Green Power: Big-D joined the Rocky Mountain Power “Blue Sky” program that promotes wind power.

The Big-D Office uses 34% less power than a standard office building.

BIG-D CONSTRUCTION OFFICE CASE STUDY

Materials & Resources

Indoor Environmental Quality

Ventilation effectiveness, Low emitting materials Daylight and views

Innovation & Design Process

Low emitting materials used on furniture and seating
Stewardship of the Built Environment

May 27, 2009

BIG D CONSTRUCTION OFFICE CASE STUDY

**Qualify for LEED Silver rating**

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
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<tr>
<td>Sustainable Sites</td>
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<tr>
<td>Total</td>
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“GOLD”

BIG-D CONSTRUCTION OFFICE CASE STUDY

**Demonstrate Economic Feasibility**

- Project Cost: $6.5 M
- $96/SF

- Non-traditional Economic Incentives
  - Low interest RDA loan $2.5 M
  - Rehabilitation Investment Tax Credit $0.9 M

- Net Cost/SF after Tax Credit $82/SF

“The project would not have feasible without the tax credits.”

– Jack Livingood, CEO, Big-D Construction

SCOWCROFT WAREHOUSE CASE STUDY

**Social**
- Building conservation
- Central Business District revitalization
- Enhance workplace productivity
- Health/Safety/Welfare
- Public/Private partnership

**Environmental**
- LEED Silver
- Reduce/reuse/recycle
- Reduce exposure to contaminants

**Economics**
- Urban revitalization
- Rehabilitation investment tax credits
- Economic Feasibility
SCOWCROFT WAREHOUSE CASE STUDY

- Four story brick construction; Full basement
- 120' x 206'
- Simple open rectangular plan on all floors
- 8 Wooden columns running N-S 20' apart
- 7 Wooden columns running E-W 14' apart
- 2 Freight elevators (9' square) along central E-W axis
- Large stairwell on north end with identical flights flanking the entrance
- Smaller stairwell east of easternmost freight elevator
- Open plan except walk-in safe and small office on 4th floor
- Ceiling heights are 10' in basement, 14'-6" on 1st floor, 13'-0" on the 2nd and 3rd floors and sloping from 13-0" to 11'-6" on fourth floor.

Timeline
- 1906 Constructed as warehouse and office for Scowcroft Co.
- 1958 Building closed
- 1975 Building suffers interior fire damage
- 1978 Listed on National Register of Historic Places
- 2002 Purchased by Cottonwood Partnership
- 2004 Rehabilitation Completed
  - Leased to the General Services Administration
  - Received Historic Preservation Tax Credits
- 2005 Certified as LEED Silver

Goals
- LEED Silver
- Demonstrate Successful Adaptive Reuse
- Promote Preservation/Retention of Existing Buildings
- Revitalize Neighborhood
- Demonstrate Economic Feasibility

Process
- Assessment and Research
- Programming
- Schematic Design
- Design Review
- Construction Documents
- Construction
- Commissioning

Building Interior

Exterior Character Defining Features

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SCOWCROFT WAREHOUSE CASE STUDY

Interior Character Defining Features

Physical Assessment

National Register of Historic Places Nomination

Research

SCOWCROFT WAREHOUSE CASE STUDY

Floor Plans

Construction

New Monitor Skylight and Atrium

Raised Access Flooring

SCOWCROFT WAREHOUSE CASE STUDY

Qualify for LEED Silver rating

Sustainable Sites

Water Efficiency

Energy & Atmosphere

Materials & Resources

Indoor Environmental Quality

Innovation & Design Process

Sustainable Sites

Qualify for LEED Silver rating

Sustainable Sites

Water Efficiency

Energy & Atmosphere

Materials & Resources

Indoor Environmental Quality

Innovation & Design Process

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SCOWCROFT WAREHOUSE CASE STUDY

Sustainable Sites

1: Site Selection
2: Urban density redevelopment
4.1: Alternative transportation: Public transit/ Light rail

SCOWCROFT WAREHOUSE CASE STUDY

Sustainable Sites

4.4: Alternative transportation: Car Pool allocation

SCOWCROFT WAREHOUSE CASE STUDY

Sustainable Sites

7.1: Landscape and exterior designed to reduce heat islands: non-roof
7.2: Landscape and exterior designed to reduce heat islands: roof

SCOWCROFT WAREHOUSE CASE STUDY

Sustainable Sites

8: Light Pollution Reduction

SCOWCROFT WAREHOUSE CASE STUDY

Water Efficiency

1.1: Water Efficient landscaping: Drought tolerant native plants adjoins parking lot and the building.
3.1: Water reduction fittings on plumbing

SCOWCROFT WAREHOUSE CASE STUDY

Energy & Atmosphere
SCOWCROFT WAREHOUSE CASE STUDY

Energy & Atmosphere
Indirect/Direct Evaporative Cooling (IDEC) System
Displacement air-conditioning system

SCOWCROFT WAREHOUSE CASE STUDY

Energy & Atmosphere
Upgraded windows.

SCOWCROFT WAREHOUSE CASE STUDY

Energy & Atmosphere
Lighting is controlled by occupancy sensors and daylighting dimmers.

SCOWCROFT WAREHOUSE CASE STUDY

8: Green Power
Purchased WindCurrent Green Energy Certificates for power offsets from 100% wind power for two years

SCOWCROFT WAREHOUSE CASE STUDY

Materials & Resources

SCOWCROFT WAREHOUSE CASE STUDY

Materials & Resources
Stewardship of the Built Environment

May 27, 2009

SCOWCROFT WAREHOUSE CASE STUDY

Indoor Environmental Quality

- Ventilation effectiveness, Low-VOC emitting carpeting
- Daylight and views

Innovation & Design Process

Scowcroft Building Education Center

Quality for LEED Silver rating

- Sustainable Sites: 7
- Water Efficiency: 2
- Energy & Atmosphere: 7
- Materials & Resources: 6
- Indoor Environmental Quality: 9
- Innovation & Design Process: 3
- Total: 34

SCOWCROFT WAREHOUSE CASE STUDY

Demonstrate Successful Adaptive Reuse
Promote Preservation/Retention of Existing Buildings
Revitalize Neighborhood

Awards and recognitions:

- LEED Silver Certification by the U.S. Green Building Council.
- GSA “Best Project Award”
- Intermountain Contractor 2003 Best of Awards – Best Renovation and Preservation
- 2004 Utah Heritage Foundation Award
- Ogden Mayors Business Beautification Award 2004 – Honorable Mention
- 2004 Utah Masonry Council-Special Award
- 2006 Governors Award – Quality Growth of Excellence for Implementation
- BOMA 2008 The Outstanding Building of the Year - Runner Up.
## SCOWCROFT WAREHOUSE CASE STUDY

### Demonstrate Economic Feasibility

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<td>$11.4 M</td>
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<tr>
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<td>$109/SF</td>
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<tr>
<td>Rehabilitation Investment Tax Credit</td>
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<tr>
<td>Net Cost/SF after tax credit</td>
<td>$90/SF</td>
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*Estimated by author*