Evaluating Adaptability

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Evaluating Adaptability

This Final Project is presented to
The Faculty of the College of Architecture and Construction Management

By

Rebecca Robinson

In partial fulfillment of the requirements for The Degree of

Bachelor of Architecture

Kennesaw State University, Marietta, Georgia

Spring Semester 2017
Student's Full Name: Rebecca Elizabeth Robinson  
Thesis Project Title: Evaluating Adaptability  
Thesis Summary:  

This thesis aims to understand the process of adaptive reuse from the point of view of an owner and architect while uncovering the difficulties faced in schematically assessing existing building value and determining steps needed to preserve structures for continued occupation.

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Chapter 1.
Design Theorem
The environmental impacts imposed during the construction process, even in the design of new, energy-efficient buildings, can take up to 80 years to outweigh its negative effects. With the average life span of a building at 75 years, the harmful impacts from construction can still exist even when the building may not. Studies done by the National Trust for Historic Preservation and Athena Sustainable Materials Institute show that adapting an existing building rather than tearing it down can have a better environmental impact based on the savings in embodied energy and material reuse. However, the process of adaptive reuse and the associated assessment challenges faced by owner and architect are understated in today's architectural profession causing many to forgo adaptive reuse in lieu of demolition.

This thesis aims to understand the process of adaptive reuse from the point of view of an owner and architect while uncovering the difficulties faced in schematically assessing existing building value and determining steps needed to preserve structures for continued occupation. This thesis will look at three approaches to the redevelopment of an existing building located in Atlanta's Sweet Auburn District, each proposing a different degree of deconstruction while measuring the associated short-term capital and long-term operational cost of the building owner. A new metric is proposed to facilitate building evaluation and cost projection that are organized around six categories: structure, interior, envelope, systems, site, and historic value.

### 1.1 Hypothesis

Cradle to Cradle by William McDonough and Michael Braungart is asking us to change the way we think and create products and start looking towards new outlooks and methods of production that do not involve the use of harmful materials. The persistence in production without consideration of product life cycle leads to degradation of the environment; we need to find a way to reuse what we have.

We live in a Cradle-to-Grave model where our products, including our buildings, come from virgin materials, get used by the consumer, and then thrown away into a landfill. Some products are “recycled-down,” or undergo an alteration after its use, that is no more helpful to the environment than its previous state. Materials can only undergo this cycle a few times before they are disposed of in a landfill.

McDonough and Braungart are not asking consumers to go without the products that make up their lives, but for producers to create those products with more environmental consciousness so they exist in a Cradle-to-Cradle model.
The Greenest Building: Quantifying the Environmental Value of Building Reuse

A study completed by the Preservation Green Lab in partnership with AIA|JOA|Green Building Council, Green Building Services, Skanska, and Quantis, the Greenest Building study focuses on the Environmental impacts of Building Renovation compared to new construction. The studies completed an in-depth evaluation of six building typologies in four different post-industrial climate locations in North America through the Life Cycle Assessment. The study found that building renovation has fewer environmental impacts than new construction in all building typologies except warehouse-to-multifamily conversion. The advantages that an existing building reuse has over new construction are their original design for passive heating and cooling along with their existing material use.

The Greenest Building study conducted building assessment after renovation, assessing only components that changed. They focused on materials and energy consumption in three main categories: embodied energy, operational energy, and building transportation energy. It compared buildings that were of the same energy performance level and of equal size. When assessing the material of the renovated building they did not look at the materials that remained in the building.

Though this study’s findings have publicized the environmental impacts of building renovation and reuse over new construction, it does not offer the ability to discover the worth of a building. There is a need for an evaluation tool for existing buildings that is easily accessible for the building industry.

“Reuse of buildings with an average level of energy performance consistently offers immediate climate-change impact reductions compared to more energy-efficient new construction.”

Summary of Results - The Greenest Building: Quantifying the Environmental Value of Building Reuse

<table>
<thead>
<tr>
<th>Environmental Impacts of Renovation as a Percentage of New Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legend</td>
</tr>
<tr>
<td>Warehouse</td>
</tr>
<tr>
<td>Office</td>
</tr>
<tr>
<td>Retail</td>
</tr>
</tbody>
</table>

Figure 1.3

Figure 1.4

[Image of flowchart and chart with data on environmental impacts of renovation compared to new construction]
The study was completed for Parks Canada by the Athena Institute and Morrison Hershfield Consulting Engineers. The objective was to design and develop a template that would allow people to consider the environmental impacts of demolishing historic or existing buildings and building anew. The team studied four different historic preservation buildings across Canada using the Life Cycle Assessment (LCA) and the ATHENA EcoCalculator. Once the buildings were assessed using the concepts of the LCA, their findings were compared to a new building of the same use and size using the Athena EcoCalculator.

The overall study focused on only one aspect on the environmental impact of construction energy. The study looked at embodied energy of the new construction and the operational energy of both the new construction and the renovated building. When looking at the building, they did not take into consideration what effects the renovated building would cause the environment. The template that was created is step-by-step directions on how to collect data to input into the ATHENA EcoCalculator so that an average person can use. This study also only looked at the comparison of new construction versus an already renovated building; the tool does not look at the potential of an unrenovated existing building. 

"There is a tremendous impact to the environment when we construct something new, so avoiding new construction may be the most eco-conscious approach to our environment."

The avoided GWP impact of the Chinese Freemasons Building is equivalent to the CO2 emissions from 224 homes for one year.

**Total Avoided Impacts Summary**

<table>
<thead>
<tr>
<th>Building Component</th>
<th>Total Primary Energy (MJ)</th>
<th>Total GWP (Eq. CO2 tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columns &amp; Beams</td>
<td>150117</td>
<td>66</td>
</tr>
<tr>
<td>Intermediate Floors</td>
<td>1195360</td>
<td>76</td>
</tr>
<tr>
<td>Exterior Walls</td>
<td>1166611</td>
<td>103</td>
</tr>
<tr>
<td>Windows</td>
<td>1327700</td>
<td>64</td>
</tr>
<tr>
<td>Interior Walls</td>
<td>867302</td>
<td>28</td>
</tr>
<tr>
<td>Roofs</td>
<td>704028</td>
<td>28</td>
</tr>
<tr>
<td>Whole Building Demolition</td>
<td>203840</td>
<td>116.48</td>
</tr>
<tr>
<td><strong>Total Avoided Impacts (Whole Building)</strong></td>
<td><strong>6,970,013</strong></td>
<td><strong>484.48</strong></td>
</tr>
</tbody>
</table>

---

Annotated Bibliography of Important Literature


This study talks about how the three building phases, pre-building, building use, and post-building, affect the flow of materials through the building lifespan. It gives examples of construction types and how they affect the environment through the three building phases.


This book gives a good foundation and understanding on how to approach visualizing large forms of data in a way that all different types of user groups can relate to. This is helpful when designing the dashboard for this thesis with different kinds of data from various sources.


This article is about construction waste management. It includes a background on waste management and data from multiple studies.
1.3 Thesis Situated

Building Assessment:
The process of evaluating a building to see how it performs.

The Greenest Building study assessed many buildings, both new and existing, to see their effects on climate change, resource depletion, human health, and ecosystem quality. Building assessment was very important to the Preservation Green Lab to understand the effects buildings have on the environment and to see if there is a way to decrease those effects. They found that adapting an existing building instead of building a new one has environmental savings in comparison to the new construction.

Adaptation:
The process of making something suitable for a new use.

The Greenest Building study used the term adaptation to refer to the process that an existing building underwent to accommodate contemporary building standards so it could have a new use.

Reuse:
To be used again.

The Greenest Building Study refers to reuse when talking about a building being used for another purpose other than its original program.

Life Cycle:
The series of change in the life of an organism.

Both Cradle to Cradle and the Greenest Building Study refer to the life cycle of a building as the process of constructing the building starting from how the original building materials were made to what happens to those same materials after the building has reached the end of its usefulness.

The Life Cycle Assessment is a process of evaluation that looks at the life cycle of an object. In the case of the literature studies the Life Cycle Assessment was of the building.

Post-industrial:
An economy that relies on services rather than heavy industry.

America’s largest cities now produce more services than goods, leaving many industrial buildings without use and multiple companies that need offices.

Atlanta is ranked number 7 on the top largest metro areas that produce more services than goods with a ratio of 5.26, the highest being Washington D.C. with a ratio of 11.17.

1.4 Underlying Principles

Historical Preservation:
To protect or conserve anything with historical significance.

The buildings that are placed on any historic preservation list have a harder time getting demolition permits passed so a majority are never demolished. These buildings need a new use so they are adapted but in a way that they do not completely lose their original identity. A lot of studies look at historic buildings because there is a higher percentage of historic preservation buildings becoming adapted than buildings of a similar age that do not have any historical significance.

Reuse: To be used again.

The Greenest Building Study refers to reuse when talking about a building being used for another purpose other than its original program.
LEED is a rating system for buildings from the U.S. Green Building Council. The latest version of LEED is Version 4, under the LEED V4 is a building rating category: Building Operations and Maintenance (O+M). LEED O+M is for Existing Buildings, Retail, Schools, Hospitality, Data Centers, Warehouses, and distribution centers. The rating system is for existing buildings to become more environmentally friendly through renovation.

LEED O+M has eight major credit categories each with multiple subcategories. Each category has a goal for sustainable standard. The building is rated by achieving these goals, thus earning points in those categories. Those categories are Location and Transportation (LT), Sustainable Sites (SS), Water Efficiency (WE), Energy and Atmosphere (EA), Materials and Resources (MR), Indoor Environmental Quality (EQ), Innovation (IN), and Regional Priority (RP). There are four different levels of LEED Certification for a building: LEED Certified requires 40-49 points, LEED Silver requires 50-59 points, LEED Gold requires 60-79 points, and LEED Platinum requires 80-110 points.

LEED V4 can be used to rate a building after construction or it can be used as guidelines during construction to achieve sustainable construction. However, LEED was not designed to evaluate an existing building without changes before the renovation process. LEED is used after the owner has decided that they want an environmentally friendly building. If that owner decides to keep the original structure they would then use LEED V4 O+M to reach their desired level of sustainability.

### 1.5 Case Studies

**Gubelstrasse 22**

Zug, Switzerland

LEED V4 O+M Existing Building Status: Gold

22 Gubel Street was built in 1942 as a seven story office building. The building is now on the city of Zug's historical industrial structures registry. The building was able to receive 26 Energy and Atmosphere points out of a possible 38 primarily for the original design of the façades. Each floor has large windows that allow in natural light to all the occupants. The owner was able to move parking underground and create a garden area that reduces water runoff on the site and reduces the heat island effect. The building also uses a water pump heating and cooling system to collect cool water from a nearby lake and circulate it through the building slab then return the water back to the lake. These changes allowed the building to receive 5 Sustainable Sites points out of 10, 10 Water Efficiency points out of 12, 0 Material and Resources points out of 8, 8 Indoor Environmental Quality points out of 17, 2 Regional Priority credits out of 4. The building also received 7 Region Priority and 5 Location and Transportation points out of 10 for 70% alternative transportation. The building did not receive any points for Material and Resources. This means that the materials that they used for the renovation are not from recycled or sustainable materials along with their furniture and they did not divert 70% of their waste from landfills.
The ATHENA EcoCalculator

The ATHENA EcoCalculator is a LCA tool for building assemblies. The tool was developed by the Athena Institute in association with the University of Minnesota and Morrison Hershfield Consulting Engineers. The EcoCalculator has pre-defined assemblies that have been assessed programmed into the tool so it can generate instant results. Though the tool can be used for retrofits, its purpose is to quickly assess the environmental impact of a new building assembly. It looks at seven different types of building assemblies, foundations and footings, columns and beams, intermediate floors, exterior walls, windows, interior walls, and roofs. Each calculator download is sorted by climate region, building type, and height. Quite a few assumptions are made in the EcoCalculators, such as commercial building have 40% windows and all windows are double-glazing with low-E silver coating and argon-filled cavity. All assumptions correspond with modern building practices which makes the EcoCalculator a great tool to assess new construction but not to assess an existing building for potential reuse.

The Avenue Lofts

1438NW Irving Street Portland, Oregon

Built in: 1923
Designed by Sutton and Whitney
Renovated in 2004 by SERA

The Avenue Lofts were originally a warehouse for Meier & Frank, a Portland based clothing company. They were placed on the National Register of Historic Places (NRHP) in 2000. According to the documentation for the NRHP, the interior of the building was unfinished with concrete floors, ceilings, and support columns. The exterior of the building was reinforced concrete.

In 2004 the structure became a multi-family building with 153 units. At this time multiple warehouses were converted to lofts and commercial buildings. The Avenue Lofts was evaluated by the Preservation Green Lab for the Greenest Building: Quantifying the Environmental Value of Building Reuse study to see if adapting the building was better for the environment or if tearing it down and building anew would have been more beneficial. The study found that the Avenue Lofts effected human health 5% more than new construction of the same use and size would have.

The Greenest Building Study retrospectively evaluates what was done to the building. The exterior of the building had to be brought up to new building standards with high-performance windows while the interior had to be completely renovated, as it was not finished in the first place. The renovation of the Avenue Lofts also called for a 5,500sf atrium to be cut into the center of the building from the third floor to the roof.
There are multiple existing tools that evaluate buildings. LEED V4 EB O+M evaluates the renovated building and Athena Eco Calculator evaluates new construction but there is not a tool that will help an owner make an educated decision based on the building’s potential for adaptability and reuse. With an estimated one quarter of today’s building stock being torn down and replaced before 2030, and each one of those new buildings needing up to 80 years to overcome the negative climatic impacts, there is a need to understand what our existing buildings are worth and if they should be a part of that one fourth that is replaced or if they should be adapted to save 80 years of climate change impacts.

Creating a dashboard that combines existing assessment tools for renovated buildings or new construction with the individual assessment of the existing building can provide the owner with knowledge to make an environmentally-conscious decision to renovate or tear down. It would take the most relevant outputs from each existing tool to create the data that makes the building’s potential.

1.6 Synthesis Summary

The scope of this thesis is situated before the decision of whether to tear down and build anew or to renovate the existing structure.
Chapter 2.
The Site
2.1 Process
This thesis is evaluating the impact of three different building options that an architect or owner can choose when faced with the existing building on a lot. The first option is to bring the existing building up to operable standards. This option would pass all Atlanta Construction Codes and the Atlanta Code of Ordinance for the neighborhood, as this site is located. The second option is to demolish the existing building and build a new building that would suit the client best but still correspond to the Atlanta code of ordinance and the Atlanta construction codes. This thesis will evaluate the three options by understanding their construction cost, environmental impact, and their energy efficiency, to see what would be needed to achieve the base standard of operable buildings.

2.2 Site Selection
The Site:
Zoning: HC-20C
Neighborhood: Sweet Auburn
City Council District: 5
Overlay: Martin Luther King Jr. Landmark District in Atlanta, GA
The Building:
Built in 1941
935 Edgewood Ave, Atlanta, GA 30312
3530 SF
The Building Choice: This lot was chosen for this thesis because it offers many positives for an adaptive reuse project. The area is to preserve the environmental character and physical appearance of the area that was present during the life of Martin Luther King, Jr. 395 Edgewood Ave is a part of sub area 4 of the Martin Luther King Jr. Landmark District in Atlanta, GA. This gives this property a site that is near or has reached the end of its life and is to preserve the environmental character, and physical appearance of the area that was present during the life of Martin Luther King, Jr. 395 Edgewood Ave is a part of sub area 4 of the Martin Luther King Jr. Landmark District in Atlanta, GA. This gives this property a site that is near or has reached the end of its life and is profitability to a potential owner.

Building Selection Criteria:
A building built in 1950 of before
• The building lifespan ranges from 65-75 years, so a building that is near or has reached the end of its life is likely to be adapted.

Building Choice: 395 Edgewood Ave, Atlanta, GA 30312
This building is found in this site of this thesis because it offers many positives for an adaptive reuse project. The area is to preserve the environmental character and physical appearance of the area that was present during the life of Martin Luther King, Jr. 395 Edgewood Ave is a part of sub area 4 of the Martin Luther King Jr. Landmark District in Atlanta, GA. This gives this property a site that is near or has reached the end of its life and is profitability to a potential owner.

Building Choice:
395 Edgewood Ave
• 935 SF
• Built in 1941
• The Building:
• The Building is zoned HC-20C
• Neighborhood: Sweet Auburn
• City Council District: 5
• Overlay: Martin Luther King Jr. Landmark District

Positives:
• Building height: the zoning allows for a six story building.
• No onsite parking; there is no need for worrying about parking on the lot.
• The compatibility rule applies to the block, not the block face allowing for a taller building.

Design Challenges:
• To preserve the environmental character and physical appearance of the area.
• Multiple levels in the interior of the building.

Site:
• To start the evaluation a site needs to be found with an existing building that meets the site requirements. Once the site is acquired the existing building will be evaluated in person, then through the existing tools to achieve a baseline to improve upon. After the in-person inspection, an architectural neighborhood study will be conducted with a study of the Atlanta Construction Code and Ordinance for the neighborhood to decide upon the square footage and relationship of materials for each option.

Existing Tools
This thesis will utilize the existing tools to understand their construction cost, environmental impact, and their energy efficiency, to see a direct comparison of each option.

Building Height: The building lifespan ranges from 65-75 years, so a building that is near or has reached the end of its life will be assessed with the same building occupancy with the same baseline. The buildings will have the same functional type III A so all codes and building materials will be held to the same standards. Each option is assumed to be to the Atlanta Construction Codes for each option along with the Atlanta Code of Ordinance, but this option would only need to keep up with the existing structure. The third option is to demolish the existing building and build a new building that would suit the client best but still correspond to the Atlanta code of ordinance and the Atlanta construction codes. This thesis will evaluate the three options by understanding what would be needed to achieve the base standard of preservation and operation.

Design
To create a controlled evaluation, each option will be held to the same standard. Each option is assumed to be built to the Atlanta Construction Codes and the Atlanta Code of Ordinance, but this option would only need to keep up with the existing structure. The compatibility rule applies to the block, not the block face allowing for a taller building.

2.3 Design Challenges
• To preserve the environmental character and physical appearance of the area.
• Multiple levels in the interior of the building.

The Site:
• Zoning: HC-10C
• Neighborhood: Sweet Auburn
• City Council District: 5
• Overlay: Martin Luther King Jr. Landmark District

The Building:
• Built in 1941
• 935 SF

Positives:
• Building height: the zoning allows for a six story building.
• No onsite parking; there is no need for worrying about parking on the lot.
• The compatibility rule applies to the block, not the block face allowing for a taller building.

Design Challenges:
• To preserve the environmental character and physical appearance of the area.
• Multiple levels in the interior of the building.
Figure 2.1
Transportation and Walking Distance

Figure 2.2

Street Car

Figure 2.3

Bike Paths

Figure 2.4

Walking Distance

Figure 2.5

Sec. 16.280.091: Statement of Intent

2. To ensure that those individual buildings of particular significance to the life and legacy of Martin Luther King, Jr. will be preserved and enhanced within the landmark district;

3. To ensure the environmental character and physical appearance of the area, including residential, commercial and institutional structures that were built during the late 19th Century and that were present during the life of Martin Luther King, Jr.;

4. To preserve the existing street and lot patterns and the orientation of the buildings that are characteristic of the historic character and the unique historic relationship between the commercial uses and the residential uses, and the unique historical relationship between the commercial uses and the rest of the city;

5. To ensure that new development is complementary to and compatible with the existing historic structures in the landmark district;
Contributing Buildings:

These buildings are considered contributing buildings because they
add to the historical integrity and make the district significant. Other
contributing properties that are more important to the district are
the birthplace of Martin Luther King Jr. and the Ebenezer Baptist
Church. These buildings are not included in this diagram because
they are not the same typology of this thesis's site and they are not
located on the same street. All of the structures in this diagram
were built before or during the life of Martin Luther King Jr., and
any change to the front façade or new construction in this area
must contribute to the street in the same manner that these existing
buildings do.

The sidewalks and building heights are determined by the buildings
located on the same block as the new building, not just the block
front face.
B1 Section
Figure 2.10

B2 Section
Figure 2.11

B1&B2 Section
Figure 2.12
1" = 3/32"

South Elevation
Figure 2.13

West Elevation
Figure 2.14

North Elevation
Figure 2.15
Scale 1:"3/32"
Chapter 3.
The Evaluation
3.1 Existing Tools

For this thesis, multiple existing tools that have their own research and databases are being used for information on the options. All data that is being generated from an existing tool is created by that tool's database. This thesis then focuses on the important information collected.

The existing tools that are used in this thesis are leaders in their fields of expertise but do not completely cover, or do not even address, an existing building condition. The Buildings are evaluated based on six categories, each category is then broken down into subcategories that the existing tools measure. The information that is needed is different for each subcategory. A broad amount of information is needed for the location, type, year of construction, floor plan, and an understanding of the materials that are used in the building. The building is also evaluated on how it meets the state of Georgia's construction codes and its ease of occupation.

The building is evaluated on how it meets the state of Georgia's construction codes and its ease of occupation.

The thesis used Cost-link to calculate the building cost of each option accurately. This thesis used Athena Impact Estimator to calculate the environmental impact of the construction of each option along with the embodied environmental impact of the existing structure. This thesis uses Sefaira to calculate the operational cost and environmental impact of each option. This thesis uses COMcheck to evaluate the energy code standing of each option.
This thesis's three approaches to the redevelopment of the existing building are based on the mixed use occupancy of multifamily residential on the top and Business/Mercantile on the first floor. These occupancies were chosen for multiple reasons, the existing building structure, construction cost, how long it will take to pay off the investment based on the average rate of rent of that occupancy and the existing conditions along the street.

Though mixed use occupancy does not have the cheapest construction cost or the quickest payoff rate it made the most sense for the adaptation of the existing building with minimal impact. The existing building has multiple floor height changes on the second story. Residential can exit out into the alleyway condition behind the building, allowing for less demolition. Every building on the street has mercantile or business on the street level so to keep with the rest of the street. To be consistent with the comparison of the approaches to the redevelopment to the existing building option one: minimal impact set the occupancies for the other two options, interior build out with addition and complete rebuild.

### Option 1: Minimal Impact

<table>
<thead>
<tr>
<th>Occupancy Classification</th>
<th>Investment Return</th>
<th>Return on Investment (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land value:</td>
<td>$494,900.00</td>
<td></td>
</tr>
<tr>
<td>Demolition:</td>
<td>$1,263.78</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area (SF)</th>
<th>Construction Cost</th>
<th>Rent per SF yearly</th>
<th>Total</th>
<th>Years to Pay off Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly A-2</td>
<td>$829,645.00</td>
<td>$25.00</td>
<td>$232,675.00</td>
<td>5.70</td>
</tr>
<tr>
<td>Assembly A-3</td>
<td>$675,102.00</td>
<td>$25.00</td>
<td>$232,675.00</td>
<td>5.03</td>
</tr>
<tr>
<td>Business</td>
<td>$661,012.00</td>
<td>$25.00</td>
<td>$232,675.00</td>
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</table>

### Option 2: Interior Build out with Addition

<table>
<thead>
<tr>
<th>Occupancy Classification</th>
<th>Investment Return</th>
<th>Return on Investment (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land value:</td>
<td>$494,900.00</td>
<td></td>
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<tr>
<td>Demolition:</td>
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<table>
<thead>
<tr>
<th>Area (SF)</th>
<th>Construction Cost</th>
<th>Rent per SF yearly</th>
<th>Total</th>
<th>Years to Pay off Investment</th>
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<tbody>
<tr>
<td>Assembly A-2</td>
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<td>$313,234.00</td>
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</table>

### Option 3: Complete Rebuild

<table>
<thead>
<tr>
<th>Occupancy Classification</th>
<th>Investment Return</th>
<th>Return on Investment (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land value:</td>
<td>$494,900.00</td>
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<tr>
<td>Demolition:</td>
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<table>
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<tr>
<th>Area (SF)</th>
<th>Construction Cost</th>
<th>Rent per SF yearly</th>
<th>Total</th>
<th>Years to Pay off Investment</th>
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<td>Assembly A-2</td>
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<td>Business</td>
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<tr>
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<tr>
<td>Mercantile</td>
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<td>$684,350.00</td>
<td>7.80</td>
</tr>
<tr>
<td>Residential</td>
<td>$5,054,017.00</td>
<td>$25.00</td>
<td>$684,350.00</td>
<td>7.80</td>
</tr>
</tbody>
</table>

---

**Occupancy Classification**

This thesis's three approaches to the redevelopment of the existing building are based on the mix use occupancy of multifamily residential on the top and Business/Mercantile on the first floor. These occupancies were chosen for multiple reasons, the existing building structure, construction cost, how long it will take to pay off the investment based on the average rate of rent of that occupancy and the existing conditions along the street.

Though mixed use occupancy does not have the cheapest construction cost or the quickest payoff rate it made the most sense for the adaptation of the existing building with minimal impact. The existing building has multiple floor height changes on the second story. Residential can exit out into the alleyway condition behind the building, allowing for less demolition. Every building on the street has mercantile or business on the street level so to keep with the rest of the street. To be consistent with the comparison of the approaches to the redevelopment to the existing building option one: minimal impact set the occupancies for the other two options, interior build out with addition and complete rebuild.
3.2 Options

Option 1: Minimal Impact

This adaptive reuse approach is to keep as much as the existing building as possible while still having a viable building for multiple programs.

For this approach there are minimal changes to the envelope, only the addition of new openings in the front and the replacement of all glazing to meet the code, along with repairs to the roof. The changes to the interior include changing the second level into two apartments and the first floor into two retail spaces. Any problems that were noted during the existing building evaluation will be repaired and some of the floor height differences will be resolved by removing the floor in B1R7 and continuing the floor from B1R5. All the systems in the existing building will need to be replaced which is a large portion of the renovation cost.

First floor: 459sf will need to have the plaster removed and gypsum walls put up.
Second floor: 234sf would need to be gutted and the floor replaced. Two kitchens and bathrooms need to be constructed for the apartments.
Front: there needs to be 125sf of fenestration put on the front of the building.
Back: there needs to be stairs that allow access to the two apartments.
Roof: the roof needs to be patched.
Overall there needs to be more insulation placed on the outside walls and the interior needs to be painted.

Option 2: Interior Build Out with Addition

This adaptive reuse approach is to rebuild the interior to hold the third floor addition.

For this option, there are minimal changes to the existing envelope, new opening in the existing facade at the front, the replacement of all glazing to meet code, along with repairs to the roof. This approach also has an addition of a new story. The changes to the interior include changing the second level to six apartments that open up to the third floor and changing the first floor to two retail spaces. The interior structure will be replaced to support the new addition and to level the flooring for the second-floor apartments. All the systems in the existing building will need to be replaced.

The addition is wood construction with the brick exterior to match the rest of the street. The addition is stepped back 7ft from the property line so it does not qualify as a party wall and matches the contributing structures on the street.

Interior: all of the interior is deconstructed. The new interior is designed to have two mercantile or business units.
Second and Third floor: the second and third floor becomes six, two-story residential units, with a 7ft exterior patio space.
Front: the front gains 125sf of fenestration and another door that acts as a second exit for the second floor.
Back: a new door for access from the alleyway condition to the second-floor apartments.
This approach is demolishing the existing building on the lot and rebuilding.

Option 3 is a completely new structure on the existing site. The building builds up to the property line on the east and west side along with building to the sidewalk on the north for the first and second floor. Floors three through five step back from the property line seven feet so that the building maintains the street and is able to have glazing on the east and west side. This building is five stories with a mezzanine level on the fifth floor to allow for the maximum floor area for the allowable height.

This option has the capacity to hold two mercantile or business spaces and 16 rentable residential units. This is a wood construction building with a brick exterior to match the materiality of the street.
Fenestration
Sec. 16-20C.008 3.d
1. A minimum of 60 percent of the length of the building façade shall contain fenestration.

Building Height
Sec. 16-20C.006 2.a
1. Maximum building heights shall be permitted up to a maximum of one and one-half times the height permitted utilizing the compatibility rule, provided that:
   - For property located east of Interstate 75/85, no building shall be permitted to exceed a maximum height of 68 feet.
   - The building heights permitted in this subsection are intended to be the maximums authorized but are subject to further compatibility restrictions under other provisions of this district relative to building form, scale, massing, and materials.

Sidewalks
Sec. 16-20C.007 1.a.
1. Public sidewalks shall be located along all public streets and shall consist of two zones: an amenity zone and a walk zone.
   - New sidewalks and their corresponding zones shall be the same width as the sidewalk on abutting properties. If no sidewalk exists on abutting properties, the new sidewalk shall match sidewalk widths on the block.

Property Lines
Sec. 16-20C.007 3.
1. Set back, front, rear, side yards. All front, rear and side yards for this subdivision shall be established through the compatibility rule, except that zero for the side yard shall be permitted as a minimum side yard allowance regardless of the compatibility rule application.

Parking
Sec. 16-20C.009 1.a
1. Off-street parking for non-residential uses:
   - Minimum Bicycle Parking: The greater of: two spaces or one space for every 4,000 square feet of floor area
   - Minimum Automobile parking: None
This building would need to be constructed with at least 60% of its front façade fenestration.

Building Height
Sec. 16-20C.006 2.a
1. Maximum building heights shall be permitted up to a maximum of one and one-half times the height permitted utilizing the compatibility rule, provided that for property located west of Interstate 75/85, no building shall be permitted to exceed a maximum height of 68 feet.

The building heights permitted in this subsection are intended to be the maximums authorized but are subject to further compatibility restrictions under other provisions of this district relative to building form, scale, massing and materials.

Sidewalks
Sec. 16-20C.007 1.a
1. Public sidewalks shall be located along all public streets and shall consist of two zones, an amenity zone and a walk zone.

In new sidewalks and their corresponding zones shall be at least as wide as the sidewalk on the abutting property. If no sidewalk exists on abutting properties, the new sidewalk shall match sidewalk widths on the block.

Because there is not any exterior work being done on the facade of the building, the owner does not need to consider the sidewalk.

Property Lines
Sec. 16-20C.007 3.a
1. The building envelope is designed to be a minimum 60% side yard allowance regardless of the compatibility rule application.

The block that this building sits on has over 50% of its building envelope that has a balance of the buildings that have a back or front yard and four building that have a back or front yard for the sidewalk to be established through the compatibility rule, except that zero-lot-line side yards shall be permitted as a minimum side yard allowance regardless of the compatibility rule application.

Parking
Sec. 16-20C.009 3.a
1. For all other residential and dwelling uses except single-family and two-family dwellings, no off street parking.

This building does not need off street parking.
3.4 Envelope

The term envelope refers to the building envelope that is made up of assemblies like exterior walls, roof, windows and doors.

Sub-categories:
- Materials
- Condition
- R-value
- Passive strategies
- Energy code

Programs:
- Athena Impact Estimator
- Sedona
- COMcheck

The Information that is Needed:
- The materials of envelope assemblies
- The year that it was constructed
- The year that it was remodeled, if applicable
- Dimensions and thickness of each item
- Energy efficiency
- A computer model

Evaluations:
- Ability to meet Atlanta’s construction Codes
- Ability to meet the Energy code
- Toxic Materials
- Operational cost
- Environmental impact

The exterior walls look to be structurally adequate. I did not observe any cracks or settling in any of the walls. Though, none of the walls seem to be insulated so that would have to be remedied before occupation.

The windows are single pane, and most are broken and painted over. They would need to be replaced.

The roof has a few leaks that could have because more damage that is visible. From the aerial view, it seems that the roof needs to be re-roofed.

All data is from Athena’s Impact Estimator for Buildings.
**Option 1: Minimal Impact**

**Construction Type 602.3**
Type III construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. Fire-retardant treated wood framing complying with section 602.15 shall be permitted within exterior wall assemblies of a 2-hour rating.

**U-Factor**
Table 402.1.1
25 Climate zone 3: Fenestration u-Factor = 0.5, Mass Wall r=5/8 or U=0.141

**Construction Type 602.3**
Type IIIB construction because the exterior walls are noncombustible and interior building is not heavy timber.

**Fire Separation**
Table 602.15
Fire separation distance<5ft = 1hr Fire Separation Distance for all type of construction with occupancy of A,B&R

This building has single pane glass windows that sit in a steel frame. This has a u-value of 1.20 according to the ICC 2009 Table 303.1.3. All the windows will have to be replaced and brought up to code. The exterior walls have a U-value of 0.37 so they will have to be insulated to reach the need U-value.

According to the National Concrete Masonry Association a 12" wide hollow core concrete masonry unit has a fire rating of 3hr.

**Option 2: Interior Build Out with Addition**

**Construction Type 602.3**
Type IIIA construction because the exterior walls are noncombustible and interior building is not heavy timber and the building is equipped with an automatic sprinkler system.

**Fire Separation**
Table 602.15
Fire separation distance>5ft = 1hr Fire Separation Distance for all type of construction with occupancy of A,B&R

This building would need to replace all openings to comply with the code.

The top floor has a fire separation distance of 7ft. The east and west walls only need 1hr rating. The first two floors are existing.

**Exterior Wall Openings**
Table 705.8
50 to less than 100: 25% allowable area for unprotected openings

The area of the east and west wall is 710sf to 23% is 177sf of openings.

**Figure 3.35-3.37**
*Figure 3.38-3.41*
Table 402.1.1

Climate zone 3: Fenestration U-Factor = 0.5, Mass Wall $r=5/8$ or $U=0.141$

Table 602

Fire separation distance <5 ft = 1 hr Fire Separation Distance for all types of construction with occupancy of A, B, & R

Table 706.4

Group M, R-2 = Fire-resistance rating (hours) 3

All new walls and windows must conform to this code.

The top four floors have a fire separation distance of 7 ft for the fire separations walls so they only need a 1 hr rating. The first two floors are party walls so they need to have a 3 hr rating.

The area of the east and west wall is 3120 sf so 25% is 780 sf of openings.

3.5 Structure

The term structure refers to the columns, bracing, slab, substructure, and the floor construction that the building poses.

Subcategories:
- Materials
- Condition
- Toxic Materials

Programs:
- Athena Impact Estimator

The information that is needed:
- The materials that make up the structure
- The year it was constructed
- The year it was remodeled, if applicable
- Dimensions of the structure

Evaluated on:
- Ability to meet Atlanta’s construction Codes
- Condition
- Toxic Materials

The information that is needed:
- The materials that make up the structure
- The year that it was constructed
- The year that it was remodelled, if applicable
- Dimensions of the structure

Evaluated on:
- Ability to meet Atlanta’s construction Codes
- Condition
- Toxic Materials

Option 3: Complete Rebuild

This building is classified as B4A for the first two floors then the building is Type 3R with sprinklers.

All new walls and windows must conform to this code.

The top four floors have a fire separation distance of 7 ft for the fire separations walls so they only need a 1 hr rating. The first two floors are party walls so they need to have a 3 hr rating.

The area of the east and west wall is 3120 sf so 25% is 780 sf of openings.

This building is classified as B4A for the first two floors then the building is Type 3R with sprinklers.

All new walls and windows must conform to this code.

The top four floors have a fire separation distance of 7 ft for the fire separations walls so they only need a 1 hr rating. The first two floors are party walls so they need to have a 3 hr rating.

The area of the east and west wall is 3120 sf so 25% is 780 sf of openings.
Any existing gravity load carrying structural element for which an alteration cause an increase in design gravity load of more than 5 percent shall be strengthened, supplemented, replaced or otherwise altered as needed to carry the increased gravity load required by this code for new structures. Any existing gravity load-carrying structural element whose gravity load-carrying capacity is decreased as part of the alteration shall be shown to have the capacity to resist the applicable design gravity loads required by this code for new structures.

Construction Type

Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. Fire-retardant treated wood framing complying with section 2303.2 shall be permitted within exterior wall assemblies of a 2-hour rating.

III A

Any structure that is in disrepair needs to be replaced and the rest of the structure needs to be strengthened, supplemented or replaced to accommodate these changes.

The interior structure of this building varies by section of the building. One side of the wood interior structure that does not rely on the exterior walls to be load bearing while the other side of the building has a steel truss system with wood flooring that uses the exterior wall as load bearing.
**Option 2: Interior Build Out with Addition.**

**Existing structural elements 3404.3**

Any existing gravity load-carrying structural element for which an alteration causes an increase in design gravity load of more than 5 percent shall be strengthened, supplemented, replaced or otherwise altered as needed to carry the increased gravity load required by this code. Any existing gravity load-carrying structural element whose gravity load carrying capacity is decreased as a part of the alteration shall be shown to have the capacity to resist the applicable design gravity loads required by this code for new structures.

**Construction Type 602.3**

Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. Fire-retardant treated wood framing complying with section 2303.2 shall be permitted within exterior wall assemblies of a 2-hour rating.

**Table 503**

IIIA max height is 65ft, for group M, stories = 4 and area per story = 18,500sf

The entire existing building is being replaced there in not any existing structure.

The building is equipped with an automatic sprinkler system so there is an increase in max building height and the allowable stories is increased to five. The area per floor is under the max floor area for the group and construction type so there is not a need for a floor area increase. This building is only five stories but the top floor has a mezzanine to maximize the rentable space for the height allowed by the city of Atlanta.

---

**Option 3: Complete Rebuild**

**Existing structural elements 3404.3**

Any existing gravity load-carrying structural element for which an alteration causes an increase in design gravity load of more than 5 percent shall be strengthened, supplemented, replaced or otherwise altered as needed to carry the increased gravity load required by this code. Any existing gravity load-carrying structural element whose gravity load carrying capacity is decreased as a part of the alteration shall be shown to have the capacity to resist the applicable design gravity loads required by this code for new structures.

**Construction Type 602.3**

Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. Fire-retardant treated wood framing complying with section 2303.2 shall be permitted within exterior wall assemblies of a 2-hour rating.

**Table 503**

IIIA max height is 65ft, for group M, stories < 4 and area per story < 18,500sf

The entire existing building is being replaced there in not any existing structure.
3.6 Interior

The interior of a building includes the interior walls and all finishes.

Subcategories:
- Materials
- Condition
- Energy code
- Maintenance cost
- Floor layout

Programs:
- Athena Impact Estimator
- Safetys
- COMcheck

Information that is needed:
- The materials that make up all walls and finishes
- The year that it was constructed
- The year that it was remodeled, if applicable
- Energy efficiency
- Dimensions of the materials
- Floor to floor height

Evaluated on:
- Ability to meet Atlanta’s construction Codes
- Condition
- Toxic Materials
- Operational cost
- Environmental impact

Existing Building

Wood Flooring

Fossil fuel Consumption: 45.56 Gigatons
Global Warming Potential: 1.34 Tonnes
Ozone Depletion Potential: 0.00000004 Kilograms

Wood flooring is overall in good shape except for the areas directly under the roof that area would need to be replaced.

Wood walls with plaster

Fossil fuel Consumption: 96.78 Gigatons
Global Warming Potential: 10.12 Tonnes
Ozone Depletion Potential: 8.36 Kilograms

The plaster is cracking and falling off all the surfaces. It would have to be replaced.

Wood walls with Gypsum Board

Fossil fuel Consumption: 8.36 Gigatons
Global Warming Potential: 0.17 Tonnes
Ozone Depletion Potential: 30.07 Kilograms

The wood walls the gypsum board would all have to be replaced. The gypsum is falling off due to water damage and the wood framing also has water damage.
Option 1: Minimal Impact

Existing Materials 5401.4.1 (1)

Material already in use in a building in compliance with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless determined by the building official to be unsafe per section 116.

Conditions 116.1.1

Structures or existing equipment that are or hereafter become unsuitable, unsanitary or deficient because of inadequacy of sanitation, ventilation, or which constitute a fire hazard, or otherwise dangerous to human life or the public, welfare, or that involve illegal or improper occupancy or inadequate maintenance, shall be taken down and removed or made safe, as the building official deems proper.

An alteration that affects or could affect the usability of or access to an area of a facility that contains a primary function shall be made so as to ensure that, to the maximum extent feasible, the path of travel to the primary function shall be made so as to ensure that, to the maximum extent feasible, the path of travel to the primary function shall be made accessible.

Separation of Occupancies

2010 ADA Standards 28 CFR 35.151 (4)

This building complies with the code that was in effect at the time of construction so the building materials can remain as long as the areas that were deemed unsafe be repaired.

Exit Access Travel Distance Table 1016.2

This building does not exceed the travel distance of 200 ft. The longest travel distance is 84 ft.

2010 IBC Standards

Not all of this building is accessible for people with disabilities. A person with disabilities would be able to access the first floor and have access to the restrooms, telephones, and drinking fountains

Path of Travel 28 CFR 35.151 (4)

The building does not contain any materials that contain harmful materials such as asbestos or structural damage caused by termites. If this building did contain such materials and damage, they would have to be removed properly.

The bathroom is not accessible for a person with a movement disability. A person with a movement disability would need a ramp or an elevator for a story with a 15.5 ft floor height difference between B1R2 and B1R1. There is a slope that is less than 4%.

The interior of the existing building is torn out and a new interior structural system is put in. This allows floor heights to be the same and for better accessibility.

The interior of the existing building is torn out and a new interior structural system is put in. This allows floor heights to be the same and for better accessibility.

Seperation of Occupancies Table 508.4

The building is equipped with an automatic sprinkler system.

This building complies with the code that was in effect at the time of construction so the building materials can remain as long as the areas that were deemed unsafe be repaired.

Separation of Occupancies Table 508.4

This building complies with the code that was in effect at the time of construction so the building materials can remain as long as the areas that were deemed unsafe be repaired.

Residential (R)

Mercantile (M) & Business (B)
Separation of Occupancies

Table 508.4

<table>
<thead>
<tr>
<th>Separation between Occupancies</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>R and R</td>
<td>No separation</td>
</tr>
<tr>
<td>R and M for a building equipped with automatic sprinkler</td>
<td>1 hr</td>
</tr>
<tr>
<td>R and M for a building without automatic sprinkler</td>
<td>2 hr</td>
</tr>
<tr>
<td>M and M</td>
<td>No separation</td>
</tr>
</tbody>
</table>

This building has an automatic sprinkler system, so the only area that needs to have a 1 hr separation is the floor between the mercantile space and the residential space above.

Path of travel

An alteration that affects or could affect the usability of or access to a facility that contains a primary function shall be made so as to ensure that, to the maximum extent feasible, the path of travel to or from the altered area is readily accessible to and usable by individuals who use wheelchairs, unless the cost and scope of such alterations is disproportionate to the cost of the overall alteration.

New construction must abide by ADA and allow accessibility to those with disabilities.

Exit Access Travel Distance

Table 1016.2

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Travel Distance (with sprinkler system)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M &amp; R</td>
<td>250 ft</td>
</tr>
</tbody>
</table>

This building does not exceed the travel distance of 200 ft.

Option 3: Complete Rebuild

3.7 Systems

System

The systems in the buildings are the mechanical, electrical, and plumbing.

Subcategories:
- Materials
- Condition
- Applicable Code
- Programs:
  - Athena Impact Estimator
  - Sefaira

Information that is needed:
- The year that it was constructed
- The year that it was remodeled, if applicable
- The materials that make up each assembly
- The connection of each system
- Amount of potential tenants
- Amount of water and energy that will be used by the building
- Price of water and energy of that area
- What appliances will be in the building

Evaluated on:
- Ability to meet Atlanta’s construction Codes
- Condition
- Toxic Materials
- Operational cost
- Environmental impact
Annual Space Cooling: 180,610 kBTU
Annual Space Heating: 95,419 kBTU
Annual Grid Fuel Used: 95,419 kBTU

Air Distribution System
Design fan Power: 526 cfm/hp
Ventilation Rate: 0.07 cfm/ft²

Cooling Equipment
Cooling COP: 3

Heating Equipment
Heating COP (Efficiency): 0.85

The condition of the systems seems to be in disrepair. I do not have any expertise in this area, but from looking at the systems that were in the building, I believe that all the systems should be replaced. There is exposed wiring, plumbing in random rooms and the HVAC does not go to every space. Also, the building does not have a water heater.

The existing building does not have a water heater.

Table 2902.1
Mercantile need 1 water closet per 500 people.
Residential for R-2 needs one water closet per dwelling unit.

Artificial light
Artificial light shall be provided that is adequate to provide an average illumination of 10 footcandles (107 Lux) over the areas of the room at a height of 30 inches above the floor level.

Heating and Cooling
Heating and cooling system design loads for the purpose of sizing systems, appliances and equipment shall be determined in accordance with the procedures described in the ASHRAE/ACCA standard 183. Alternatively, design loads shall be determined by an approved equivalent computation procedure, using the design parameters specified in Chapter 3 of International energy conservation code.

This building is 50% mercantile and 50% residential. So there is a need for one water closet per residential unit and 1 water closet per 500 people.

Sprinkler Systems
Where the provisions of this code require that a building or portion thereof be equipped throughout with an automatic sprinkler system in accordance with this section, sprinklers shall be installed throughout in accordance with NFPA 13 except as provided in section 903.3.1.1.

The existing building has an automatic sprinkler system.
Where the provisions of this code require that a building or portion thereof be equipped throughout with an automatic sprinkler system in accordance with this section, sprinklers shall be installed throughout in accordance with NFPA 13 except as provided in section 903.3.1.1.1.

This building has an automatic sprinkler system.

Artificial light shall be provided that is adequate to provide an average illumination of 10 footcandles (107 Lux) over the area of the room at a height of 30 inches above the floor level.

The existing building does not have sufficient interior lighting.

Heating and cooling system design loads for the purpose of sizing systems, appliances and equipment shall be determined in accordance with the procedures described in the ASHRAE/ACCA standard 183. Alternatively, design loads shall be determined by an approved equivalent computation procedure, using the design parameters specified in Chapter 3 of international energy conservation code.

The existing building does not have sufficient HVAC system and will need a complete new system.

This building is 50% mercantile and 50% residential. So there is a need for one water closet per residential unit and 1 water closet per 500 people.

New construction needs new plumbing that abides by this code or the International Plumbing Code 2012 and Georgia amendments. With at least 1 water closet per sleeping unit.

New construction needs new artificial lighting that abides by this code or the National Electrical Code 2014.

New construction needs a new HVAC system that abides by ASHRAE standard 183.

Where the provisions of this code require that a building or portion thereof be equipped throughout with a complete new plumbing system, sprinklers shall be installed throughout in accordance with NFPA 13 except as provided in section 903.3.1.1.1.
3.8 Historic Value

Historic Value

Historic Value is a category that not every building will have. The Historic Value of a building has many possible items such as brick pattern, past, and community identity. The information that is needed is found in historic records.

Programs:
- Local Historic databases

Evaluated on:
- What can be saved
- How the option treats the historic value of the site

The building was built in 1941 and was previously owned by Keen-Edge Co machinist shop until 2014.

Existing Building

Statement of Intent 16-20C.0014

1. To ensure that redevelopment and rehabilitation of the landmark district will contribute to and enhance the particular significance of the area in which one of Atlanta’s most renowned citizens, Martin Luther King, Jr., was born and grew to international prominence;

4. To preserve the existing spatial relationships where significant and to ensure that any new development within the landmark district is compatible with the historic architectural and spatial attributes that prevail;

5. To encourage the preservation of the Martin Luther King, Jr. Landmark District in such a way as to reflect and reinforce the historic neighborhood character and the unique historical relationship between the surrounding residential uses and the commercial uses, and the unique historical relationship between the commercial uses and the rest of the city.

The original building was built during the lifetime of Martin Luther King Jr. so there is a need to preservation of the existing spatial relationship of the street as well as preserving one of the original commercial structures of the time when Martin Luther King Jr. would walk down the streets.

Atlanta Code of Ordinance

Figure 3.82
Statement of Intent

1. To ensure that redevelopment and rehabilitation of the Landmark District will contribute to and enhance the particular significance of the area in which one of Atlanta's most renowned citizens, Martin Luther King, Jr., was born and grew to international prominence;

4. To preserve the existing spatial relationships where significant and to ensure that any new development within the landmark district is compatible with the historic architectural and spatial attributes that prevail;

5. To encourage the preservation of the Martin Luther King, Jr. Landmark District in such a way as to reflect and reinforce the historic neighborhood character and the unique historical relationship between the surrounding residential uses and the commercial uses, and the unique historical relationship between the commercial uses and the rest of the city;

The original building was built during the lifetime of Martin Luther King Jr. so by keeping most of the existing building exterior there is preservation of the existing spatial relationship of the street as well as preserving one of the original commercial structures of the time when Martin Luther King Jr. would walk down the street.

There are changes to the façade but those changes abide by the code or have become a part of the street identity. One change is the increase of the fenestration that will increase the safety of the streets. Another change is the painted façade, this façade is not original to the building but it has become a part of the new identity of the street and is recommended that it is not removed.

The building code of this district allows for a building up to 68ft. This building has an extra story than the buildings to the left and to the right so the third story addition is stepped back to preserve the spatial relationship of the street and its accommodation to the human scale.
The building code of this district allows for a building up to 10 stories. The building is designed to the maximum height of the surrounding buildings, and to accommodate the human scale.

The new façade must have the organization and architecture details that are found on the block. This reinforces the new façade to lending a brick with architectural details from the late 19th century.

The compatibility rule shall apply to a principal structure's architectural and spatial attributes that prevail.

The building code of this district allows for a building up to 10 stories. The building is designed to the maximum height of the surrounding buildings, and to accommodate the human scale.

The new façade must have the organization and architecture details that are found on the block. This reinforces the new façade to lending a brick with architectural details from the late 19th century.
Environmental Impact:

This option has the least impact on the environment during construction because this option keeps most of the original structure.

Addition to the embodied energy of the existing structure:
- Total Primary Energy: +370,000 MJ
- Non-Renewable Energy: +370,000 MJ
- Fossil Fuel: +350,000 MJ

This option has the most heat gain from the walls out of all options but has the least heat gain from glazing because this option has the percentage of glazing out of the three.

All three options use the same amount of water because it is based on the percentage of water used per person, which does not change per option.
Option 2: Interior Build Out with Addition

**Capital Cost:**
- Land value: $494,900.00
- Demolition: $14,239.71
- Constructions:
  - Shell: $244,486
  - Inteior: $420,261
  - Services: $402,817
  - Subtotal: $1,376,704
- Contractor’s Overhead and Profits: $272,398
- Architect’s Fees: $135,082
- Contingency 5%: $61,393
- Total: $1,955,933
- Price per SF: $196.13

**Return:**
- Envelope Compliance Certificate
- Software check-Web
- Generated by COM

**Operational Cost:**
- Annual Electricity: 390,905 KBTU
- Annual Heat: 148,472 KBTU
- Annual Water: 266,158gal
- Annual Sewage: 148,472KBTU
- Total Annual Utility Cost: $14,095
- Monthly Utility Cost: $1,174

**Financial Data:**
- Area (SF): 12529.36
- Rent: $2,029,802.00
- Property Taxes: $313,234.00
- Net Operating Income: 8.11%

**COMcheck:**
- Assembly A-2: $2,029,802.00, $25.00, $313,234.00, 8.11%
- Assembly A-3: $1,862,105.00, $25.00, $313,234.00, 7.57%
- Factory: $1,855,286.00, $15.00, $187,940.40, 12.58%
- Business: $1,855,286.00, $18.00, $225,528.48, 10.48%
- Residential: $1,929,244.00, $13.68, $171,401.64, 14.23%
- Mercantile: $1,855,286.00, $18.00, $225,528.48, 10.48%
- Mercantile/Business: $3911.25, $18.00

**Section 2: Envelope Assemblies and Requirements Checklist**
- 1. All joints and penetrations are caulked, gasketed or covered with a moisture vapor-permeable wrapping material installed in accordance with the manufacturer’s installation instructions.
- 2. Windows, doors, and skylights certified as meeting leakage requirements.
- 3. Component R-values & U-factors labeled as certified.
- 4. No roof insulation is installed on a suspended ceiling with removable ceiling panels.
- 5. ‘Other’ components have supporting documentation for proposed U-Factors.
- 6. Component Name/Description Gross
  - Ext. Wall: Concrete Block, 12in., Unreinforced, Cells Empty,Light
    - Density, Furring: Metal
  - Roof: Insulation Entirely Above Deck
    - Density, Furring: Metal
- Air Leakage, Component Certification, and Vapor Retarder Requirements:
  - 7. Stair, elevator shaft vents, and other outdoor air intake and exhaust openings in the building envelope are equipped with motorized dampers.
  - 8. Cargo doors and loading dock doors are weather sealed.
  - 9. Building entrance doors have a vestibule equipped with self-closing devices.
  - 10. Building entrances with revolving doors.

**Section 3: Energy Code Compliance**
- Energy Code: New Construction
- Project Type: Option 1
- Building Use: Activity Type(s)
  - Retail: 4706.86 (Retail)
  - Multifamily: 7821
- Building Location (for weather data): Atlanta, Georgia
- Vertical Glazing / Wall Area Pct.: 13%
- Climate Zone: 3a

This option also has a high heat gain from the walls. This could be because this option is using the existing exterior walls along with adding an addition, so it does not have a high percentage of glazing to take into account for the percentage of heat loss.
Environmental Impact:

This option can use the embodied energy from the existing façade, but because this option reconstructs the interior and adds an addition it does have an impact on the environment during construction.

Addition to the embodied energy of the existing structure:
Total Primary Energy: +1,320,000MJ
Non-Renewable Energy: +1,250,000MJ
Fossil Fuel: +1,200,000MJ

Capital Cost:

<table>
<thead>
<tr>
<th>Option</th>
<th>Phase</th>
<th>Description</th>
<th>Cost (in thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1</td>
<td>Demolition</td>
<td>Substructure</td>
<td>$51,798</td>
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<tr>
<td></td>
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<td>Shell</td>
<td>$946,424</td>
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<td></td>
<td></td>
<td>Interiors</td>
<td>$1,046,025</td>
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<tr>
<td></td>
<td></td>
<td>Services</td>
<td>$1,533,924</td>
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<tr>
<td></td>
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<td>Subtotal</td>
<td>$3,596,072</td>
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<td>Architect's Fees</td>
<td>$972,737</td>
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<td></td>
<td>Contractor's Overhead and Profits</td>
<td>$246,973</td>
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<tr>
<td></td>
<td>Contingency 3%</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>$5,011,755</td>
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</tr>
<tr>
<td></td>
<td>Price per SF</td>
<td>$203.19</td>
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</table>

Return:

<table>
<thead>
<tr>
<th>Component Name/Description</th>
<th>Gross Area (SF)</th>
<th>U-Factor (a)</th>
<th>R-Value</th>
<th>Cavity Density</th>
<th>Furring: Metal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall</td>
<td>2132</td>
<td>0.7</td>
<td>9.4</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>Floor</td>
<td>2928</td>
<td>0.35</td>
<td>0.36</td>
<td>0.38</td>
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<tr>
<td>Roof</td>
<td>21885</td>
<td>0.063</td>
<td>0.123</td>
<td>0.13</td>
<td></td>
</tr>
</tbody>
</table>

Operational Cost:

<table>
<thead>
<tr>
<th>Component</th>
<th>Annual Heat</th>
<th>Annual Water</th>
<th>Annual Sewage</th>
<th>Annual Electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed</td>
<td>818,664</td>
<td>824,935</td>
<td>824,596</td>
<td>786,718</td>
</tr>
</tbody>
</table>

Total Annual Utility Cost: $22,314
Monthly Utility Cost: $1,859

Total Construction Cost: $5,099,013

Option 3: Complete Rebuild

- 16 Residential apartments: 1000sf
- Mezzanine: 1366sf
- 1st floor: 5489sf
- 2nd floor: 5489sf
- 3rd - 5th floor: 4099sf

Total square footage: 24641sf

Rentable Area:
- 16 Residential apartments: 1000sf
- Two mercantile/business spaces: 2744sf and 2744sf

People per unit:
- Residential: 40 (2.5 people/unit)
- Mercantile/ Business = 4 (2 people /NFT / space)
This option has the most heat loss from the glazing because this option has the highest percentage of glazing out of the three because it is the largest building and does not use the existing exterior wall.

Environmental Impact:
This option tore down the original building so it does not have any embodied energy, causing this option to have the most environmental impact during construction.

Addition to the embodied energy of the existing structure:
Total Primary Energy: +3,160,000MJ
Non-Renewable Energy: +2,600,000MJ
Fossil Fuel: +2,430,000MJ
Chapter 4.
Conclusion
### 4.1 Conclusion

**Possible Building Candidates Evaluation**

- Site Selection
- Decided on site
- Neighborhood Study
- Physical Assessment
- Documentation
- Environmental Impact Evaluation
- Design of Possible Outcomes

**Phase 1**

- Baseline Operational Evaluation
- Atlanta Code of Ordinance

**Phase 2**

- Building Code
- Environmental Evaluation
- Operational Evaluation
- Atlanta Code of Ordinance

**Phase 3**

- Design of Possible Outcomes
- Environmental Impact Evaluation

### Physical Assessment

During the physical evaluation, I found it difficult to understand the condition of the structure. HACO systems and the roof because I did not have the tools or the knowledge to evaluate those systems.

- **Ground Floor:** To decide if the structure was sound I relied on sight, touch and pounding with my foot. If there was no crack or damage from water or bugs that I could see, then I would feel for damage or cracks and then I would feel it with my pounding my foot to see what showed. If there was no damage along with no cracks or chips that I could feel, and there was no rotation from bending, then I determined the structure safe. There could be damage under the surface or in another area that could endanger the entire system. The evaluation process did not notice or simply did not have the tools and knowledge to check.

- **Solution:** A better solution for architects and owners would be to have a matrix of common problems. I only felt for cracks and/or signs of damage that someone with a better skill and knowledge to check.

- **Structure:** To determine if the structure was sound I relied on sight, touch and pounding with my foot. If there was not any damage from water or bugs that I could see, then I would feel for damage or cracks and then I would feel it with my pounding my foot to see what showed. If there was no damage along with no cracks or chips that I could feel, and there was no rotation from bending, then I determined the structure safe. There could be damage under the surface or in another area that could endanger the entire system. The evaluation process did not notice or simply did not have the tools and knowledge to check.

- **Solution:** A better solution for architects and owners would be to have a matrix of common problems. I only felt for cracks and/or signs of damage that someone with a better skill and knowledge to check.

- **HVAC:** A list of images that show common problems would help in this situation. I could only evaluate the HVAC equipment through sight and touch. I looked to find a roof that is similar. To understand what it was made up of I had to do research on what I could see. I could not understand the materiality of the roof or its condition. To understand the materiality of the roof, I had to do research on what I could see. I could understand what it was made up of I had to do research on what I could see. To understand the materiality of the roof, I had to do research on what I could see. I could not understand the materiality of the roof or its condition. I only looked at the roof to understand the condition. There was some water damage so I would recommend that a new roof would be placed on the building if during that process it is decided that the roof only has some water damage so I would recommend that a new roof is placed on the building. If during that process it is decided that the roof only has some water damage I would recommend that a new roof is placed on the building.

- **Condition:** To decide if the roof was saved, I could only look at the roof to understand the condition. There was some water damage so I would recommend that a new roof would be placed on the building. I could understand what it was made up of I had to do research on what I could see. I could not understand the materiality of the roof or its condition. I only looked at the roof to understand the condition. There was some water damage so I would recommend that a new roof would be placed on the building if during that process it is decided that the roof only has some water damage so I would recommend that a new roof is placed on the building. If during that process it is decided that the roof only has some water damage I would recommend that a new roof is placed on the building.

- **Solution:** A better solution for architects and owners would be to have a matrix that has common signs of cracks or areas of problems that someone with limited knowledge could easily recognize and deem a problem. Though I could understand what it was made up of I had to do research on what I could see. I could not understand the materiality of the roof or its condition. To understand the materiality of the roof, I had to do research on what I could see. I could not understand the materiality of the roof or its condition. To understand the materiality of the roof, I had to do research on what I could see. I could only look at the roof to understand the condition. There was some water damage so I would recommend that a new roof is placed on the building.

- **Roof:** I could only look at the roof to understand the condition. There was some water damage so I would recommend that a new roof is placed on the building if during that process it is decided that the roof only has some water damage I would recommend that a new roof is placed on the building.

### Possible Solution

There are websites that have common problems with old houses or information so that a crack means but there is not one place that makes it quick and straightforward to access all information from different problems areas such as toxic materials, structural issues, etc. There is not one place that makes it quick and straightforward to access all information from different problems areas such as toxic materials, structural issues, etc. It would be easy to access and would make purchasing an older building easier.

### Overall Remarks

There is not one option that is best. The best option depends on the situation and the owner is the one who will understand the community. The owner would most likely choose option 1. It is the least costly option. It keeps most of the original structure that is a part of the community. Now if the owner wanted to make more money but did not want to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. Overall, it is not an option that is best. The last option can depend on the situation and the owner is the one who will understand the community. Their needs to include the owner's goals to see if the project is for the building or how much money the owner is connected to the community and wants to support the existing community. That owner would most likely choose option 3. It is the least costly option. It keeps most of the original structure that is a part of the community. Now if the owner wanted to make more money but did not want to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. For an owner who wants to spend a lot up front, option 2 is a good choice. Overall, it is not an option that is best. The last option can depend on the situation and the owner is the one who will understand the community. Their needs to include the owner's goals to see if the project is for the building or how much money the owner is connected to the community and wants to support the existing community.
4.2 Works Cited


1. By Author

3. By Author

2. By Author

1. By Author

Ch.1

1.1.108-110 The base image was generated by Athena's Impact Estimator for Buildings.

1.1.82 Google street view

1.1.79 https://www.leasecorp.com/assets/default/images/icons/icon-HVAC.jpg

1.1.78 https://clipartfest.com/categories/view/d44763446a898914a02ab0162a10670342299046/energy-efficient-light-bulbs-clipart.html

1.1.77 http://www.clipartbest.com/plumbing-clip-art-free

1.1.6 The rent per SF is the average of related properties in the area.

1.1.4 By Author

1.1.3 By Author

1.1.2 By Author

1.1.1 By Author

Ch. 2

2.1. All images are by Author


2.1.9 http://myzug.ch/wp-content/uploads/2012/08/l-g.jpg

2.1.8 http://www.stadtzug.ch/de/ueberzug/ueberzugrubrik/aktuelles/newsarchiv/?action=showinfo&info_id=179484

2.1.7 http://www.vmzinc.com/images/vmzinc/environment/leedanglais.jpg

2.1.6     By Author


2.1.4 By Author

2.1.3 By Author

2.1.2     By Author

2.1.1     By Author

Ch. 3

3.1. All images are by Author

3.1.12 http://www.buildhoff.com/products/condo-ae

3.1.11 https://calculatelca.com/software/impact-estimator/

3.1.10 http://www.willowp.com/software/about/


3.1.7 https://www.iconfinder.com/icons/268621/buy_estate_for_sale_home_house_real_real_estate_sign_icon

3.1.6 Google street view

3.1.5 https://clipartfest.com/categories/view/405a42f29da392620296fbe507176ec5873056d4/fire-sprinkler-clipart.html

3.1.4 https://clipartfest.com/categories/view/d44763446a898914a02ab0162a10670342299046/energy-efficient-light-bulbs-clipart.html

3.1.3 http://www.clipartbest.com/plumbing-clip-art-free

3.1.2 The rent per SF is the average of related properties in the area.

3.1.1 By Author

Ch. 4

4.1. All images are by Author

4.1.12 http://www.bsdsoftlink.com/products/costlink-ae

4.1.11 https://calculatelca.com/software/impact-estimator/

4.1.10 http://www.willowp.com/software/about/


4.1.7 https://www.iconfinder.com/icons/268621/buy_estate_for_sale_home_house_real_real_estate_sign_icon

4.1.6 By Author


4.1.4 By Author

4.1.3 By Author

4.1.2     By Author

4.1.1     By Author