Authors by alphabetical order are as follows: Ryan Bundy, Matt Cook, Aric Farnsworth, Aaron Fennell, Dugan Frehner, Matt Garlick, Evan Haslam, Shaida Khamedoost, Chi-Yow Lee, Jacquey Mauer, Jarrett Moe, Megan Sebring, Nicholas Stock, Alex Stoddard, Mike Zeller

This report was written in partial fulfilment of the course requirements for ARCH/CMP/REDEV-6353 "Building Performance Analysis" offered by the University of Utah College of Architecture + Planning. This report is part of an academic exercise intended to provide the student with a "hands on" experience in building performance analysis. The building owner is advised that the recommendations in this report must be validated as "appropriate" by a licensed architect, licensed engineer, or other accredited personnel prior to their implementation. In all cases the University of Utah, the College of Architecture + Planning, the personnel associated with the administration of this course, and the report authors shall be held harmless in any action concerning damage to the subject property and/or improvements as well as injuries to occupants based in the implementation of any portion of the material content of this report.
EXECUTIVE SUMMARY: The Sill Center once housed the leading home economic program in the nation, however as society’s focus shifted away from the home and out into the workforce the Sill Center became a forgotten piece of the U of U’s culture and history. This paper Details how the Sill Center might be preserved and updated to once again serve the needs of a new generation of U of U students and faculty. Throughout the analysis care was taken to preserve the building’s unique history, integrate it into the campus’ current list of sustainable building, and resolve current and future user concerns, all while maintaining an affordable approach.

In accordance with the preceding values the following recommendations will be made in detail in the body of this paper. First the building must be updated to meet current ADA regulation, many of the violations found will require little to no major renovation. Second updates to the building envelope such as Clear Double Pane windows (u 0.52), R-21 Insulation for exterior walls, R-31 insulation for the roof, 3 step daylighting controls, and Reduced Lighting Power Density will both bring the building up to the university’s current level of sustainability and resolve many of the current and future occupant concerns found.

INTRODUCTION

Purpose
The Sill Center represents an important historical and cultural element in both the University of Utah’s landscape and history. Unfortunately many visitors, students and even some faculty are unaware of the building’s significance. Administration would like to reinvigorate the building so as to entice students to use the faculties programs, preserve its history and integrate the building into the campus’ extensive collection of environmentally responsive and sustainable buildings. This paper will offer recommend by which the administration might accomplish their vision for the Sill Center.

Who we are
It is fitting that this analysis should be done from the point of view of architecture, planning and real estate development students. We collectively represent students who are both part of the administration’s desired user group, as well as a knowledgeable body of persons passionately involved in historical preservation and sustainable design. We are invested in this project because it will impact us, culturally, educationally and financially. The fifteen of us have invested a considerable amount of our time, energy and our education into understanding how the Sill Center might be adapted to best serve and represent the University's faculty, student body, and cultural legacy.

Methodology (how the project was studied and compiled)
In order to accomplish this goal numerous studies, interviews, analysis and research were conducted in order to construct a complete vision of the Sill Center’s past and present states so as to accurately project the most promising future for the facility. The work presented represents the collaboration of fifteen University of Utah students over the course of a semester. All work was done under the tutelage of Robert A Young ( PE, FAPT, LEED ap) an knowledgeable and experienced professor and practitioner of historic preservation and sustainable design strategies. It is our hope that this paper might help in some capacity to assist in the renovation of the Sill Center, so that the building might be better recognized for its historical importance and become a more integral part of student life and sustainable design at the University of Utah.
EXISTING CONDITIONS

1. HISTORY

1.1. Sterling W. Sill Center 1953 – 1995
The building of the Sterling W. Sill Center began in 1951 and it was officially dedicated on June 8, 1953. See Figure 2. A pamphlet promoting the Sterling W. Sill Center pamphlet explains, “In 1950 Dr. Virginia Cutler, then chairman of the HE department began working and planning with the University of Utah’s President, A. Ray Olpin, with Sterling Sill, then Chairman of the Board of Regents and with Raymond J. Ashton, architect. Three years were spent in planning and obtaining money and materials necessary to complete the project. Mr. Sill also found donors who provided the building materials and all the furnishings, and arranged for a no-profit contract from the builder, Ted Jacobsen. Ashton, Evans, and Brazier, architectural firm, designed the building and supervised its construction on a no-fee basis” (Sterling W. Sill Center 1974-79).

The center is unique because none of it was funded by tax money, a Deseret News article explains, “The Sterling W. Sill Center was built and furnished by contributions of men who sensed the need of better, practical homemaking training among the girls who will be tomorrow’s mothers” (Deseret News 1953). It was a $300,000 project and all of it was donated, everything from the foundation, plumbing, wiring, rugs, dishes, furniture was contributed by local firms and private citizens.

A Deseret News article explains the purpose of the center and how it functioned in its early years, “Two girls move into one of the six two room apartments-designed to be about the size of the small apartments that 97 percent of all young couples live in for four or five years before they can afford a down payment on a house. The girls, most of whom expect an early wedding date, are given a credit of $500 with which they must completely furnish the apartment. They soon learn a lesson that some young brides never learn—that one must be practical, that one can have sterling silver only if one is prepared to sleep on the floor for awhile. They soon develop a sense of values far different from that of the average young college coed. Each girl lives in the center for about six weeks, during which time she prepares means and keeps house on a dollar-a-day-budget. At the end of that time, if she does not know more about low-cost nutrition and washing windows and cleaning rugs than her grandmother ever did, it will not be the fault of Dr. Virginia Cutler, head of the University's home economics department, whose dream come true the
center is” (Deseret News 1953). The girls in residence were required to keep daily time schedules to include home making duties as well as regular class work. They were required to stay within a budget of $1 a day for food and expendable items; meals for a week were planned in advance. The group of girls met with Dr. Cutler each morning for an hour to go over schedules and plan activities; any woman at the University of Utah could sign up to live at the center regardless of their major.

Some of the classes that were taught to students of the center included home decoration, simple carpentry, home management, family meals, weaving, and home sewing for the family. The girls shared a living room with a book-filled book shelf, a stone fireplace, television and grand piano; they also shared a utility room with a mangle, automatic washers, freezers, and a sewing center (See Figure 3). The center also held a kitchen, dining room, lecture rooms, a room containing upholstering equipment and looms, walk-in locker, and a patio. The center also believed that each girl should learn a valuable creative skill such as weaving or upholstering; the girls also entertained family and friends as part of their homemaking training. Each girl held a special occasion party such as a barbeque, a buffet, or a Hawaiian party once during their stay.

In 1954 the center created a statement of operation that read, “Statement of Policy for Operation of the Home Living Center March 18, 1954,”

1. Work conducted in the Center appropriately will encourage former residents of the Center to participate in cooperative research projects and to use facilities of the Center for this purpose.

2. The Center will be used for special lectures, both lay and professional, to promote interest in family life throughout Utah.

3. The Center will be available to present and former student residents for wedding functions. (For receptions the guest list should be restricted to not more than 200 people because of limitations of the Center’s facilities.)

4. The Center may be used for such purposes as may be approved by the president of the University” (Statement of Policy 1954). There were many wedding receptions of the girls that once lived at the center and University of Utah functions held at the center in its early years.

When the center was built in 1953 there was nothing like it in the country; there were other home economics programs, but the Sterling W. Sill Center was the only one with individual apartments. Many other home economics
living programs followed the example provided by the University of Utah program. The Sterling W. Sill Home Living Center was a very successful program in its early years, but it began to decline in the early 1970’s.

On June 3, 1963 the Sterling W. Sill Plaque ceremony was held to commemorate the plaque made that included the names of the donors who contributed more than $200 towards the center. This plaque still hangs on the building today.

The Home Living Center’s enrollment began to dwindle in the 1970’s. From 1973 to 1977 the two directors of the center during that time period made great progress in restoring the home management experience after it had been in a slump for several years.

In 1977 only 12 students attended the six week live-in program, but 40 had signed up for the next year. Because of poor leadership from the director at that time, that did not happen. Josephine Nichols wrote, “Students at the University of Utah do want a program in home management experiences at Sill Home Living Center if it is allowed to function under effective leadership” (Sterling W. Sill Center 1978).

In the early 1980’s the Home Living Center was converted into an office building and a reading/study area, a storage room, and a grad student office were added. In 1990 a geography office, geography graphics lab, studio, staff office, elevator, and another storage room were added.

1.2. Sterling W. Sill Center 1996-2012
In 1996 the Sterling W. Sill Center was remodeled to house Undergraduate Studies, the Honors Program, and the Center for Teaching and Learning Excellence, and International Student Center. The name was also changed to the Sill Center to better facilitate its current uses while keeping the history of the first name. Currently the Sill Center is The Office of Undergraduate Studies. The Office of Undergraduate Studies website explains the roles of the Sill Center, “Maintaining in cooperation with departments and colleges, general education and bachelor degree requirement courses; assisting students as they transition to the University from high school and other education institutions, complete their General Education and Bachelor’s Degree requirements, and pick a major; administering a variety of student and faculty awards and scholarships; establishing new degree programs; oversee the following programs:

The Bachelor of University Studies degree
The Center for Teaching and Learning Excellence
Continuing Education
The Honors College
The Learning, Engagement, Achievement, and Progress (LEAP) first-year experience program
National Student Exchange
Orientation
Study Abroad
The Undergraduate Council
The Undergraduate Research Opportunities Program
University College Advising” (Office of Undergraduate Studies 2012).

The Sill Center is an essential part of the University of Utah campus that coordinates many valuable University departments.

In the late 1950s to early 1960s, changes in American women’s social roles resulted in the decline of home economics education. Although the program covered a variety of lessons, the home economics name often suggested a gender stereotyping which women were struggling to overcome at the time, as well as having an “old fashioned” image, which didn’t appeal to a society looking for more progressive elements for their young women.

In order to provide a thorough history of the Sill Center we wanted to find out if others universities had similar programs during the 1950’s and 1960’s; there were similar programs at Brigham Young University and Cornell University.
The Joseph F. Smith Family Living Center at Brigham Young University began classes in 1956. The Mountain West Digital Library states, “The Living Center was designed for the promotion of family life and for professional training in home sciences, houses the Department of Sociology and Psychology, the College of Nursing, and the College of Family Living” (Mountain West Digital Library 2012). The building housed twenty classrooms, twenty eight laboratories, and seventy seven offices.

Cornell University in New York opened up its program during the first decade of the 1900s. Each semester, eight women students lived with a resident advisor in the practice apartment, where they took turns performing a full range of homemaking activities in a scientific and cost efficient manner. By 1969 the ideology of the college favored hard science over practical education, and the practice apartments were dropped from the Cornell curriculum.

2. CULTURE

2.1. Sill Center Tenants
The Office of Undergraduate Studies is the tenant of the Sill Center, its purpose is to retain a talented and diverse student body by engaging students in meaningful learning experiences both on campus and in the community. Undergraduate Studies includes several programs to accomplish this goals including: LEAP, Center for Teaching and Learning Excellence (CTLE), Undergraduate Research Opportunities Program (UROP), Study Abroad, and Undergraduate Advancement. These programs create a lot of student interaction, especially LEAP.

A survey was given to users to gage the utility and the comfort of the building. These are the areas that were addressed:

- Usage
- Top Three Areas Used
- Transportation
- Work Space Rating
- Acoustical Performance Rating
- Common Areas Rating
- Features to Keep
- Suggested Improvements

2.2. Sill Center Usage
The hours of normal usage for the Sill Center fall between 7:00-5:00, but the building is accessible to tenants during most of the day. Generally the tenants stay in the building during lunch.

2.3. Top Three Areas Used by Tenants
The most commonly used area in the Sill Center is the office spaces for the tenants. The conference rooms are used very often followed by the kitchen area.

2.4. Work Space Rating
The Work Space Rating was on a scale from 1-5 (low to high). It should be noted that the majority of the office spaces are not similar.

<table>
<thead>
<tr>
<th>Rate Your Workplace</th>
<th>Average</th>
<th>St.Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Lighting</td>
<td>3.92</td>
<td>1.08</td>
</tr>
<tr>
<td>Natural Lighting</td>
<td>4.23</td>
<td>1.17</td>
</tr>
<tr>
<td>Comfort Cooling</td>
<td>2.62</td>
<td>0.96</td>
</tr>
<tr>
<td>Comfort Heating</td>
<td>2.62</td>
<td>0.87</td>
</tr>
<tr>
<td>Acoustics</td>
<td>3.50</td>
<td>1.38</td>
</tr>
<tr>
<td>Interaction</td>
<td>3.38</td>
<td>1.26</td>
</tr>
</tbody>
</table>
Comments on Workplace

- The buildings' temperatures are extreme, ranging from too hot or too cold.
- The basement is isolated and gloomy.
- The lighting in the building isn't sufficient, especially noticeable on cloudy days and when it is dark.

2.5. Acoustical Performance Rating
The Acoustical Performance Rating was on a scale from 1-5 (low to high).

<table>
<thead>
<tr>
<th>Comments on Acoustical Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Large conference room upstairs can be heard by those in the basement.</td>
</tr>
<tr>
<td>• Lobby gets extremely loud when meetings end in the large conference room.</td>
</tr>
<tr>
<td>• Air conditioning can be extremely loud.</td>
</tr>
</tbody>
</table>

2.6. Performance of Common Areas
The Performance of Common Areas Rating is on a scale from 1-5 (low to high).

<table>
<thead>
<tr>
<th>Table 3 - Performance Rates</th>
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<tbody>
<tr>
<td>Rate Performance of Common Areas</td>
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<tr>
<td>Echoes</td>
</tr>
<tr>
<td>Average: 3.15</td>
</tr>
<tr>
<td>St. Dev: 0.99</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Rates</th>
<th>Echoes</th>
<th>Mechanical Noise</th>
<th>Exterior Sounds</th>
<th>Office Noises</th>
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</thead>
<tbody>
<tr>
<td>Average</td>
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<td>3.45</td>
<td>2.42</td>
<td>1.00</td>
</tr>
<tr>
<td>St. Dev</td>
<td>1.11</td>
<td>1.04</td>
<td>1.00</td>
<td>1.08</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rates</th>
<th>Electric...</th>
<th>Natural...</th>
<th>Comfort...</th>
<th>Comfort...</th>
<th>Acoustics</th>
<th>Plumbing</th>
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<tr>
<td>St. Dev</td>
<td>1.16</td>
<td>1.16</td>
<td>1.16</td>
<td>1.16</td>
<td>1.16</td>
<td></td>
</tr>
</tbody>
</table>
Features to Keep in the Sill Center

- The natural lighting and all of the windows.
- Gardens and green spaces outside.
- The green features of the building. (recycling, solar panels, energy projects)
- The large conference room

2.7. Improvement Ideas for the Sill Center

- Student Lounge
- More LEAP offices on the main floor
- Improved lighting in the building
- HVAC/AC improvements
- Better use of space, there are lots of unutilized space
- Improvement of exterior aesthetics
- Bathrooms need to be improved
- Basement is depressing and is not conducive to collaboration or collegiality

3. SITE

3.1. University of Utah Landscaping Standards
The University of Utah has a basic standard for its landscape architecture. Tree and planting guidelines are to be specified in accordance with ISA (International Society of Arboriculture), Utah State University Extension Service (Extension Forester), and the U.S. Department of Agriculture, except where the requirements are more restrictive. Products were selected to eliminate complications inherent to stocking multiple manufacturers’ parts on campus and standardize landscaping systems. The Landscape architect is required to specify drought resistant plants in accordance with the University of Utah Plant List. Trees are important to the beauty and feel of the campus, and the condition of each tree on campus has added significance since the University is Utah is a State Arboretum. All plants on campus shall be nursery grown, sound, healthy, vigorous, and free from pests and diseases. They should also be well branched, in full leaf, and have a healthy root system.

All plants conform to USDA zone requirements and must be suitable to the local soils. Plants should be selected according to appropriate solar aspect, exposure, and micro climates. Trees and shrubs should be placed to reduce solar gain in the summer and allow solar gain in the winter. Only healthy, well adapted plants should be used, and landscapes ought to be zoned by grouping plants together according to their water requirements. Year-round interest should also be considered when choosing and placing plants. After completion of all planting, all irrigated non-turf areas shall be covered with a minimum layer of 3" of Mulch to retain water, inhibit weed growth and moderate soil temperature. Non-porous material should not be placed under the mulch.

All irrigation systems include an electric automatic controller with multiple programs and multiple repeat cycle capabilities and a flexible calendar program. The controller is programmable for multiple start times for repeat and rest periods, and shall be capable of water budget adjustment. All controllers are also capable of temporarily shutting down the system by utilizing internal/external options (such as rain, wind, and freeze devices) and the ability to adjust run times based on a percentage of maximum ET or by use of a soil sensor.

Exterior benches and tables are required to be products of the approved manufacturer Landscape Forms, Inc. “Plexus” benches, and “Carousel” tables. All other manufacturers and products must be reviewed and approved by University Facilities Management prior to bid. Bike racks should be specified as an inverted “U” rack with no cross bar. The inverted “U” rack will be fabricated from 2” schedule 40 galvanized tubing. Waste receptacles are to be located at each main entry to the building (next to the entry door but out of the way for snow removal) and on each patio and must be cast concrete units manufactured by WAUSAU TILE CO., Number TF1040, and sand colored. The receptacle will be equipped with a No. TF2094 Snuffer Attachment. Wall mount urns are cast concrete matching the trash receptacles, with the specified Number UR10201 NS or UR11201NSPL, in a sand color.
4. BUILDING

The Sterling Sill Center is composed, primarily, of un-reinforced masonry with wood and steel framing. The primary perimeter support walls are cast-in-place concrete (at the lower level) with solid brick masonry walls above. The North West end of the building consists of a post and beam configuration; to accommodate a repeating rhythm of glazing on both levels. Accent walls composed of a solid brick core, with natural sandstone veneer finish anchor the south walls on the west side of the building.

The unreinforced masonry construction brings to question the integrity of the structure in a seismic event. Most of Salt Lake City has the potential to experience 10-20% peak acceleration as a percent of gravity. (USGS, 2011) There is evidence of some type of seismic reinforcing done in conjunction with a remodel circa 1996; the extent of which requires further research over and above the scope of this report.

The Glazing systems in the building consist almost exclusively of single pane, steel framed windows and curtain walls. A system which certainly calls for scrutiny in regards to thermal efficiency.

The Roof appears to be in prime shape (XXX, R. 2012) in regards to the waterproofing system, with 10 plus or more years left in its effective lifespan.

The following outlines the methodology and findings in regards to the research conducted of the building materials and construction.

Analysis Methodology

The protocol adopted through the investigation of the materials and predominant construction methods of the Center took on three different aspects. Review of the available records and drawings, physical observations and measurements of the structure as well as an interview/Site visit with roofing professional who has worked on the building, along with research on the predominant construction methods from when the building was first constructed.

4.1. Review of Available Records/Drawings

The First step in the initial investigation involved reviewing of the available records and drawings relating to the original construction of the building. Several drawings were made available for review through the University’s GIS department. The original architect of the facility was Ashton, Evans and Grazier, Architects & Engineers, 24 South West Temple in Salt Lake City. Of the original construction documents from 1951, only the first floor framing plan could be located. (Appendix 1.1)

Several As-built documents were reviewed relating to renovations done circa 1996. DMJM Architects/Engineers of Salt Lake City authored the As-Built Second Floor Plan (Appendix 1.2), As-Built Roof Plan (Appendix 1.3) and Contract Documents First Floor Plan (Appendix 1.4). There is indication in these documents work was being performed in an effort to stable the structure in a seismic manner (DMJM Architects, 1996) Eaton Mahoney Associates issued Main Level Plan in November of 2000, which indicates existing layout of the main level as well as proposes a new addition to the southwest corner of the existing building. To this date, this addition has yet to be realized.

4.2. Physical Observations

Three separate visits where made to the facility with the purpose of investigating the existing materials and construction during the period of February –April of 2012. During each of these physical investigations, information was gathered to further document the known or less than apparent information on the buildings construction. During the physical investigations, numerous pictures, drawings and measurements were taken and cataloged in an effort to confirm several key components of the building. (Fig. 1)
4.3. Interviews
A site visit was conducted on April 2 with Carpenter and Roofing Shop Employee familiar with the building, Mr. Rich Beck. During this visit, a physical inspection of the roof surface was conducted. The Ceiling cavity was observed at this time by accessing the ceiling hatch in the north east stairwell. Waterproofing, Framing and roof cavity conditions were observed which are reported in section 2.6 (Existing Roof Construction/Materials). In an effort to confirm the insulating materials of the current roof, Mr. Beck communicated with Mr. Todd St.Onge of T-Co Roofing. Mr. St.Onge was involved with the installation of the PV panels of the roof circa 2006. From his recollection, Mr. St.Onge confirmed the insulating materials installed in the roof assembly.

4.4. Research of Predominant methods of the era
To further aid in assembling a more accurate indication of the current components present in the building, several publications have been consulted. The purpose of these consultations is to gleam a complete understanding of the contemporary practices in construction during the original construction of the building in 1951. A full list of publications consulted in this process is listed in the references section.

Construction and Materials

Considering the very incomplete information remaining from the original construction documents, the above techniques have been utilized to further compile a more complete understanding of the existing structural, weatherproofing and thermally isolative components present. Based on the information reviewed, the components and systems are organized as follows:
- Walls – structural
- Walls – Non Structural
- Glazing – Including windows and curtain walls
- Doors – Interior and exterior
- Floors – Structural
- Roof – Structure, Insulation and weatherproofing.

4.5. Walls - Structural
The structural systems in the building consist of several very common materials. The main load bearing walls comprising the lower level (much of which is below grade) consist of 12” wide, cast-in-place concrete walls. There is evidence of minor reinforcing of these walls consisting of (2) ¾” dia. “bars” at the top, bottom and under sills of all openings (Ashton, Evans, Glaser, 1951).

These walls comprise much of the perimeter of the building, at varying heights.

On the second or main level, a large portion of the perimeter walls consist of 12” wide, un-reinforced masonry brick. A common brick 4” wide x 8” long x 2.5” tall are used in formation of all brick walls.(Fig. 2)
4.6. Walls - Non Structural
The Predominant Materials utilized for the interior, non-load bearing division of space is studs with drywall. Gypsum plaster is applied to the cast-in-place concrete walls to create the interior finish on the perimeter of the lower floor. The same type of gypsum plaster is used extensively on the upper floor, on the interior side of the load bearing brick walls.

4.7. Glazing
The major glazing components (Windows and curtain walls) use a single pane of glass with steel frames. There is no thermal break present between the glass and frame; only a small amount of sealant to secure the glass with respect to water infiltration.

4.8. Doors - Interior and Exterior
There are two major types of doors present in the project: Interior and Exterior doors. The majority of the interior doors are of the solid wood variety, Approximately 1.5” in thickness. The Exterior doors are predominately steel construction, between 1.5” to 1.75” in thickness. Many of the exterior doors contain glass, or are a "commercial storefront " style. The glass present in these doors is also single pane with steel frames. A thermal break between the glass and the frame could not be confirmed.

4.9. Floors - Structural
The most prevalent type of structural floor in the building is cast-in-place, two way “T” slab. As outlined in the original floor framing plan from 1951 as well as the “1st Floor As-builts” from 1996 remodel, the “T” slab is comprised of a 2 ½” thick slab, with 14” deep joists and 12”-20” beams cast directly into the underside of the slab providing the support to the entire floor.

4.10. Roof
The structural Framing for the roof consists of Metal Bar Joists (11 7/8” in depth), spaced at 16”. The metal bar joists are decked by 1”x4” T&G wood boards. Upon inspection, there is no evidence of insulation beneath the T&G decking between the joists; Although it should be noted the limited area available for inspection of the framing and decking of the roof structure. During the roof inspection, it was confirmed the Insulation Materials of the roof are one of two types: (2) layers 1” thick Vermiculite rigid insulation sheets – or – (1) layer 1” thick Vermiculite rigid insulation sheet plus (1) layer of 1” thick Polysocyanurate rigid insulation sheet. Either scenario may occur throughout the entire roof, with insulation built up in various locations to accommodate proper drainage of the roof waterproofing. The waterproofing system of the building is composed of a 4 ply built up roof (Asphaltic impregnated ply). The roofing department at the university estimates the waterproofing to have approximately 10-20 years left in its usable life.
PERFORMANCE ANALYSIS

1. LANDSCAPING

2.1. Analysis of Sill Center Landscaping

The Sill Center adheres to the standards set for University of Utah Landscaping. The architectural landscaping of the Sill Center’s site is minimal. The vegetation located around the building is in accordance with the University of Utah’s Plant List. The trees appear in good health. No visible disease or wounds were observed, although one tree on the Southern end was removed after significant damage due to a severe storm in the fall of 2011. When dealing with the solar aspects of the Sill Center and its adjacent landscaping, there seems to be little application. There are no trees located near windows on the South facing facades, with only one tree located near the east façade. A larger tree is further away from the northern side of the West façade, but it is able to provide shading in the later hours of the day. While there are few trees located near the Sill Center, three trees are located along the northern side of the building. Tags with names and information can be found on most of the older trees. (Fig. 1) This system is no longer used, so tags are absent on newer trees.

Although there is nominal architectural landscaping around the Sill Center, there is one significant program that can be found on the site. The Office of Sustainability runs two “outdoor labs”, one of which is located on the Southwest side of the Sill Center. Plant beds are used by various classes for projects, as well as a thriving co-curricular gardening and food production project. In partnership with various classes and an Edible Campus Garden Student group, a great diversity of plants, mostly annuals with a few additional perennials, are grown. A majority of the plants are started in a Biology Greenhouse where over 40 different varieties of fruits and vegetables are planted.

A few of the current plants include:

- **Heirloom Annuals**: salad greens, kale, collards, arugula, lettuce, radishes, tomatoes, peppers, eggplant, squash, onions, carrots and garlic
- **Perennials**: sage, thyme, lemon balm, rosemary, lavender, shasta daisy, red currants

The program hopes to introduce more plants including hops for a living wall, and grape vines. Funding to run the program comes from the Office of Sustainability, multiple departments, Continuing Education, Biology, produce sales, the Sustainable Campus Initiative Funds, ASUU, and the Lowell Bennion Community Service Center.

![Figure 7 - Metal nametags are located on many of the older trees around the Sill Center, and throughout campus.](image-url)
2. CODE COMPLIANCE (ADA..)

2.1. Overview
As part of any building performance analysis, it is crucial to give attention to building and zoning codes that may pertain to the site or region in which the building exists. Without an awareness of these codes, building components that are essential to the life and functionality of the building may go overlooked. As a result, the building may lack features necessary for the protection, safety, and welfare of building inhabitants.

Of course, not all codes are designed for the purpose of protecting the life safety of building occupants. Many prescribe desirable construction processes; others provide directions for conserving energy over the expected lifetime of the building. Still others discuss sustainable landscaping paradigms, and of course many codes discuss the welfare, comfort, safety, and accessibility of building users, both disabled and not.

The purpose of this analysis of the Sill Center is to assess the current conditions of the building, and address those that do not comply with code. Certainly, to address every component of a half-century old building from a modern-day code standpoint would be inappropriate. To perform such a critique and suggest full-scale update/modification would ignore the historic value of the building, and such an analysis could be intensely long. For this reason, the analysis herein performed addresses only those codes which pertain to life safety and standards set by the American with Disabilities Act. The goal of this analysis is to provide enough information so that building revisions can be suggested that would improve the Sill Center, and create a safer, healthy, and more welcoming space.

The International Existing Building Code provides several different levels of conformance which can be adopted in a building modification project. Information regarding these conformance procedures was collected from Building Codes and Historic Buildings – a National Trust Publication.

“The sliding scale of requirements is called “pro-portionality.” Proportionality is defined as a reasonable relationship between the work an owner wishes to do on an existing building and the additional improvements required to accompany that work as a matter of regulatory policy. To establish predictability and proportionality, the International Existing Building Code divides work on existing buildings into the following categories based on type of work:

- Repair
- Alteration Level 1
- Alteration Level 2
- Alteration Level 3

Repair is defined as “the patching, restoration, or minor replacement of materials, elements, equipment, or fixtures for the purpose of maintaining such materials, elements, equipment, or fixtures in good or sound condition.” Repair involves minor work. It triggers the least level of required building code conformance.

Alteration – Level 1 is defined as “the removal and replacement or the covering of existing materials, elements, equipment, or fixtures using new materials, elements, equipment, or fixtures using new materials, elements, equipment, or fixtures that serve the same purpose.” This level of work involves structural work or extensive repair, but no reconfiguration of floor space.

Alteration – Level 2 is defined as the “reconfiguration of any space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.” This level of work involves changing doors, windows, or partitions, or the installation of equipment, such as new heating or air-conditioning equipment.

Alteration – Level 3 is defined as a situation “where the work area exceeds 50 percent of the aggregate area of the building.” This level of work involves changing hallways, corridors, or exit ways; or work that requires a building or part of a building to be closed for construction. It triggers the highest level of required building code conformance. This is often called a "gut rehab."

As is evident by the existence of these alteration levels, existing buildings are not all required to make full-scale modifications to comply with new codes. Building codes are constantly under revision, so it would be impossible to keep any given building completely up to date for its entire lifetime. When revisions are made, however, the above listed alteration levels should be considered. By doing so, preservation analysis can determine what level of conformance the building must acquire and then design accordingly. The international Building Code confirms this with the following:
**International Building Code 102.6 Existing structures.** The legal occupancy of any structure existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code, the International Property Maintenance Code or the International Fire Code, or as is deemed necessary by the building official for the general safety and welfare of the occupants and the public.

**3407.1 Historic buildings.** The provisions of this code relating to the construction, repair, alteration, addition, restoration and movement of structures, and change of occupancy shall not be mandatory for historic building where such buildings are judged by the building official to not constitute a distinct life safety hazard.

### 2.2. Existing Conditions

Existing conditions of the Sill Center were analyzed with a thorough walkthrough of the building to determine what ADA and life safety codes were lacking. The documented building plans were also analyzed to look at the layout of the building. It was found that many alterations have been made to the building which takes up space originally designed to accommodate safe egress. Hallways and egress areas are currently being used for storage and office space. Hallways are divided up and occupied with cubicles for office space.

There are some obvious concerns regarding Americans with Disabilities Act (ADA) compliance. The cluttered hallways create difficulties for a wheelchair to maneuver. The lower level of the building is really not accessible for wheelchairs as is. It is important that access is provided for wheelchairs that does not require the person in the wheelchair to feel they are not given the same accessibility as those not in a wheelchair. To access the lower level in a wheelchair, one must go around the exterior of the building down a long ramp leading to one door. However, this door is locked at all times for security reasons making it inaccessible. Any sort of weather or rain would also make the ramp either treacherous or unusable for a wheelchair as it is not covered.

There is no elevator in the building making an indoor transition from the two levels impossible for those in a wheelchair. The lower level does not provide an ADA accessible bathroom. Also, the bathrooms upstairs, although sized correctly for accessibility, do not have an automatic door opening system to allow easier access for the disabled. There is currently an automatic door opener for the disabled on the main entrance door. However, it is currently not working properly as it takes a very long time to open. Building codes have been defined to help mitigate some of the existing problems noted above. The codes discussed in this document were collected from the University of Utah supplement of the Division of Facilities Construction and Management requirements (DFCM).

### 2.3. Discussion of Alternatives

The Utah State Building Board sometimes requires higher standards than those suggested by the Americans with Disabilities Act.

3.1.B.1: “It is the policy of the Utah State Building Board that, when appropriate for the intended use of the building and achievable within the project budget, the following accessibility enhancements beyond those required by the Americans with Disabilities Act be provided for in state owned buildings and buildings leased by DFCM or the University: (1) powered door openers for the primary entrance designated for use by people with disabilities, and (2) powered door openers for one uni-sex restroom or for one male and one female restroom in the building unless restrooms with a door-less entry are provided.

As noted, the main entrance to the Sill Center is the only ADA accessible entrance for the entire facility. The current condition of the ADA push-button door opener is somewhat lacking due to the slow operation of the mechanism. Code requires that automatic door openers shall be required on at least one door in all ADA accessible entries, so it is advised that the condition of the current door opener be improved. Furthermore, the lower level of the Sill Center is essentially non-accessible for disabled individuals. To require that disabled individuals leave the building, travel several hundred feet down an unsheltered ramp to a locked back door with no push-button door opener is certainly not ADA code compliant. It is suggested that in a building modification project, new designs should include an elevator. Simply adapting the back door entry into an ADA accessible entrance in insufficient.

As is evident by the existence of these alteration levels, existing buildings are not all required to make full-scale modifications to comply with new codes. Building codes are constantly under revision, so it would be impossible to keep any given building completely up to date for its entire lifetime. When revisions are made, however, the above listed alteration levels should be considered. By doing so, preservation analysis can determine what level of conformance the building must acquire and then design accordingly. The International Building Code confirms this with the following:

The interior of the building has several other issues pertaining to ADA standards as well as life safety. As noted above, the hallways and corridors of the building are cluttered with cubicles, offices, and storage cabinets. The
hallways are also filled with extra furniture and partitions which in some cases makes navigating the hallways difficult. In addition to being inconvenient and against code, this condition can be dangerous and life-threatening – particularly in a fire. In Mechanical and Electrical Equipment for Buildings, suggestions are given regarding design for safe exit during a fire. “Designers can provide clearly defined pathways to exits (exit access) that can be kept relatively clear of smoke. To accommodate a wheelchair, a minimum clear width of 32 in (813 mm) is required.” In a building remodel situation, the Sill Center should consider the safety of all its inhabitants and preserve the space in all corridors.

As codes are constantly changing, an existing building will not comply with all current codes, nor is it expected to be brought into full compliance. The level of alteration the Sill Center goes through will determine the level of compliance the building must meet. As the Sill Center is remodeled, it is recommended that alterations be made to far exceed the ADA requirements since the Sill Center, after all, is meant to be a place where all students can feel welcome.

3. ENERGY

Methodology
To obtain an understanding of how different improvements would affect the energy performance the energy modeling used eQUEST, developed by the Department of Energy, to create an approximation of the existing building’s energy usage. eQUEST allows users to estimate the impact of upgrades to the building envelope and mechanical systems. A breakdown of each energy efficiency measure (EEM) follows with a recommended course of action to improve the overall performance of the building.

Energy modeling for the Sill Center at the University of Utah began with a site visit focused on existing conditions that impact energy consumption. Further understanding was obtained from technical drawings and historical consumption data for the building. We examined floor plans of the building from a recent remodel and used independent measurements of the building to determine the envelope shape. Wall assemblies and their corresponding thermal properties were also investigated. As was common for the era, energy performance was not a priority during the design and construction of the Sill Center, as is evidenced by poor performing walls, roof and windows. The envelope shape and thermal properties were included in the energy model to create a baseline for comparison against potential upgrades. Figure 8 (below) shows the eQUEST 3D visualization.

Another important set of information needed for energy modeling is the lighting power density (LPD), measured in watts per square foot, and the window to wall ratio. This data was collected room by room and included fixture counts and the estimated watts per luminaire. The survey team obtained the wall to window ratio by measuring the existing glazing and walls to obtain a fraction and assigned that percentage of glazing to the digital energy model. The baseline assumptions used for the Sill Center are as follows:

- Above Grade Walls- Three course brick with an overall R-value of 6.4
- Below Grade Walls- 12” Cast in Place Concrete with an R-value of 10.3

1 The savings presented by this report are not intended to reflect the actual building performance, rather they are to be used to prioritize energy saving measures and anticipate approximate savings created by individual EEMs as well as the savings of an interactive measure package.
- Windows: Single Pane Steel Framed with a U-value of 1.1
- Roof: Steel Joist with 2" Rigid Insulation with an R-value of 11.2
- Lighting Power Density: 1.27 w/sf

3.1. EEM 1 - Windows

**Description:** A large factor affecting the Sill Center’s energy performance is the high quantity of glazing. Single pane, steel frame windows are found throughout the building. By decreasing the U value of the glazing and frame systems (increasing the R value), the building will be less affected by the high seasonal temperature differences in Utah, allowing less heat to enter in the summer and reducing the heat loss in the winter. For this study, we examined three upgrades to the window system:

- Window Assembly 1: double pane clear glazing with a thermally unbroken aluminum frame
- Window Assembly 2: double pane low-e glazing with a thermally broken aluminum frame
- Window Assembly 3: triple pane low-e glazing with an insulated fiberglass frame

**Savings:** There is a significant jump in efficiency from the baseline to the first option, going from 1461mbtu to 1425mbtu that represents a 2.5% reduction in whole building energy use. Option 2, which includes a “higher performing” window, actually shows a slight increase in energy consumption for the building over option 1 most likely due to the low-e coating reducing solar gain in the winter. A drop of 0.5% is noticed between options 1 and 3 and considering the cost difference between double and triple glazing, it is the most probable that option 1 is the economically useful upgrade.

**EEM details:** To maintain the historic look of the building, it is also important to choose glazing that does not change the look of the building drastically. Option 1 with its un-tinted clear glazing achieves this. Additional study would be required to investigate the economic return of window upgrades. See Figure 9 below.

![Figure 9 - EEM assessment (windows)](image_url)

3.2. EEM 2 - Walls

**Description:** Wall insulation is an effective way to increase the energy efficiency in a small, envelope dominated building such as the Sill Center. While keeping the existing solid masonry structure, adding insulation either inside the building or outside would be beneficial. To keep the historic character, however, use only those strategies that insulate on the interior, leaving the exterior brick exposed. The investigated interior insulation levels incorporated into framed-out walls include:

- Wall Assembly 1: R-6
- Wall Assembly 2: R-21
- Wall Assembly 3: R-36
Savings: From the baseline insulation of R-6.4, an additional R-6 (bringing the total wall R value to 12.4) shows a significant reduction of 3.4% total building energy usage. From option 1 to 2, an additional 0.6% reduction is observed. From option 2 to 3, the energy consumption is reduced an additional 1.1% bringing it to a total of 5.1% less than the baseline.

EEM details: This was the highest energy-saving measure studied and it typically comes at a lower price than most EEMs. R-21 is easily achievable in a 2x4 framed out wall at a low cost and this level of insulation would be advisable for an energy upgrade. See Figure 10 above.

3.3. EEM 3 - Additional Roof Insulation

Description: To reduce the amount of energy used for heating and cooling the Sill Center, additional insulation can be added to the current roof assembly. The Sill Center currently has just two inches of roof insulation for an R value of just over 11.2. Several insulation options have been examined. They include the following:

- Roof Assembly 1: R-13
- Roof Assembly 2: R-34
- Roof Assembly 3: R-42
- Roof Assembly 4: R-59

Savings: For this EEM, the additional insulation increased overall energy performance between 1-2%. Roof Assembly 1 reduced the energy use of the building by 1% overall while the last three options were 2% increases with slight performance increases with each roof assembly. Roof assembly 2 has proved to be the most cost effective means with the greatest energy savings.

EEM details: Roof insulation is generally one of the most important elements required for good energy performance. The current roof assembly at the Sill Center is lacking greatly in its energy performance. Using the space below the roof assembly between the roof joists is a simple addition to add insulation while rigid board insulation can be added to the top of the roof assembly for additional energy savings. This will reduce heat loss in the winter and heat gains in the summer lowering the overall energy consumption of the building. See Figure 11 below.
3.4. EEM 4 - Daylighting Controls
Description: To conserve electricity daylighting controls can be installed within the Sill Center to utilize natural light when it is sufficient to light the building. No controls are currently installed in the building. It is recommended that a two way stepped lighting control unit capable of operation at full power, 50%, and off be installed to manage the lighting usage in the building. This would be set at 50 foot candles.

Savings: Daylighting controls will reduce the electrical energy consumption of the building by utilizing natural light instead of light fixtures to light the building when sufficient light is available.

EEM Details: Adding the stepped daylighting controls decreased the overall energy consumption of the building by 2%. This is a simple solution with a large reduction in energy usage which requires no large modifications to the existing building.

4.5. EEM 5 - Lighting Power Density (LPD) Reduction
Description: To reduce the amount of electric energy used for lighting the Sill Center, high efficiency lights can be used. Currently the Sill Center uses linear fluorescent lights as well as recessed can lights. The lights could be upgraded to high efficiency fluorescent lights with high efficiency ballasts in some cases and removed entirely in other cases.

Savings: Lighting in the Sill Center account for approximately 16% of the total energy consumption. Currently, the building LPD is 1.27 watts/square foot of space. If this building were built under the current code, it would be required to be under 1.0 w/sf.

EEM details: For this EEM, the LPD was reduced from 1.27 to 0.8 w/sf. The observed result was a 3% reduction from the baseline. Shown below in Figure 12 is a table of all EEMs studied.

The existing building was modeled as closely as possible, using observed envelope, mechanical and electrical systems to create a digital approximation of how the Sill Center would perform on a typical weather year. The team modeled the building according to ASHRAE 90.1 Appendix G, the current building code for Utah. This contained specified values for the windows, exterior wall assemblies and roof. The as-is “baseline” model projected an annual consumption of 1461 mbtu. The code compliant model projected 1351 mbtu annually, 8% lower than the existing building. The existing building does not meet the current energy code.
3.5. **Recommended Strategy**

Previously, each measure was evaluated independently against the baseline model. As a recommendation, six measures were combined as a package where the savings are cumulative and dynamic, showing additive effects of implementing several measures in the building. See Figure 13 below for a table of combined measure energy impacts. The final recommended measure package consists of:

- Clear Double Pane windows (u 0.52)
- R-21 Insulation for exterior walls
- R-31 insulation for the roof
- 3 step daylighting controls
- Reduced Lighting Power Density
This is the most practical and cost effective selection from the EEMs considered, although a deeper analysis including costing data and a life cycle analysis would be necessary to optimize performance within a budget. Window upgrades are typically costly but considering the performance of the original windows, an upgrade would most likely make economic sense. A double-paned clear window can preserve the look of the historic building to as much an extent as possible. Due to the passive solar heat gain they allow in winter, they reduced the overall energy consumption of the building when compared with the higher insulating, more expensive low-e coated windows. Wall insulation had the biggest effect on energy performance in the individual EEM study. To preserve the appearance of the brick exterior walls, place insulation in the interior of the building and not to the exterior. Using a standard 3.5” frame wall, an additional R value of 21 can be achieved at a low price. Another large impact observed was with the addition of roof insulation, both to the roof trusses in the form of batt insulation and as a continuous layer of rigid foam on the roof surface. The implementation of daylighting controls reduces the amount of electrical energy the building requires but also incurs a penalty on the heating load in winter due to the loss of heat produced by electric lights when daylight controls have them off. This penalty also occurs with a reduced lighting power density, more efficient lights produce less heat, but the electric reduction is greater than the lost heating energy. These combined measures reduce the annual energy consumption to 1,264 mbtu, an overall net 13% reduction from the baseline and 6% better than a modern code compliant Sill Center.

3.6. Utility Data
The University of Utah campus does not meter the utilities for every one of its building, and therefore comprehensive utility data was not available. Electrical consumption is metered for the Sill Center, but water and gas consumption are not. The utility section will therefore focus primarily on electricity.

The eQUEST energy model projected an overall energy consumption distribution as follows. In lieu of specific gas consumption data, this distribution will be helpful to keep in mind as this report outlines different energy scenarios.

![Projected Energy Distribution](image)

Table 4 - Gas versus power distribution

Month by month electrical utility data was available from the Facilities Management Department.
According to Facilities Management, the gross square footage of the Sill Center is 13,107 sq ft. Consumption data on a per square foot basis is obtained from this information, and compared to the campus at large, for the years 2008 – 2011.

The Sill Center has experienced a fairly consistent reduction in electricity consumption over the last four years. Interestingly, the consumption for the entire campus and the Sill Center both drop by exactly 14 percent between 2009 and 2010. Then between 2010 and 2011, the Sill Center drops yet another 30 percent, while the entire campus continues to drop, but only by 3 percent. Certain campus wide initiatives illustrate possible causes for these recent trends. The Sill Center installed a solar array in December 2009, which is likely accounting for at least a portion of their reduced consumption. University of Utah implemented a cogeneration power plant in 2008. It is likely that these initiatives had an effect on energy consumption, but there are undoubtedly other factors as well.

The electricity cost follows a similar trend as the consumption, which is to be expected. Energy costs per unit of energy fluctuate over time, generally trending upwards.
In 2011, the University of Utah paid roughly 5 cents per KWH, and $1.32 per Therm. The total University cost was over $12 million for electricity, and almost $18 million for gas.

With its solar panels and associated advertising campaign, the Sill Center has positioned itself as a model campus building for energy generation on a localized scale. This identity should continue to be cultivated with any changes that are made to the building.

**RECOMMENDATIONS AND SUMMARY**

**Culture**

- **Workplace**
  - Stabilize building temperatures
  - Renovate basement to make more inviting and user friendly
  - Update lighting system to resolve current low lighting concerns

- **Acoustical Performance**
  - Better insulate conference room and lobby to prevent sound transference to basement
  - Investigate AC issues to produce a more silent solution

- **Features to Keep in the Sill Center**
  - Keep natural lighting and all windows
  - Keep/invest in gardens and green spaces
  - Bring more/keep green features of the building. (recycling, solar panels, energy projects)
  - Keep current large conference room

- **Improvement Ideas for the Sill Center**
  - Student Lounge
  - More LEAP offices on the main floor
  - Improved lighting in the building
  - HVAC/AC improvements
  - Better use of space, there are lots of unutilized space
  - Improvement of exterior aesthetics
  - Bathrooms need to be improved
  - Basement is depressing and is not conducive to collaboration or collegiality
**Code Compliance**

- Clean hallways/readjust cubical locations to maintain clear paths of egress throughout hallways
- Redesign egress paths to basement facility to be ADA compliant
- Integration of an elevator system as well as automatic doors
- Renovate bathrooms specifically basement bathroom to be ADA Compliant

**Energy**

- Clear Double Pane windows (u 0.52) to better insulate the building from heat transference and to preserve current historical aesthetic
- R-21 Insulation for exterior walls to better insulate current envelope, meet code and stay low cost.
- R-31 insulation for the roof to insulate current envelope
- 3 step daylighting controls to provide more efficient lighting
- Reduced Lighting Power Density to reduce power consumption and heat gain throughout the building.

**Conclusion**

The Sill Center once represented a standard of excellence, which housed programs that became templates for similar programs on a national scale. The Sill Center should be remembered for its past, and preserved for future generations of university students in a way that allows it to lead from a new focus, as a building responsive to environmental, educational, economical and occupant concerns. The Sill Center can achieve a renewed presence on the university campus, but in order for this to happen, changes must be made. The research and recommendations contained in this paper represents a foundation and a starting point from which these changes might begin to occur.
### Top 3 Spaces

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### Summary Statistics

| Average | 3.92 | 4.23 | 2.62 | 2.62 | 3.56 | 3.38 | 3.35 | 2.92 | 3.54 | 3.00 | 3.17 | 3.45 | 2.42 | 2.58 | 3.08 | 3.08 |
| StDev    | 1.08 | 1.17 | 0.96 | 0.87 | 1.38 | 1.26 | 0.99 | 1.32 | 1.27 | 1.00 | 1.11 | 1.04 | 1.00 | 1.08 | 1.15 | 1.00 |
Work Place Comments

Survey #

1. Temperature Control in my office is difficult to impossible. Very often it is too hot in my office.

2.

3.

4. The light in 005A sometimes goes off, while the rest of the office remains lit.

5. The basement is pretty isolated, but the 3 of us in 005 get to interact together but rarely with those upstairs. Basement office has not working vents for cooling or heating

6. Working in the basement is a psychological downer

7.

8. I'm in a cubbie

9. Love my view, enough space to have private meeting

10. Space is rather cave like. Office either too hot or too cold

11. I have my space heater on quite a bit, even in the summer- it's usually freezing or broiling in here, also, I have fluorescent lighting

12. In east office of CTLE there is not a happy medium of temperature. Too hot or too cold. Too hot during week, too cold Monday morning

13. Lots of natural light which is good, but it get very dark on cloudy days and in the evening
Acoustical Performance Comments

Survey #

1

2

3 Work in the hall, so that impacts results

4

5 In 005 basement. We can hear the large conference room when it gets noisy or there are lots of people

6

7 My office is right next to a mechanical room, so the noise is pretty regularly loud.

8 You can hear everything

9 Room #116 is so noisy even though we paid to have the doors sealed, it makes a terrible office for that person, and noises carry. When the roaring air conditioning turns off around 5pm you can hear conversations way down the halls, in detail.

10 Probably the quietest in the building

11 There are a lot of hard surfaces in the hall so it can get loud at times

12

13 When meetings get out of the large conference room the lobby gets unbearably loud.
APPENDIX B
Landscape
APPENDIX C
Construction Documents

C.1 – “First Floor Framing Plan: Home Economics – Living Center” 1951 (Ashton, Evans and Grazier)
C.2 – “As Built Documents – Second Floor Plan” 1995 (DMJM)
C.3 – “As Built Documents – Roof Plan” 1995 (DMJM)
C.4 – “Contract Documents – First Floor Plan” 1995 (DMJM)
C.5 – Wall Types Diagram, 2012
APPENDIX D
Applicable codes

The following represent the minimum codes and ordinances for which projects must comply (conflicts must follow the most stringent).

(a) Boiler and Pressure Vessel Regulations, State of Utah
(b) Federal Manufactured Housing Construction and Safety Standards Act (HUD), as approved per the Utah Administrative Code R156-56
(c) International Building Code (IBC), approved version per the Utah Administrative Code R710-4, and as amended by Utah Administrative Code R156-56
(d) International Energy Conservation Code (IECC), approved version per the Utah Administrative Code R156-56
(e) International Fire Code (IFC), approved version and amended per the Utah Administrative Code R710-4
(f) International Fuel Gas Code (IFGC), approved version per the Utah Administrative Code R710-4
(g) International Mechanical Code (IMC), approved version per the Utah Administrative Code R710-4 and as amended by R156-56
(h) International Plumbing Code (IPC), approved version per the Utah Administrative Codes R710-4 and R156-56
(i) International Residential Code (IRC), approved version per the Utah Administrative Code R156-56
(j) Life Safety Code (LSC), as approved and amended in the Utah Administrative Code R710-4
(k) Model Energy Code
(l) National Electrical Code (NEC), approved version per the Utah Administrative Code R156-56
(m) National Fire Protection Code (NFPA), as approved and amended in Utah Administrative Code R710-4
(n) Pipeline Safety Regulations, Parts 191 & 192, Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety
(o) Planning & Design Criteria to Prevent Architectural Barriers for the Aged and Physically Handicapped
(p) Salt Lake City Ordinances (Where Applicable, i.e. Research Park and off-Campus Locations)
(q) Standard for Energy Efficiency in New State Buildings
(r) University of Utah Design Standards (DFCM Design Manual, University of Utah Supplement)
(s) Utah Occupational Safety and Health Rules & Regulations (UOSH)
(t) Utah State Building Board
(u) Utah State Fire Marshal Requirements
(v) Utah State Department of Health Requirements
(w) All applicable rules of the Utah Administrative Code

(2) The following are added to the lists above to represent industry standards for which projects must comply (conflicts must follow the most stringent).

(a) Air Conditioning and Refrigeration Institute (ARI)
(b) Air Diffusion Council (ADC)
(c) Air Movement and Control Association (AMCA)
(d) American Concrete Institute (ACI)
(e) American Concrete Research Institute (ACRI)
(f) American Gas Association (AGA)
(g) American Institute of Steel Construction (AISC)
(h) American National Standards Institute (ANSI)
(i) American Public Works Association (APWA)
(j) American Society of Heating, Refrigeration & Air Conditioning Engineers (ASHRAE)
(k) American Society of mechanical Engineers (ASME)
(l) American Society for Testing and Materials (ASTM)
(m) American Water Works Association (AWWA)
(n) Associated Air Balance Council (AABC)
(o) Cooling Tower Institute (CTI)
(p) ETL Testing Laboratories (ETL)
(q) Heat Exchange Institute (HEI)
(r) Hydraulic Institute (HI)
(s) Hydronics Institute (HI)
(t) Industrial Ventilation, A Manual of Recommended Practice (ACGIH)
(u) Institute of Electrical and Electronic Engineers (IEEE)
(v) International Society of Arboriculture (ISA)
(w) Irrigation Association
(x) Masonry Institute of America (MIA)
(y) Questar-Recommended Good Practices for Gas Piping and Appliance Installations
(z) National Electrical Manufacturers Association (NEMA)
    (aa) Scientific Apparatus Makers Association (SAMA)
(bb) Sheet Metal and Air Conditioning Contractors’ National Association (SMACNA)
(cc) Thermal Insulation Manufacturers Association (TIMA)
(dd) Tubular Exchanger Manufacturers Association, Inc. (TEMA)
(ee) Underwriters Laboratories (UL)
(ff) United States of American Standards Association (USAS)
## APPENDIX E

### Power Data

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**YEARLY AV** 281,723.24

*For 2006, November, *current read is lower than last read. So, an average of surrounding months is used, for statistical purposes.*  
*There was no data available for December 2011, so 2010’s December data is substituted for analysis.*
SOURCES


DMJM Architects/Engineers. 1996. As built Second Floor Plan: As built Roof Plan, Contract Documents First Floor Plan, Office of Undergraduate Studies; Univ. of Utah, Salt Lake City, Utah.


“Ground Breaking.” Folder 1, number 6. University of Utah Archives B Sill Center.

“The Joseph F. Smith Family Living Center, ca. 1956” Brigham Young University Harold B. Lee Library.

“Living Room.” Folder 1, number 3. University of Utah Archives B Sill Center-Interior.

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