8-2021

Smith Neilson Library: The Sustainability Story

Smith College

SMITH NEILSON LIBRARY

The Sustainability Story

COLLABORATIVE TEAM

The Smith College Neilson Library project engaged over 1,900 Smith community members and dozens of expert consultants in its planning process. The project embodies the trifecta of deep research, expertise and community engagement.

Owner:	Smith College
Design Architect	Maya Lin Studio
Architect:	Shepley Bulfinch
Energy:	Transsolar
MEP:	Vanderweil
Lighting:	Tillotson Design Associates
Landscape:	Ryan Associates
Civil:	Nitsch Engineering
Sustainability:	Thornton Tomasetti
Construction Manager:	Shawmut Design and Construction

SUSTAINBILITY WORKSHOPS

Sustainability is a priority of Smith College and therefore it was prioritized as a key discussion topic during early design meetings and workshops for the Neilson Library. Key stakeholders discussed and prioritized opportunities that aligned with larger goals of the campus (i.e. net zero carbon campus by 2030).

Photos from early workshops with key stakeholders of the Neilson Library

SUSTAINBILITY CHARTER

A Sustainability Charter was developed as a guiding document for the Neilson Library that summarized the sustainability goals and referenced requirements from targeted third-party certification programs (including LEED, Passive House and Living Building Challenge). It highlights **four primary focus areas** deemed highest priority for the Neilson Library in regards to sustainability impact.

Neilson Library Sustainability

5 October 2016

Sustainability is a priority of Smith College and will be reflected in the design of the new Neilson Library.

Smith is committed to a net zero carbon campus by 2030. The design of the new Neilson is informed by input from the campus community and a number of sustainable building standards (including LEED). The following four areas are the focus for sustainable design in the project.

1. ***The new Neilson is smaller than the old, featuring collaborative use of space which reduces energy use and carbon emissions.***
   The project embodies the notion of using and reusing shared physical resources -- library collections and space -- as an inherently sustainable practice.

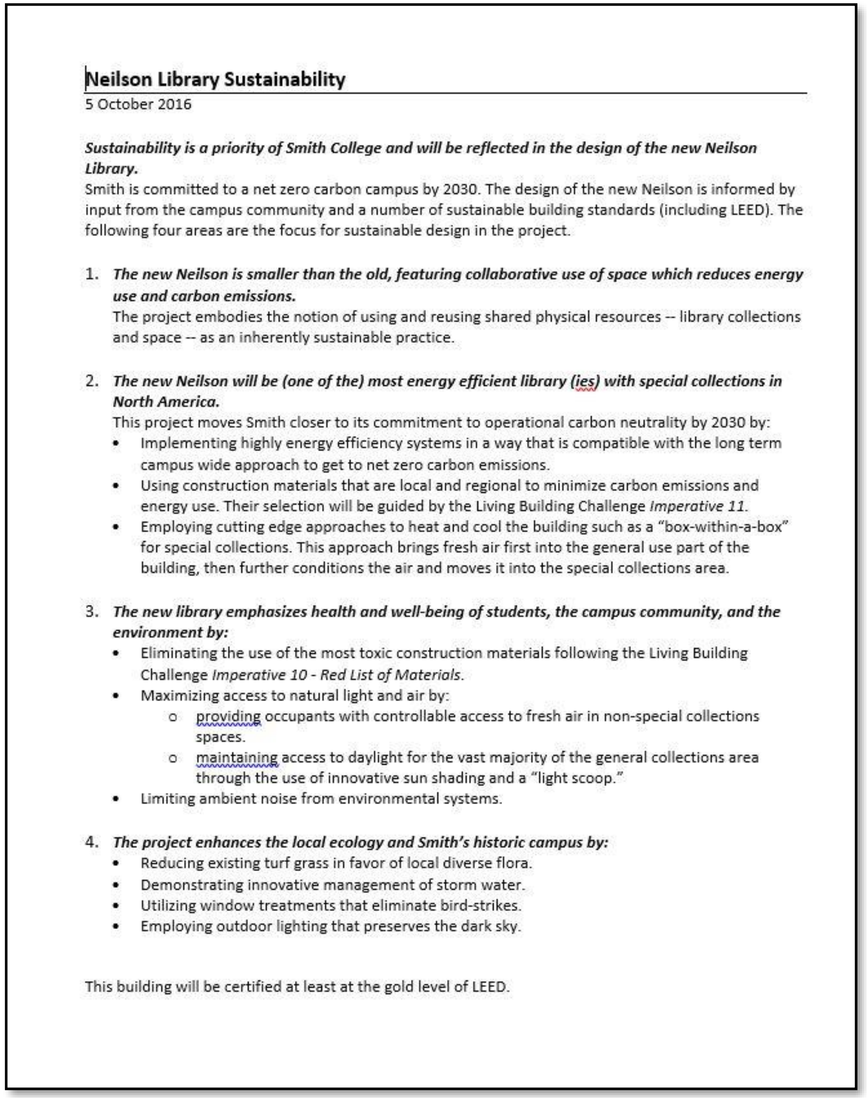
2. ***The new Neilson will be (one of the) most energy efficient library (ies) with special collections in North America.***
   This project moves Smith closer to its commitment to operational carbon neutrality by 2030 by:
   - Implementing highly energy efficiency systems in a way that is compatible with the long term campus wide approach to get to net zero carbon emissions.
   - Using construction materials that are local and regional to minimize carbon emissions and energy use. Their selection will be guided by the Living Building Challenge *Imperative 11*.
   - Employing cutting edge approaches to heat and cool the building such as a "box-within-a-box" for special collections. This approach brings fresh air first into the general use part of the building, then further conditions the air and moves it into the special collections area.

3. ***The new library emphasizes health and well-being of students, the campus community, and the environment by:***
   - Eliminating the use of the most toxic construction materials following the Living Building Challenge *Imperative 10 - Red List of Materials*.
   - Maximizing access to natural light and air by:
     - providing occupants with controllable access to fresh air in non-special collections spaces.
     - maintaining access to daylight for the vast majority of the general collections area through the use of innovative sun shading and a "light scoop."
   - Limiting ambient noise from environmental systems.

4. ***The project enhances the local ecology and Smith's historic campus by:***
   - Reducing existing turf grass in favor of local diverse flora.
   - Demonstrating innovative management of storm water.
   - Utilizing window treatments that eliminate bird-strikes.
   - Employing outdoor lighting that preserves the dark sky.

This building will be certified at least at the gold level of LEED.

FOUR PRIMARY SUSTAINABILITY GOALS



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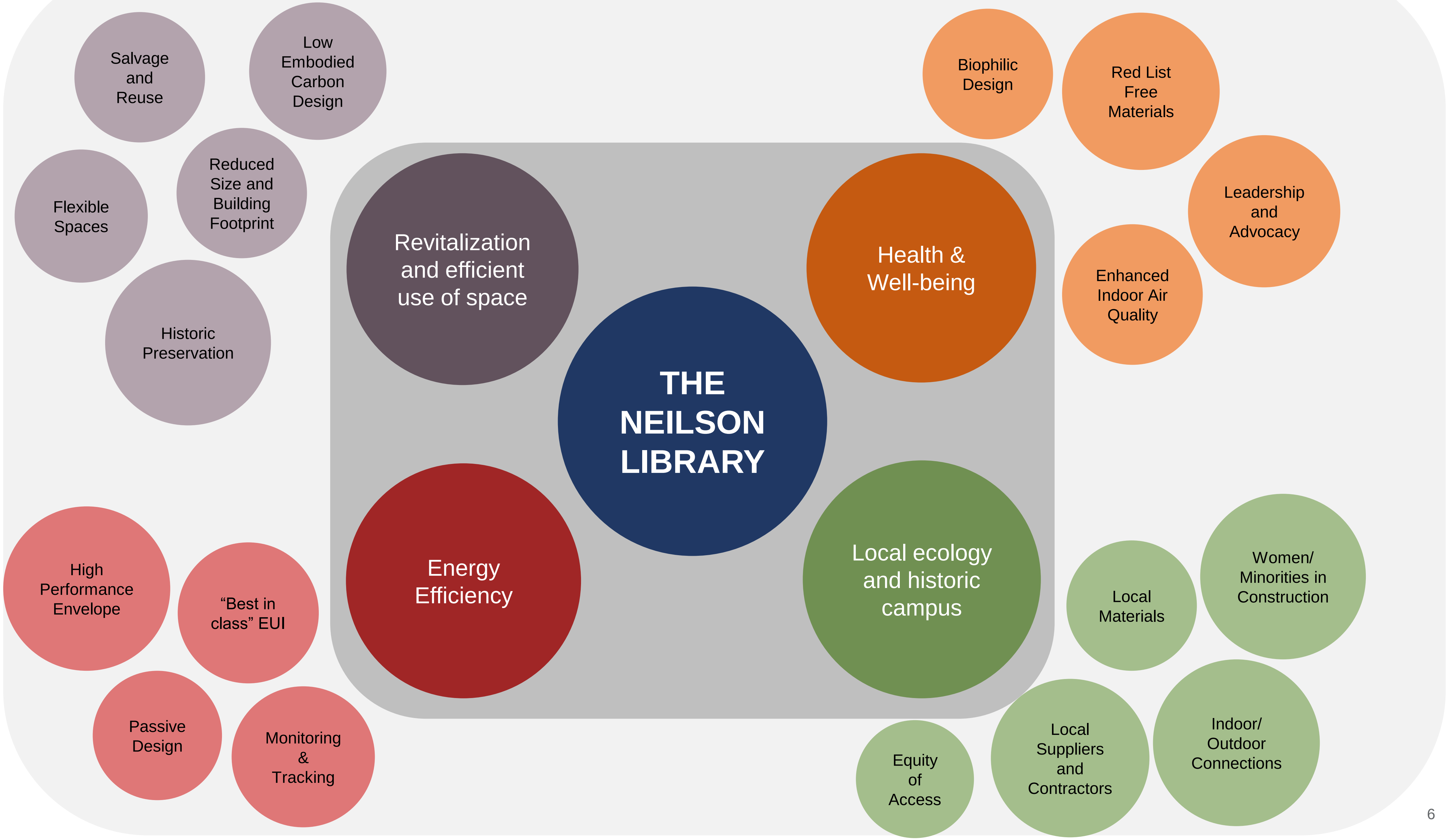
The new Neilson Library will:

1. Feature collaborative use of space which reduces energy use and carbon emissions.

2. Be one of the most energy efficient libraries with special collection spaces in North America.

3. Emphasize health and well-being of students, campus community and the environment.

4. Enhance the local ecology and Smith's historic campus.



Salvage and Reuse
Low Embodied Carbon Design
Flexible Spaces
Reduced Size and Building Footprint
Historic Preservation
Revitalization and efficient use of space
THE NEILSON LIBRARY
Health & Well-being
Biophilic Design
Red List Free Materials
Leadership and Advocacy
Enhanced Indoor Air Quality
Energy Efficiency
High Performance Envelope
"Best in class" EUI
Passive Design
Monitoring & Tracking
Local ecology and historic campus
Local Materials
Women/ Minorities in Construction
Equity of Access
Local Suppliers and Contractors
Indoor/ Outdoor Connections

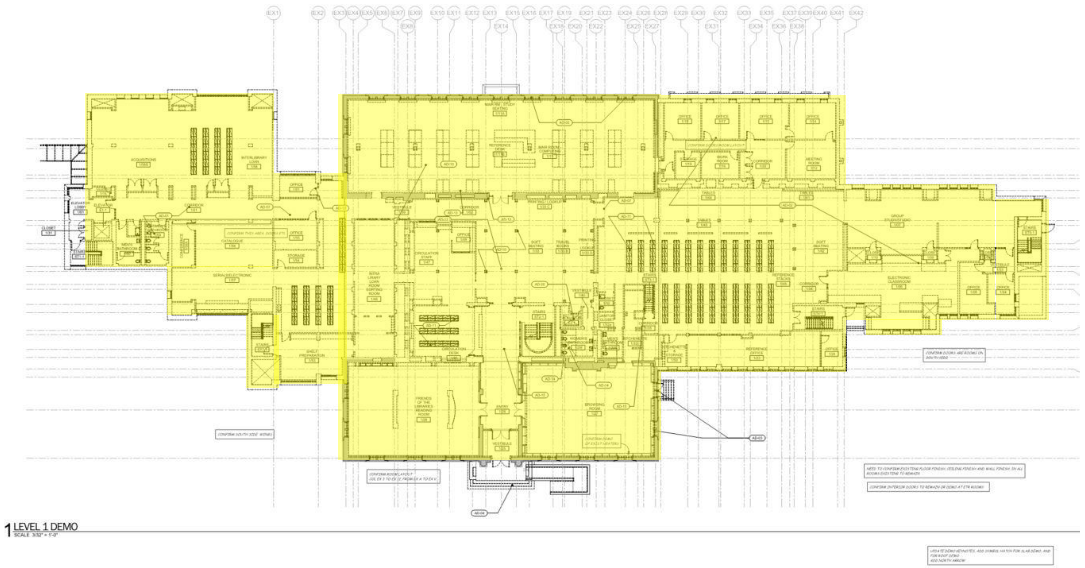
SUSTAINABILITY PRIORITY 1

The new Neilson is smaller than the old, featuring collaborative use of space which reduces energy use and carbon emissions.

- Reduced Size
- Flexible Spaces
- Historic Preservation
- Salvage and Reuse
- Low embodied carbon design

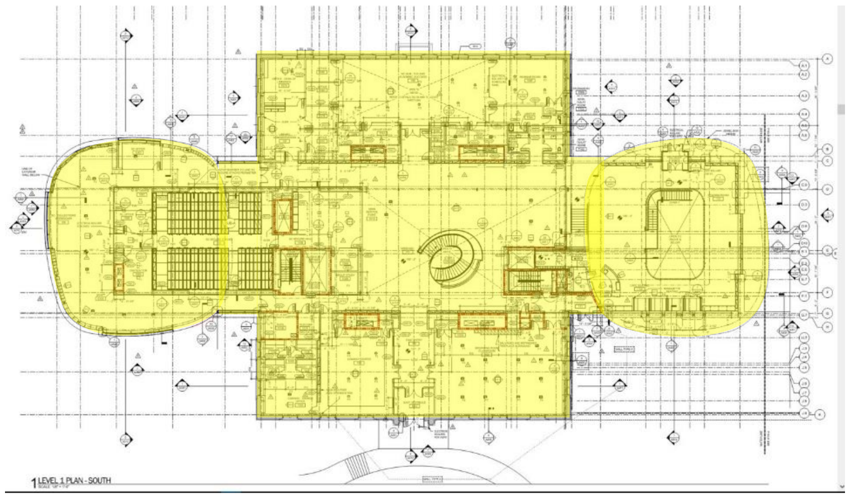
REDUCED SIZE

A decision was made in early design phases to be **“A Better, Not Bigger, Library”**. The original Neilson Library was the largest building on campus, accounting for 6% of the college’s indoor space. The new design is 25% smaller than the original structure, decreasing it from approximately 200,000 SF to approximately 150,000 SF. (i.e. slightly smaller than the size of one football field). This results in less heating and cooling, and operational costs for Smith College.



Original Neilson Library

Approximately 200,000 SF



New Neilson Library

Approximately 150,000 SF

PROCESS FOR PRESERVATION

The façade was determined to be far more structurally unstable than initially anticipated based on the original structural drawings. This resulted in a three-month process to install helical anchors and perform pressure grouting. Xray imaging was used to find voids and workmanship issues within the exterior walls. A specialist was brought on-board to design custom connections and drill through original brick.




Photo credits: Shawmut Design and Construction

The image on the left highlights the eye hooks, which were screwed into large pieces of stone at the top of the wall with tension cables down to the foundation to prevent the exterior facade from turning outward.

SALVAGED AND REUSED MATERIALS

Salvaged materials were prioritized for the project to reduce the embodied carbon associated with procuring new building materials. These salvaged materials include brick, millwork, and light fixtures.

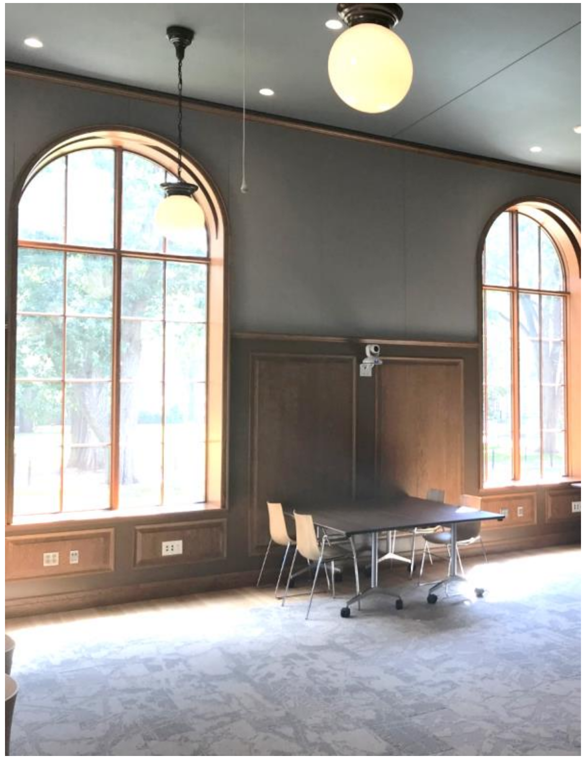


Photo credits: Shawmut Design and Construction

Salvaged building materials include brick for the reconstruction of the Neilson façade, salvaged millwork for the Browsing Room, and restored original exterior scone light fixtures for use on the front side entry of Neilson Library.

ELM TREE STORY

There was a 130-year-old Elm Tree located on the project site that needed to be removed for the new Neilson Library. Smith worked closely with the Botanical Gardens to remove the at-risk tree, and Maya Lin requested the trunk be kept for the design team.

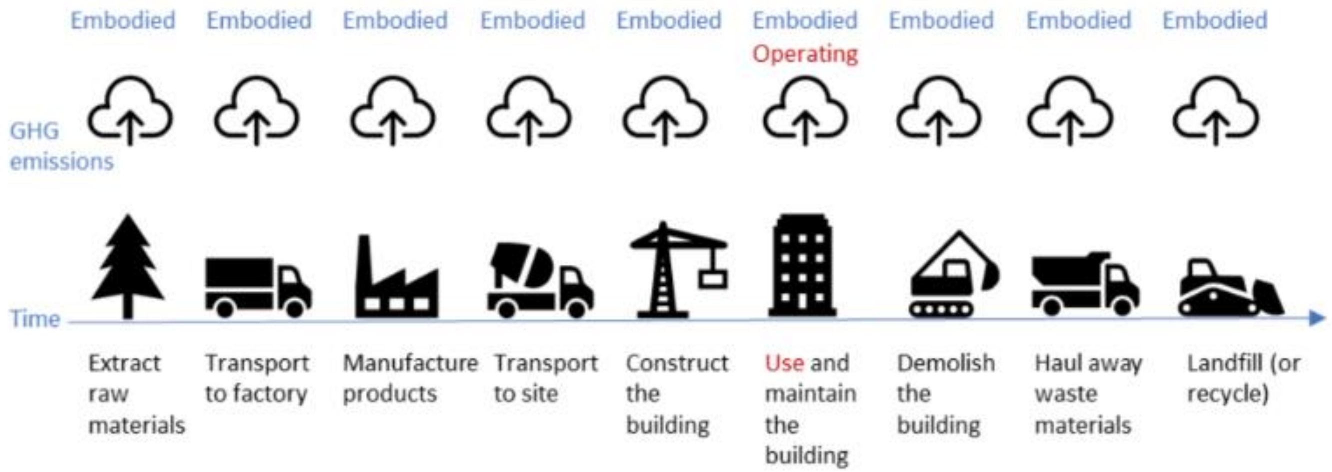
- ❖ Gill CC woodworking was hired to craft three 11-foot reading tables, four nine-foot benches, and two coffee tables from the elm that involved close collaboration with Maya Lin.

- ❖ Rings of the tree can be counted on the coffee tables. This is being turned into artwork to mark historical events over the last 130 years.

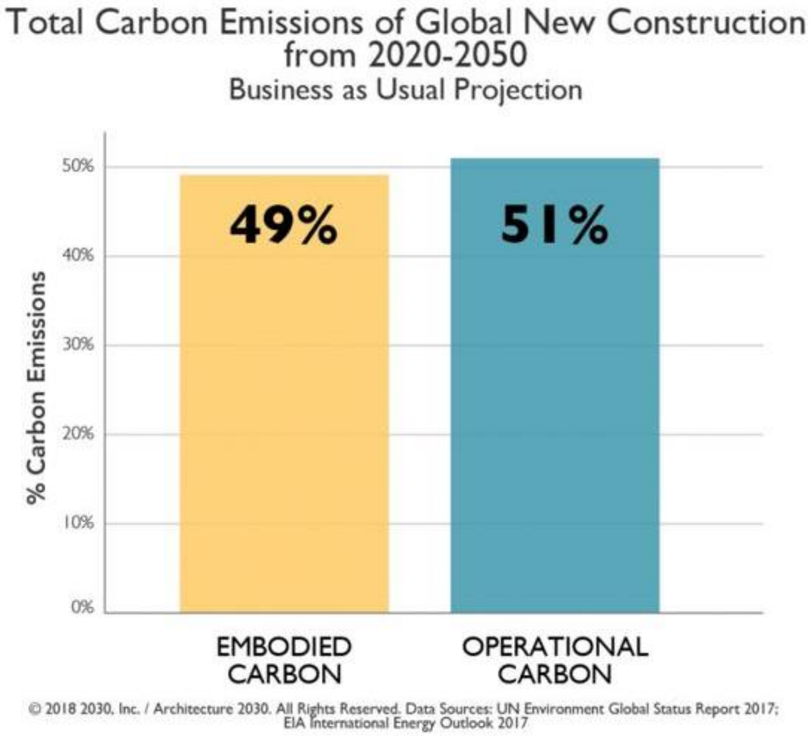
Source: https://libraries.smith.edu/news/2020/08/live-edge-furniture-production-neilson-library

EMBODIED CARBON

With buildings getting more efficient from an operational carbon perspective (i.e. the carbon emissions associated with operating a building once it is occupied), embodied carbon becomes an increasingly important topic. Embodied carbon encompasses the carbon dioxide (CO_2) emissions associated with materials and construction processes throughout the entire lifecycle of a building. This includes the CO_2 emissions resulting from extracting, manufacturing and transporting materials to the site, and the emissions associated with end of life.



Credit: Embodied Carbon of Buildings and Infrastructure: International Policy Review report, September 2017



EMBODIED CARBON: NEILSON LIBRARY

Images highlighting the timber-framed curtain wall.

Image credits: Top, Smith College, The New Neilson Video Tour March 2021. Bottom, Shawmut Design and Construction

1. **Whole building Life Cycle Assessment**

   A whole building Life Cycle Assessment (LCA) was performed during design to study opportunities to reduce the embodied carbon in the structure and enclosure of the Neilson Library. It demonstrated the following achievements in six impact categories:

   - 19% reduction in Global Warming potential (greenhouse gases)
   - 24% reduction in depletion of the stratospheric ozone layer
   - 16% reduction in the acidification of land and water sources
   - 19% reduction in eutrophication
   - 13% reduction in the formation of tropospheric ozone
   - 0.6% reduction in the depletion of non-renewable energy sources.

2. **Low Carbon Material Selection**

   In order to reduce embodied carbon in the new Neilson, wood was prioritized for its low carbon impact and biophilic properties, and its tactile expression of sustainability. This includes wood flooring, wood stacks, wood railings, wood furniture, and timber-framed curtain wall (i.e. non-structural exterior wall in the jewel boxes).

EMBODIED CARBON: LCA

The results from the whole building life cycle assessment (LCA) have been provided below. The baseline represents a typical regional building and includes typical percentage of recycled steel, aggregates to concrete, and minimum code insulation. The model then reports on performance as compared to this baseline and relevant to the impact categories listed below. See full LCA report fore more information.

The life cycle assessment was calculated using One Click LCA. The results are summarized in following table. The results represent the total life cycle impact during 60 year service life.

Impact category	Unit	Baseline result	Proposed design result	Reduction, %
Global warming potential (greenhouse gases)	$kgCO_2$ eq	2,323,833	1,871,694	-19
Depletion of the stratospheric ozone layer	kgCFC-11 eq	11.34	8.58	-24
Acidification of land and water sources	$kgSO_2$ eq	9,665	8,159	-16
Eutrophication	N eq	3,425	2,790	-19
Formation of tropospheric ozone(photochemical oxidant formation)	NO_xeq	121,867	106,561	-13
Depletion of non-renewable energy resources	MJ	222,257,884	220,906,463	-0.6

Number of environmental impact categories with more than 10 % reduction: 5

A minimum of 3 impact categories need to achieve 10% or more reduction. Neilson Library achieved this requirement in 5 out of the 6 categories.

Image credit: Excerpt from whole building life cycle assessment report produced by Thornton Tomasetti.

EMBODIED CARBON: CONCRETE

As one of the most popular building materials given its versatility, durability and affordability, **concrete accounts for 8% of the global CO_2 emissions.** Concrete is a mix of water, aggregates, chemical additives and cement, which generates most of the concrete's emissions. To reduce carbon emissions, supplementary cementitious materials (SCM) were used to replace cement quantity. This includes byproducts like fly ash from coal-fired power plants and blast furnace slag from iron and steel products. **The concrete used on the Neilson Library contains 20% fly ash and 30% slag to help achieve carbon reduction goals.**

Photo credits: Shawmut Design and Construction

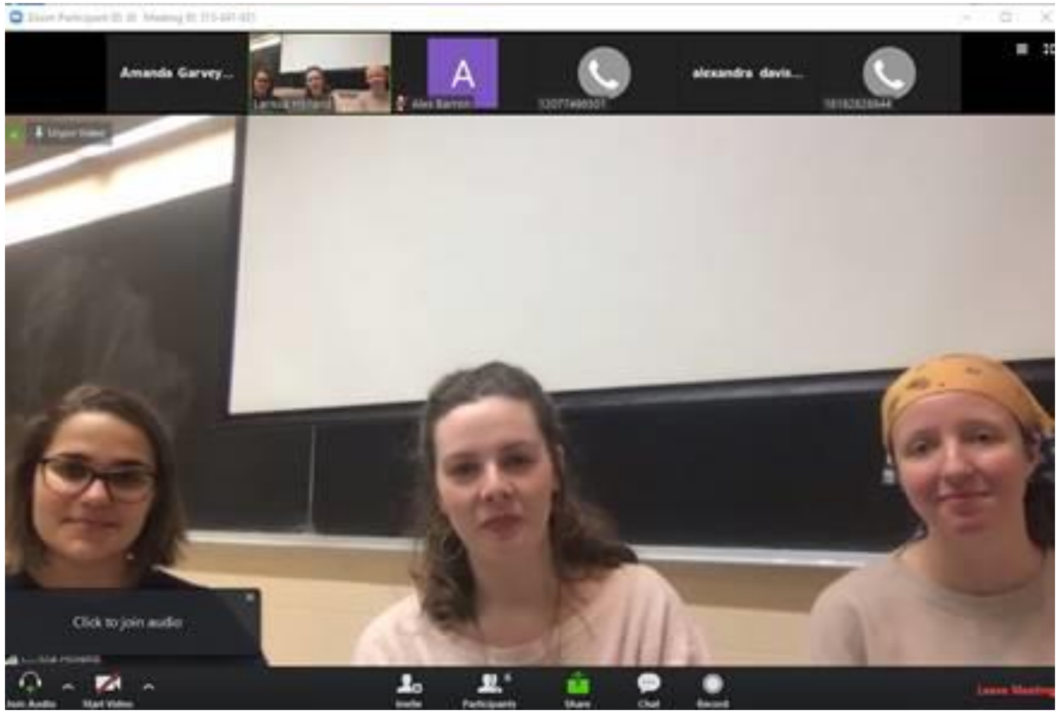
*The Neilson Library used 7,534 cubic yards of concrete in its construction. A cement truck can typically hold 10 cubic yards. This equates to **753.4 cement trucks.***

EMBODIED CARBON: CAPSTONE PROJECT

The LCA consultant, Thornton Tomasetti, partnered with Smith College to support a capstone research project related to embodied carbon on Smith's campus. The final report **"Exploring Embodied Carbon within Smith College Construction"** utilizes Neilson Library as a case study and provides recommendations for Smith College Campus Planning, Capital Construction and future students related to embodied carbon.

Highlights from this report:

1. Set goals for embodied carbon within construction materials
2. Partner with contractors and consultants who make the reduction of embodied carbon a priority
3. Explore the idea of using mass timber in future projects
4. Analyze how different embodied carbon calculators fare in comparison to each other.
5. Calculate how much of Smith's Scope 3 construction emissions are from embodied carbon in building materials



Screenshot from virtual meetings between Thornton Tomasetti and Smith students

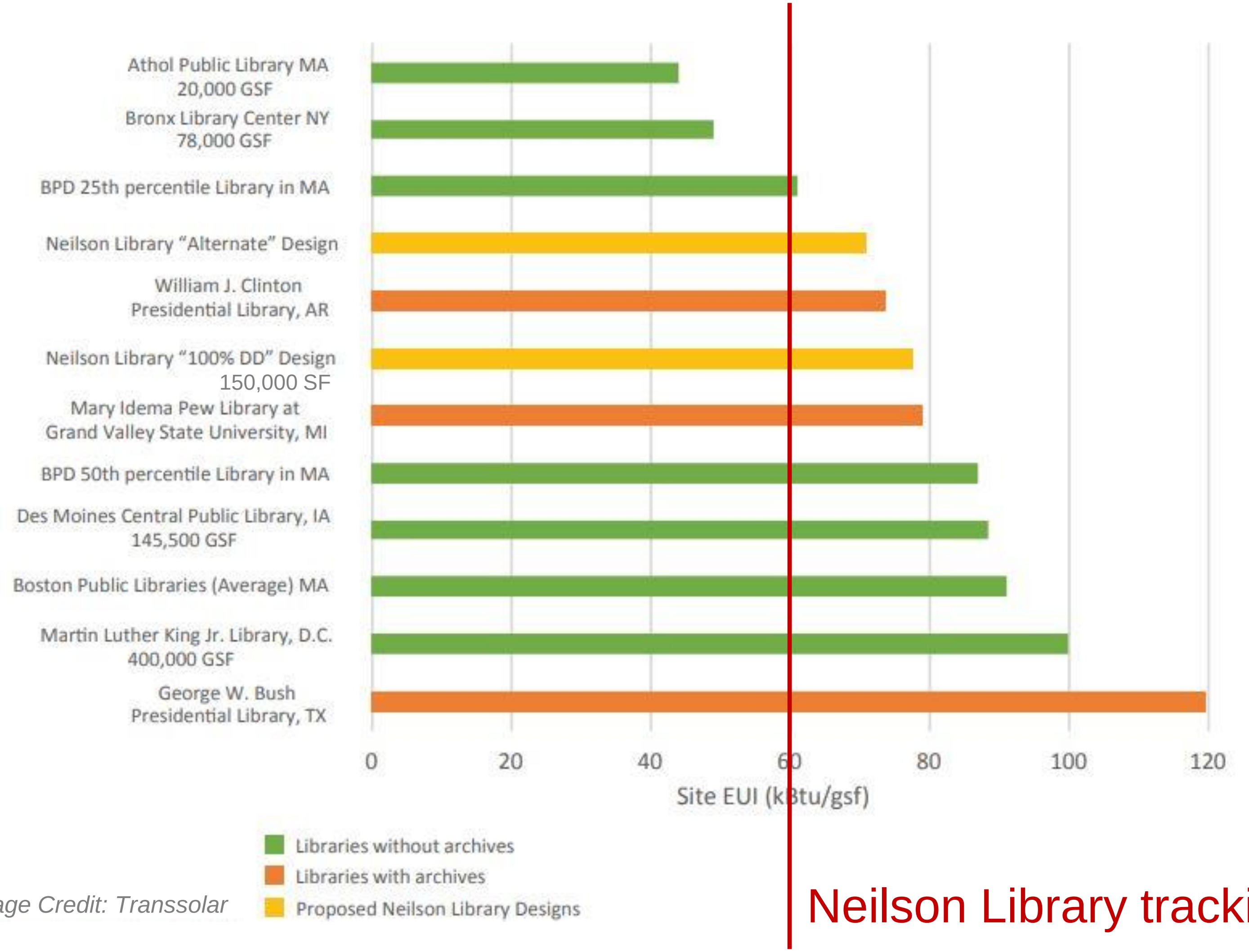
SUSTAINABILITY PRIORITY 2

The new Neilson will be (one of the) most energy efficient library (ies) with special collections in North America

- Passive Design
- High Performance Envelope
- Load Reduction
- High Efficiency HVAC
- Special Collections
- Monitoring and Tracking

FIRST STEP: ENERGY BENCHMARKING

The team performed energy benchmarking studies to better define the “Best in class” energy use intensity (EUI) target for libraries with special collections. See below for excerpt from 100% DD energy modeling report.



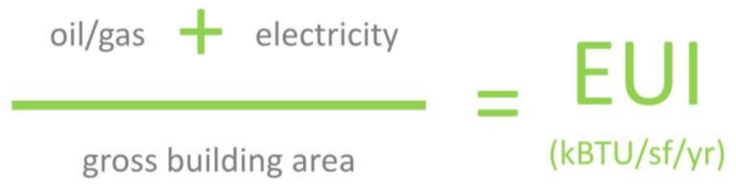


Image Credit: Transsolar

Neilson Library tracking an EUI of **60** kBtu/sf/year

PASSIVE DESIGN FIRST

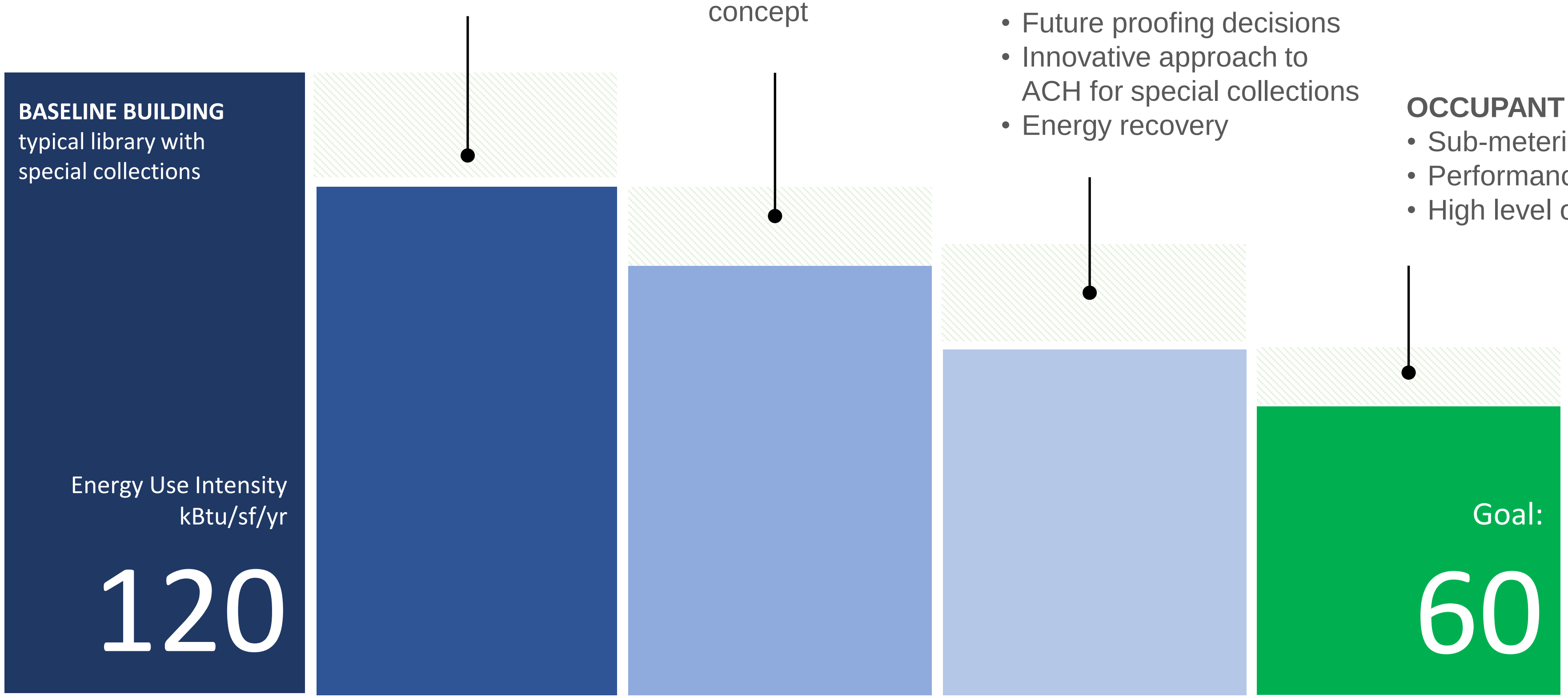
Path to achieving an energy use intensity (EUI) target of 60 kBtu/sf/year, in order of priority.

BUILDING ENVELOPE
- Solar shading
- High insulation glazing
- High performance windows
- Airtight building
- Envelope commissioning
- Natural daylight

REDUCED LOADS
- LED Lighting
- Daylight dimming
- Occupancy sensors
- Box within a box concept

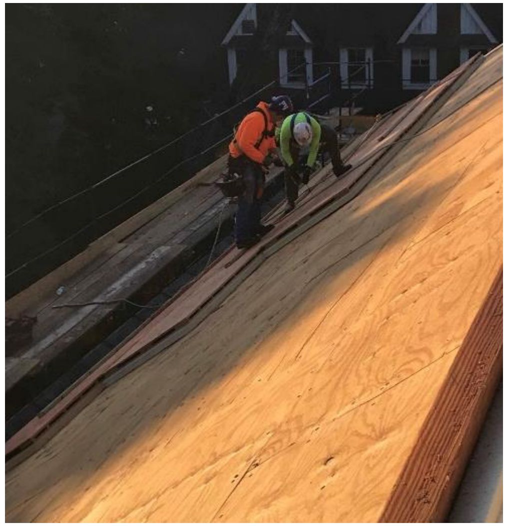
HIGH EFFICIENCY HVAC
- High efficiency boilers
- Chilled beams
- Future proofing decisions
- Innovative approach to ACH for special collections
- Energy recovery

OCCUPANT ENGAGEMENT
- Sub-metering
- Performance monitoring
- High level of controllability



THERMAL ENVELOPE: NEILSON LIBRARY

Thermal break between old and new



SIPS panels on the roof

30% window-to-wall ratio supports energy goals

Top photos from Shawmut Design and Construction

Bottom image capture: Smith College, The New Neilson Video Tour March 2021

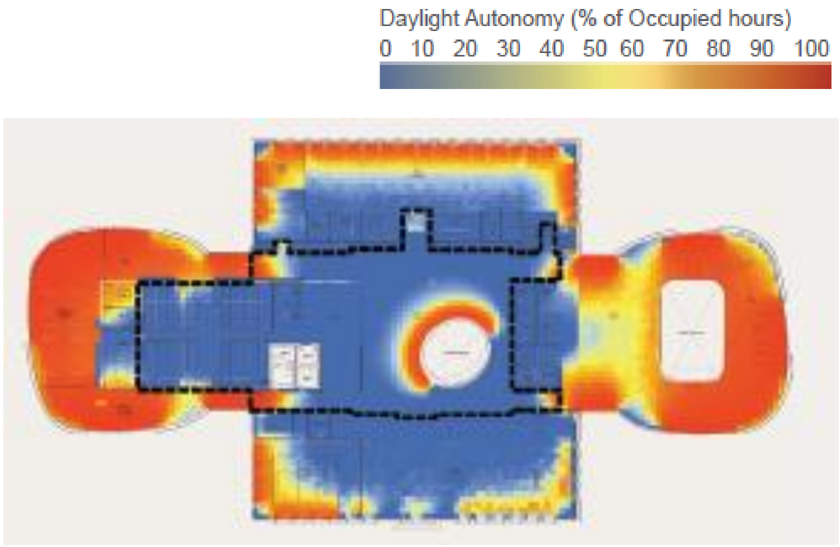
1. **High Performance Envelope**
   - High performance glazing provides solar control and high U-values through low-e coatings
   - Optimized insulation, R-30 opaque walls and R-40 roof
   - Structural insulated panels (SIPs) on the roof for airtight construction
   - Elimination of thermal bridging.
     - The skin of the old Neilson façade is totally isolated from the new internal structure using a soy-based high density foam product to seal the helical anchors.
     - Fabreeka Pads used for structural thermal breaks.
2. **Airtight Construction**
   - Blower door tests were performed after construction completion to confirm air infiltration rates.
   - The target was 0.2 cfm/sf, and the result was 0.12 cfm/sf (with the doors sealed)
3. **Window to Wall Ratio**
   - Window-to-wall ratio optimized (30%) to reduce energy use

CONSTRUCTION MOCKUP

A mockup of the Jewel Box curtain wall was built at the Intertek Facility in Pennsylvania. The entire system assembly was built and tested for air and water tightness. The team could review the performance and aesthetics of the entire system. Ultimately it helped the team work though tolerance issues, adjustments to connection details, workmanship and productivity/efficiency in the field.

Photos of the construction mockup taken by Shawmut at the Intertek facility.

REDUCED LOADS: NEILSON LIBRARY



Daylight autonomy study completed during early design

The oculus brings natural daylight into the existing building and reduces internal loads. *Image Credit: Transsolar*

1. **Natural Daylight**
   - Daylight autonomy studies occurred during early design understand how much of the building's lighting needs could be met through natural daylight
   - 70% of the spaces in the Jewel Boxes are daylit for at least half of the year
   - The oculus bring daylight into the existing building. It's specular properties (i.e. decreasing diameter as it approaches the ground floor) that demonstrate daylight redirection.
2. **Exterior Louvers**
   - Exterior louvers were optimized at each orientation to cutoff direct solar radiation at high sun angles during the summer, while allowing passive solar heating in the winter.
3. **Efficient lighting and controls**
   - Daylight dimmers, occupancy sensors and LED lamps help reduce internal loads

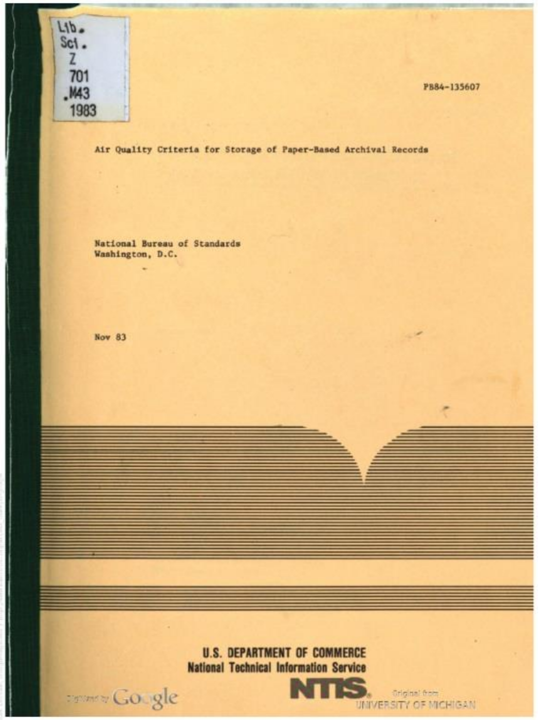
SPECIAL COLLECTIONS

The Special Collections room is the most energy intensive space in the building. When designing special collections spaces, the most commonly used standard (National Bureau of Standards 1983, Chapter 3) recommends 6 to 8 air changes per hour (ACH) as the minimum air circulation. Every air change requires a significant amount of energy use, which can greatly impact the overall energy use of libraries with special collections.

Special Collections space in the Neilson Library.

Image capture: Smith College, The New Neilson Video Tour March 2021

NBS 1983 standard



Lib. Sci. Z 701 .M43 1983

PB84-135607

Air Quality Criteria for Storage of Paper-Based Archival Records

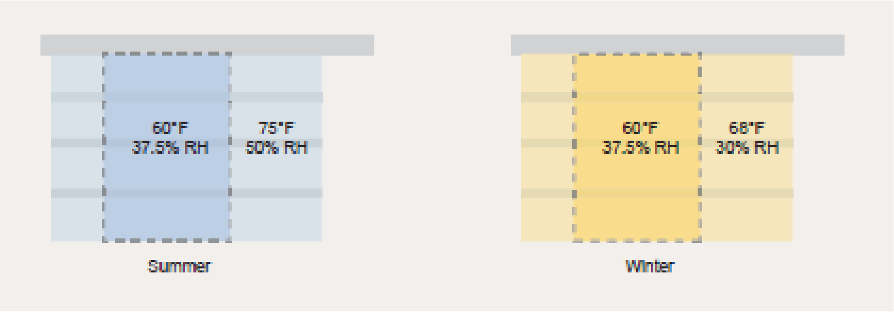
National Bureau of Standards
Washington, D.C.

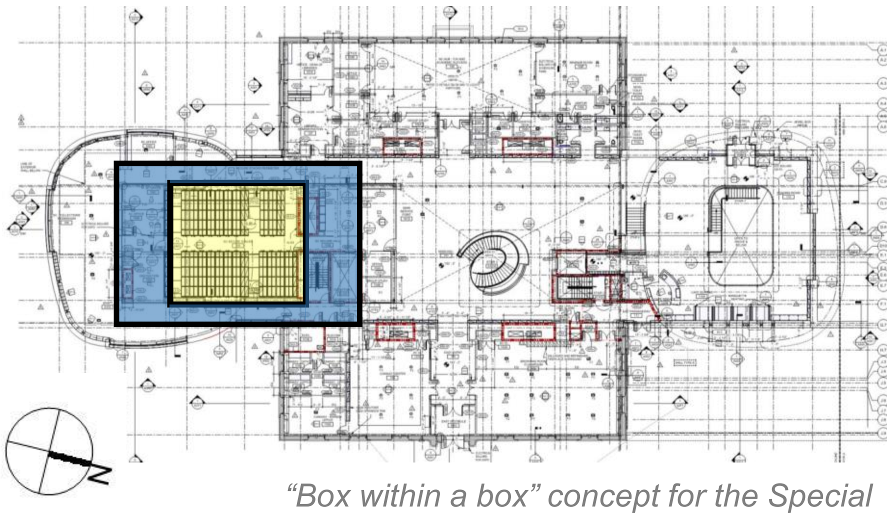
Nov 83

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
NTIS

SPECIAL COLLECTIONS: NEILSON LIBRARY

50% reduction in heating capacity and 6% overall EUI savings for the project





"Box within a box" concept for the Special Collections located in the south Jewel Box.

1. **Archival consultant brought onto the team**

   Archival consultant, Image Permanent Institute (IPI), was brought on-board to provide more accurate/scientific information that allowed the team to develop innovative strategies to environmental control needs for the special collections.

2. **"Box within a box" concept**

   Special collections is located non-intuitively on the south side of the building, which receives more sun and heat. The north side was reserved for students because of the better access to natural daylight. A "Box within a Box" concept for the south Jewel Box was developed to buffer the special collections from the exterior. Perimeter spaces serve as thermal and humidity buffers for the special collections so no direct radiation is received in the space. A constant 60 deg F and 37.5% humidity can be maintained at all times to help preserve the books.

3. **Innovative HVAC Design**

   The ventilation fan energy is reduced in the Neilson Library special collections through the modulation of supply air volume based on temperature and humidity sensors, while ensuring sufficient ventilation is provided. The team reduced the 6 to 8 air changes per hour (ACH) to 3 ACH based on information from IPI.

HIGH EFFICIENY EQUIPMENT: NEILSON LIBRARY

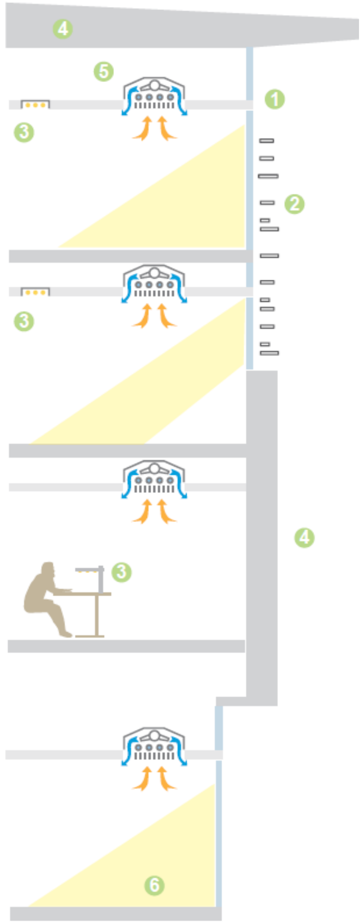


Diagram on the left: Image from Transsolar demonstrating the connection between active and passive systems in the building
Image on the right: Chilled beam located in a classroom space.

1. **Chilled Beams**
   - Is it less common to see chilled beams in libraries due to condensation risk, so it is a big win from an environmental standpoint to have chilled beams in the Neilson Library.
   - They are well-suited for spaces with lower floor-to-floor heights since the ductwork can be much smaller.
   - Their plenum-style product works well with the architectural aesthetic requirements for the Neilson Library.

2. **High Efficiency Boilers**
   - The design incorporates four boilers operating at 90%+ efficiency, compared to traditional steam boilers at 80-85% efficiency.

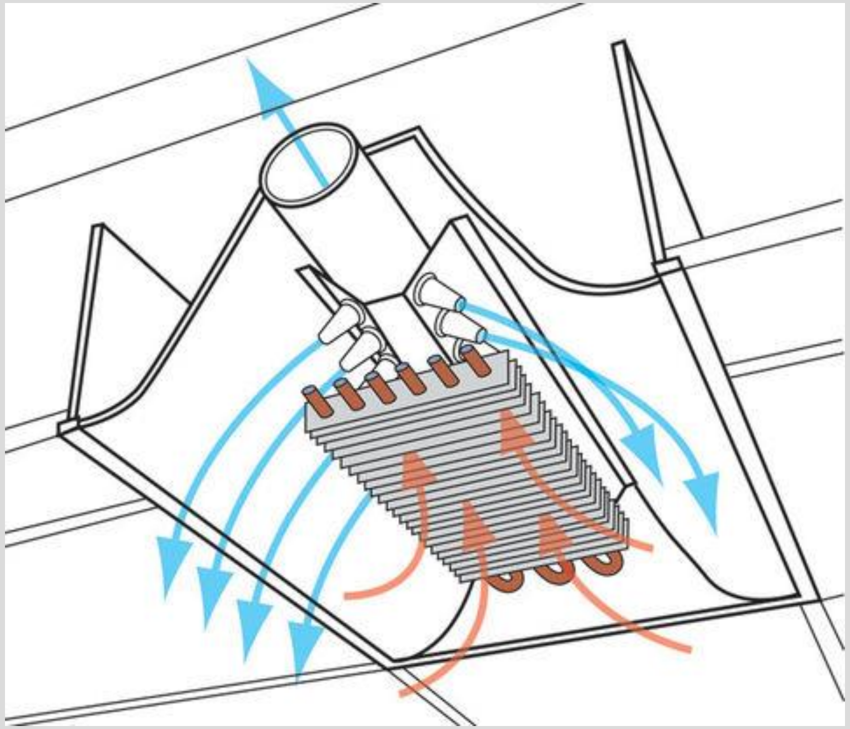
3. **Flexibility for the Future**
   - Equipment is ready for the low temperature hot water (HW) loop once the campus switches over to ground source heat pump system distribution for the central campus.
   - Smith's fossil fuel-free energy system is anticipated to come online in the next decade to achieve the 2030 carbon neutrality goals.

CHILLED BEAMS

Active Chilled Beams (ACBs) are ceiling mounted heat exchangers. Warm room air (red arrows in) enters the chilled beam through induction and moves across the water coil where the room air is either cooled or heated. The now cooled or heated room air is mixed with the primary air (from the circular duct at the top) and discharged back into the space (blue arrows down). This system supplies both cooling and heating, as well as ventilation air.

Why so efficient?

1. ACBs require less airflow, so less energy is needed to power pumps and fans.
2. Ductwork sizing is decreased since less airflow is required
3. Water is used to transport energy more efficiently than air
4. Chiller performance can be much more efficient and size can be reduced.



Source: BuildingGreen, Diagram: Rumsey Engineering

SUSTAINABILITY PRIORITY 3

The new library emphasizes health and well-being.

- Biophilic Design Principles
- Indoor Air Quality
- Healthier Materials

BIOPHILIA

Biophlic Design is the practice of connecting people and nature within our built environments and communities. Research proves that in the presence of biophilic elements, people are significantly more relaxed, perform better in short term memory test, and feel more engaged.

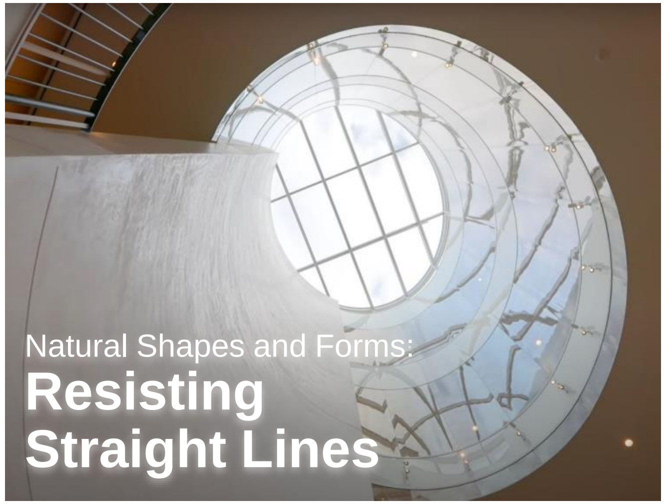
BIOPHILIC CATEGORIES AND CORRESPONDING DESIGN ELEMENTS

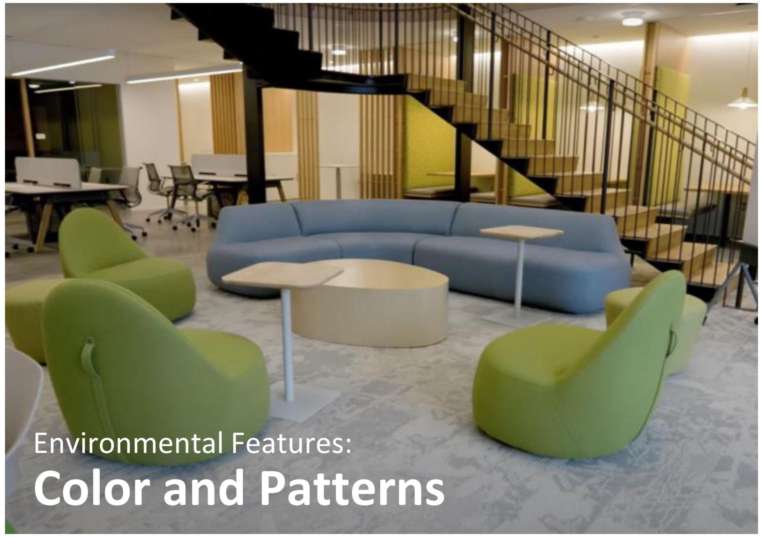
Environmental features	Natural shapes and forms	Natural patterns and processes
• Color • Water • Air • Sunlight • Plants • Animals • Natural materials • Views and vistas • Façade greening • Geology and landscape • Habitats and ecosystems	• Botanical motifs • Tree and columnar supports • Animal (mainly vertebrate motifs • Shells and spirals • Egg, oval, and tubular forms • Arches, vaults, domes • Shapes resisting straight lines and right angles • Simulation of natural features • Biomorphic elements • Geomorphology • Biomimicry	• Sensory variability • Information richness • Age, change, and the patina of time • Growth and efflorescence • Central focal point • Patterned wholes • Bounded spaces • Transitional spaces • Linked series and chains • Integration of parts to wholes • Complementary contrasts • Dynamic balance and tension • Fractals • Hierarchically organized ratios and scales
Light and space	**Place-based relationships**	**Evolved human-nature relationships**
• Natural light • Filtered and diffused light • Light and shadow • Reflected light • Light pools • Warm light • Light as shape and form • Spaciousness • Spatial variability • Space as shape and form • Spatial harmony • Inside-outside spaces	• Geographic connection to place • Historic connection to place • Ecological connection to place • Cultural connection to place • Indigenous materials • Landscape orientation • Landscape features that define building form • Landscape ecology • Integration of culture and ecology • Spirit of place • Avoiding placelessness	• Prospect and refuge • Order and complexity • Curiosity and enticement • Change and metamorphosis • Security and protection • Mastery and control • Affection and attachment • Attraction and beauty • Exploration and discovery • Information and cognition • Fear and awe • Reverence and spirituality

Source: Biophlic Design Guidebook, June 2018, International Living Future Institute

Image capture: Smith College, The New Neilson Video Tour March 2021

BIOPHILIA: NEILSON LIBRARY





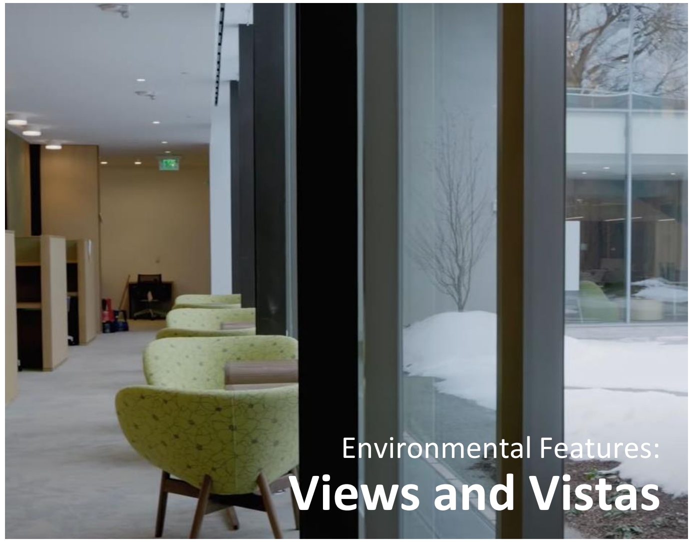


Image captures: Smith College, The New Neilson Video Tour March 2021

1. **Environmental Features:**

   Natural materials and wood elements features throughout the library

2. **Natural shapes and forms:**

   Cuvatures of the jewel boxes, oculus, furniture and light fixtures

3. **Natural patterns and processes:**

   Bounded and transitional spaces with varying floor-to-ceiling heights

4. **Light and Space:**

   Natural daylight creating filtered and diffused light, shadow, warmth, variety

5. **Place-based relationships:**

   Along the Cappawonganick – Sculpture in the Main Lobby - a river outline map of the Mill River created from one-inch recycled industrial glass marbles.

ENHANCED INDOOR AIR QUALITY (IAQ)

Studies prove that buildings with good indoor air quality, with increased ventilation rates and reduced exposure to volatile organic compounds (VOCs), perform better and score higher on cognitive function tests. Since people spend 90% of their time indoors (on average), enhanced indoor air quality in the built environment is very important topic.

Conventional:	"Green":	"Green +":
Typical volatile organic compound levels (506-666 μg/m^3) and 20 cfm outdoor air per person	VOC levels reduced to approximately 50 μg/m^3 and 20 cfm outdoor air per person	VOC levels reduced to approximately 50 μg/m^3 and 40 cfm outdoor air per person

On average, cognitive function scores were:

- **61 percent higher** in green building conditions
- **101 percent higher** in "green +" building conditions

Source: *The Harvard T.H. Chan School for Public Health; Center for Health and the Global Environment.*

ENHANCED IAQ: NEILSON LIBRARY

Covered ductwork during construction, Shawmut

CO2 sensors in all densely occupied spaces, Shawmut

1. **Enhanced filtration:**

   Filters with a minimum efficiency reporting value (MERV) rating of 13 provided in all air handling units (AHUs)

2. **Entryway systems**

   Permanent entryway systems (at least 10' in direction of travel) capture particulates entering the building

3. **Carbon dioxide monitoring**

   Carbon dioxide (CO_2) monitoring devices located in all densely occupied spaces (3-6 feet above the floor). Alert the building automation system if the CO_2 concentrations exceed set point by more than 10%

4. **Low emitting materials**

   Red List free, formaldehyde free materials and materials meeting the VOC emissions evaluation were prioritized to reduce concentrations of chemical contaminants in the space.

5. **Building flush-out & covered ductwork**

   All ductwork was covered during construction to reduce potential contamination. Additionally, the building was flushed out with 14,000 cubic feet of outdoor air per square foot to remove any contaminants and pollutants from construction prior to occupants using the building.

PROJECT SHOWCASE

Smith Neilson Library
Materials Health Initiative

MATERIAL HEALTH INITIATIVE

Image capture: Smith College, The New Neilson Video Tour March 2021

Smith College decided to utilize the iconic nature of this building to advocate for positive change in the marketplace and encourage manufacturers to eliminate “Red List” chemicals.

WHY HEALTHIER MATERIALS?

1. **It is an environmental justice issue.**

   Disproportionate health effects of toxic chemicals caused by systemic racism and other social injustices. This includes fenceline communities, which are topically low-income households and communities of color that cannot afford to live elsewhere.

2. **Women are disproportionally impacted by chemical exposure.**

   - Women are more likely to store environmental pollutants in their tissues
   - Women are more vulnerable to health damage from toxic chemicals due to rapid physiological changes during different stages of life (i.e. pregnancy, lactation, menopause, etc)
   - Many chemicals are linked with lower fertility rates, miscarriages, and birth defects.
   - Chemicals can be passed on to unborn children through the placenta.

3. **Institutions can drive market transformation in the absence of regulations.**

   U.S. Federal regulations are behind. According to the Toxic Substances Control Act (TSCA), over 82,000 chemicals are registered in the U.S., 650 are monitored through the EPA Toxic Release Inventory, 200 have been tested for threats to human health and safety, and only 9 are banned. It takes institutions like Smith College, and design firms like Maya Lin, Shepley Bulfinch and Thornton Tomasetti, leading the way by making commitments to remove toxic chemicals from their buildings and campuses.

WHY NEILSON LIBRARY

1. **Iconic nature of the building to serve as an agent for change.**

   The Neilson Library was well-positioned to drive market transformation given the iconic nature of the building and the world-renowned design architect, Maya Lin Studio. Material researchers and product vetters were able to leverage the size, scale and prestigious nature of the project to inspire manufacturers to change their formulations and provide Red List free products.

2. **Chemical exposure to students and staff spending long hours in the building.**

   Students and staff spend long hours working, learning and interacting with each other in the building. Chemicals enter the body through inhalation, ingestion and absorption, and the affect on human health depends on the duration, extent and frequency of exposure. Given the intended function and usage of the building, it was a prime candidate for reducing and eliminating chemicals of concern.

3. **Alignment with the sustainability charter.**

   Sustainability Priority #3 from the Sustainability Charter is to create a new building that emphasizes health and well-being. The formulations of building materials can have a dramatic effect on human health and indoor air quality.

PART OF A LARGER MOVEMENT

There are many organizations, campaigns, coalitions fighting for chemical policy and reform, promoting environmental health and justice, educating industries and consumers, demanding change and providing guidance to consumers. Momentum is continuing to build, and the building sector is a critical addition to the conversation.

BUILDING INDUSTRY MOMENTUM

With the inception of the International Living Future Institute (ILFI) in 2009, LEEDv4 in 2013 and Healthier Hospitals in 2012, the building industry made significant strides towards product disclosure and optimization through advocacy for Red List Free building products, Health Product Declarations (HPDs), Environmental Product Declarations (EPDs), FSC Certified wood, and VOC emissions testing to name a few. There are a growing number of resources available to design firms and owners seeking to reduce and eliminate toxic chemical exposure from their buildings.

MATERIAL DATABASES

In addition to product labels, there are several databases available to help institutions and firms find healthier products free of harmful chemicals. See below for a summary of a few notable databases used to support the Neilson Library efforts.

- Declare Product Database

  https://declare.living-future.org/
- Mindful Materials

  https://mindfulmaterials.origin.build/#/shared/materials/
- Health Product Declaration Public Repository

  https://declare.living-future.org/
- Cradle to Cradle Material Health Registry

  https://www.c2ccertified.org/products/mhcregistry
- BIFMA Level Product Database – Furniture

  https://level.ecomedes.com/
- UL SPOT

  https://spot.ul.com/
- LBC Materials Petal Database

  https://healthyurbanplaces.wixsite.com/materialspetal
- Red2Green

  https://materiallybetter.com/red2green/

Source: https://healthymaterialslab.org/material-collections/product-libraries/external-certification-libraries

PROCESS OVERVIEW – NEILSON LIBRARY

STEP 1: Develop the product list. The team started by developing a targeted approach that focused on the highest priority product categories identified by Smith College and the design team. This included products that directly impacted occupant health and air quality, prominently featured products, and high cost/high extent products (leveraged to increase manufacturer response and participation). See below for a summary of the product categories used in the building that are free of Red List chemicals.

List of Product Categories:

- Concrete underlayment
- Fiberboard
- Gypsum Board
- Insulation
- Air barriers
- Fireproofing
- Wood doors
- Curtain wall
- Plaster
- Flooring systems
- Acoustical ceiling tiles
- Adhesives and sealants
- Paints and coatings
- Roller window shades

	Industry Characteristics							
Product Categories	Prominently Featured Product	Impact on Occupant Health & Air Quality	Manufacturing and Disposal Impact	High Cost & Extent	Commonly contains Red List Issues	Opportunity to specify existing Innovative Products	Synergies with LEED	Limited Market - Advocacy Needed
Millwork/Doors	2	2	2	1	2	1	2	
Gypsum Board		2		1		2	1	
Interior Paints & Coatings	1	2	2	2	2		2	
Acoustic & Thermal Insulation		2	2		2	1	2	1
Interior Adhesives & Sealants		2	2		2		1	
Flooring	2	2	1	2		2	2	
Ceilings	2	2		2		2	1	
Interior Wall Systems	2	2		2		2	1	
Fire Proofing		1			1			2
Furniture and Furnishings	2	2		2	1	1	1	
Air Distribution	1	1	1	2				2
Plumbing Fixtures	1				1			2
Cabling and Wiring			2	2	2			2
Conveying Equipment	1			1				2

Key
1 = Some
2 = High

VETTING BASELINE

Step 2: Determine the baseline. The International Living Future Institute's Red List was utilized as the baseline for materials research and vetting. The list was developed by the ILFI, Healthy Building Network and the Pharos Project in 2006, and continues to be updated annually with the release of new information. It is an easy-to-use and well-recognized baseline in the industry that Smith College had used on a previous campus project.

- Antimicrobials (marketed with a health claim)
- Alkylphenols and related compounds
- Asbestos compounds
- Bisphenol A (BPA) and structural analogues
- California-banned solvents
- Chlorinated Polymers, including:
  - Chlorinated polyethylene (CPE)
  - Chloroinated polyvinyl chloride (CPVC)
  - Chloroprene (neoprene monomer)
  - Chlorosulfonated polyethylene (CSPE)
  - Polyvinylidene chloride (PVDC)
  - Polyvinyl chloride (PVC)
- Chlorobenzenes
- Chlorofluorocarbons (CFC) and hydrochlorofluorocarbons (HCFC)
- Formaldehyde (added)
- Monomeric, polymeric and organo-phosphate halogenated flame retardants (HFRs)
- Organotin Compounds
- Perfluorinated compounds (PFCs)
- Phthalates (orthophthalates)
- Polychlorinated biphenyls (PCBs)
- Polycyclic aromatic hydrocarbons (PAHs)
- Short-chain and medium-chain chlorinated paraffins
- Toxic heavy metals
  - Arsenic
  - Cadmium
  - Chromium
  - Lead (added)
  - Mercury
- Volatile organic compounds (VOC) (wet-applied products)*
- Wood Treatments containing creosote or pentachlorophenol

*VOCs are limited, not banned. Refer to the v4.0 Materials Petal Handbook for specific reference standard + thresholds.

https://living-future.org/declare/declare-about/red-list/

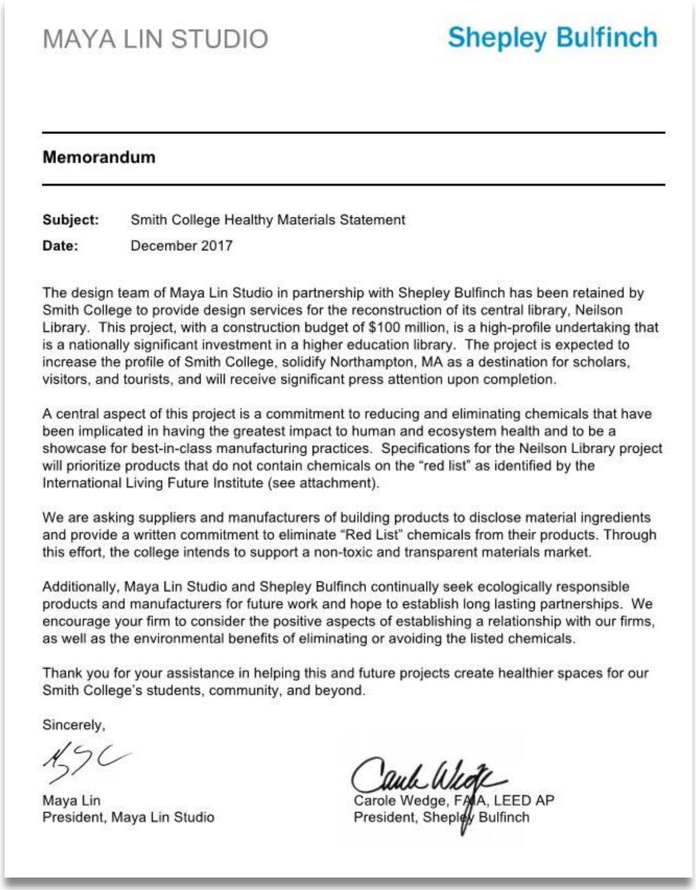
HEALTH RISKS

The common health risks associated with chemical classes addressed on the Red List.

Chemical classes	Partial list of health risks
Chemical flame retardants	Thyroid disruption, lower IQ, reduced fertility, cancer, immune impairment
Per- and poly fluoroalkyl substances (PFAS)	Testicular and kidney cancers, early menopause, elevated cholesterol, diabetes
Antimicrobials	Antibiotic-resistance; endocrine, thyroid, and reproductive changes
Halogenated polymers	Cancers, developmental effects
Phthalates & bisphenols	Adversely affects child mental, motor and behavioral development
Volatile organic compounds (VOCs)	Neurotoxicity, reproductive toxicity, and carcinogenic effects
Heavy metals	Reduced mental function, damage to blood, lungs, kidneys, liver, and other organs

LETTER OF COMMITMENT

Step 3: Sign letter of commitment. A commitment letter, communicating the intentions of the material health imitative, was used to support the manufacturer outreach efforts. In order to have the greatest amount of impact and influence in the market, it was determined that the commitment letter needed to come from the Shepley Bulfinch and Maya Lin Studio and note their commitment to healthier materials for not only Neilson Library, but for future work as well. Since signing the commitment, Shepley Bulfinch has created an internal Healthier Materials working group within their firm to follow through.



MAYA LIN STUDIO Shepley Bulfinch

Memorandum

Subject: Smith College Healthy Materials Statement
Date: December 2017

The design team of Maya Lin Studio in partnership with Shepley Bulfinch has been retained by Smith College to provide design services for the reconstruction of its central library, Neilson Library. This project, with a construction budget of $100 million, is a high-profile undertaking that is a nationally significant investment in a higher education library. The project is expected to increase the profile of Smith College, solidify Northampton, MA as a destination for scholars, visitors, and tourists, and will receive significant press attention upon completion.

A central aspect of this project is a commitment to reducing and eliminating chemicals that have been implicated in having the greatest impact to human and ecosystem health and to be a showcase for best-in-class manufacturing practices. Specifications for the Neilson Library project will prioritize products that do not contain chemicals on the "red list" as identified by the International Living Future Institute (see attachment).

We are asking suppliers and manufacturers of building products to disclose material ingredients and provide a written commitment to eliminate "Red List" chemicals from their products. Through this effort, the college intends to support a non-toxic and transparent materials market.

Additionally, Maya Lin Studio and Shepley Bulfinch continually seek ecologically responsible products and manufacturers for future work and hope to establish long lasting partnerships. We encourage your firm to consider the positive aspects of establishing a relationship with our firms, as well as the environmental benefits of eliminating or avoiding the listed chemicals.

Thank you for your assistance in helping this and future projects create healthier spaces for our Smith College's students, community, and beyond.

Sincerely,

Maya Lin
President, Maya Lin Studio

Carole Wedge, FAIA, LEED AP
President, Shepley Bulfinch

"Maya Lin Studio and Shepley Bulfinch will continually seek ecologically responsible products and manufacturers for future work and hope to establish long lasting partnerships. We encourage your firm to consider the positive aspects of establishing a relationships with our firms, and the environmental benefits of eliminating the "Red List" chemicals."

MANUFACTURER OUTREACH

Step 4: Reach out to manufacturers and request ingredient disclosure. Thornton Tomasetti led the materials vetting effort, utilized the commitment letter from the design team, and requested transparency from manufacturers. This effort was focused on education and advocacy, and occurred throughout the entirety of the design development and construction documents phases.

Neilson Library Healthy Materials Manufacturer Commitment

Date: XX/XX/XXXX

Product: XXXX

Directions:

1. Please provide one or more of the following documents for our team to review against the Red List to confirm that the materials contain no red list chemicals:

   - An SDS or MSDS sheet, listing all materials used and CAS numbers.
   - A “Cradle to Cradle” certificate, with a minimum score of “Bronze”
   - A “Declare” Label, indicating the product is “red list free”
   - A Health Product Declaration (HPD), listing all materials used and CAS numbers

1.a. If none of the above documents are available, please complete the following table:

Component Description (if applicable)	Material / Ingredient Name	% of Total Product by weight or volume	CAS#

DESIGN TEAM COORDINATION

Step 5: Share vetting results and discuss healthier alternatives.

SHEPLEY BULFINCH

MAYA LIN STUDIO

Thornton Tomasetti

Biweekly calls:

- Design Development through Construction Documents
- Thornton Tomasetti shared vetting research updates & proposed alternates
- Architecture team provided feedback from a design perspective (durability, performance, aesthetics, etc)
- Healthier basis of design (BOD) products discussed and confirmed

FINAL MATERIALS LIST

The following product types were integrated into the project as Healthy Materials Basis of Design (BOD) products. This list does not include all of the natural materials, like the wood finishes, which were also prioritized for the project.

Product Type	Manufacturers
Concrete underlayment and sealers	Ardex, Curecrete and Advanced Floor Products
Fiberboard	SierraPine and USG
Mineral wool insulation	Owens Corning
Vapor-permeable air barrier	Prosoco and VaproShield
Fireproofing materials	Isolatek
Flush wood doors and mineral core doors	Assa Abloy
Curtain wall	Baubuche and YKK
Acoustical plaster and sealants	BASWAPhon and USG
Gypsum board	USG
Tile mortar and grout	Mapei
Tile floor	Royal Mosa and Lea Ceramiche
Acoustical ceiling tiles	Armstrong
Rubber sheet flooring	Nora
Resilient base	Johnsonite
Other flooring	Duraflex and Crossfields
Sprayed fiber insulation	Cellulose Corp
Paints and coatings	Benjamin Moore and Sherwin Williams
Roller shades	Mermet
Furniture	HHI compliant manufacturers

SUMMARY OF SUCCESS

- Educated and advocated to over 100 manufacturers
- 96 products with healthy materials language incorporated into specs
- 68 products specifically designated as “Healthy Materials Basis of Design”
- Furniture was compliant with Healthy Hospitals Initiative (HHI)
- Manufacturers indicated that they are noticing a trend in the demand for healthier materials
- Process and outcomes are influencing other large institutions
- Smith is being seen as a leader by other institutions looking to get involved

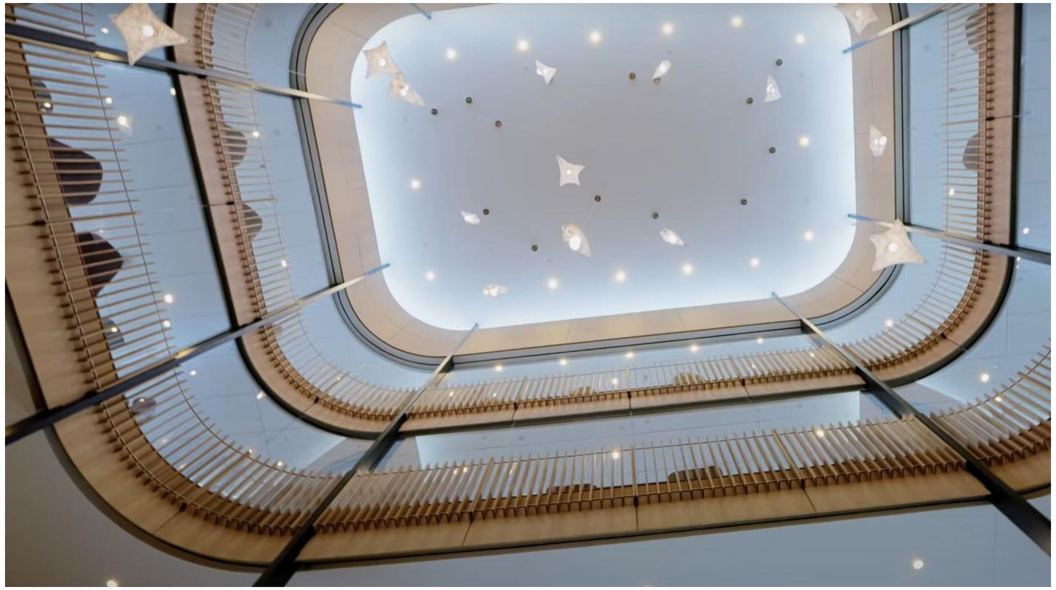


Image captures: Smith College, The New Neilson Video Tour March 2021

THE RIPPLE EFFECT

Smith College and the Neilson Library design team have presented at national conferences, such as Greenbuild, to share the process and findings from the Materials Health Initiative. Smith College's commitment to leadership and advocacy is having a ripple effect nationwide. Other institutions are implementing similar initiatives on their campuses to pilot Red List free materials in their own buildings.

Image from the Greenbuild Conference and Expo, 2018 in Chicago. Amanda Garvey, Matthew Gifford and Dano Weisbord served as presenters.

RED LIST FREE AVAILABLE

JUST NEEDED TO ASK

- **Carpet:** Carpet free of PVC carpet backing, no HFRs and PFCs in fibers
- **Paint:** Red List Free painting schedule that meet additional LEED requirements
- **Insulation:** Formaldehyde-free mineral wool insulation

Image capture: Smith College, The New Neilson Video Tour March 2021

RED LIST FREE POSSIBLE

WITH A FEW TWEAKS

- **Ceiling tiles:** Innovative plant based acrylic binders to remove formaldehyde
- **Rubber Flooring:** Formaldehyde, BPA, and PVC free

Image captures: Smith College, The New Neilson Video Tour March 2021

RED LIST FREE NOT POSSIBLE

BUT COMMITTED TO CHANGE

- **Laminated Veneer Lumber:**
  - Design team met with and educated the manufacturer about the Red List chemicals
  - Manufacturer tested Red List free alternates
  - Red List free alternates tested, but none passed strength requirements.
  - Manufacturer made commitment to continue studying until they find a suitable alternate that will meet Red List Free requirements on future projects.

Image capture: Smith College, The New Neilson Video Tour March 2021

SUSTAINABILITY PRIORITY 4

The project enhances the local ecology and Smith’s historic campus.

- Indoor/Outdoor Connections
- Equity of Access
- Women and Minorities
- Local Community

INDOOR/OUTDOOR CONNECTIONS

- The smaller footprint allows for more permeability to the rest of campus
- Physical and visual connectivity in the heart of campus, restoring the Olmsted landscape master plan
- Flat roofs used on the Jewel Boxes to ensure the historic building was not overpowered
- White oak prioritized over elm since it is the most common tree on campus
- Bird strike glass used on the upper floors of the western elevation where most bird strikes happen

Image capture: Smith College, The New Neilson Video Tour March 2021

EQUITY OF ACCESS

- Equity within library spaces was prioritized, ensuring equal access for all from north to south of the building
- Long interior views used to connect the student body
- Rooftop terrace designed in a way that if standing full height versus in a wheelchair on the paved area that it will be the same experience for all

Rooftop Terrace, Image capture: Smith College, The New Neilson Video Tour March 2021

WOMEN & MINORITIES

- Shawmut worked closely with the local Carpenters, Laborers, and Masons who put forth great efforts to help drive the pursuit of increased women and minorities in the workforce for the Neilson Library.
- **Goal: 16% minority and 7% women***
- **Achieved: 19% minority and 6.9% women**

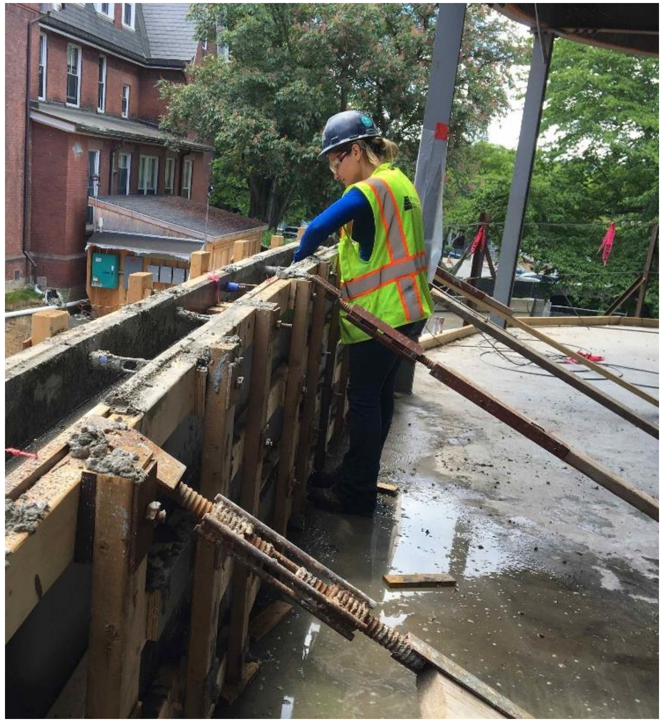


Photo credits: Shawmut Design and Construction

**Aligns with local government requirements, agreement between Shawmut and Smith*

LOCAL COMMUNITY

- Local materials were specified and procured
- Shawmut elevated and prioritized local businesses - artisans, manufacturers, suppliers
- Teams to highlight from the Western Massachusetts region:
  - Carpenters - Salvaged and refinished the millwork
  - Masons – Finish masonry and demolition/ structural rehab of original Neilson Library. The engineering, planning and execution of the existing façade was extremely challenging and time intensive

Safety Meeting, *Photo credit: Shawmut Design and Construction*

THIRD-PARTY CERTIFICATION

LEED NCv4 Gold Certification target