LEARNING OBJECTIVES

1. Be able to identify key areas for architectural and engineering coordination and collaboration in the pursuit of integrated sustainable solutions.

2. Understand how regionally specific sustainability guidelines compare to nationally recognized rating systems and can be successfully implemented.

3. Learn about evaluation tools and team processes used to maximize early sustainable decision-making for project success.

4. Explore sustainable solutions for daylighting, HVAC, and acoustics from both an architectural and engineering perspective.
“This Minnesota team was the only one to have the vision of creating design guidelines for new buildings to be followed by benchmarking to ensure that new data was continually fed into a building’s performance equation. B3 includes the benchmarking tool as well as the design guidelines. In 2009, the Legislature required the addition of a net-zero energy standard to the design guidelines—SB 2030.”

- Janet Streff, Minnesota State Energy Office, retired

“Minnesota has a beautiful landscape with more than 10,000 lakes. We’ve gone through Independent governors, Republican governors, and DFL governors during the course of the B3 program, and they have all maintained its funding and support. I think there is an environmental ethic here in this state that allows us to have this long-term consistency of environmental vision.”

- Tom McDougall, The Weidt Group, retired
B3 VERSUS LEED

GUIDELINES

- Performance Management
- Site & Water
- Energy & Atmosphere
- Indoor Environmental Quality
- Materials and Waste

LEED

- Integrative Process
- Location and Transportation
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality
- Innovation
- Regional Priorities
INTEGRATED DESIGN PROCESS

INTENT
To support high-performance, cost-effective project outcomes through an early analysis of the interrelationships among systems.

REQUIREMENTS
Beginning in pre-design and continuing throughout the design phases, identify and use opportunities to achieve synergies across disciplines and building systems described below. Use the analyses to inform the owner’s project requirements (OPR), basis of design (BOD), design documents, and construction documents.

REQUIRED PERFORMANCE CRITERIA
Develop an Owner’s Project Requirements (OPR) document, beginning at the predesign or equivalent phase. This document is developed in coordination between the owner, commissioning authority, architect, engineer and any other relevant stakeholders. A commissioning authority must be established at the predesign phase to complete the early-phase goal setting.
• Sustainability must be on your very first meeting agenda.

• Shared goals lead to shared success
THE 2030 CHALLENGE

All new buildings, developments, and major renovations shall be carbon-neutral by 2030.

- TODAY: 70% Fossil Fuel Energy Reduction, 30% Renewable
- 2020: 80% Fossil Fuel Energy Reduction, 20% Renewable
- 2025: 90% Fossil Fuel Energy Reduction
- 2030: CARBON NEUTRAL

The 2030 Challenge

Source: ©2015 2030, Inc. / Architecture 2030. All Rights Reserved.
*Using no fossil fuel GHG-emitting energy to operate.
BENCHMARKS & BASELINES

**B3 - constant baseline**
- 2003 Representative Building
  - 2015: 70%
  - 2020: 80%

**LEED - movable baseline**
- ASHRAE 90.1 2007
- ASHRAE 90.1 2013
  - v3.1
  - v4.1
ENERGY MODELING EDUCATION

• The math is very scientific
• The assumptions used are ASSUMPTIONS based on data

Goal
10%
20%
30%
35%
PREDICTIVE VS COMPARATIVE ENERGY MODELING
Physics Lab programmatic needs:
- Access to natural light
- Mitigation of static electricity
- Temperature stability

B3 Guideline I.2:
During the coldest portion of the heating season keep the dewpoint below 35°F

To address static electricity risks humidification was required. Desired conditions:
- 70°F, 40-45% RH
- Dewpoint: approximately 45°F
Evaluate inside surface temperature in comparison to dewpoint
Duct zone has the most dimensional flexibility:

- Supply ducts are insulated. With hangers and insulation duct max height is 18” in a 20” space
- Max aspect ratio of 3 to 1. A 22” deep duct has a maximum width of 66”
- Supply duct fire damper sizes and configurations need to be considered at shaft penetrations
FLOOR TO FLOOR HEIGHT

- 28x70 Main
- 20x54 Main
- 20x54 Main

10” Deep Distribution
## Primary supply duct mains

<table>
<thead>
<tr>
<th>Duct size</th>
<th>Perimeter</th>
<th>Friction Loss (in wc/100 ft)</th>
<th>Number of Fire Damper Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 x 102</td>
<td>246”</td>
<td>0.084</td>
<td>5</td>
</tr>
<tr>
<td>22 x 96</td>
<td>236”</td>
<td>0.083</td>
<td>Not available (max 72” width allowable)</td>
</tr>
<tr>
<td>24 x 86</td>
<td>220”</td>
<td>0.082</td>
<td>Not available</td>
</tr>
<tr>
<td>26 x 78</td>
<td>208”</td>
<td>0.081</td>
<td>Not available</td>
</tr>
<tr>
<td>28 x 70</td>
<td>196”</td>
<td>0.081</td>
<td>6 Sections 2 vertical, 3 horizontal</td>
</tr>
<tr>
<td>30 x 64</td>
<td>188”</td>
<td>0.081</td>
<td>6 sections 2 vertical, 3 horizontal</td>
</tr>
</tbody>
</table>

The longer the perimeter, the higher the duct weight and first cost.
Higher friction losses result in higher energy costs - it’s a balancing act!
STRUCTURAL ANALYSIS: UMN TATE HALL
STRUCTURAL ANALYSIS: TATE HALL
DAYLIGHTING ANALYSIS
DAYLIGHTING ANALYSIS

Percentage of Floor Area where Daylight Factor (DF) is measured is 2.52 feet above the floor level.

Uniformity Ratio: 0.04
ACOUSTIC MITIGATION

- Open Lab
- Gradient of acoustic isolation
ACOUSTIC MITIGATION

- Wall acoustic insulation
- Door perimeter seals
- Thresholds and automatic door bottom seals
- Seal all penetrations through walls
- Highly equipment dependent
SMART ARCHITECTURAL AND ENGINEERING TEAMING FOR SUSTAINABLE PROJECTS

2019 I'SL Annual Conference

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