DESIGN PHILOSOPHY & GUIDING PRINCIPLES

Design for district-scale efficiency

Create a community that builds on Boston’s beloved neighborhoods

Design with a changing climate in mind
MORE HOUSING
Provide new housing stock to address Boston’s regional housing crunch

STAY HISTORIC
Preserve the historic character of South Boston and the “triple-decker” feel

DENSIFY
Satisfy environmental, financial, and livability goals with sufficient density

LESS GHG
Aim to meet Boston’s citywide 2020 greenhouse gas emission reduction goals

MODERNIZE
Provide new buildings that can meet modern performance standards

MANAGED RETREAT
Scale back development in flood-prone coastal areas in anticipation of sea level rise

RESPONDING TO CONFLICTING VALUES:
REFERENCE BLOCK: TYPICAL SOUTH BOSTON

- primarily 3-5 story residential buildings
- taller buildings located at corners
- narrow gaps between buildings
- mixed uses on ends of blocks
PROTOBLOCK A: HISTORIC BOSTON

Classic triple-decker feel

PROTOBLOCK B: NEW SEAPORT

High-density and high value
## DAYLIGHTING ANALYSIS

### DESIGN A
- **Floor Area Ratio**: 2.04
- **Window-to-Wall Ratio (%)**: 60
- **Occupants**: 767
- **Energy Use Intensity (kWh/m²)**: 136
- **Energy Use per Occopant (kWh/p)**: 3540
- **Global Spatial Daylight Autonomy (%)**: 13.6

### DESIGN B
- **Floor Area Ratio**: 1.51
- **Window-to-Wall Ratio (%)**: Res 50 (SE 60), Ret & Off 60 (SE 80)
- **Occupants**: 674
- **Energy Use Intensity (kWh/m²)**: 122
- **Energy Use per Occopant (kWh/p)**: 2526
- **Global Spatial Daylight Autonomy (%)**: 30.5

### DENSITY

<table>
<thead>
<tr>
<th>FAR</th>
<th>Design A</th>
<th>Design B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low FAR</td>
<td>Low FAR</td>
</tr>
<tr>
<td>Base</td>
<td>Base FAR</td>
<td>Base FAR</td>
</tr>
<tr>
<td>High</td>
<td>High FAR</td>
<td>High FAR</td>
</tr>
</tbody>
</table>

### WINDOW-TO-WALL RATIO

- **WWR 80%**
- **WWR 20%**
- **WWR 60%**
- **WWR 40%**
NATURAL VENTILATION POTENTIAL

ENERGY USE INTENSITY

110
120
130
140
150
160
Cooling Nat Vent Hybrid

Minutes
0
300
600
900
1200
1500

Cooling Nat Vent Hybrid

NATURAL VENTILATION POTENTIAL
Regulating EUI is our best option for reconciling our neighborhood goals with potential energy efficiency gains.

- **“BOOT” GEOMETRY ANALYSIS**
- **“PAC-MAN” GEOMETRY ANALYSIS**
SUMMARY

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor Area Ratio</td>
<td>2</td>
</tr>
<tr>
<td>Gross Floor Area ($m^2$)</td>
<td>335,708</td>
</tr>
<tr>
<td>Residential</td>
<td>63%</td>
</tr>
<tr>
<td>Office</td>
<td>28%</td>
</tr>
<tr>
<td>Retail</td>
<td>9%</td>
</tr>
<tr>
<td>Occupants</td>
<td>10,814</td>
</tr>
<tr>
<td>Public Park (% of total area)</td>
<td>13%</td>
</tr>
<tr>
<td>Max. Building Height</td>
<td>9 floors</td>
</tr>
<tr>
<td>Average Building Height (Story)</td>
<td>4 floors</td>
</tr>
</tbody>
</table>
MAIN STREETS

South: Maximum open space and flood mitigation plan

Middle: Mixed-use with walkable design and ample public amenities

North: Mixed-use with higher-density office development
SOUTH SIDE

Inspiration from South Boston residential style

Energy simulation allows for better performance while still evoking historic typologies

Density gradient from low (south) to medium to mediate between two contrasting neighborhood characters
NORTH SIDE

Increased building heights with small block footprints

Stylized to fit with boston waterfront developments to the north
Energy use intensity varies significantly between our two block typologies.

Intuitively important metric for a residential/mixed use neighborhood such as ours.

Sacrifice in energy efficiency for historical style and neighborhood quality.
DESIGNING FOR DISTRICT-SCALE EFFICIENCY

<table>
<thead>
<tr>
<th></th>
<th>BASELINE</th>
<th>REVISED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infiltration Rate</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>Attic U-Value</td>
<td></td>
<td>Added more fiberglass insulation</td>
</tr>
<tr>
<td>Basement U-Value</td>
<td>Fiberglass batting</td>
<td>XPS Board</td>
</tr>
<tr>
<td>Basement Wall U-Value</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>Wall U-Value</td>
<td>Fiberglass batting</td>
<td>XPS Board</td>
</tr>
<tr>
<td>Total Heating COP</td>
<td>0.9</td>
<td>0.92</td>
</tr>
<tr>
<td>Total Cooling COP</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>Windows (U-values)</td>
<td>Clear</td>
<td>Low E</td>
</tr>
<tr>
<td>Equipment</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>Lighting</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Cooling Setpoint</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>Heating Setpoint</td>
<td>20</td>
<td>19.5</td>
</tr>
</tbody>
</table>

ENERGY CONSUMPTION BY HOUR ON JANUARY 23RD

ENERGY CONSUMPTION BY HOUR ON JULY 9TH
Daylighting threshold relaxed to 150 lux for residential uses and 200 lux for all other uses.

14% of space meets new standards.
FINANCIAL PERFORMANCE

INPUTS

<table>
<thead>
<tr>
<th>Annual Rent Rates ($/m²/a)</th>
<th>Residential</th>
<th>600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Official</td>
<td>575</td>
<td></td>
</tr>
<tr>
<td>Retail</td>
<td>450</td>
<td></td>
</tr>
<tr>
<td>Daylighting Premium (%)</td>
<td>0.2</td>
<td></td>
</tr>
</tbody>
</table>

RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>with Daylighting Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Flow from Operations</td>
<td>$147,036,491</td>
<td>$148,594,813</td>
</tr>
<tr>
<td>CFO/Construction Cost</td>
<td>21.2%</td>
<td>21.4%</td>
</tr>
</tbody>
</table>

COSTS AND ANNUAL INCOME

- Construction
- Energy Consumption
- Maintenance
- Revenue w/ Daylighting Premium
- Revenue w/o Daylighting Premium

[Bar chart showing costs and annual income with categories such as Residential, Office, and Retail.]

Millions $
BUILDING OFF BOSTON’S NEIGHBORHOODS – WALKABILITY
SPRING MORNING: MAY AT 10:00AM
Urban Thermal Comfort Index:
No thermal stress 95%
Moderate heat stress 5%

• The areas of moderate heat stress are close to buildings.
• Heat stress appears to correlate with the areas of lower wind speeds.

SUMMER LUNCHTIME: JULY AT 1:00PM
Urban Thermal Comfort Index:
No thermal stress 15%
Slight heat stress 2%
Moderate heat stress 31%
Strong heat stress 52%

• Design should creating shade through street trees, awnings, or overhangs.
• Design interventions that reduce wind speeds would not be desirable

FALL EVENING COMMUTE: SEPTEMBER AT 5:00PM
Urban Thermal Comfort Index:
No thermal stress 100%
DESIGNING FOR A CHANGING CLIMATE
DESIGNING FOR A CHANGING CLIMATE

RECOMMENDED STRATEGIES

- Critical systems located above first floor
- Permeable Streets
- Operable Windows
- First floor designed to withstand flooding
- All occupied floors above BFE

Potential flooding due to a major storm in 2050, assuming 2 ft of sea level rise and a 5 ft storm surge

Image Credit: Sasaki Associates
### South Boston Waterfront

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land area (m²)</td>
<td>220,000</td>
</tr>
<tr>
<td>Building area (m²)</td>
<td>350,000</td>
</tr>
<tr>
<td>Residents (pp/m² land)</td>
<td>0.017</td>
</tr>
<tr>
<td>Workers (pp/m² land)</td>
<td>0.016</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy and Environmental Impact</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation energy (kWh/m²y)</td>
<td>135</td>
</tr>
<tr>
<td>Embodied energy (kWh/m²)</td>
<td>2050</td>
</tr>
<tr>
<td>Building GHG emissions (kgCO₂/m²)</td>
<td>140</td>
</tr>
<tr>
<td>Daylight area (%)</td>
<td>4</td>
</tr>
<tr>
<td>Walkability score (%)</td>
<td>85</td>
</tr>
<tr>
<td>ROI (%)</td>
<td>21</td>
</tr>
</tbody>
</table>
1. Design for district-scale efficiency
   - Energy-efficient buildings reduce environmental impact
   - Rooftop PV can offset peak demands
   - Load shifting and demand response should be considered in the future
   - Tradeoffs require that certain design parameters are prioritized (EUI vs. sDA)

2. Design with a changing climate in mind
   - Flood mitigation is a critical aspect of this site's design
   - Street trees and permeable surfaces can offset summer heat

3. Create a community that builds on Boston’s best neighborhoods
   - Human scale, walkability, and thoughtful building design were key aspects of our site