PDX LIVING BRIDGE

ENERGY PROGRAM
CONTENT

INTRODUCTION AND NARRATIVE

DATA SHEET

BAR GRAPHS

SPACE DIAGRAMS

SCHEMATIC SITE PLAN

ARCHITECTURAL IMPLICATIONS
PDX LIVING BRIDGE - ENERGY PROGRAM

Project Thesis Statement:

Portland’s Central City is split in two by the Willamette River. No strong pedestrian connection exists. The Living Bridge will provide a true urban connection in the form of buildings, parks and infrastructure, drawing the two parts together.

Urban/ Environmental Response, Energy Consumption and the Living Bridge:

Portland has a reputation for responsible urban design and environmental response. The Living Bridge is the embodiment of both of these concepts, creating an icon for the city’s strongest traits.

The Central City on the west side of the river has achieved the walkable urbanity that is inherently characteristic of great cities worldwide. Districts blend into each other almost naturally. However, the districts on the east side that are walkable are unreachable by pedestrian means due to the barriers of the river, the I-5 freeway, and the Industrial Sanctuary. The Living Bridge seeks to reconcile the space in-between and permeate the barriers without destroying the positive qualities that each offers.

Part of responsible urban design is environmental response. The whole point of increasing density in urban areas is to reduce human impact on the environment. The chief way to achieve that is to reduce energy consumption. The Living Bridge is intended to be a net producer of energy through various means described herein.
Energy Conservation Strategies:

The Living Bridge will use only its annual water and solar budget – the amount of rain and solar energy that lands on the site over the period of one year.

The project will employ:

» Passive solar heating (sunshading and thermal mass)
» Natural ventilation (operable windows and vents w/ efficient fans)
» Water reclamation systems (eisterns, bioswales, and greenroofs)
» Water recycling (gray water systems)
» Geothermal heating and cooling (coils and pumps)

It will draw energy from:

» The river (hydroelectric turbines)
» The sun (photovoltaic cells)
» The wind (wind turbines)

Each of the described strategies will have a direct impact on the form of the buildings on the bridge and hence the overall form of the project. For example the orientation of the bridge is roughly east - west with predominantly north and south exposure. These present opportunities for passive solar heating, daylighting, and natural ventilation. If the buildings on the south are terraced appropriately, the buildings on the north will receive adequate exposure. If the buildings on the north are separated at intervals, the summer winds can be exploited to cool all of the buildings, north and south.
# PDX Living Bridge - Energy Program Data Sheet

## Spaces

<table>
<thead>
<tr>
<th>Space Description</th>
<th>Frequency of Use</th>
<th>Activity Type</th>
<th>Light Levels</th>
<th>Allowable Temperature Range</th>
<th>Space Dimensions</th>
<th>Space Height</th>
<th>Area/Space</th>
<th># of Spaces</th>
<th>Total Area</th>
<th>Notes</th>
</tr>
</thead>
</table>
| Parking, air conditioned                              | Very Frequent/ Frequent | B/E | 5/50 | Large | - | 8-0" | 110 spaces | 2 | 220 spaces | 1 per residence, 1 per 1000 sf leaseable office
| Parking Total                                         |                  |               |              |                             | 73000 sf | 36500 sf x 2 |
| Vehicle Lift / Lift Control Booth                    | Very Frequent/ Frequent | B/E | 5/50 | Large | 20-0" x 20-0" | Shaft | 400 sf | 4 | 1600 sf |
| Recycling/Waste Management                           | Rare/ Occasional  | E             | 5/50 | Large | 33-6" x 100-0" | 16-0" | 3500 sf | 2 | 6600 sf |
| Mechanical / Electrical                              | Rare/ Rare        | E/ E          | 5/50 | Large | 75-9" x 100-0" | 16-0" | 7500 sf | 2 | 15000 sf (including (4) geothermal loop lines at each pier
| Machine Room for Drawbridge Lift                     | Rare/ Rare        | E/ E          | 5/50 | Large | 20-0" x 10-0" | 30-0" | 2000 sf | 2 | 4000 sf locate in pier |
| Control Booth for Drawbridge Lift                    | Per US Coast Guard B | - | 5/50 | Large | 16-0" x 16-0" | 8-0" | 101 sf | 1 | 101 sf locate over pier |
| Storage                                               | Rare/ Rare        | B/E           | 5/50 | Large | 40-0" x 10-0" | 8-0" | 4000 sf | 2 | 8000 sf |
| **Grand Total**                                       |                  |               |              |                             | 34980 sf |

## Mixed Use Residential (4 Buildings)

<table>
<thead>
<tr>
<th>Space Description</th>
<th>Frequency of Use</th>
<th>Activity Type</th>
<th>Light Levels</th>
<th>Allowable Temperature Range</th>
<th>Space Dimensions</th>
<th>Space Height</th>
<th>Area/Space</th>
<th># of Spaces</th>
<th>Total Area</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lobby (incl. Reception/Office/Mailroom)</td>
<td>Very Frequent/ Frequent</td>
<td>B/E</td>
<td>5/50</td>
<td>Small</td>
<td>30-0&quot; x 70-0&quot;</td>
<td>16-0&quot;</td>
<td>1400 sf</td>
<td>4</td>
<td>5600 sf</td>
<td></td>
</tr>
<tr>
<td><strong>Leasing Office</strong></td>
<td>Very Frequent/ Rare</td>
<td>C/E</td>
<td>10/50</td>
<td>Small</td>
<td>10-0&quot; x 5-0&quot;</td>
<td>10-0&quot;</td>
<td>150 sf</td>
<td>4</td>
<td>600 sf</td>
<td></td>
</tr>
<tr>
<td><strong>Janitor's Closet</strong></td>
<td>Rare/ Frequent</td>
<td>B/E</td>
<td>5/50</td>
<td>Small</td>
<td>6-0&quot; x 8-0&quot;</td>
<td>8-0&quot;</td>
<td>65 sf</td>
<td>4</td>
<td>260 sf</td>
<td></td>
</tr>
<tr>
<td><strong>Maintenance Office</strong></td>
<td>Very Frequent/ Rare</td>
<td>C/E</td>
<td>10/50</td>
<td>Small</td>
<td>10-0&quot; x 7-0&quot;</td>
<td>8-0&quot;</td>
<td>75 sf</td>
<td>4</td>
<td>300 sf</td>
<td></td>
</tr>
<tr>
<td><strong>Retail Lease Space A: Bar / Restaurant</strong></td>
<td>Rare/ Very Frequent</td>
<td>A/E</td>
<td>2/50</td>
<td>Small</td>
<td>45-0&quot; x 70-0&quot;</td>
<td>16-0&quot;</td>
<td>3000 sf</td>
<td>6</td>
<td>24000 sf (2 units x 4 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Retail Lease Space B: Bingo / Cafe / Service</strong></td>
<td>Very Frequent/ Frequent</td>
<td>B/E</td>
<td>10/50</td>
<td>Small</td>
<td>30-0&quot; x 70-0&quot;</td>
<td>16-0&quot;</td>
<td>1400 sf</td>
<td>20</td>
<td>20000 sf (5 units x 4 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Dwelling Space A: Studio / 1-bedrm</strong></td>
<td>Frequent/ Very Frequent</td>
<td>B/E</td>
<td>10/50</td>
<td>Small</td>
<td>20-0&quot; x 80-0&quot;</td>
<td>10-0&quot;</td>
<td>800 sf</td>
<td>50</td>
<td>40000 sf (4 units x 4 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Dwelling Space B: 1-bedrm w/ office</strong></td>
<td>Frequent/ Very Frequent</td>
<td>B/E</td>
<td>10/50</td>
<td>Small</td>
<td>30-0&quot; x 6-0&quot;</td>
<td>9-0&quot;</td>
<td>1200 sf</td>
<td>64</td>
<td>76000 sf (16 units x 4 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Dwelling Space C: 2-bedrm w/ office</strong></td>
<td>Frequent/ Very Frequent</td>
<td>B/E</td>
<td>10/50</td>
<td>Small</td>
<td>30-0&quot; x 6-0&quot;</td>
<td>9-0&quot;</td>
<td>2000 sf</td>
<td>36</td>
<td>72000 sf (9 units x 4 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Common Event Space</strong></td>
<td>Frequent/ Occasional</td>
<td>B/C/E</td>
<td>5/10/30</td>
<td>Small</td>
<td>30-0&quot; x 40-0&quot;</td>
<td>9-0&quot;</td>
<td>1200 sf</td>
<td>4</td>
<td>4800 sf</td>
<td></td>
</tr>
<tr>
<td><strong>Circulation Space (incl. Elevators &amp; Stairs)</strong></td>
<td>Very Frequent/ Frequent</td>
<td>B/C/E</td>
<td>5/10/30</td>
<td>Large</td>
<td>10-0&quot; x 10-0&quot;</td>
<td>9-0&quot;</td>
<td>100 df</td>
<td>16</td>
<td>1600 sf 4 floors x 4 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Elevator / Data Closet</strong></td>
<td>Rare/ Rare</td>
<td>E/ E</td>
<td>5/50</td>
<td>Large</td>
<td>10-0&quot; x 10-0&quot;</td>
<td>9-0&quot;</td>
<td>100 sf</td>
<td>16</td>
<td>1600 sf 4 floors x 4 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Recycle/ Waste</strong></td>
<td>Frequent/ Occasional</td>
<td>B/E</td>
<td>5/50</td>
<td>Large</td>
<td>10-0&quot; x 10-0&quot;</td>
<td>9-0&quot;</td>
<td>100 df</td>
<td>16</td>
<td>1600 sf 4 floors x 4 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Loading Dock</strong></td>
<td>Occasional / Rare</td>
<td>B/E</td>
<td>5/50</td>
<td>Large</td>
<td>20-0&quot; x 60-0&quot;</td>
<td>16-0&quot;</td>
<td>1200 sf</td>
<td>8</td>
<td>9600 sf 2 loading docks x 4 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Vehicle Lift / Lift Control Booth</strong></td>
<td>Very Frequent/ Rare</td>
<td>B/E</td>
<td>5/50</td>
<td>Large</td>
<td>20-0&quot; x 20-0&quot;</td>
<td>Shaft</td>
<td>400 sf</td>
<td>4</td>
<td>1600 sf</td>
<td></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>33600 sf</td>
<td>384000 sf x 4 bldgs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Mixed Use Commercial (2 Buildings)

<table>
<thead>
<tr>
<th>Space Description</th>
<th>Frequency of Use</th>
<th>Activity Type</th>
<th>Light Levels</th>
<th>Allowable Temperature Range</th>
<th>Space Dimensions</th>
<th>Space Height</th>
<th>Area/Space</th>
<th># of Spaces</th>
<th>Total Area</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lobby (incl. Security)</td>
<td>Very Frequent/ Frequent</td>
<td>B/E</td>
<td>2/50</td>
<td>Small</td>
<td>30-0&quot; x 70-0&quot;</td>
<td>16-0&quot;</td>
<td>1400 sf</td>
<td>2</td>
<td>2800 sf</td>
<td></td>
</tr>
<tr>
<td><strong>Retail Lease Space A: Bar / Restaurant</strong></td>
<td>Rare/ Very Frequent</td>
<td>A/E</td>
<td>2/50</td>
<td>Small</td>
<td>45-0&quot; x 70-0&quot;</td>
<td>16-0&quot;</td>
<td>3000 sf</td>
<td>4</td>
<td>12000 sf (2 units x 2 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Retail Lease Space B: Shoe / Cafe / Service</strong></td>
<td>Very Frequent/ Frequent</td>
<td>B/E</td>
<td>5/50</td>
<td>Small</td>
<td>30-0&quot; x 70-0&quot;</td>
<td>16-0&quot;</td>
<td>1400 sf</td>
<td>10</td>
<td>14000 sf (5 units x 2 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Office Lease Space</strong></td>
<td>Very Frequent/ Occasional</td>
<td>C/E</td>
<td>10/50, 100</td>
<td>Small</td>
<td>-</td>
<td>-</td>
<td>10&quot;</td>
<td>12000 sf</td>
<td>3</td>
<td>24000 sf 3 floors x 2 bldgs</td>
</tr>
<tr>
<td><strong>Circulation Space (incl. Elevators &amp; Stairs)</strong></td>
<td>Very Frequent/ Frequent</td>
<td>B/C/E</td>
<td>5/10/30</td>
<td>Small</td>
<td>-</td>
<td>-</td>
<td>10&quot;</td>
<td>12000 sf</td>
<td>3</td>
<td>24000 sf 3 floors x 2 bldgs</td>
</tr>
<tr>
<td><strong>Recycle/ Waste</strong></td>
<td>Frequent/ Occasional</td>
<td>B/E</td>
<td>5/50</td>
<td>Large</td>
<td>10-0&quot; x 10-0&quot;</td>
<td>9-0&quot;</td>
<td>100 sf</td>
<td>0</td>
<td>600 sf 3 floors x 2 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Recessed</strong></td>
<td>Frequent/ Occasional</td>
<td>B/E</td>
<td>5/50</td>
<td>Large</td>
<td>10-0&quot; x 10-0&quot;</td>
<td>9-0&quot;</td>
<td>100 sf</td>
<td>0</td>
<td>600 sf 3 floors x 2 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Janitor's Closet</strong></td>
<td>Rare/ Frequent</td>
<td>B/E</td>
<td>5/50</td>
<td>Small</td>
<td>7-0&quot; x 10-0&quot;</td>
<td>8-0&quot;</td>
<td>75 sf</td>
<td>4</td>
<td>300 sf 2 floor x 2 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Maintenance Office</strong></td>
<td>Very Frequent/ Rare</td>
<td>C/E</td>
<td>10/50</td>
<td>Large</td>
<td>10-0&quot; x 11-0&quot;</td>
<td>8-0&quot;</td>
<td>110 sf</td>
<td>2</td>
<td>220 sf</td>
<td></td>
</tr>
<tr>
<td><strong>Loading Dock</strong></td>
<td>Occasional / Rare</td>
<td>B/E</td>
<td>5/50</td>
<td>Large</td>
<td>20-0&quot; x 60-0&quot;</td>
<td>16-0&quot;</td>
<td>1200 sf</td>
<td>4</td>
<td>4800 sf 2 loading docks x 2 bldgs</td>
<td></td>
</tr>
<tr>
<td><strong>Vehicle Lift / Lift Control Booth</strong></td>
<td>Very Frequent/ Rare</td>
<td>B/E</td>
<td>5/50</td>
<td>Large</td>
<td>20-0&quot; x 20-0&quot;</td>
<td>Shaft</td>
<td>400 sf</td>
<td>2</td>
<td>800 sf</td>
<td></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>126000 sf</td>
<td>63300 sf x 2 bldgs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Serve entire complex of buildings, two separate facilities oriented equally east and west of the drawbridge

**Notes:**
- Mechanical / Electrical space needs are included in all Retail and Dwelling Lease Spaces
- Restroom space needs are included in all Retail and Dwelling Lease Spaces
- Internal Gains and Occupant Density for all spaces were low
  - (<23 Btu/hr sf for Internal Gains, <5.5 people/100 sf for Occupant Density)
NOTE: COLORS CORRESPOND TO ENERGY PROGRAM DATA SHEET

*CONTROL BOOTH LOCATED AT SURFACE LEVEL ABOVE WEST PIER ON SOUTH SIDE
NOTE: COLORS CORRESPOND TO ENERGY PROGRAM DATA SHEET

- RESIDENCES: 58%
- COMMON SPACE: 27%
- RETAIL: 15%

- RESIDENCES OFFICES: 58%
- LOBBY: 22%
- RETAIL SPACES 'B' - DAY ORIENTED: 10%
- RETAIL SPACES 'A' - NIGHT ORIENTED: 7%
- CIRCULATION: -1%
- LOADING DOCK: -1%
- VEHICLE LIFT: -1%
- COMMON EVENT SPACE: -1%
- ELEC./DATA & RECYCLE: 0.02%
- RESTROOM & JAN. CL.: 0.02%
PDX LIVING BRIDGE - ENERGY PROGRAM BAR GRAPH (MIXED-USE COMMERCIAL, TYPICAL OF 2 BUILDINGS)

NOTE: COLORS CORRESPOND TO ENERGY PROGRAM DATA SHEET

PROGRAM

FLEXIBLE OFFICE SPACE 49%
COMMON SPACE 31%
RETAIL 20%

ENERGY

FLEXIBLE OFFICE SPACE MAINTENANCE OFFICE 49%
CIRCULATION LOADING DOCK VEHICLE LIFT 23%
LOBBY RETAIL SPACES ‘B’ - DAY ORIENTED 13%
RETAIL SPACES ‘A’ - NIGHT ORIENTED 9.5%
RESTROOMS & JAN. CLS. 4.5%
ELEC./DATA & RECYCLE - 1%
NOTE: COLORS CORRESPOND TO ENERGY PROGRAM DATA SHEET
PDX LIVING BRIDGE - ENERGY PROGRAM SPACE DIAGRAM SHOWING ENERGY NEEDS (MIXED-USE RESIDENTIAL, TYP. OF 4 BLDGS.)

LEVEL 4

LEVEL 3

LEVEL 2

LEVEL 1

NOTE: COLORS CORRESPOND TO ENERGY PROGRAM DATA SHEET

ROBIN SHANE BEST / 95092888 / ARCHITECTURAL PROGRAMMING / J. von BARGEN / UNIVERSITY OF OREGON PORTLAND CENTER / FALL 2007
PDX LIVING BRIDGE - ENERGY PROGRAM SPACE DIAGRAM SHOWING ENERGY NEEDS (MIXED-USE COMMERCIAL, TYP. OF 2 BLDGS.)

LEVEL 3

NOTE: COLORS CORRESPOND TO ENERGY PROGRAM DATA SHEET

LEVEL 2

LEVEL 1

ROBIN SHANE BEST / 95092888 / ARCHITECTURAL PROGRAMMING / J. von BARGEN / UNIVERSITY OF OREGON PORTLAND CENTER / FALL 2007
OPERABLE WINDOWS ARE GIVEN ENHANCED PERFORMANCE THROUGH USE OF EFFICIENT FANS

NORTHERN BUILDING SEGMENTED TO ALLOW SUMMER BREEZE FROM NORTHWEST (COOLS SOUTHERN BUILDING AS WELL AS NORTHERN BUILDING)

COVERED WALKWAY BETWEEN SEGMENTS
PDX LIVING BRIDGE - ENERGY PROGRAM ARCHITECTURAL IMPLICATIONS (SECTION AT RESIDENCES FACING WEST)

SOUTHERN BUILDING
TERRACED TO AFFORD
ADEQUATE EXPOSURE
TO NORTHERN BUILDING

NORTHERN BUILDING
SEGMENTED TO ALLOW
SUMMER BREEZE FROM
NORTHWEST