LEAP COLLABORATIVE | DISPLAYING SUSTAINABLE DESIGN IN DOWNTOWN KNOXVILLE

LEED Breakdown:
66 Total Credits, **Gold Ranking**

- 24 Sustainable Sites
- 6 Water Efficiency
- 16 Energy and Atmosphere
- 4 Materials and Resources
- 15 Indoor Environmental Quality
- 1 Inovation and Design Process

KNOXVILLE, TN

Occupancy: Mixed Use (B,M,A-2)
Construction Type: II-A
Height: 70'
Area: 41,655 sq.ft.
Sprinklered
Protected

01 DESIGN & INNOVATION

The LEAP Collaborative is imagined as a collection of landscape architects, engineers, architects, and planners who contract projects with an emphasis on sustainable design. Therefore, for their headquarters, we wanted to express that commitment to sustainable design and display some of those practices clearly to the pedestrian and passer-by. One of the main goals was the clarity of programatic pieces. The retail approaches the street edge to invite shoppers. The laboratory, highly visible, pushes forward towards the street edge but is less accessible to the public by being raised up on pilotis. The multiple terraces are connected through the use of plantings that even move vertically along walls to connect plaza to upper roof terraces. The use of planting was important to bringing habitats and greenery back to an asphalt parking lot site in the middle of the city.

03 LAND USE & SITE ECOLOGY | NATIVE TN PLANTINGS:

[a] virginia creeper (green wall)
light: excels in shade and sun
moisture: does well in seasonally moist climates

[b] wild hydrangea (courtyard plantings)
light: excels in shade
moisture: does well in mesic and seasonally moist climates
soil: non-acidic soil preferred

[c] wild azalea (courtyard)
light: does well in sun and shade
moisture: does well in mesic and seasonally moist climates
soil: does well in basic or acidic soil

02 REGIONAL/ COMMUNITY DESIGN

The LEAP Collaborative Office on W. Chuch Ave is in the heart of downtown Knoxville. The location has easy access to restaurants on Market Square and Gay Street, Civic Buildings including the library and post office, and parks. The city bus station is less than a half-mile away providing public transportation options to much of the metropolitan area and long distance transportation options via Megabus.

Metric:
The site has a walk score of **86** which is considered "very walkable" (most errands can be accomplished on foot).

Market Square, Downtown Knoxville
A walkable district full of restaurants, civic life, and performing arts. Most highly used in the evenings and weekends.

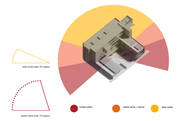
04 BIOCLIMATIC DESIGN

Knoxville is characterized by a humid, modified continental climate. This includes cool winters with moist, warm summers. The nearby Cumberland and Smokey Mountain ranges have a pronounced effect upon prevailing wind. Daytime winds typically have a southwesterly prevailing direction, while nighttime winds usually come from the northeast. Wind speeds are greater than 5 mph year round, offering good natural cooling potential in summer.

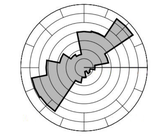
Our project implements a variety of plazas with different solar orientations that can be used during different seasons. The southern plaza would be preferrable in winter months with more solar access. The northern plaza would be preferrable in summer months with more shading and protection. The largest areas of glazing are positioned on the Northern facade which would have the least solar gain. Clerestories with overhangs are used on the Southern facade. Operable windows allow user control for comfort and natural ventilation. Green walls help shade the laboratory space on the 2nd and 3rd floors.

	J	F	M	A	M	J	J	A	S	O	N	D
1 am	36.1	36.3	45.1	54.4	61.1	67.2	71.1	72.0	65.7	54.6	44.5	41.2
2	34.4	35.3	44.3	53.8	60.5	66.5	70.4	70.9	64.9	53.3	43.1	40.7
3	34.2	34.6	43.5	53.1	59.8	65.8	69.8	70.7	64.4	52.6	43.0	40.1
4	33.9	33.9	42.7	52.4	59.1	65.1	69.1	70.1	63.7	51.8	42.7	39.8
5	33.3	33.2	42.0	52.0	58.5	65.3	69.1	69.6	62.7	51.3	42.0	39.6
6	32.3	32.6	41.4	51.6	58.8	65.5	69.2	69.2	62.5	50.8	41.9	38.8
7	32.0	32.4	41.7	51.1	60.1	65.7	69.2	69.5	62.6	50.3	41.4	38.9
8	31.8	32.2	43.1	53.8	62.6	68.8	72.2	71.8	65.4	52.8	41.7	38.9
9	33.0	34.9	45.5	56.7	65.0	71.6	75.2	74.8	69.0	55.6	44.5	40.0
10	36.0	37.9	47.9	58.4	67.5	74.7	78.2	77.8	72.2	58.2	48.3	42.3
11	37.2	40.7	50.1	61.6	69.2	76.6	80.3	80.2	74.6	58.9	51.5	44.4
12 noon	38.8	43.0	52.3	63.8	70.9	78.5	82.3	82.1	77.0	63.3	54.3	47.2
1 pm	40.3	45.1	54.4	66.0	72.6	80.4	84.4	82.8	78.7	65.9	56.6	48.7
2	41.5	46.1	55.5	67.1	72.9	80.7	84.7	84.1	79.5	66.7	58.6	50.9
3	42.3	47.1	56.5	68.2	73.2	80.8	85.0	83.5	79.8	67.6	59.1	51.8
4	42.8	47.8	57.6	69.3	73.5	81.1	85.3	83.5	79.8	68.5	59.1	51.6
5	42.4	47.6	56.2	68.3	72.4	80.1	83.9	83.1	78.9	68.2	58.3	50.3
6	40.5	45.5	54.8	67.3	71.4	79.2	82.4	82.3	76.9	63.9	54.8	47.5
7	39.1	43.2	53.3	66.2	70.3	78.2	80.9	79.9	73.9	61.5	52.5	46.3
8	38.5	41.5	51.6	63.9	68.3	75.6	78.5	77.6	71.9	59.9	50.2	45.1
9	37.5	40.2	49.8	61.6	66.4	73.1	76.2	75.6	69.8	58.3	48.2	43.3
10	37.0	38.8	48.1	59.3	64.5	70.6	73.8	74.5	68.3	56.7	46.9	42.9
11 pm	36.2	37.6	47.2	57.6	63.4	69.5	72.9	73.3	67.2	55.7	45.9	42.3
12 mid	36.2	36.8	46.3	56.2	62.5	68.5	72.1	72.5	66.3	54.8	44.9	41.2

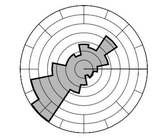
Cold	Cool	Comfort	Hot
< 32	32-44.9	45-59.9	≥ 60



Sun path diagram for building. Highest amount of solar exposure on southern facade of building.

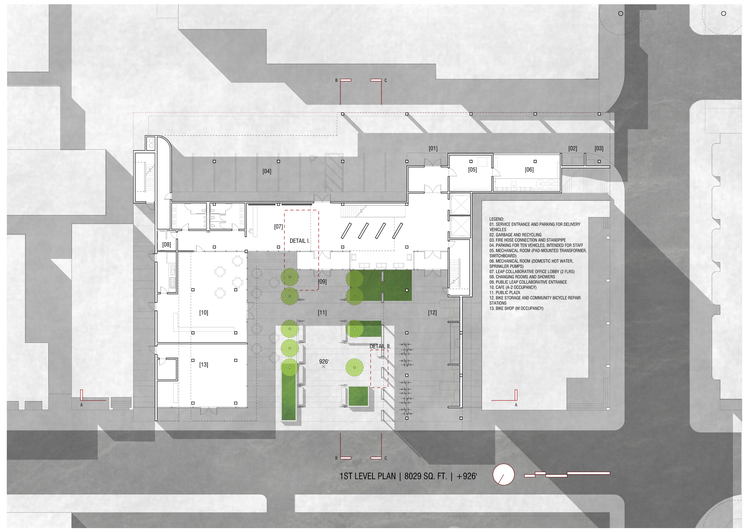


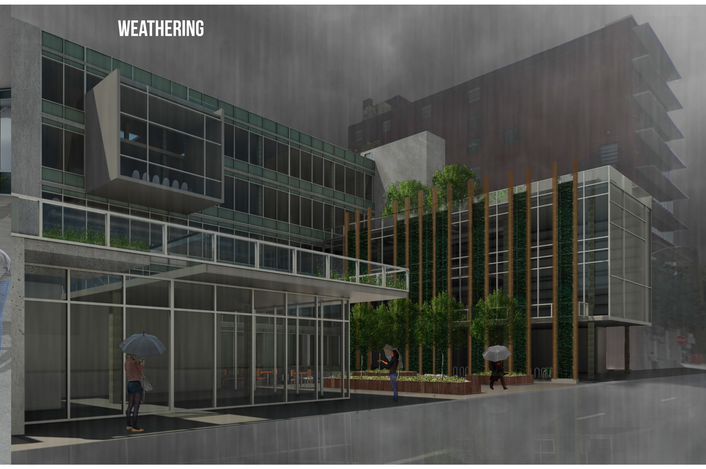
Wind Rose: January



Wind Rose: July

Metric:
Percent of the year that occupants will be comfortable using passive systems: **27.8 %**

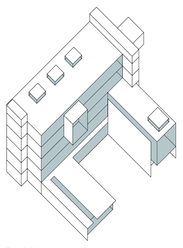




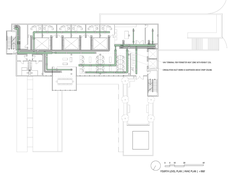
05 LIGHT & AIR

The LEAP Collaborative Office is seeking to be an example of a building that uses its surroundings to its benefit. Multiple daylighting techniques are employed including clerestories, lightwells, and large expanses of glass on the northern facade. The high amount of daylighting can limit electric lighting needs in most of the office space, but task lighting is to be included at each workstation for flexibility. Operable clerestory windows in the private offices as well as an operable curtain wall with push-out windows helps provide natural ventilation in the less extreme weather seasons.

Metric:
Percent of the building that can be daylit (only) during occupied hours: **79%**
Percent of floor area with views to the outdoors: **57%**
Percent of floor area within 15 ft. of an operable window: **37.2%**



Daylighting
Areas of glazing are highlighted in blue. Amount of glazing in building limited to 30% of total facade area.



HVAC, Typical Floor Plan
Two vertical ducts split the heating and cooling requirements on each floor. Multiple zones exist to allow more control for individual users and to respond to solar heat gains through the day and seasons/

06 WATER CYCLE

Our design pays close attention to the usage of water and how storm water moves through the site. Landscape design includes green roofs with low-maintenance grasses and crawling vines on the vertical green walls. Vegetation in the plaza also uses stormwater that is irrigated to the planting beds. The plaza also features semi-permeable pavers to allow easy access of water into the soil and less runoff to the storm drains. Water is a valuable resource in promoting the reintroduction of flora to a underutilized parking lot in the downtown area.

Metric:
Percent of stormwater that is managed onsite: **66%**

Site				
24 Hour 2 year event	0.14	*(1) Look up this value on a published IDF [Intensity-Duration*		
Rain (ft)	1.68	*(2) Conver The 24 hour 2 year rainfall event to feet. (0.5' for*		
Storage (cf)	0	*(3) Record the amount of water storage onsite (ex. cistern,*		

(4) List all surfaces that cover the site under the surface column and their area in square feet
(5) for each surface, record the runoff coefficnet form the chart on the right

	Surface	Runoff Coefficient	Area (sf)	Total stormwater (cf) sf*Rainfall	Total Runoff (cf) sf*.5'*Runoff Co.
1	Roof	0.9	4177	7017.36	6315.624
2	Asphalt	0.9	0	0	0
3	Grass	0.17	5651	9493.68	1613.9256
4	Pavers	0.2	10193	17124.24	3424.848
5					
6					
7					
	Sub Total		**20021**	**33635.28**	**11354.3976**
	After Storage				11354.3976
	Total Percent Managed Onsite				**66%**

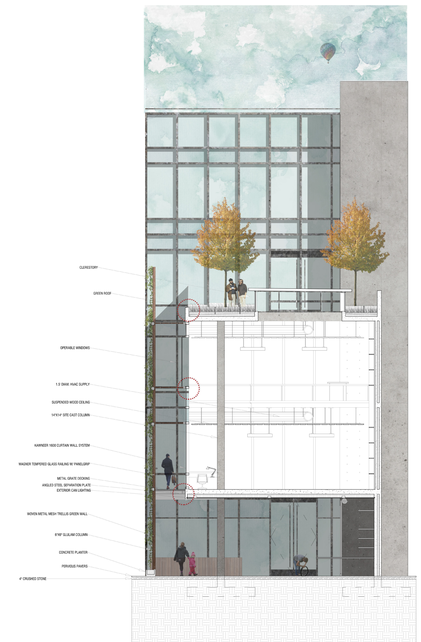
(6) The calcutated percentage is the amount of stormwater stored onsite. Adjust storage capacity o
(7) Adjust storage capacity or surface areas to try to reach 100%

07 ENERGY FLOWS & ENERGY FUTURE

The implementation of operable windows and considerations to daylighting are two steps taken to reduce energy usage in the building. The HVAC system chosen was multi-zone variable air volume to allow maximum flexibility. If for instance, the offices were not occupied on the weekend, but the cafe on the plaza wished to be open, heating/cooling would only be supplied to those spaces, not the entire building. The outdoor spaces are an important asset to the project, since meetings and demo work could be done outdoors in agreeable weather. The user is encouraged to spend time outdoors with the variety of spaces. The building materials are long-lasting and low-maintenance to prevent heavy, energy-costly renovation work over time.

Metric:
Energy requirements: **11.7 kwh/sqft**

SECTION B-B | 1/8"=1'



DETAIL SECTION II. | 1/4"=1'

08 MATERIALS & CONSTRUCTION

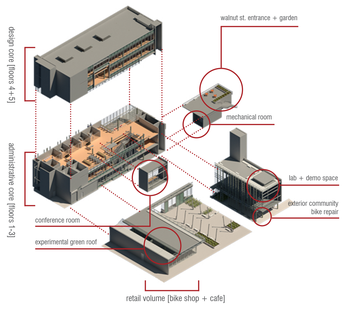
Our design focused on using a durable material that is long-lasting and can double as an interior and exterior finish. Concrete served as the main structural material as well as a typical finish for heavily-trafficked floors and some interior walls. Concrete is made from simple materials: sand, water, and gravel, thus it requires less energy than many metal structures. The mass of concrete can help with thermal issues and noise transfer between walls. Wood and cork, easily renewable resources, are used as accent materials to warm the concrete. Cork is implemented in many of the spaces as a flooring to lower the noise level. Double-paned low-e glazing is used to reduce thermal transfer through the fenestration. Plant material is also a key material to softening the grays of the concrete and giving the building a "living" atmosphere.

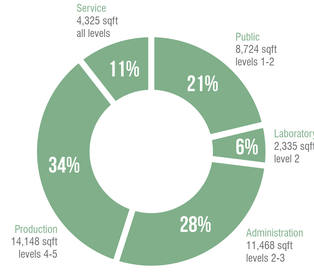
09 LONG LIFE, LOOSE FIT

The material choice of concrete reflects a desire for longevity of the building. Concrete will last for hundreds of years with minimal maintenance requirements. The structural system, two-way post-tensioned flat slab, allows for flexibility of tenant. New HVAC or lighting systems can be easily changed. Often the systems are left exposed to celebrate the many parts that make up a building. Different parts of the building can take different roles, as partition walls will be easily removed or added.

10 COLLECTIVE WISDOM, FEEDBACK LOOPS

This project was our first educational opportunity to understand the complex implications of choosing certain materials or systems. We learned how certain goals can contradict other goals and tried to find happy compromises. Important research was done to look at the Downtown Design Guidelines for Knoxville, TN. A presentation of this design to the Knoxville community would be beneficial in understanding if the community would be receptive to this product of forward-thinking design in their downtown. Through post-occupancy evaluation, we would like to investigate how water moves through the site and if the various plantings would remove as much run-off as we presupposed.





PROGRAM BREAKDOWN