

# CRUMBS- 360 KNEADING

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State University in partial fulfillment of the requirements for the degree of

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In  
Architecture

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Environment

## ABSTRACT

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### CRUMBS - 360 KNEADING

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### ABSTRACT

How can we as design professionals support a more intelligent and resilient building environment?

The myriad of factors involved in the delivery of a single type of food to a consumer poses a magnitude of complexities in our modern U.S. food system. Food loss during production, post harvesting, handling, packaging, distribution, and consumption levels occupy landfills to reckless extents. Vulnerabilities in the system result in health hazards, environmental impacts, social neglect, and economic concerns. Resources that account for the agricultural production include 80% of consumptive water use (Inventory of U.S. Greenhouse Gas Emissions and Sinks) and more than 50% of all land use (Major Uses of Land in the United States). Agricultural production subjects the environment to hundreds of millions of pounds of pesticides each year, which leads to our impaired water quality in rivers and streams. Among these environmentally harmful qualities during the soil-food waste system are the nitrous oxide and methane gas emissions caused by the decomposition of organic material (Nesheim, 2015).

The food-soil-waste system in the United States is wreaking havoc. In 2014 the EPA reported that food waste constitutes 21.6 % of municipal landfill in the United States; estimated to be more than any other material (Wasted Food Programs and Resources Across the United States). In addition to its leading waste contribution is its leading role in greenhouse gas emissions. Producing one of the most powerful greenhouse gases; methane from landfill food waste is one of the top culprits of U.S. emissions. On a global scale- food waste would be the third top emitter if it were a country, behind USA and China (Food Wastage Footprint Impacts on Natural Resources, 2013). United States accounts for approximately 15.4% of these emissions based on 2015 reports (Basic Information about Landfill Gas). In this fractured system, valuable food is being prioritized in landfills rather than with the hungry. Studies from the USDA's Economic Research Service (ERS) reveal that 40% of food that is produced, ends up in landfill (OCE | U.S. Food Waste Challenge | FAQ's.). Meanwhile in 2016, USDA documented 41.2 million Americans were living in food insecure households (Key Statistics & Graphics).

## GENERAL AUDIENCE ABSTRACT

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### CRUMBS - 360 KNEADING

Ariej Elfeky

#### GENERAL AUDIENCE ABSTRACT:

#### DESIGN OF A BAKERY IN ALEXANDRIA, VIRGINIA

Through the evolution of a baker's practices, we can understand the transitions of matter between bread, body and building. The food soil waste system of the bakery becomes an evolutionary process of recovery, remediation, restoration, replenishment, and reuse.

**"There is a crime here that goes beyond denunciation. There is a sorrow here that weeping cannot symbolize. There is a failure here that topples all our success."** (Steinbeck, 2008)

Learning from the skies above and ground beneath, I propose a horizon that binds the two in a closed loop system. As a baker combines earth, water, wind, and fire to transform dough into bread, the bakery is designed to knead these same elements together to create a harmonious relationship between man and nature

## DEDICATION

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((photo credit: Omar Elfeky “Omarinho”. In photo: My brother Salman Elfeky “Fishy” and myself)

We were written with words that were blindfolded by the night,  
Covered in all that we are, and all that we’ll never be,  
Puzzled by all that we have made from all that we haven’t,  
We tucked our troubles between the clouds, turning air to oceans.  
Apart from each other, we whispered in rain, let go in the snow, and whaled in the hail.  
Stemming from nowhere and branching everywhere;  
You - a dancing constellation of my universe  
Knitting blankets in the skies.  
Weaving through me like the warmth of sun, and guiding me by the winds,  
You’ve grounded my “what if’s” by landing me on firm soils only to be cleansed by your waters.  
You are the spotless horizon beyond my weathered views

I dedicate this book to my mother, **Mona Elboghday**, and siblings- **Sarah “Ninja Turtle”, Omarinho, and Fishy**. Every letter of support you’ve uttered echoes in the grains my feet tread on...  
...Fishy, through the years, through the tears and fears, you’ve made a girl fearful of a rock, climb a mountain.

Without you, I would have been me. Thank you for successfully mitigating a natural disaster.

## ACKNOWLEDGEMENTS

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A special token of appreciation for the man who saw the methods in me - above the madness out of me, **Mr. Harvey Howard Liebman (HHL)**.  
To my thesis committee; **Jodi, Paul, and Markus** it is truly an honor to be under your scrutiny, discipline, guidance, and freedom.  
With endless love, respect, and gratitude.

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## INTRODUCTION

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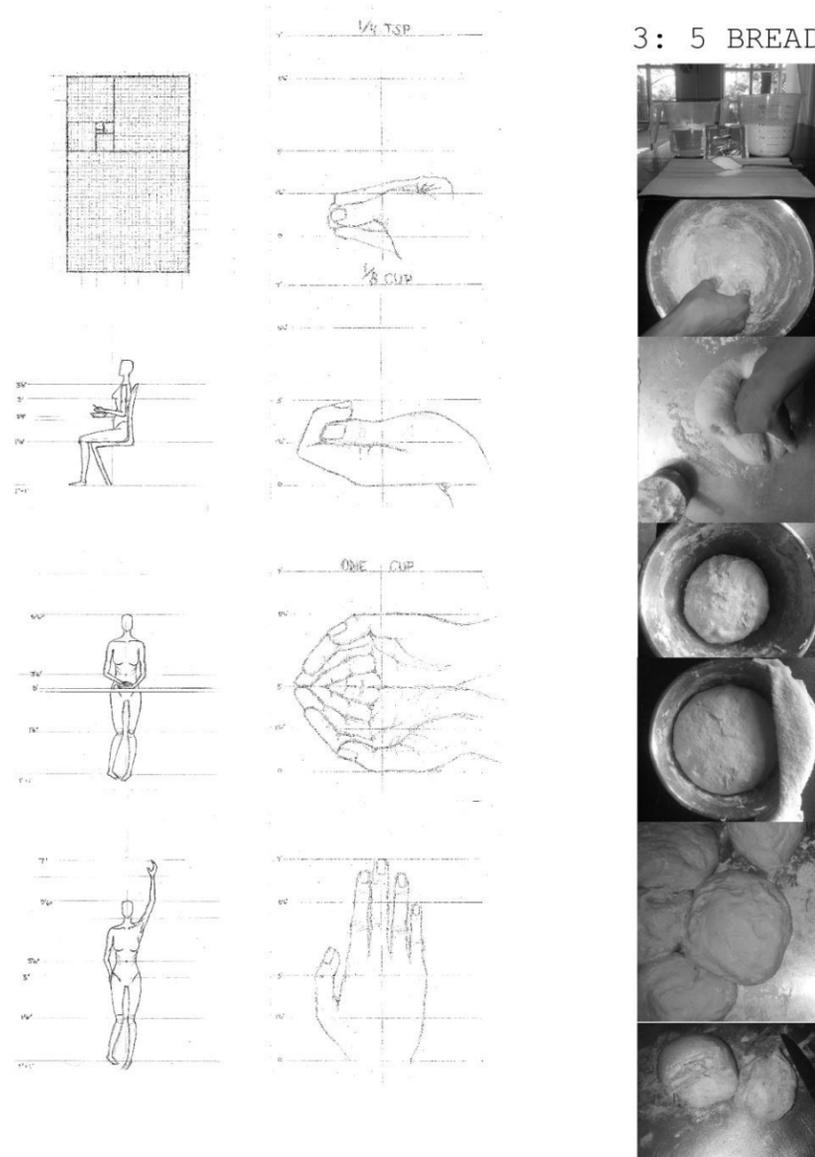
“man is a child of the earth, dust of the dust; the earth has mothered him, fed him, set him his task, directed his thoughts, confronted him with difficulties... given him problems... and at the same time whispered hints of their solution” (Semple)

My personal adventures are poorly planned, never cohesive, always negligent, and above all - enlightening.

Growing up in an orderly family environment, I was fascinated by freedom and chaos. These two elements saved me from the naïve nature of a sheltered “teenhood”, while exposing me to accidents and mistakes that taught me the discipline and drive of today. All that I’ve revealed and concealed, explored and ignored- led me to mishaps (good or bad, hard to say). But the setbacks and casualties ultimately shaped me to a devout journey that started in the kitchen. I cook traditional meals with unconventional twists. Every successful recipe was a result of endless failed trials, and impromptu additions to classic recipes. I learned proportions hold tremendous magnitude. From flour that forms soft fluffy insides of bread with a crusty shell, to the soft earth that forms brick; the balancing wonder of fire, earth, air and water is apparent from micro to macro levels. This thesis focuses on the kneading cycle of these elements on local and environmental levels of a bakery located in Alexandria, Virginia.

## KNEADING: PUSH AND PULL

“Baking bread involves so many variables. There are the tangible ones that determine texture and taste: flour, water, salt, leaven, and the fermentation of the dough. And then there are the intangible ones: judgment and intuition, experience and flexibility, common sense and skill. A good baker is a juggler, balancing the temperature of the air and the flour and water before feeding the leaven, and then test-ing the dough after the leaven has been fed. A good baker knows when to stop, when the fermentation is almost-but-not-quite too much, and when the loaf is baked to a perfect crust but never beyond.” (Forkish)



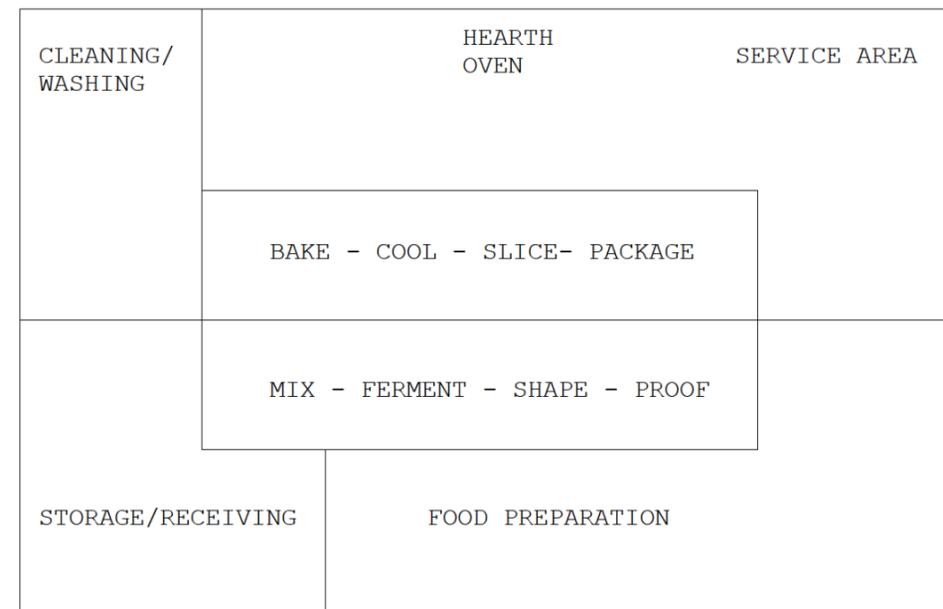
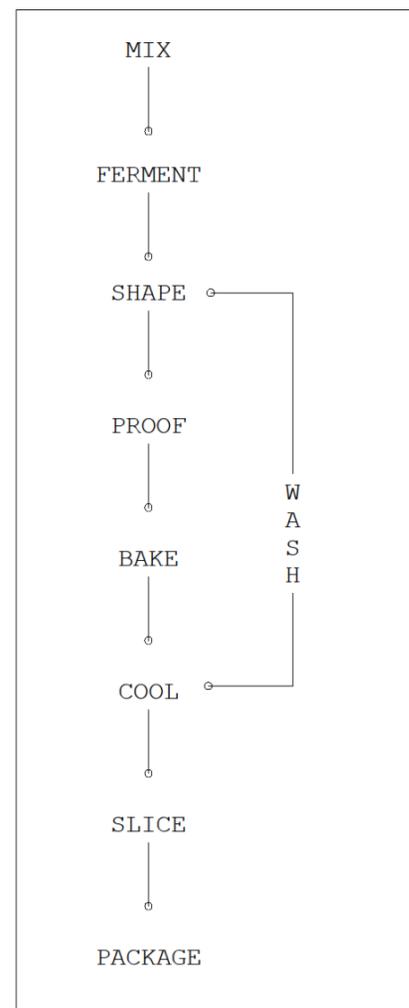
I began my thesis with a work out- a mind work out. I studied the bread making process in all its phases of life and death. From the mixing, kneading, leavening to baking and cooling- these ingredients reincarnate themselves from dough to bread. This triggered other forms of kneading I haven't given much thought to, such as wheels, massages, and kittens.

Kittens knead their mother's underbellies to stimulate milk production and the psychological attachment of comfort persists in cathood.

Comfort triggers cats to rhythmic, pushing and pulling motions that resemble a baker kneading. This represents a state of ease which mimics nursing. (Paoletta)

## BREAD. BODY. BUILDING

The bakery is used as a commercial space below and an intimate educational space above. The hierarchy of activity in the process of baking is illustrated from preparation to consumption. Preparation requires spatial clearance surrounding the upper body, while consumption requires a seated, more private comfort. This position is best described in the words of Joseph Rykwert “in the womb we all spend the beginning of our existence in a sitting or crouching position....and every time we sit down we retreat to it.” (Rykwert). Sitting down to eat is the final form the body takes in the bakery, retreating to the beginning of our existence. The variations in space and interaction with food are termed “food axis”. The term “food axis” implies not only the existence of multiple spaces that accommodate food, its processing, preparation, and consumption, but also the relationships among these spaces. Fields, gardens, outbuildings, cellar storage rooms, pantries, butteries, kitchens, and dining rooms are all part of this constellation (Davis). Understanding the use of a space is an important factor in accommodating its activities in architecture.



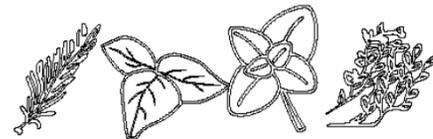
BREAD MIXING



BASIC BREAD RATIO 5:3

- 5 parts flour to
- 3 parts water
- 1 tsp yeast/lb of flour
- 2% salt

HERBS:  
Basil  
Oregano  
Rosemary  
Thyme



SEEDS:  
Caraway  
Fennel  
Poppyseed



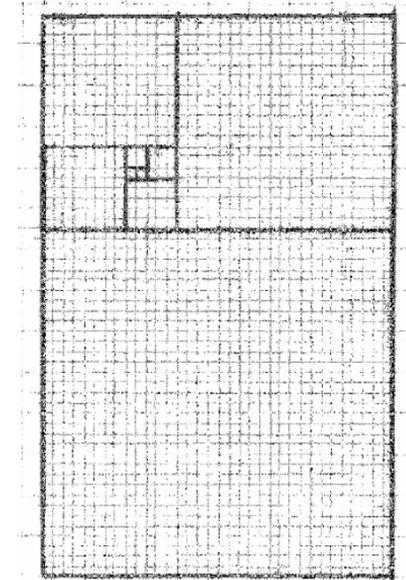
ADDITIONS:  
Cheese  
Dry roasted tomatoes  
Garlic



CONCRETE MIXING

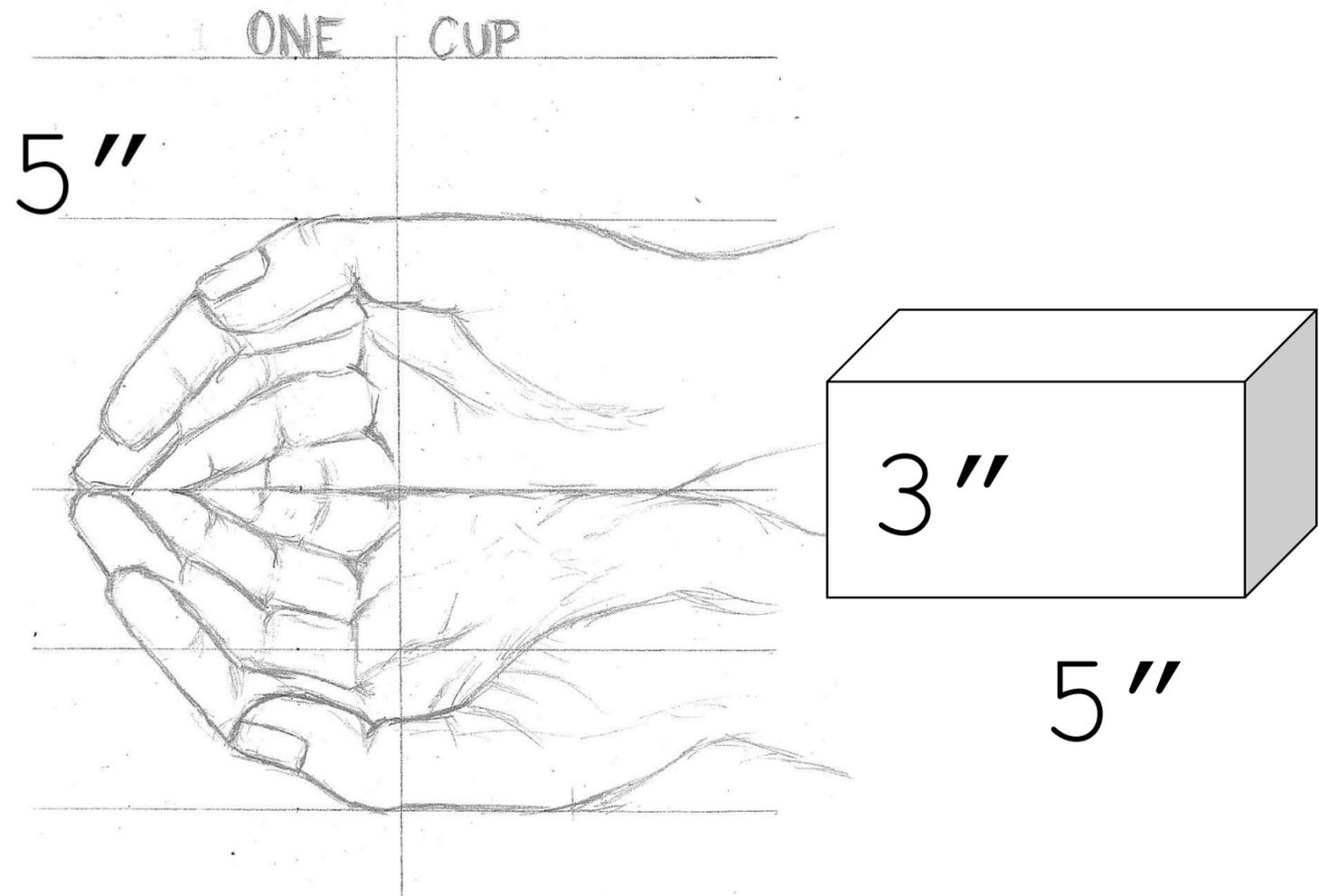
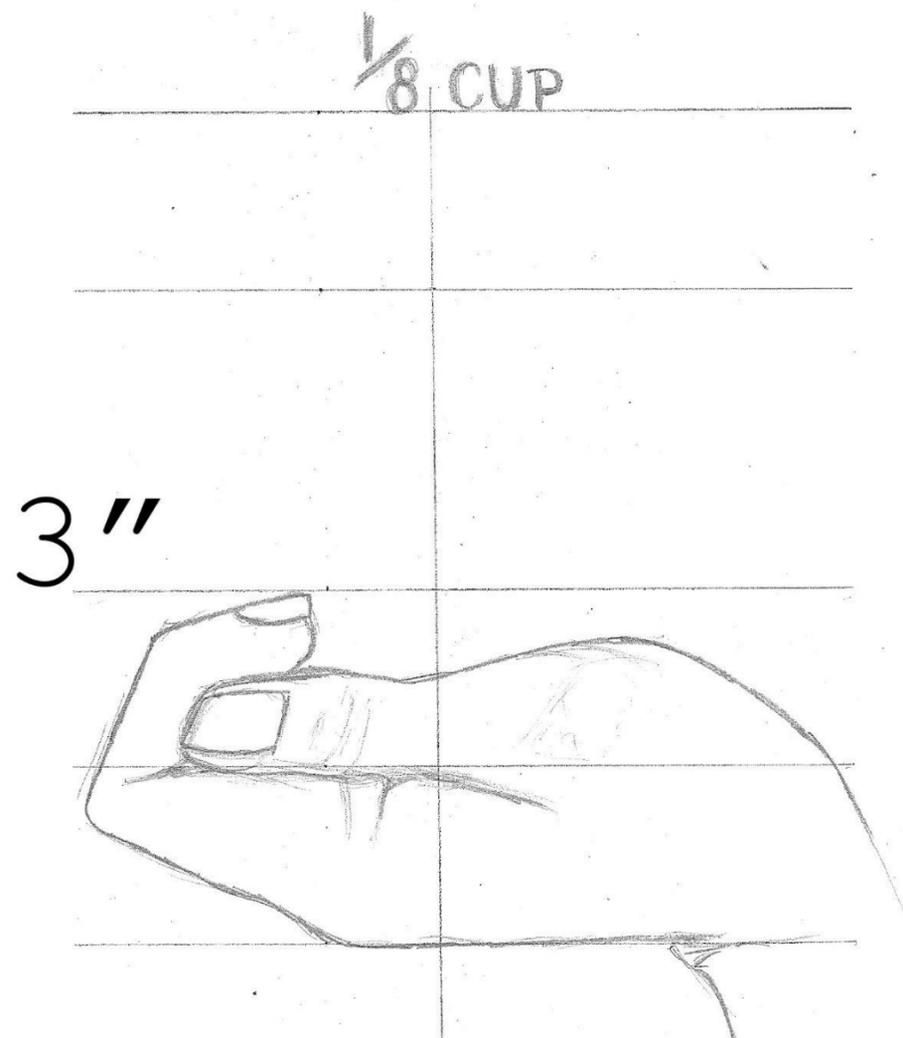
BASIC CONCRETE RATIO 3:2:1

- 3 parts sand to
- 2 parts cement
- 1 part water



MATERIAL

- Concrete structure
- Brick walls



The building is made of concrete structure and brick walls which resemble the process of bread making in the bakery. Made of earth, water, and fire; the clay and stone “metaphorize” the baking of bread. The brick measures to the cooking dimensions illustrated by the human hand. A handful (1/8 cup) - measuring 3” by a scoop (1 cup) - measuring 5”. Brick is fireproof, durable yet biodegradable, non-toxic building material which provides sufficient thermal mass to buildings. This experience carries over to man being created from mud. The harmony of the building and baking process that is communicated through the four elements allows the space to provide an earth that grounds us, fire that fuels us, air that moves us, and water to cleanse us.





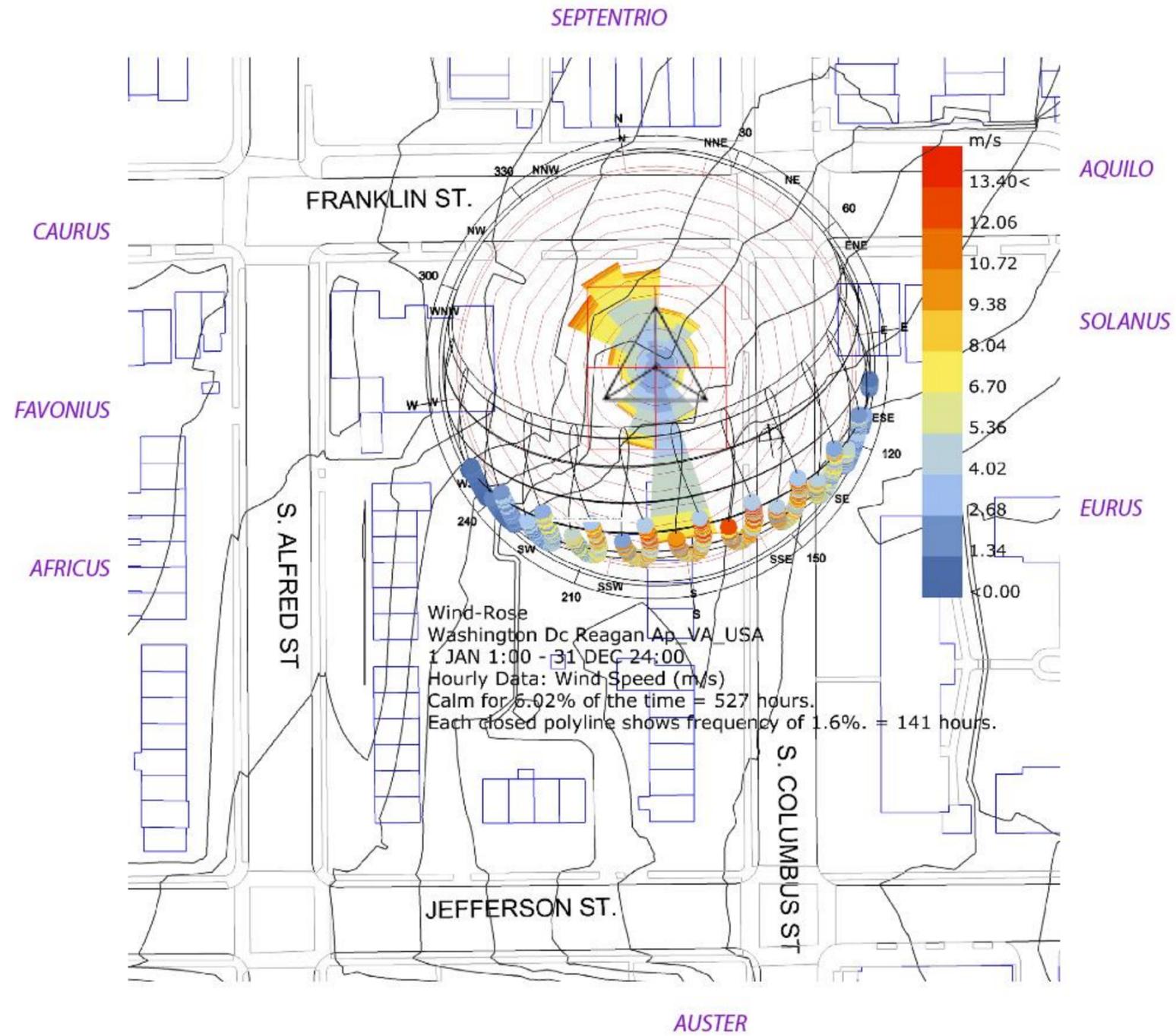
<p><b>Special Notations</b></p> <p>The maps provided hereunder are provided "as is" and the City expressly disclaims all warranties, UCC and otherwise, express or implied, including warranties as to accuracy of the maps and merchantability and fitness for a particular purpose, and further expressly disclaims responsibility for all incidental, consequential or special damage arising out of or in connection with the use or performance of the map.</p>	<p><b>Legend</b></p> <p>Private Road - - - - -</p> <p>City Boundary - - - - -</p> <p>Zoning Line - - - - -</p> <p>Block Line - - - - -</p> <p>Property Line - - - - -</p> <p>Address 1317</p> <p>Parcel No. 7</p> <p>Block No. 4</p> <p>Legal Lot No. 9811</p>	<table border="1"> <tr> <td>04</td> <td>74.03</td> <td>74.04</td> <td>75.03</td> </tr> <tr> <td>02</td> <td>80.01</td> <td>80.02</td> <td>81.01</td> </tr> <tr> <td>04</td> <td>80.03</td> <td>80.04</td> <td>81.03</td> </tr> </table>	04	74.03	74.04	75.03	02	80.01	80.02	81.01	04	80.03	80.04	81.03	<p>50 25 0 50 100 Feet</p>	<p>N</p>	<p><b>ALEXANDRIA, VIRGINIA</b> <b>ASSESSMENT MAP</b></p>	<p>SHEET NUMBER <b>80.02</b> Generated on: 1/20/2015</p>
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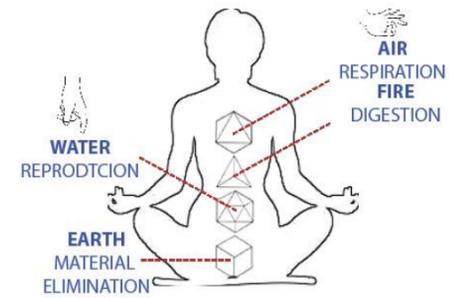
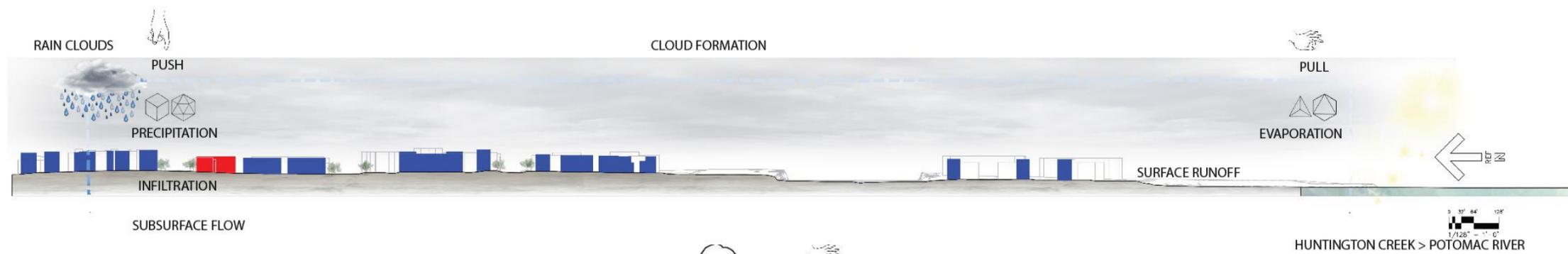


VIEW FROM FRANKLIN ST.  
VIEW FROM S. COLUMBUS ST.











NORTH ELEVATION



WEST ELEVATION



SOUTH ELEVATION



EAST ELEVATION

## PROGRAM

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The 360 bakery concept allows you to be a creator and be *recreated*.

This is exercised in a twofold process of external & internal environments:

Where the physical act of baking is an external expression that creates an internal exchange.

Both the expression and the exchange support educational and commercial functions of the bakery:

On a surface level

- the first level of bakery performs as a public space for baking services, socializing, or working.

On a mindful level

- the growing mezzanine level and second kneading studio levels operate as a school/institution for learning

On a deep level

- the ritual of the actions in the institution becomes a religious ceremony

PROGRAM SPACE		
Level	Name	Area
<b>LOWER LEVEL</b>	COMPOST	3679 SF
	MECHANICAL	1294 SF
	STORAGE	1322 SF
<b>LEVEL 1</b>	ADMIN OFFICE	178 SF
	BREAD LIBRARY	1201 SF
	DINING	1895 SF
	KITCHEN	1785 SF
	LOBBY	416 SF
	MECHANICAL	42 SF
	SERVICE	247 SF
	STORAGE/RECEIVING	316 SF
<b>MEZZANINE</b>	HERB GARDEN	1764 SF
<b>LEVEL 2</b>	KNEADING STUDIO	2436 SF
<b>PENTHOUSE</b>	POLLINATOR GARDEN	4069 SF

## BENEFITS

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8500 SQ. FT. 360 BAKERY

Produces <sup>1</sup>

- 960-1,120 HERBS

PER WEEK

*Using compost beds for basil, thyme, rosemary, oregano*

- 50% LESS ENERGY

compared to conventional greenhouses. Greenhouse can be 'self-heating' with Ceres' Ground to Air Heat Transfer (GAHTTM) System

- 90% LESS WATER

compared to conventional agriculture

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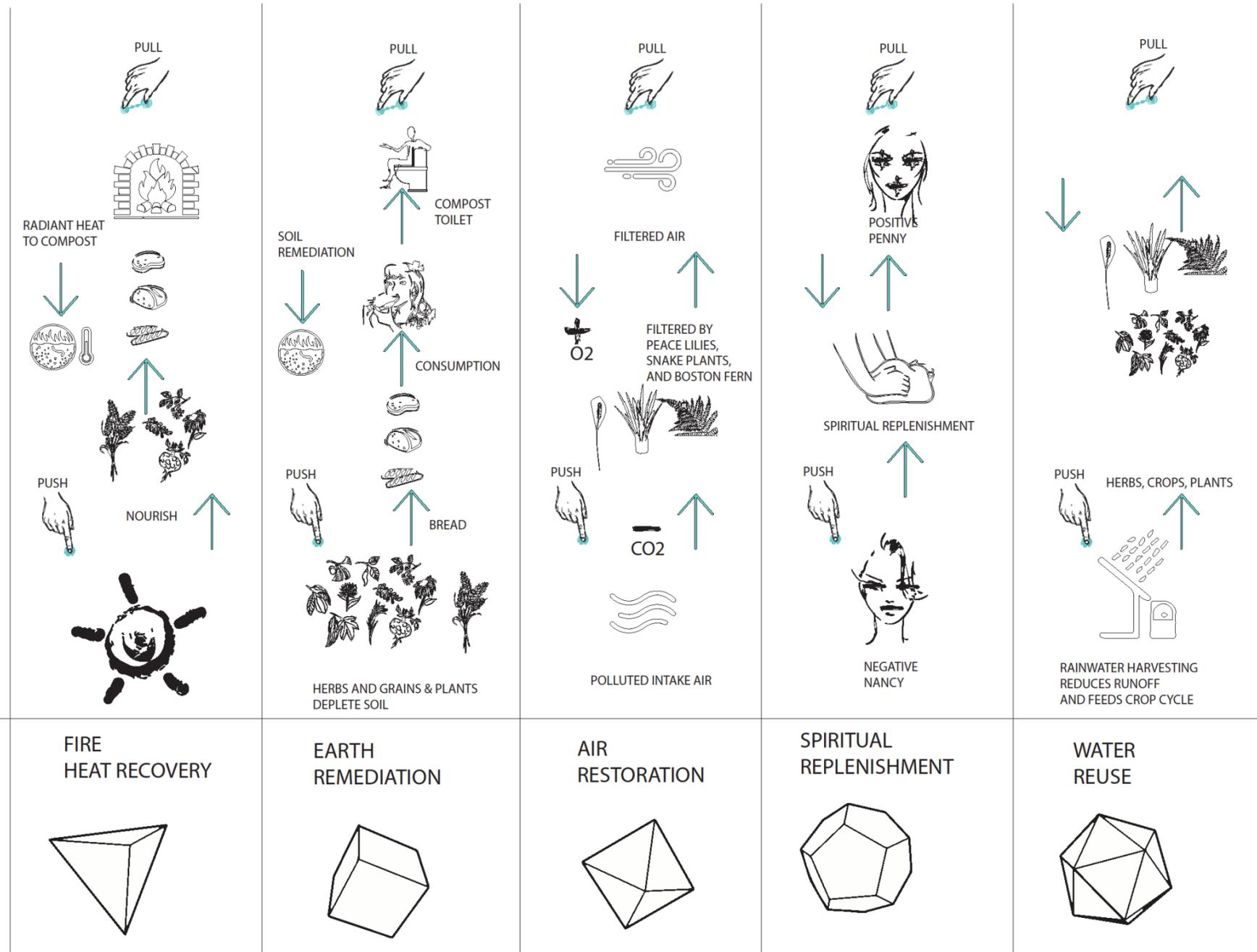
<sup>1</sup> Calculations based on guidelines from Ceres Greenhouse Solutions ("Blog." Ceres Greenhouse)

## 360 KNEADING

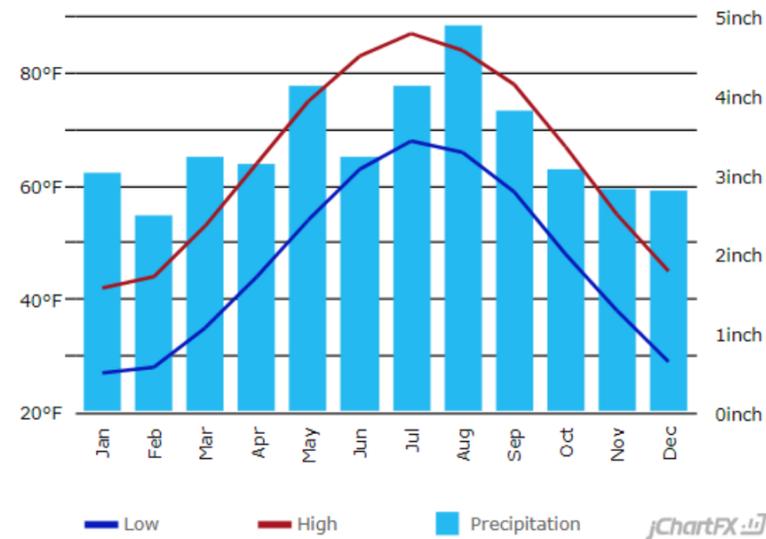
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1. Water Efficiency
  - Water catchment and reuse
  - Composting toilet
  - Waterless urinals
2. Waste Reduction and Recycling
  - Recycling
  - Composting
3. Sustainable Durable Goods & Building Materials
  - Repurposed carpet to upholstery
  - Reclaimed wood
4. Sustainable Food
  - Certified Organic or Certified Naturally Grown
  - Sourced locally
5. Energy
  - On-site landfill methane capture or waste vegetable oil conversion to energy
  - LED and LEP lamps
6. Reusables & Environmentally Preferable Disposables
  - Reusable utensils, dishes, glasses / mugs
  - Paper packaging
7. Chemical and Pollution Reduction
  - Storm water management
  - Living wall
  - Transit Oriented

# REGENERATIVE DESIGN



Washington Climate Graph - District of Columbia Climate Chart



Area	Rainfall (inches)	Total gallons (US)
85 by 100 feet	4	21,195
.000000001 acres	4	0
square miles	4	0

(“Temperature - Precipitation - Sunshine - Snowfall.” Climate District of Columbia - Washington)

Bakeries use an average **32,000** gallons per month (Panera Responsibility Report 2015-2016. Panera Responsibility Report 2015-2016)

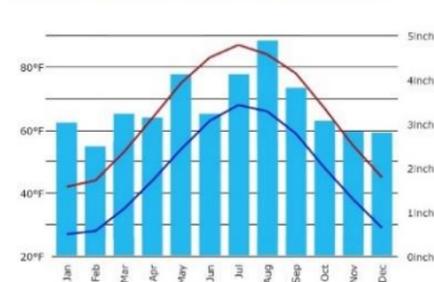
**The average rainfall per month collects 21,195 gallons of water.**

Using compost toilets- there would yield a 5120 GALLONS (16%) reduction in water use (“Restaurant Checklist.” Reduce Stormwater Runoff)

Total monthly water use for a bakery is rescaled to **26880/MONTH**- only outsourcing around **5000 gallons/month.** <sup>2</sup>

<sup>2</sup> Rainfall/month calculated by multiplying rainfall(inches) per month by site area.

Washington Climate Graph - District of Columbia climograph



Area	Rainfall (inches)	Total gallons (US)	Cubic feet	40-gallon baths
100 by 85 feet	4	21,195	2834	529.9
.000000001 acres	4	0	0	0
square miles	4	0	0	0

Data, U. C. (n.d.). Temperature - Precipitation - Sunshine - Snowfall. Retrieved December 11, 2017, from <https://www.usclimatedata.com/climate/district-of-columbia/united-states/3178>

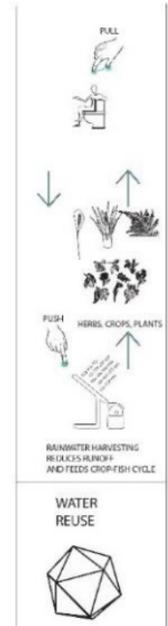
• **AVERAGE RAINFALL: 21,195 GALLONS PER MONTH.**  
 BAKERIES USE AN AVERAGE OF 32,000 GALLONS PER MONTH.  
 16% REDUCTION IN WATER USE WITH COMPOS- WATERLESS TOILETS.

• **BAKERY USAGE: 26880 PER MONTH.**

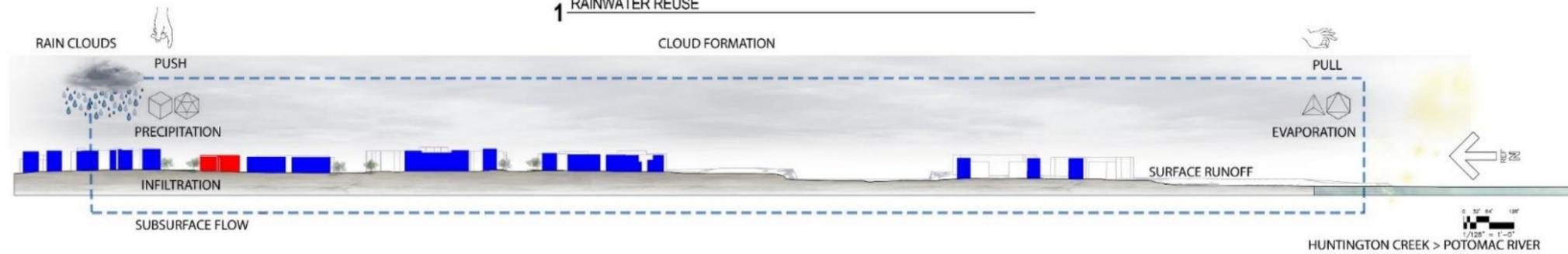
• **WATER COLLECTED FROM ROOF TRANSOMS INTO VERTICAL MULLIONS AND PERVIOUS ROOFING**

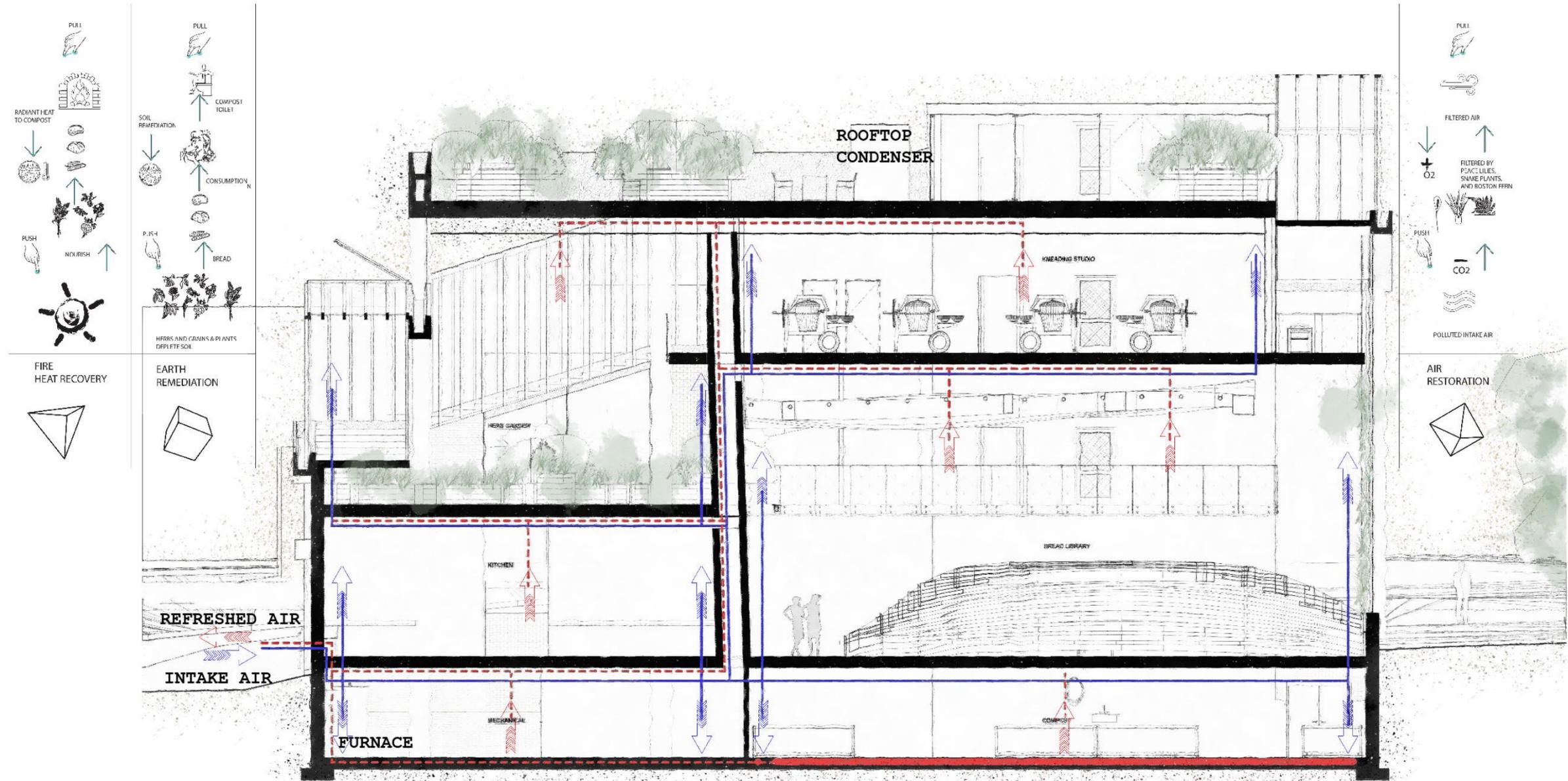
• **HORIZONTAL VESSELS COLLECT WATER FROM VERTICAL MEMBERS**

• **WATER IS FILTERED AND COLLECTED IN CISTERN FOR DISTRIBUTION**



1 RAINWATER REUSE



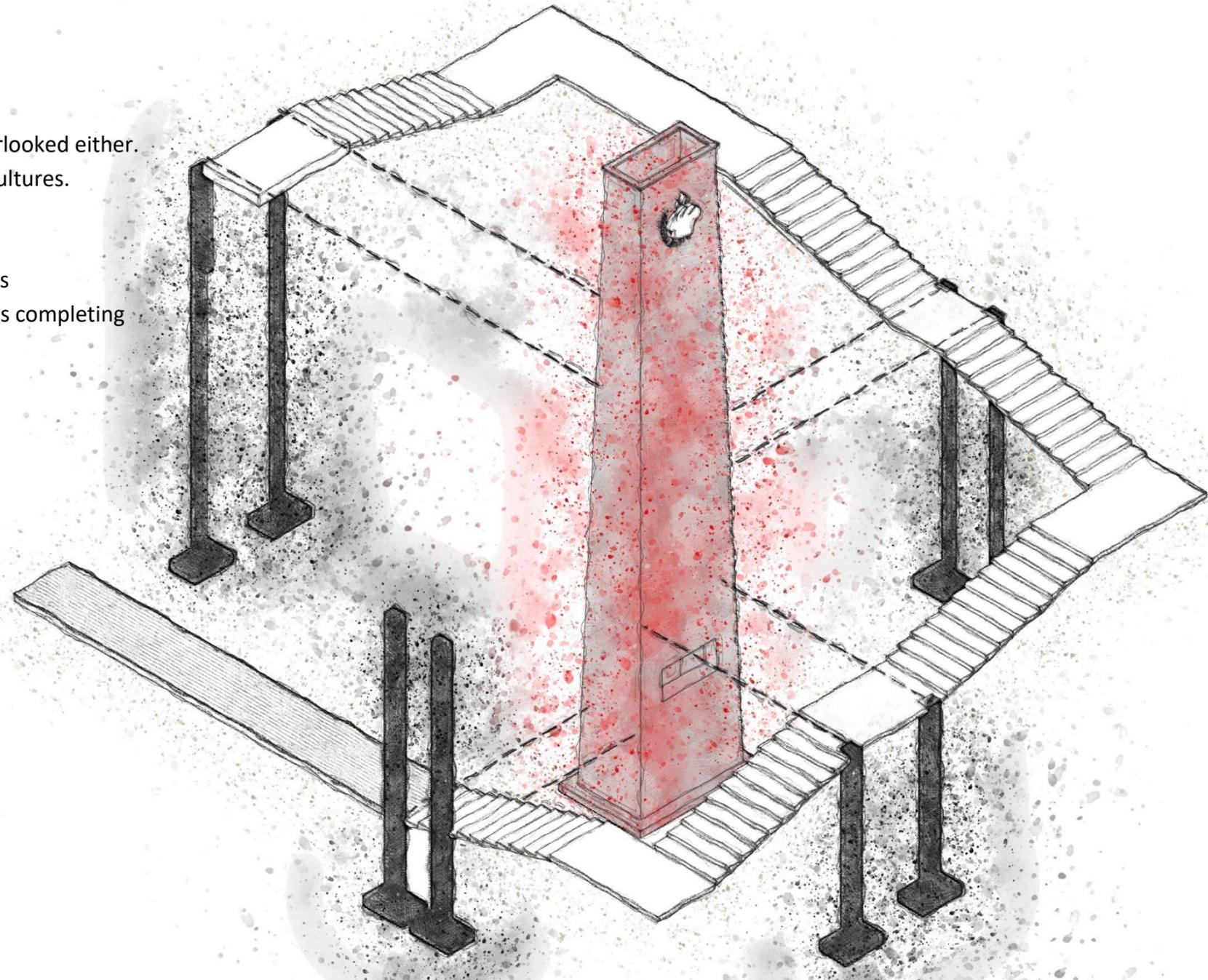


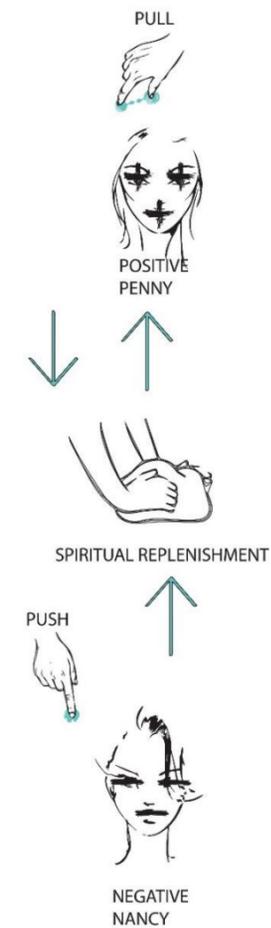
## RELIGION IN A LOAF OF BREAD

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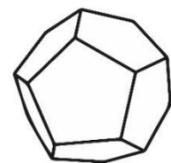
The process that occurs in the presence of fire is not to be overlooked either. Fires have been an intricate part of storytelling in indigenous cultures. It is essential to the act of passing and sharing knowledge. The building's internal experience mimics that of a pilgrimage. One ritual during Hajj involves tracing the footsteps of prophets who tread around the house of God (Kaaba). This ritual involves completing 7 laps around the holy house.

As the hearth oven serves as a focal point, each landing of the hearth invites you to the different levels involved in the surface, mindful, and deep functions of the bakery.

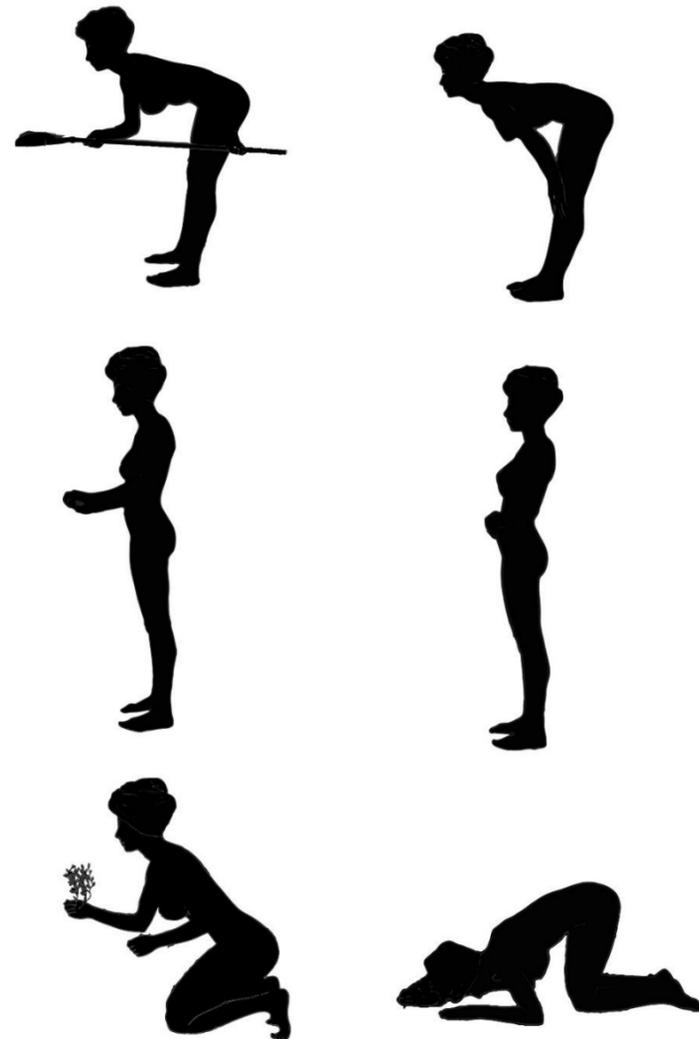




SPIRITUAL REPLENISHMENT



## ZAHIR & BATIN



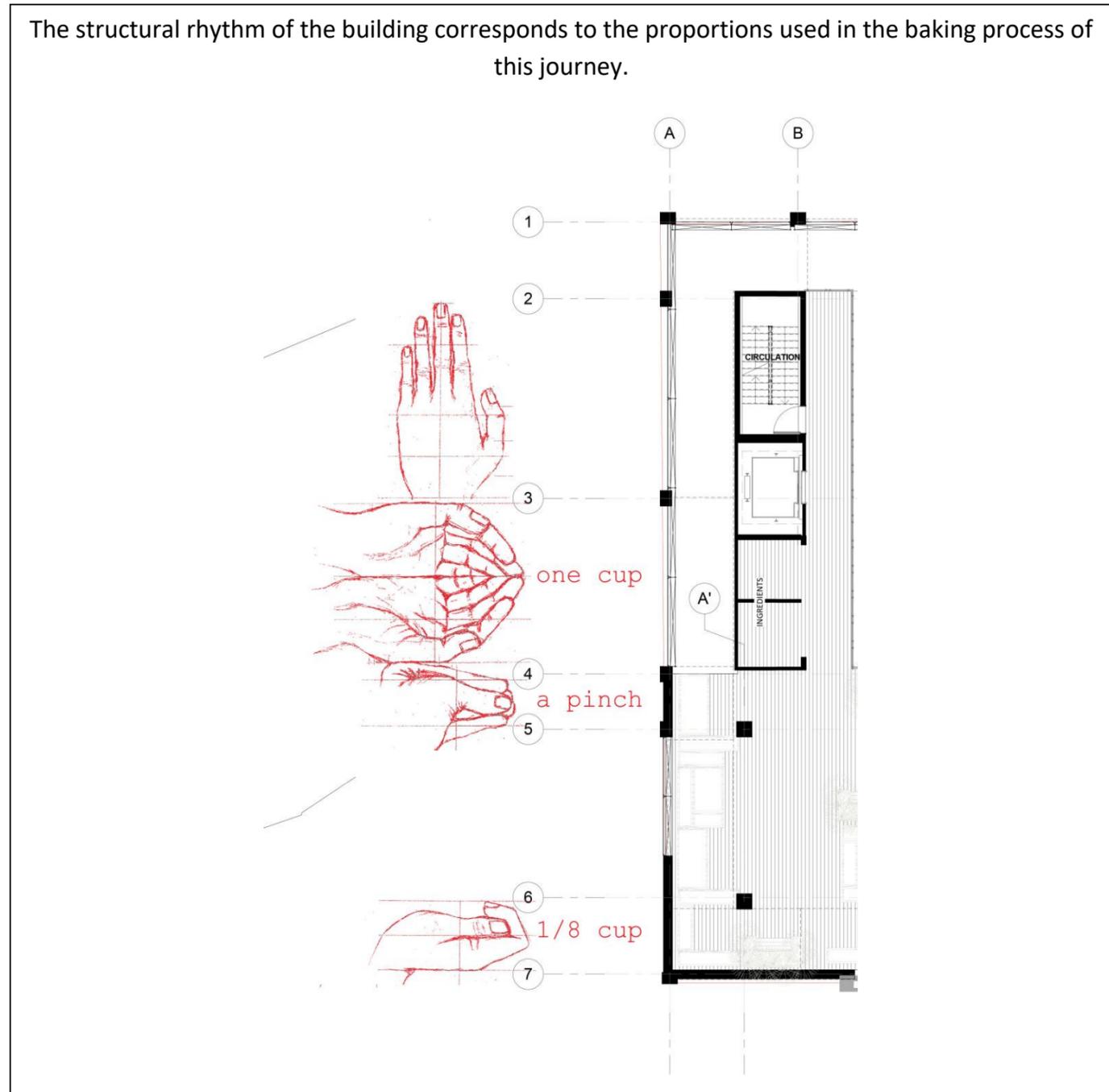
## OUTWARD & INWARD

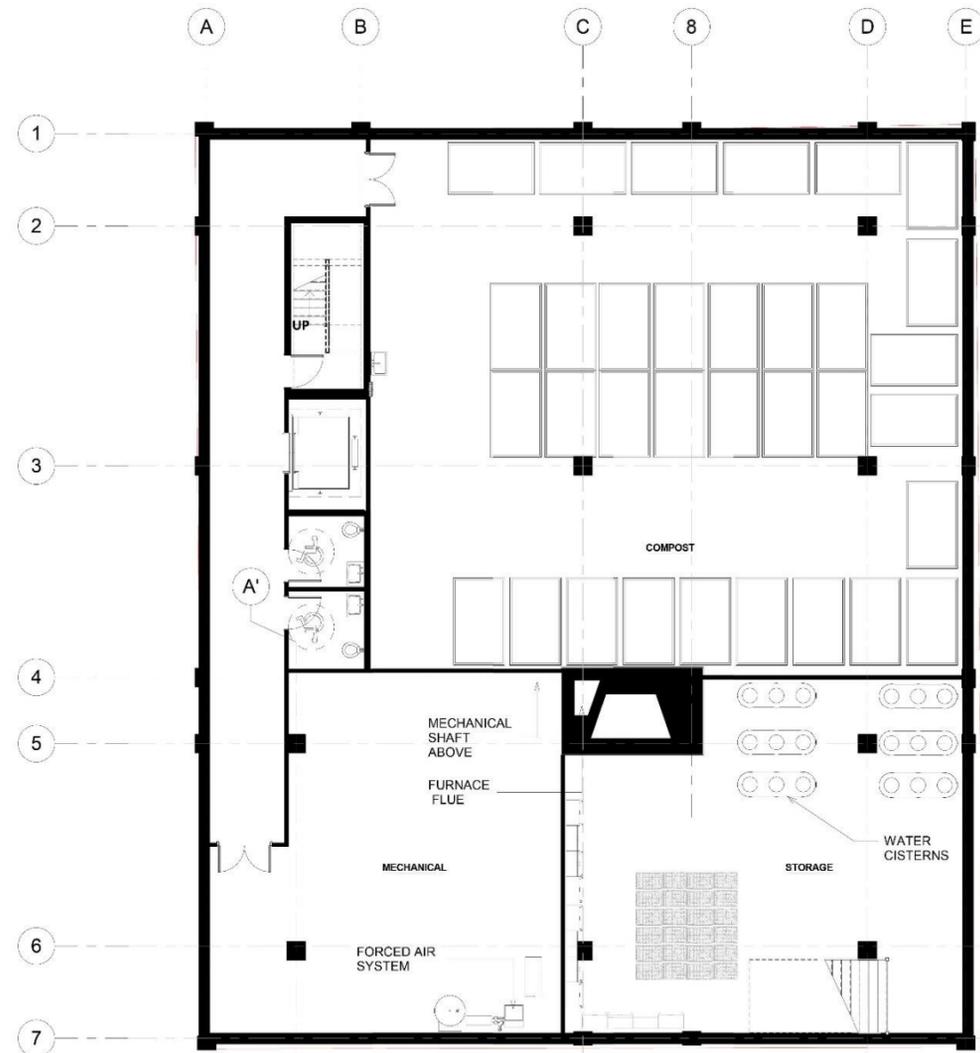
Stasis in architectural practice is oftentimes non-conductive to its users who play, pray, work, and eat. However, stasis is necessary to provide variations in design that adapt to the body which it serves. Spaces, although still, fill with movement. Objects as simple as door knobs, twisted to pull and release the latch, and held still by a doorstep used to separate and open spaces. A changing form as its frame stands still. Motions in the buildings can translate its emotions. As the body does the same. “If anything is described by an architectural plan, it is the nature of human relationships, since the elements whose trace it records walls, doors, windows and stairs – are employed first to divide and then selectively to re-unite inhabited space” (Evans, 1997).

The bakery’s design composes “situations” that resemble prayer positions for worship. Much like mental yoga, the activities of harvesting, kneading and baking become a spiritual journey on the deepest level. This is illustrated in our internal and external dimensions. In Arabic these are defined as Zahir and Batin- and what differentiate man from machine. Zahir is your outward actions that are mechanical and expressive while our Batin relates to our private inward thoughts which we protect and cover. This is a play between what we reveal and what is hidden in our chests. Connecting with your Batin uncovers what you are hiding and brings you closer to your truth. Through the baking process- we reveal ourselves and discover what was hidden.

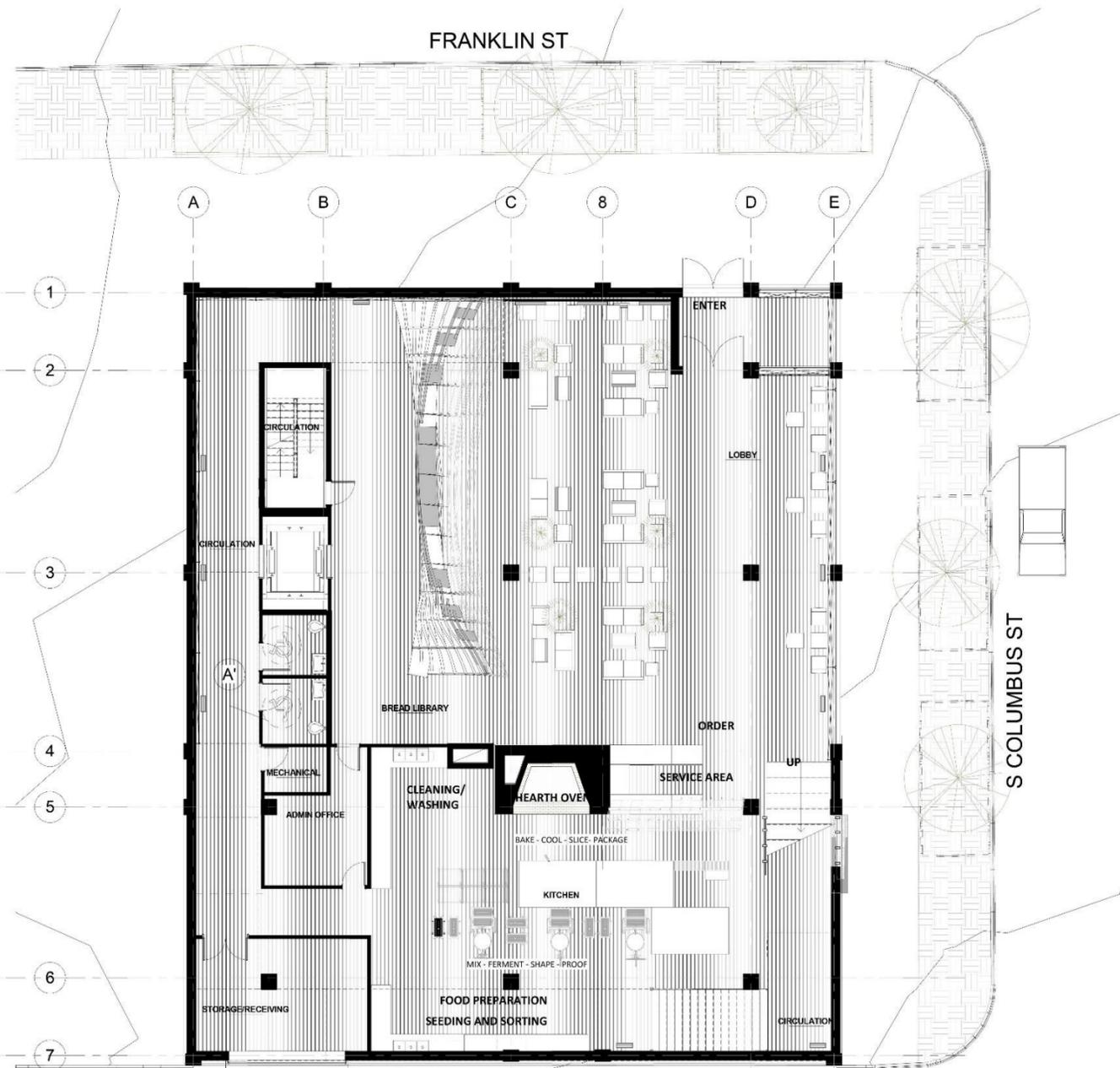
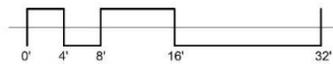


The bakery takes and gives from our experiences. Our interactions and connections to spatial understanding is one that gives a space meaning. As we transition from bread, body and building we must not lose the correlation and the essence of these forms. From the dust of the ground that created Adam and Eve, to the Garden of Eden, one mustn't lose sense of the flesh that these transitions originated from. By overwhelming our spaces with artificial intelligence, we compromise our emotional intelligence. The very vessels of corridors, stairs, and walls that are used to separate and divide should not withhold us from the elements essential to all life. Used to protect us from the harsh environmental changes of the outdoors, David Abram reminds us to not forget them. "But it does imply that we must renew our acquaintance with the sensuous world in which our techniques and technologies are all rooted. Without the oxygenating breath of the forests, without the clutch of gravity and the tumbled magic of river rapids, we have no distance from our technologies, no way of assessing their limitations, no way to keep ourselves from turning into them" (Abram, 1996).



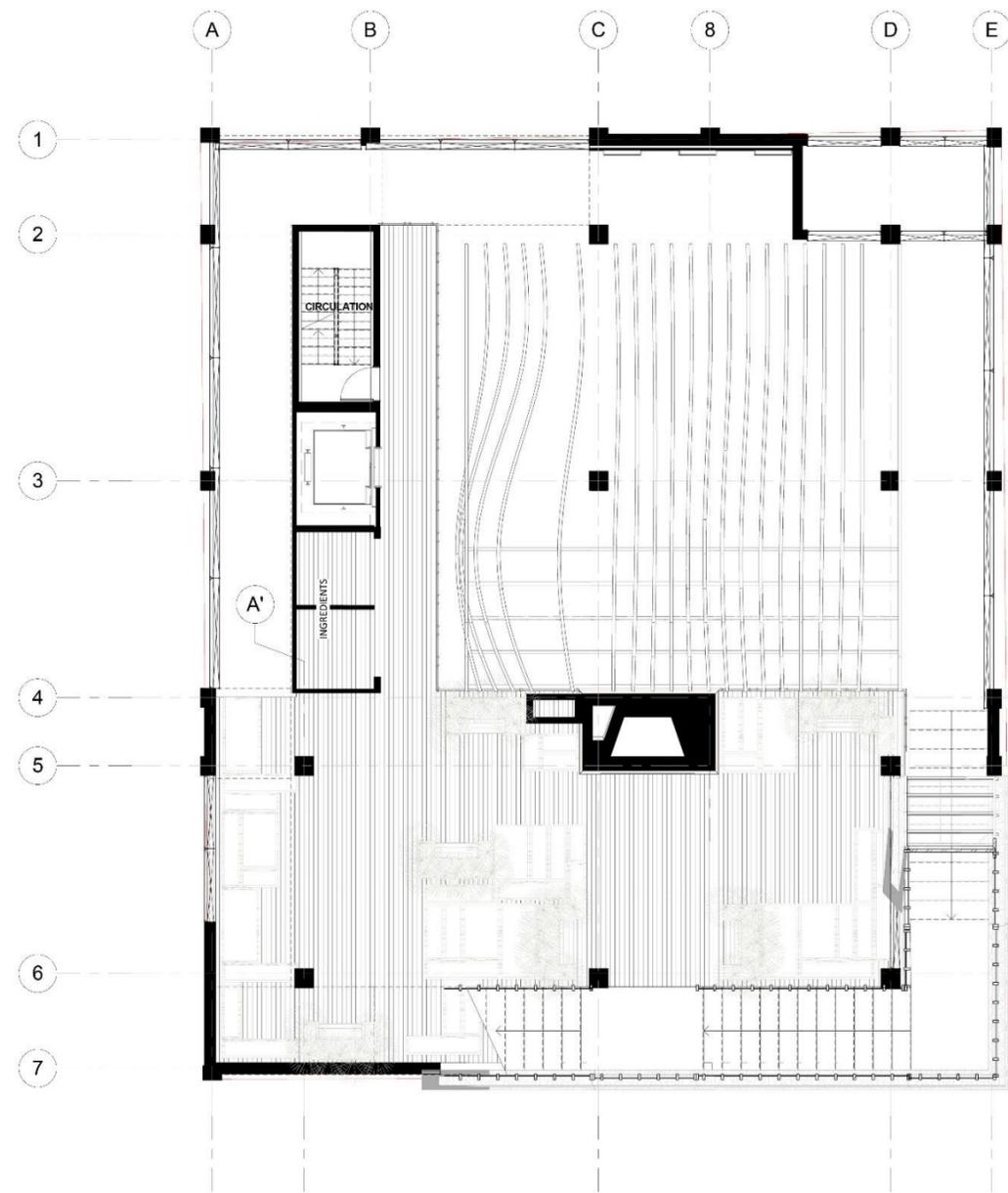


1 LOWER LEVEL

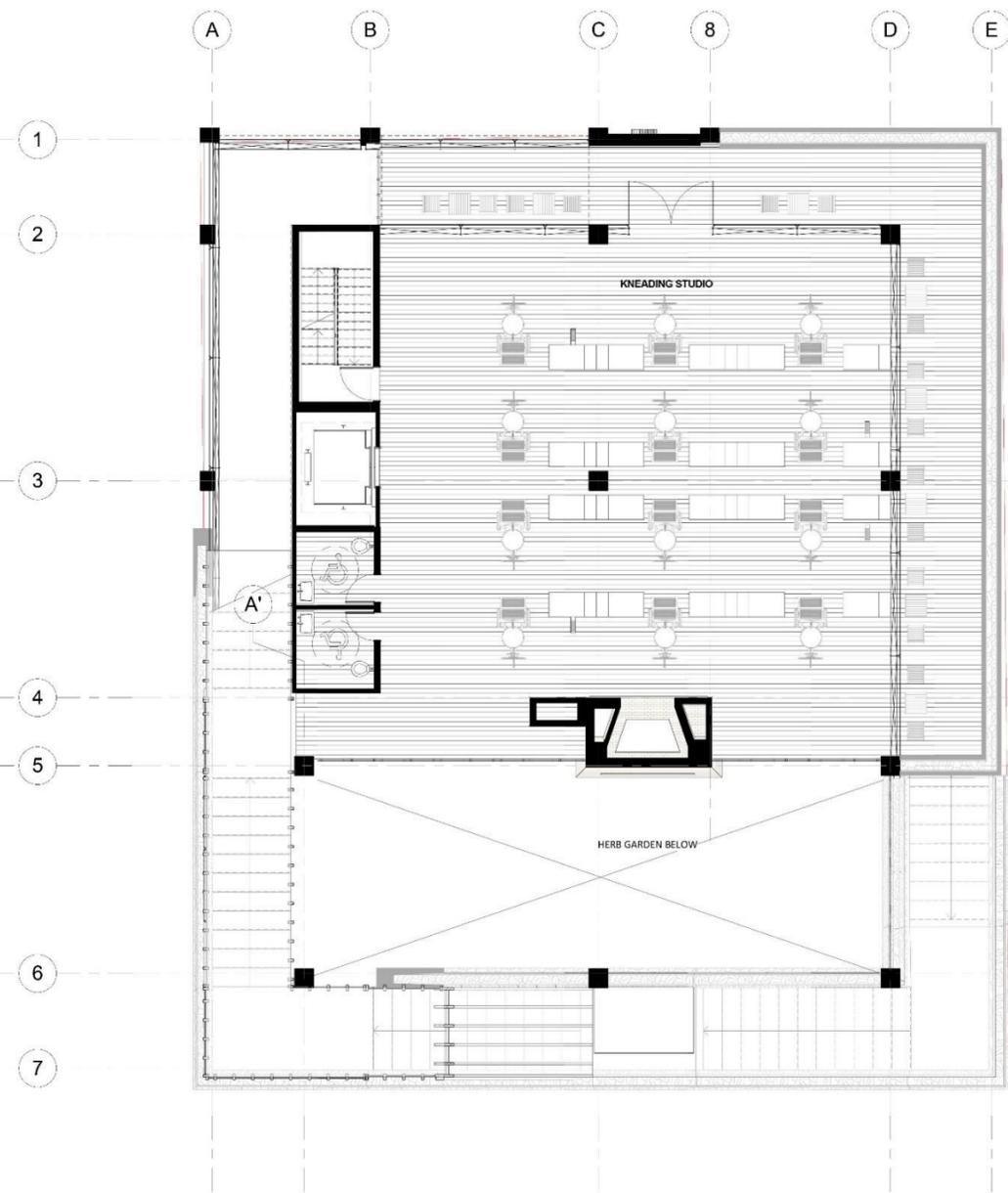
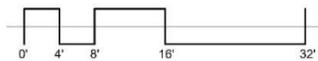


2 LEVEL 1





**3** MEZZANINE

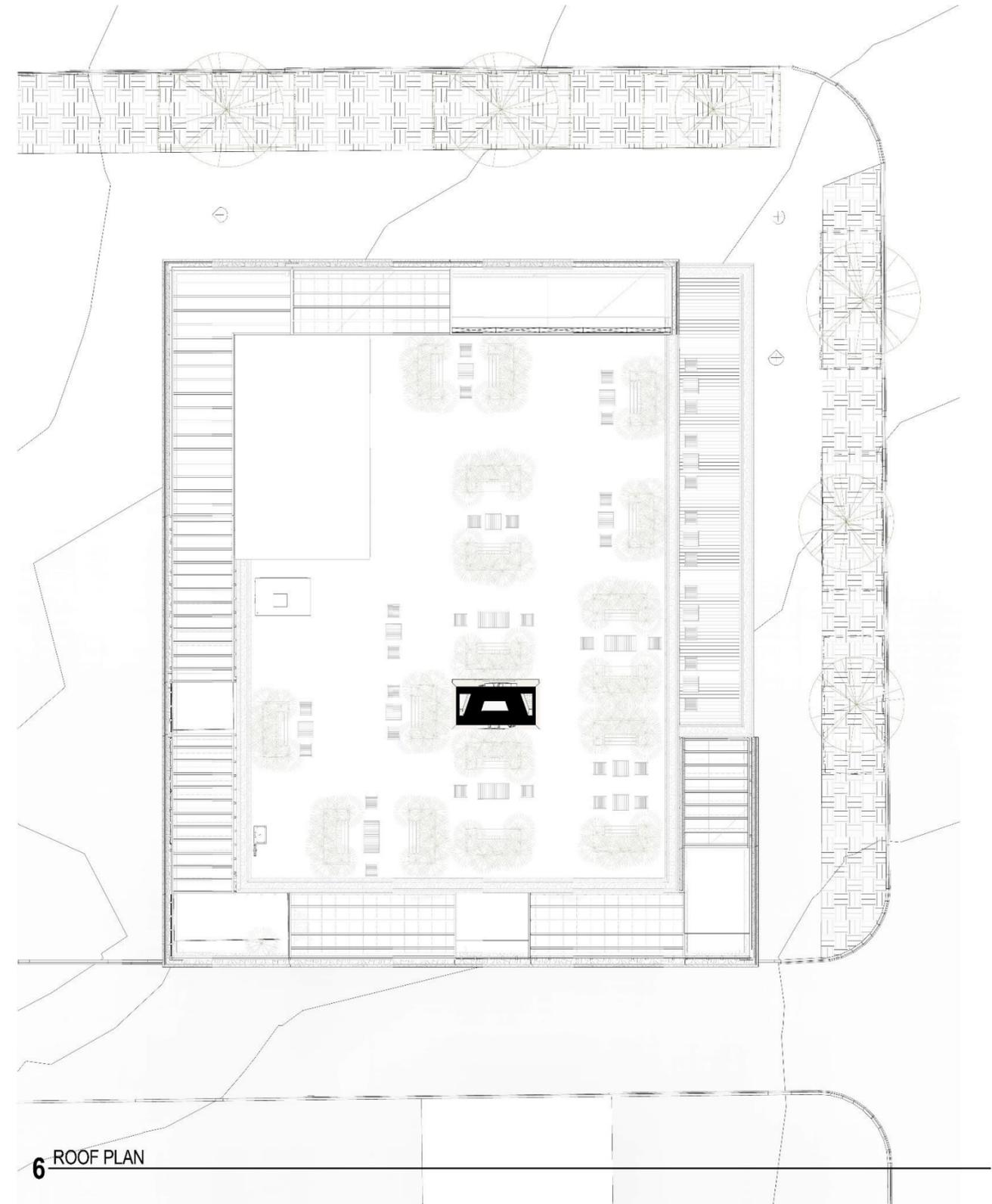
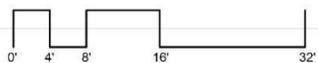


**4** LEVEL 2

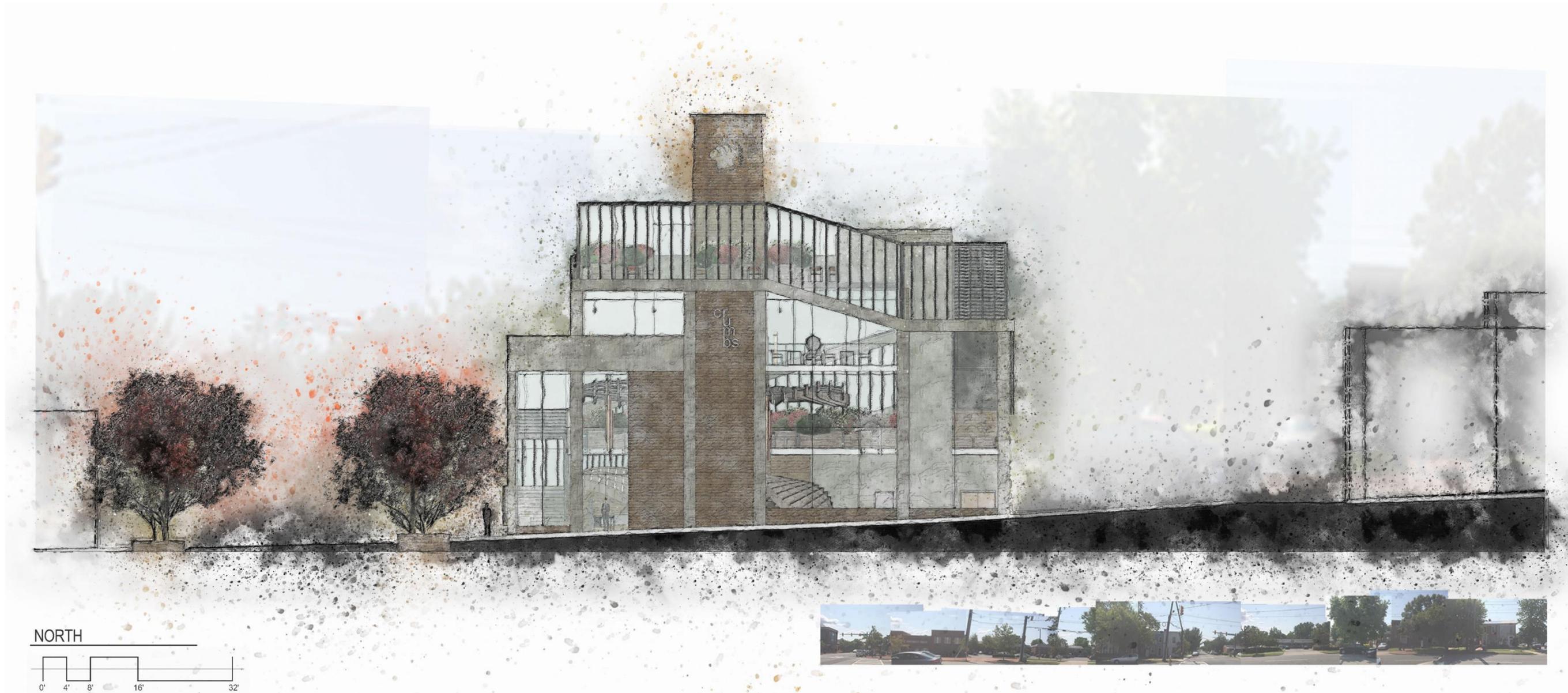


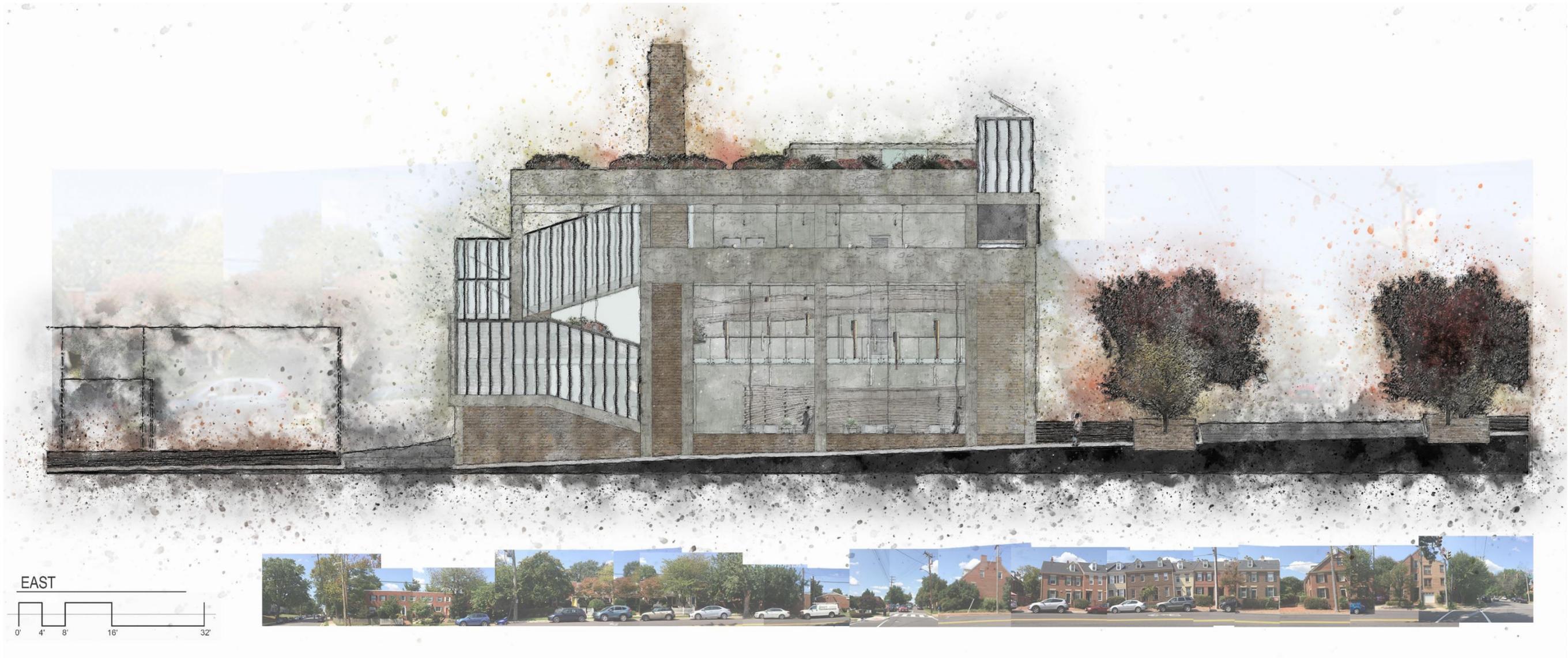


**5** PENTHOUSE



**6** ROOF PLAN







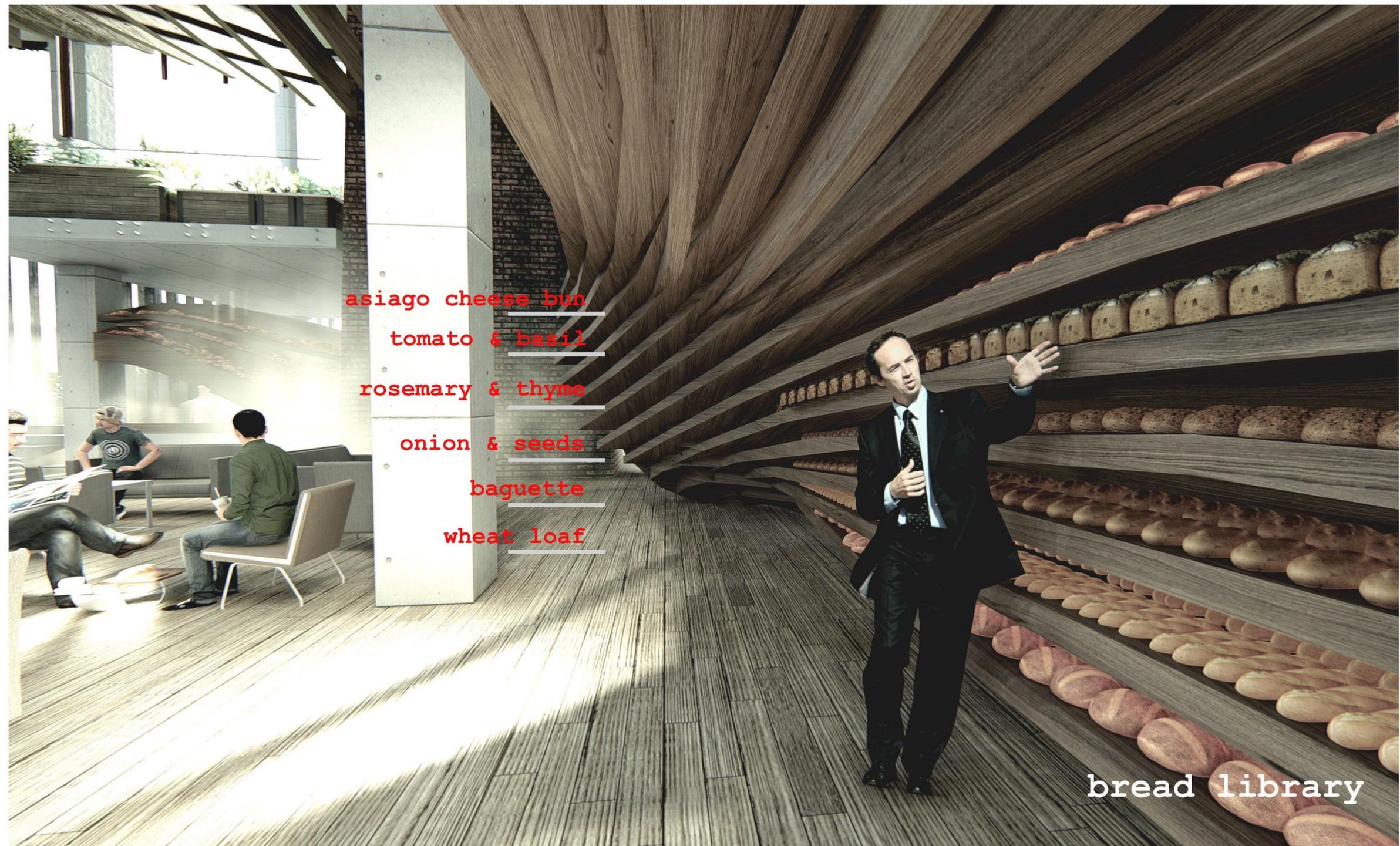












asiago cheese bun

tomato & basil

rosemary & thyme

onion & seeds

baguette

wheat loaf

bread library



virginia fern  
peace lilly  
snake plant  
wintergreen teaberry  
lowbush blueberry

seat & eat



## BIBLIOGRAPHY

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