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Table of Contents

Abstract
Research
Springdale
Wine
Site analysis
Beauty and Sustainability
Project Approach
Concept
Program
Plan Drawings
Section
Building materials
Experientials
Bibliography
What you come to see on the surface is not what you come to know. Emptiness in the desert is the fullness of space, a fullness of space that eliminates time. The desert is time, exposed time, geologic time. One needs time in the desert to see. - Terri Tempest Williams
“Is sustainability inherently beautiful? When translated to architecture, is the application of ‘latest technology’ all it takes to practice excellent (sustainable) architecture? In the pursuit of ‘honest expression’ does technology relieve the architect of searching further for beauty? Is architecture that relies less on advance technology, but more on ‘proven’ proportional aesthetic more beautiful? On the flip side, when do our romantic notions of beauty dilute the effectiveness of sustainability in architecture? How can the innovative technologies of our age be our tool to achieve beauty?” (Mcdonugh)

The architecture profession has been faced with these questions as they tackle the challenge of redefining what it takes to make a building both beautiful and socially responsible. Buildings are one of the largest consumers of natural resources, both in construction material and the energy needed to regulate and maintain the interior environment. Mitigating the drain on resources has many implications on building form and design which in many cases has been at odds with the artistic vision of the architect.

With a new generation of architectural professionals being educated steps have been taken to integrate sustainable principles into the design process. Blending design and sustainable principles into a seamless whole, maintaining a high standard in both aspects, is the ideal outcome of such explorations.

Reaching such an outcome is not simply an exercise in negotiation. When significant change is required, significant consideration and reflection is necessary to actively expand the horizon of possibilities for the creator and the recipient. Questioning the premise of every aspect of building design offers a wider opportunity for change and innovation both in the building and the outlook and education of the designer. As perspective widens so does a designers understanding of beauty.

The proposed project for the 2009 Masters Project is a winery located near Zion Canyon in Springdale, Utah. Through the process of developing this project conventionally held ideas about lifestyle, comfort, beauty and sustainability will be challenged both from a personal perspective and global perspective. Thinking and being aware of the impact of our actions is the first step to changing the core values and understanding of sustainability and beauty both in our professional and personal lives.
The Southwest region was first inhabited by different fluctuating tribes of Native Americans, the latest group in the immediate region of Zion Canyon was the Paiute tribe. The Paiute in the area were a hunter gatherer nomadic tribe subsisting on small crops.

Springdale is situated in southern Utah at the mouth of Zion Canyon and was founded by Mormon pioneers sent to establish a wider claim for the growing state of Utah.

With the automobile making travel less difficult the Zion area began to see more visitors and with photograph publishing word was spreading about the beautiful geology in the region.
In 1909 Zion Canyon was declared a National Park. This declaration changed the way of life for Springdale residence. In an effort to maintain the quality of the geology ranchers were asked to stop grazing livestock and harvesting timber in the area. Tourism became the new Springdale industry.

When Mount Carmel Tunnel was opened in 1930 it made access from both sides of the country easier. With the new highway running through the park the arrival of thousands of visitors every year solidified Zion Canyon's place as a destination for travelers in the United States.

Zion Canyon continues to draw large numbers of visitors every season and Springdale has become an integral part of the visitor experience.
**Making White Wine**

**CRUSHING**

The first stage of controlled vinification is to crush the grapes and release the pulp and juice, making them easier to press. A key decision at this stage is whether or not to remove the stems. Left with the grape stems allow juice to drain more freely during pressing, but they also release tannins. For grapes high in fruit flavour, tannins may be desirable, adding complexity, but for more subtly flavoured musts they are a disadvantage and destemming is carried out at the crushing stage.

**PRESSING**

Cooling

Delaying fermentation until after pressing is essential, where the ambient must temperatures are high the juice is cooled by pumping it through "Must coolers".

Pressing

White wine grapes are always pressed. Better quality juice results when pressing is gentle. If too aggressive the skins and stems break and bitter extraneous flavours, which overpower those natural in the grapes, are released. Good results are achieved with pneumatic presses, which are now replacing traditional vertical wooden ones. Both types yield juice of the highest quality and also enable the separation of different quality pressings.

**FERMENTATION**

Traditionally in oak vessels, (increasingly favoured for many high quality wines) white wine is now more often fermented in stainless steel vats which enable easier regulation of yeast activity through temperature control. Protracted fermentation at cool temperatures protects primary fruit characteristics and reduces the conversion of all the sugar to alcohol. After fermentation some winemakers choose to leave their wine in contact with its lees (yeast sediment) which adds both flavour and freshness to the wine, retained by bottling it without delay.

**MALOLACTIC FERMENTATION**

To soften astrangent acidic flavours and to add complexity, a second or malolactic fermentation can be encouraged (it may occur quite naturally or be brought about artificially). This converts harsher malic acids to softer lactic ones. Where retarding acidic qualities in the wine is important (in warmer climates when the grapes give greater sugar and fruit flavours at the expense of their natural acidity) this second fermentation is prevented by removing the yeasts and proteins needed to initiate it.

**MATURING**

Clarification

Filtration, centrifuging or fining with bentonite clay (which "polishes" remaining yeasts, proteins, grape skin (including tannins etc.) and precipitates them to the bottom of the vat.) To prevent unwanted malolactic fermentation and any further yeast activity once all the sugar in the wine has been converted to alcohol. It also removes the lees (dead yeast cells) and other substances leading to "off" tastes. With clarification the wine gains clarity and the processes used for this stabilization, however, are quite aggressive and many believe they yield flavour loss. Clarification is completed by removing turbidity from the wine. Modern winemakers now use thickly insulated stainless steel vats for cold stabilization. By cooling the wine to around +5°C, tartaric crystals, which may otherwise form in the bottle, precipitate and fall to the bottom of the vat. In Germany this process traditionally occurred in large oak vats situated in cellars, well enough for borax to precipitate out at ambient temperatures. After stabilization the wine may be bottled immediately or matured first in oak barrels.

Maturing in oak

Maturing white wine in new oak imparts flavours which can overpower wines of more subtle character, but add depth and complexity to others. Older barrels give more moderate flavours and are an option often favoured in Burgundy.

**FINISHING**

Bottling

During bottling cleanliness is essential, any bacterial activity which may be encouraged by warm temperatures — especially when the wine is later transported or shipped for sale — is prevented by passing the wine through a fine filter. Some producers bottle the wine straight from its lees after fermentation to retain yeast character and freshness (even slightly spritzy others). Particularly in the New World, syrinx C02 at the bottling stage for the same effect.

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Wine

Intake
- 1 to 7 days
- Short harvest time in mid August and early October.
- Harvest of small crops done by hand by seasonal workers

Crushing
- 1 to 7 days
- Crushing usually happens at outdoor location for small vineyards on the day of grape harvest
- Pressing and Clarification of white wine happens within 24 hours of crushing

Fermenting
- 2 to 3 weeks
- Clarified wine is initially fermented in stainless steel tanks; refined by addition of desired yeast mixtures
- Wine must be ‘punched’ or mixed from top of tank
- Temperature maintained to approx. 65°F, will require cooling blankets on tanks

Cask Aging
- 1 to 2 vintage years
- Wine transferred to oak casks for aging
- Storage space should maintain temperature approx. 55°F
- Minimal light for storage space; light in space needed for transfer from cask to bottle
- Protection from vibration

Bottle Aging
- 1 to 2 vintage years
- Wine transferred from cask to bottles
- Sunlight will affect quality of wine; light at bare minimum in storage space
- Storage space should maintain temperature approx. 55°F
- Protect from vibration

Architectural Implications
- Outdoor covered area shaded from direct summer sun
- Accessible from small electric vehicles used in vineyard to transport harvest grapes

Architectural Implications
- Occurs in same space as Intake portion of program
- Small number of free standing machines to be stored for the majority of the year until harvest
- Method for moving clarified and filtered liquid into fermentation tanks

Architectural Implications
- Elevation change from crushing to fermentation tanks for gravitational feed
- Raised platform for access to top of tank to punch must
- Drop in elevation at bottom of tank to fill casks in next phase of production
- Lighting and ventilation at transition point from tank to cask

Architectural Implications
- Elevation change from fermentation tanks to allow direct fill of casks
- Submerging storage space into earth minimum of 3 feet provides natural insulation to ideal constant temperature of 55°F
- Lighting and ventilation at transition point from cask to bottle

Architectural Implications
- Elevation change from cask storage to allow direct fill of bottles
- Submerging storage space into earth minimum of 3 feet provides natural insulation to ideal constant temperature of 55°F
- Lighting and ventilation at transition point from cask to bottle

Springdale is located very close to the border of Arizona. It’s close proximity and shared geographical traits makes it part of what is considered the southwest wine region of the United States. Springdale elevation near 4,000 feet, low humidity and minimal rainfall is categorized as being the subcategory of the arid interior of the southwest wine region. The combination of heat sufficient to ripen grapes, abundant sunshine, and cool evenings results in high quality grapes for wine production. Approximately two thirds of the wine output from the southwest region is white wine. The varieties of grape used for white wine production are more acclimated to the harsh arid climate. (Baxevanis 200)

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Zion Canyon is part of a much large geological area called the Grand Staircase. The Grand Canyon, Bryce Canyon and areas such as the Vermilion Cliffs are all part of the Grand Staircase. The earth crust has moved significantly in this region because of tectonic and volcanic activity. The presence of water in the region has in turn shaped the exposed material over time making the area one of the most dramatic geological regions in the United States.

The project site situated at the mouth of Zion canyon has many of the breathtaking formations that has made the area a tourist attraction for many years. Tall cliffs on either side of the site exhibit rock layering and erosion that make for very provocative backdrops and views from the site. The Virgin River running through the center of the site adds a vegetative quality which contrasts beautifully in scale and texture with the steep cliff walls.
Site Analysis

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Springdale
Elevation 3,800-4,000 ft
Latitude 36.181
Longitude -94.145
Low humidity, 30% and under
252 sunny days a year
196 growing days
Winds move up and down the canyon along the river basin SSW in the evenings

The project site is situated in the center of Springdale city. Within 5 blocks there are hotels and tourist shops. Along the back side of the site a hiking trail goes from Watchman Campground in Zion National Park to Springdale River Park at the other side of the city.

Average temperature
max 48.7 53.7 58.9 66.7 76.2 87.2 92.4 90 83.5 72.5 58.7 50.3
mean 36 40.8 45.3 52 61 70.9 76.8 75 68.2 56.9 44.4 36.8
min 23.2 27.8 31.6 37.3 45.8 54.5 61.1 59.9 52.9 41.3 30.1 23.2

Annual precipitation
inch 1.4 1.41 1.69 .92 .69 .41 1.31 1.63 1.15 1.02 1.15 .79

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The site is accessed from a smaller portion of land situated on the main street front. The majority of the land is situated behind existing commercial buildings and adjacent residential buildings. The back side of the site is accessible from a hiking trail and there is a small spot along the river that has similar elevation to allow for bridge access.

The topography on the site directs the limited amount of rainwater that the area receives. While water collection can benefit some of the daily functions of the program, orienting the vineyards in a way that directs the rainfall to the root beds will have the biggest water gain for the growing season.

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In the 21st century there has been much concern over the imbalance of consumption and resources. As a whole, society has begun to realize and project exactly what the earth is able to provide in raw material. Only recently have we begun to look at the earth as having a finite pool of resources. In a growing number of studies it has become apparent that the consumption of resources is outpacing the ability for those resources to become replenished. Some resources are in fact unreplenishable and will not regenerate within decades or centuries. While the knowledge of our diminishing resources is distressing the more unnerving subject is that we have in fact put ourselves in this position.

After the Industrial Revolution things began to speed up. The assembly line method of production was soon giving birth to thousands of cars. Lower prices made it possible for every family to have a car, or two, of their own. As transportation became easily accessible our borders became endless. Fruits could be shipped around the world and stone from Italy could be used as a facade in California. The rate of production skyrocketed as markets opened virtually everywhere. The increase in production was evident in the increase of consumption in the average household.

As technology moved forward society evolved into a culture preoccupied with speed. Fast internet, fast meals, fast meetings and project turn around, all became necessities not options. The market changed from one where the big fish ate the little fish to one where the fast fish ate the slow fish. In our effort to speed ahead we became disconnected from the process required to provide us with our possessions and lifestyles. The result of this disconnect has been unintentional and irresponsible consumption with little or no regard or awareness of our impact on the state of natural resources. We were in essence speeding toward natural resource famine.

In response to the cult of speed a reaction
called the Slow Movement has emerged. While this movement has aspired mostly to change the quality of personal life for those captive to a life of speed and excess, it can be applied to the subjects of consumption and sustainability directly.

The Slow Movement is for example applied to the food industry and the disconnect between production and consumption. Consider the tomatoes at the grocery store around the corner. Most likely these tomatoes are from out of state and were grown using pesticides and fertilizers to gain the most profit by producing a consistent size, shape, and quality tomato. These tomatoes were then picked early and transported via conditioned truck across the country to the supermarket so that restaurants can serve salads in the winter. All the steps along this process require the consumption of natural resources, most notably fuel for transport and machinery involved.

Now consider the process involved in growing a tomato in a home garden. Tending to the garden on a regular basis, watering, weeding, and pruning. The time involved in watching the plant grow and bud and the fruit grow and ripen on the vine is far different from the instant gratification of plucking a tomato off the pile at the grocery store. Time is required for the process, slow time, the pace of nature in contrast to the pace of technology and industrialization. Many of us have lost the patience or feel we don’t have the time at our disposal to grow our own food. Being aware of the time it takes to grow a garden would make us more aware of all the time and effort involved in the existence of a tomato on our dinner plate. The tomato in turn would be less likely to end up in the garbage disposal had we personally invested ourselves in its growth.

The Slow Movement is not an attack on speed. Technology has improved many aspects of our lives. More notable it is the lack of awareness that is being put into perspective. The saying ‘Stop and smell the roses’ is in fact the subtext to the idea of the slow movement. Awareness is at the heart of any social change and will be key in guiding society toward a more sustainable future. Slowing down to become aware of the origins of our consumables and the time, effort and resources involved in their production, shapes our use of those consumables.

Awareness and appreciation for the elements in our world changes our outlook on life and our experience of beauty. Poetry and art have already shown us how such ordinary simple things and moments in our lives contain beauty. It is simply our awareness of those small beautiful moments that is necessary for experience. Beauty is found when our eyes are open to not just the object in front of us but into the journey and sacrifice required for its and our existence.
Desert as teacher
Desert as mirage
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The Southwest region of the United States is one of the most unique geological areas on the continent. There is a higher concentration of national parks then in the rest of the country making it a destination for the world. Tourists from all parts of the globe come to parks such as Zion on vacation. Zion and the other National Parks have the ability to reach a large audience and inspire them with beauty.

The beauty of Zion Canyon has been explored through the years by writers, poets and artist. Terry Tempest Williams frames the feeling of the canyon in her book *Red: Desert as teacher Desert as mirage* What you come to see on the surface is not what you come to know. Emptiness in the desert is the fullness of space, a fullness of space that eliminates time. The desert is time, exposed time, geologic time. One needs time in the desert to see.

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-Terry Tempest Williams

The vastness and scale of the rock formations, and the expression of generations of time and erosion seen in their texture puts into perspective the shortness of our own lives in comparison. A person’s perception of time slows as they become aware of the landscape enveloping them.

As time shapes the rocks it is also shaping and creating wine in the program for this project. The process of making wine is not one of instant gratification, but of patience waiting, the product of the vineyard is not enjoyed for a number of years. The time and effort put into the existence of wine is admirable in an age where speed is the norm. Experiencing and understanding the process of wine making can give the observer a chance to feel the alternative to the pace of their own lives. Taking the time to see and be aware of all that is invested in such processes can give a person new perspective.

Designing a winery and restaurant that supports this slowness of time and awareness both in the wine process, dinning, and the surrounding geology, is attempting to enhance the visitors appreciation of resources and the providing natural landscape. The program, form, materials, and experiential quality should together create a structure that is immersed in the natural, connected to the landscape. Organization of space to slow the pace and heighten the senses will bring a more conscious awareness to the connection between the products of our resources and the lifestyles we live.

The comfort and ease of which we live our lives will be put into perspective by removing the boundaries between the process and the product. Experiencing wine directly from the shelf at the end of the process and eating in the garden, sharing the environmental ups and downs of the growing season, are steps in changing our awareness, our actions and our impact. Without awareness and appreciation at the core, our changes they will be fleeting. Changing the perspective of our values is the only way to make the move towards a united lasting future, symbiotic with our earth.

*Project Approach*
An exploration of the physical characteristics of slowing down lead to the expression of a fluid movement, taut and rigid in its original state and then falling and settling into a relaxed state of stillness. Once stillness was obtained the progression is reversed to return to its original state. The parallels that this draws in the formation of the building is that the slow spaces associated with wine aging is most efficient buried in the ground, settled into a still state removed from the more active spaces located on the ground plane of the site. The more active spaces of the grape intake and the dinning area act as the anchors on either end of the settled slow space in the middle. The sweeping curves defining the interior and exterior space are in response to the elongation of time along path. A straight approach would be too direct and instant to slow down the pace of the visitor. Oblique approaches in relation to defined pausing moments are employed through the structures to further slow down the visitor.
The project guidelines called for wine production space as well as a restaurant as two parts of the development. The two spaces have different needs and will function with different priorities as separate structures.

The production and storage spaces for the wine are to focus on the needs of the wine with the visitors going on guided tours through the space as observers. The essence of the space is to be as true to the process of wine making as possible and the visitors being immersed in that process as it would truly occur.

The restaurant is a more public space and is focused on creating an environment in which all parts of the dining experience are blended. Connection between the act of eating and the garden from which the food is harvested is paramount.

In an effort to minimize the impact of the building, the program was analyzed in regards to its seasonal function. The peak in visitors and harvest coincide during particularly warm months in which outdoor space can be utilized to a maximum. The low season required less enclosed space because of the decrease in need and therefore the building materials can be minimized reducing budget and ecological impact.

Auxiliary spaces were merged into primary spaces to further minimize the size of the building and material use. When possible direct connection was made between production process and observation.
The project site is separated into two parts by the Virgin river. The decision to build on the city side of the site was reached in an effort to maintain the natural setting on the other side of the river. The hiking path that stretches behind the river from one side of the city to the other gives the city residence an opportunity to enjoy the natural beauty in their backyard which is an important element for community identity. The approach path to the building arcs through the vineyard and garden space to prolong the experience and begin to slow the speed of the visitors. The intake pavilion is passed obliquely in the approach to the dining pavilion which is situated on the very edge of the riparian zone to provide connection to a beautiful and enchanting area of the site nestled in the crook of the river bend.
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-Terry Tempest Williams
The approach to the building starts in the NNE corner of the site as a lookout and then is swept along an arcing path between vineyard and garden. Two sweeping pavilions are situated in the landscape covering space used for grape intake and dinning area. Under the two canopies two smaller cob structures enclose the minimum amount of space needed for winter storage and facilities that need shelter consistently through the year. The dinning and cooking area are open air in the summer time when visitor numbers are at their highest. In the winter movable panels enclose 18 percent of the total dinning area in response to the drop in visitors. A central path between the two pavilions descends into the ground to the wine production area and is a unifying element between the two pavilions as expressed through the atrium forms protruding from the ground. The wine path emerges into the riparian zone near the river as a breath of fresh air returning the visitor to natural landscape and enhancing their awareness of nature.
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The arcing path from the vineyard descends into the underground wine production area. The steps in the wine making process begins with the production space and moves to cask storage and then to bottle storage. The path of the wine is linear along the center of the space with accents occurring at the transition points from one phase to another with the use of atrium space. The visitors are moved through the space along an oblique path approach to each space to create pause and further slow the pace as the process deepens. The process is kept as uncluttered and true as possible with a minimal palette of natural materials and light and shadows as ornament. The culmination of the process ends in the tasting space when the most pause is required to pick a bottle from the racks for tasting. The complete integration of the tasting space into the bottle storage space directly connects the product to the process.

1. Intake
2. Production/ Storage
3. Reception/ Canning
4. Kitchen
5. Dinning
6. Storage
7. Garden
8. Vineyard
9. Production/Fermenting
10. Cask Storage
11. Bottle Storage
12. Tasting
13. Storage/Shipping
14. Storage
15. Lab/ Research
16. Staff Room
17. Office

Lower Plan

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Solar Collector - A solar collector is an arrangement of tubing, usually copper, on a surface oriented to the sun. The tubing contains glycol, a fluid that will not freeze, that is run from one end of the system to the other. Covered by a special plexiglass sheet the copper tubes become heated from the direct solar rays from the sun. The glycol is cycled through a heat exchanger in a mechanical room which transfers the heat from the glycol to hot water used in the building. The high number of clear sunny days in southern Utah make this system very effective year round with a small percentage of backup heating provided by on demand water heaters on overcast days. The glycol can also be run through radiant floor heating systems in designated spaces to provide heat to individual rooms

Ventilation - In a hot arid climate obstructing the solar rays is very efficient in keeping a space cool. The lack of humidity keeps the ambient temperature of a space low if it is open to moving air. Therefore, shading a space that is open to natural ventilation will keep the perceived temperature habitable. A double roof system provides an awning to shield the enclosure structure from any direct solar rays. The space between the roofs allows for natural air flow to sweep away any hot air gathering under the upper roof. For the subterranean level of the structure ventilation is provided for a comfortable air exchange for a habitable space. Air is drawn from a location outside the building through ground tubes that release heat into the earth before making it to the interior of the building resulting in cool air being released into the space. As the air warms in the space it rises and is released through operable windows at the top of atrium spaces distributed at intervals through the building.

Cob wall - Cob is a mixture of clay, aggregate, straw and water. It has a history of being used in every climate and is especially suited for dry arid climates. The soil composition found anywhere can be adjusted to a mix that will allow the earth to dry and lock together the right proportion of straw into a solid wall. To protect the cob it should rest on a foundation high enough to keep the cob from ever sitting in water. Similarly, a roof should have sufficient overhang to keep rain water from hitting the wall directly. Cob has high thermal mass properties which allows it to absorb and release heat very well but the insulative properties of the material is low and any space built from cob needs to address heating. In most habitable spaces cob is used to collect heat from direct solar rays that is then released into the space once the sun goes down. Evaluation of the program spaces has minimized the need for enclosure with the cob structures being used mostly for storage. The cob structure spaces that are habitable are small and heated with the solar collector system. The use of cob is efficient for its purpose and true to the essence of the project.

Rammed tire retaining wall - Concrete has long been the default material for subterranean construction. Concrete has many applications and research is beginning to be done to make it more sustainable but for the most part it has not yet become an eco-friendly material. In an effort to find a material that is sustainable experimentation is being done making retaining walls out of recycled tires rammed with earth and aggregate. The netted arrangement of the tires makes it seismic stable and the flex in the material eliminates the possibility for cracks or breaks in the wall. The curved shape of the building provides lateral stability and allows for higher walls. Depending on the load, tire retaining walls can be load bearing when a bond beam is incorporated into the top course. An agricultural process was ideal for the implementation of this system. The main purpose of the wine production space it to provide storage for wine already in a sealed container. The looseness of necessary enclosure is met in the properties of the rammed tire retaining wall. The retaining wall is constructed in a battered section that holds back the earth. Gravel backfill as well as drainage material is placed along the outside to divert the majority of the water. The pervious nature of the material means that a small amount of humidity will travel to the interior of the space which is ideal for the storage of wine containers. The wall is finished with natural plaster that allows the space to breath naturally.
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