

**RICE UNIVERSITY**

**Manufacturing Resiliency**


by

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A Thesis Submitted in Partial  
Fulfillment of the Requirements for  
the Degree

**Master of Architecture**

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Houston, Texas

April, 1997

# Abstract

As a forum for a prototypical form of education/manufacturing, this thesis enables manufacturing workers to learn how to adapt to differing situations in the workplace. By designing a **resilient** facility that allows for a change of production modes and processes, one may assist in empowering the manufacturing worker with the ability to remain employable.

Upstate South Carolina has undergone a transformation over the last 40 years. The global economy has made itself readily apparent through increasing investment in the manufacturing base of this once agriculturally dominant pocket of the country. Population, demographics, real estate, and collective financial gain are but a few of the areas of life that have been directly impacted because of this addition to the area.

With the ever-increasing rate of phasing in and out of products and processes, the industrial climate demands a flexible worker. Manufacturing workers need to be able to switch between modes of production in order to remain abreast with the industry. Collecting a pension at the end of a 25 to 30 year stint at one job is not the standard work experience anymore. The new reality is that at some point in the career of most workers a change will occur, be that of employer, position, or both.

The ability to handle this change with poise, or **career resiliency**, can be achieved through early preparation and training.

Industries are already taking measures to institute educational programs that aid their employees in acquiring new skills that may lead to subsequent employment once certain products or production modes are no longer needed. By forging partnerships between big business and education, a prototypical manufacturing facility can be created that will benefit local industry and the residents of the area. Employers are provided with a capable worker, and residents are given greater career opportunities.

# Initial Investigation

## Project Origins: Site and History

Little is known about the origin of the Machen family. The farthest it can be traced is to Sanford Machen, a farmer and basket weaver in South Carolina who lived through the Civil War period. Lafayette Machen, the fourth of his five sons was born in 1862 and died in 1937 in Seneca, SC. His youngest son Orange was born in 1890. Orange Montgomery Machen made his living as a farmer, a tenant farmer for the most part.

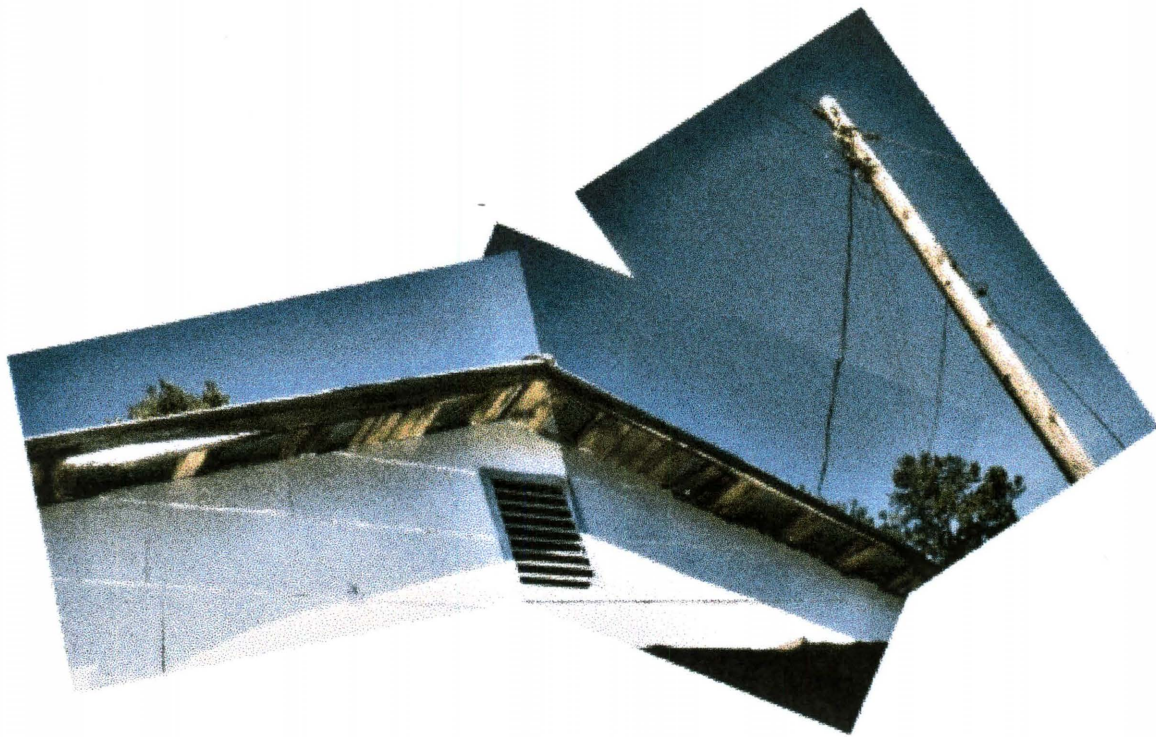
Tenant farming, or sharecropping, consisted of working and living on the land of a landowner in exchange for a percentage of the profits from raising crops on that land. Usually the profits were low, or the percentage taken by the landowner was high enough to either cause the tenant farmer to be indebted to the farmer or not leave them with only enough money to take care of their families.

The families were usually quite a bit for which to provide. Orange and his wife Pearl had seventeen children, which in large part became the work force for the farm. The remaining children who are in their 60's and 70's remember vividly the days of milking cows, feeding chickens, hoeing corn, drawing water, etc. as a part of the daily chores (Crooks 5).

It was not until late in life that Orange and Pearl were able to realize their dream: a home of their own. After years of tenant farming all over Oconee County, Orange and Pearl relocated to property previously owned by Lafayette Machen. Here, they were able to raise food and crops solely for their benefit, not for others.

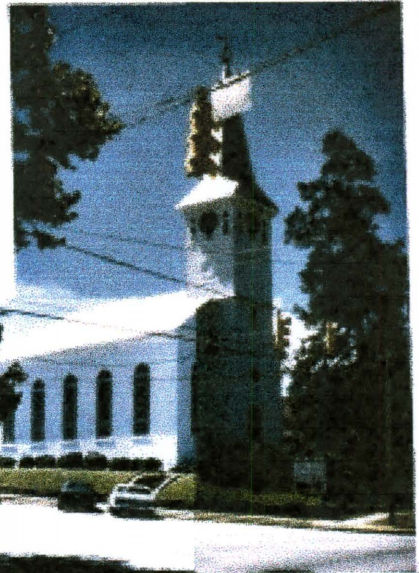
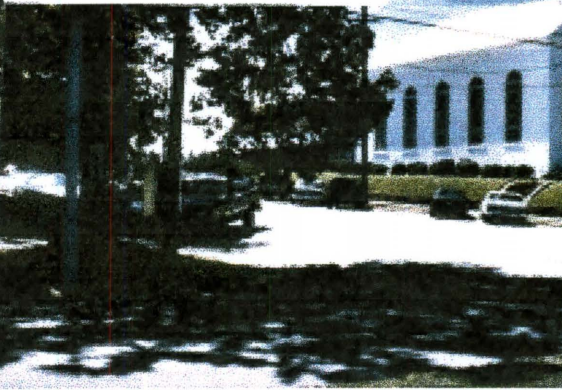
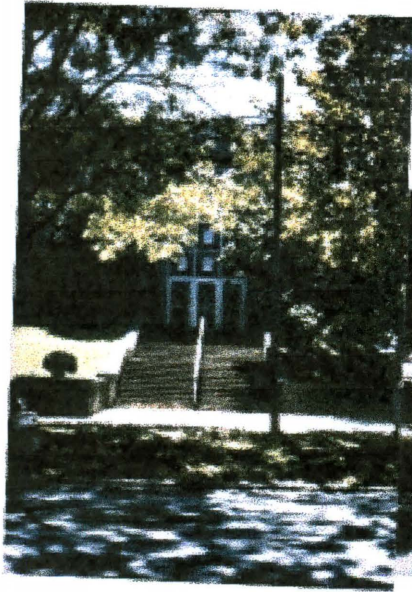
Unfortunately, times were changing, and Orange would not and could not catch up. Never able to afford an automobile, Orange continued to drive his horse-drawn carriage to and from town to sell his goods at the Farmer's Market in Seneca through the 1950's. Years of working the land had taken their toll, and he found himself unable to work as hard as he once had. The land did not yield the crops he had hoped, and the demand for his goods had waned as well. The Farmer's Market was supplanted by the Supermarket. Agriculture was all he knew, and he was too elderly to learn another trade. Orange died financially dependent upon his children in 1961.

From this point on, "the old homeplace" has not been the home to any of the family members. Eighteen acres have remained undeveloped in the heart of a growing region for more than thirty years. **In what way can this land be connected to the present and be relevant to our society?** With this question in mind, I travelled to rural South Carolina to investigate.



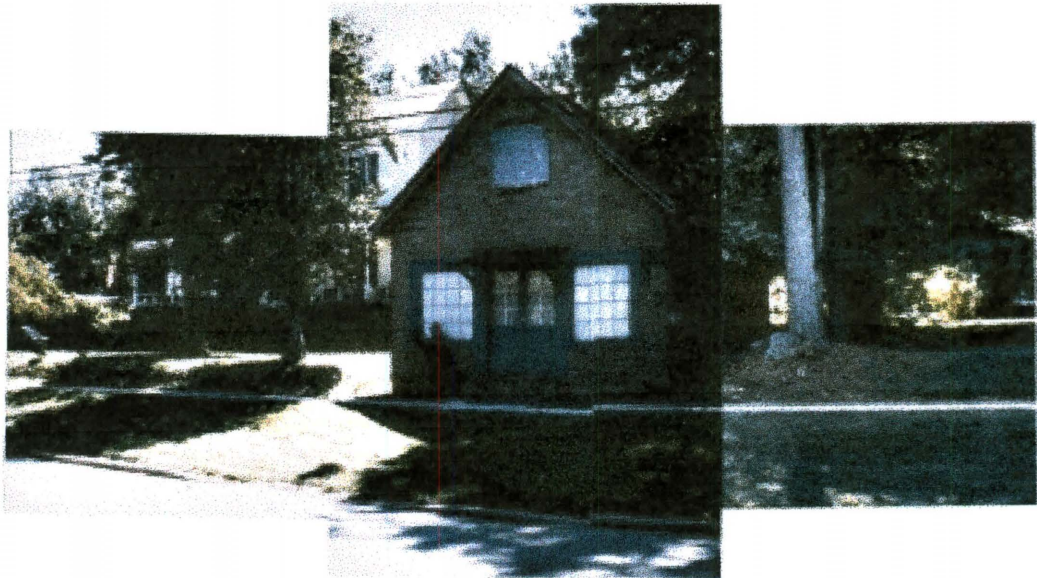
West Union, SC - Aretta Jenkins lives in a house built by her parents thirty years ago. She assisted me in my search for information concerning the site and the surrounding area.





Walhalla, SC - the county seat of Oconee County, South Carolina. Information was gathered at the Courthouse (left).





Walhalla, South Carolina

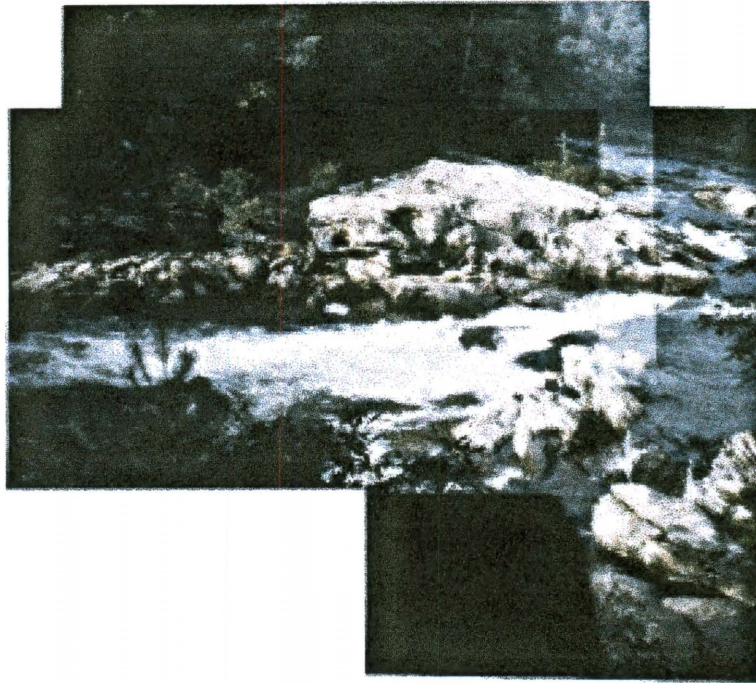






Walhalla



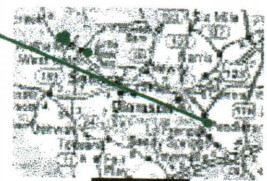


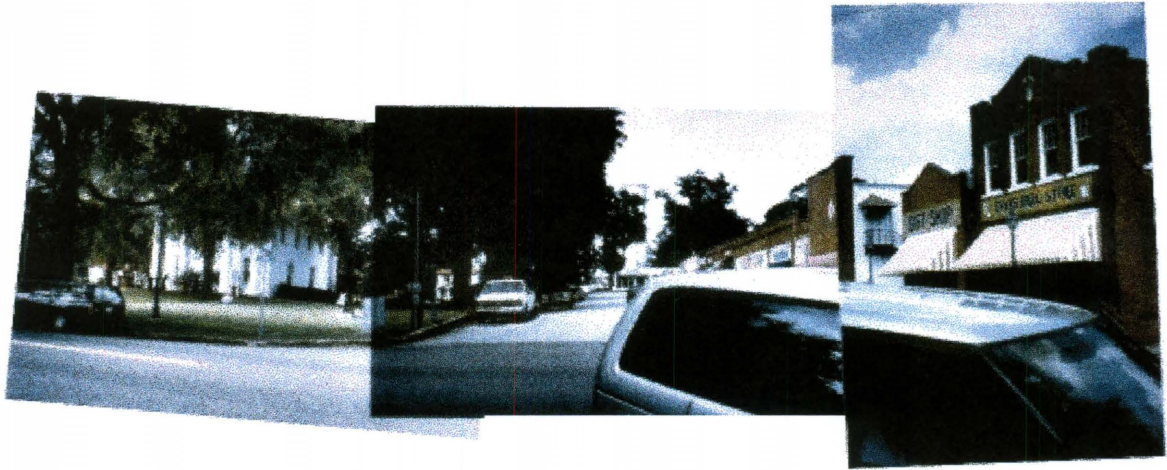
Chattooga River (GA/SC Border) - one of the popular Wild and Scenic rivers, attracts kayak, conoe, and rafting enthusiasts from around the country and the world. Scenes from the motion picture "Deliverance" were filmed here.





Pendleton, SC





Pendleton, SC





Clemson, SC - Clemson University evolved from a small, all-male military school into a national university over a period of thirty years.



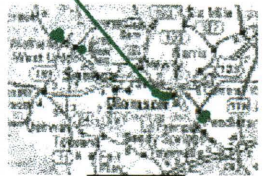


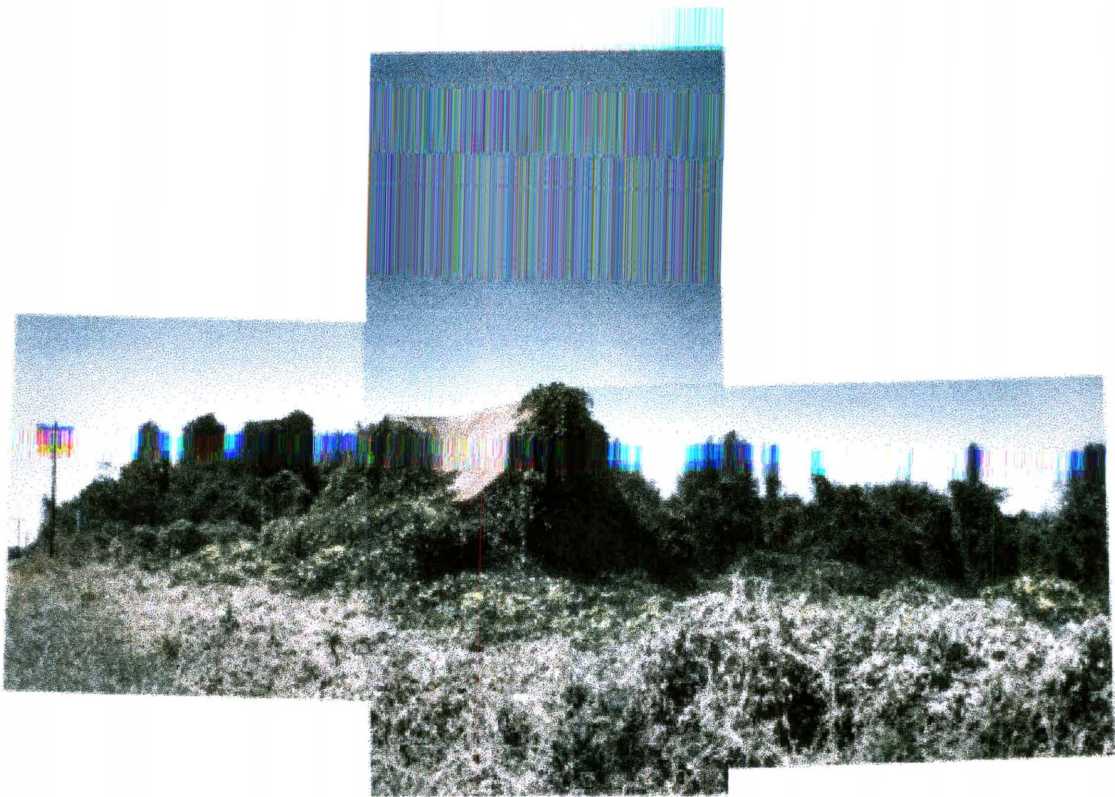
Clemson, SC - The University is located on land that was formerly the plantation of John C. Calhoun.





Clemson, SC - Memorial Stadium, or "Death Valley" transforms Clemson from a small town of 8,000 to the third largest city in the state six weekends a year.





SC Hwy 24 - Kudzu overtakes a derelict house.







Townville, SC - Essentially, an intersection of state highways, Townville is comprised of a few houses and a scattered array of abandoned commercial and semi-industrial buildings.





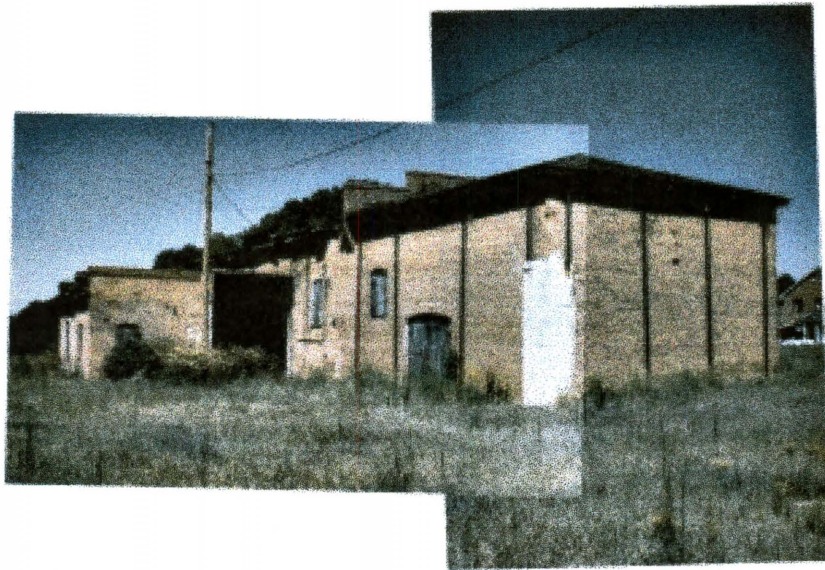
Townville, SC





Townville, SC





Townville, SC - Railroad tracks act as wall supports.



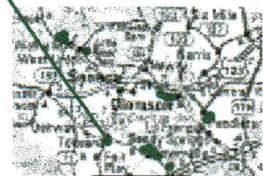


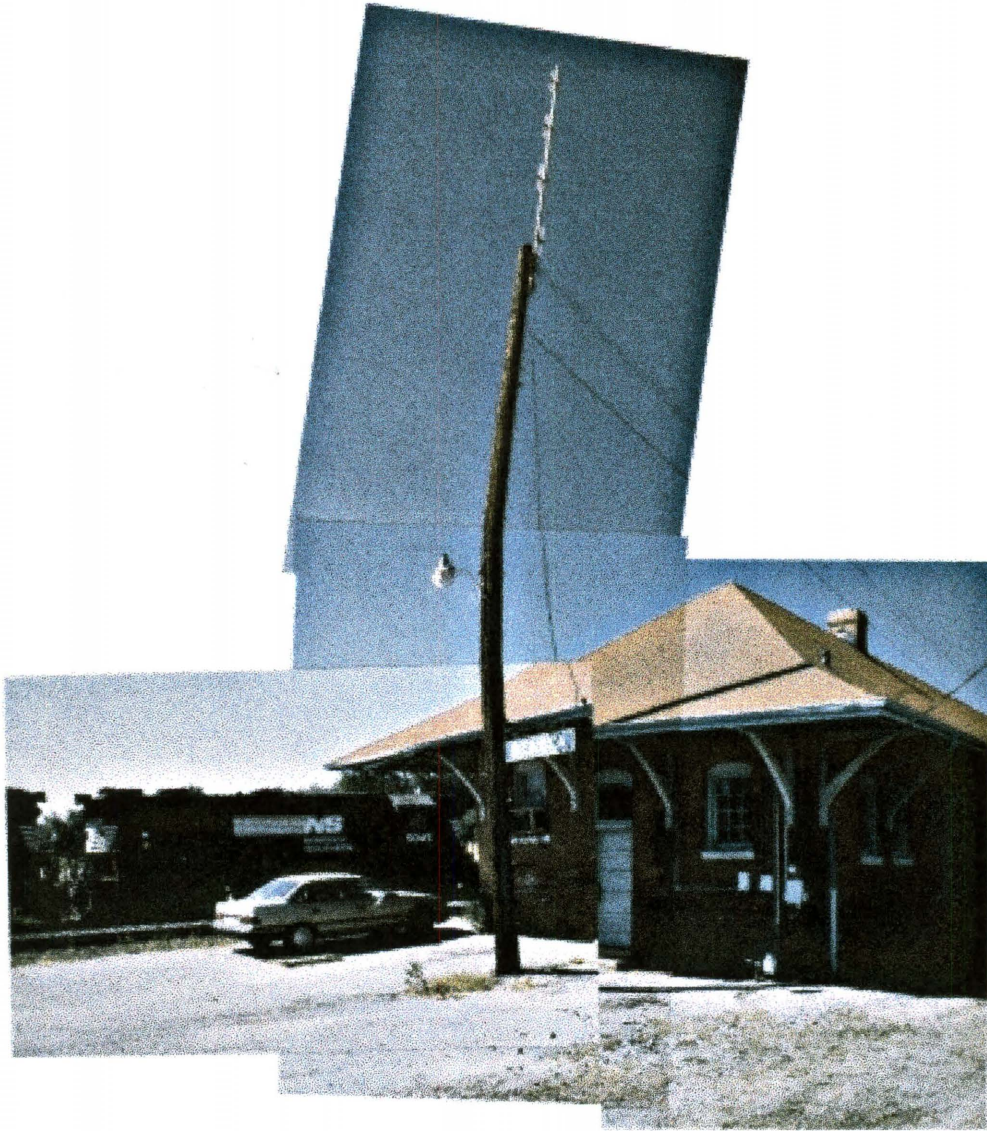
Townville, SC





SC Hwy24 & SC Hwy 59



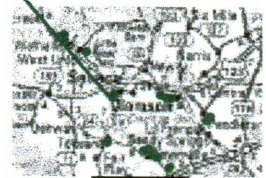


Seneca, SC - Established at the connection of two railroads between Atlanta, GA and Charlotte, NC, Seneca is the economic seat of Oconee County.

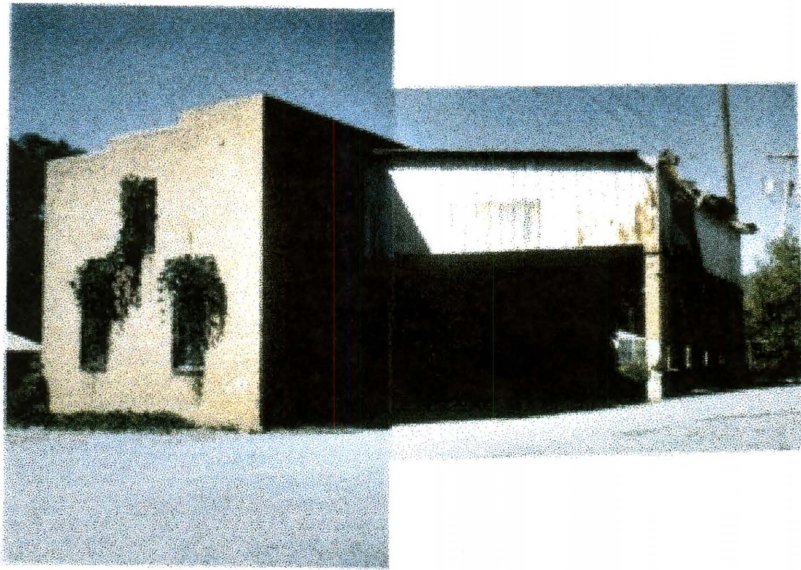




Seneca, SC

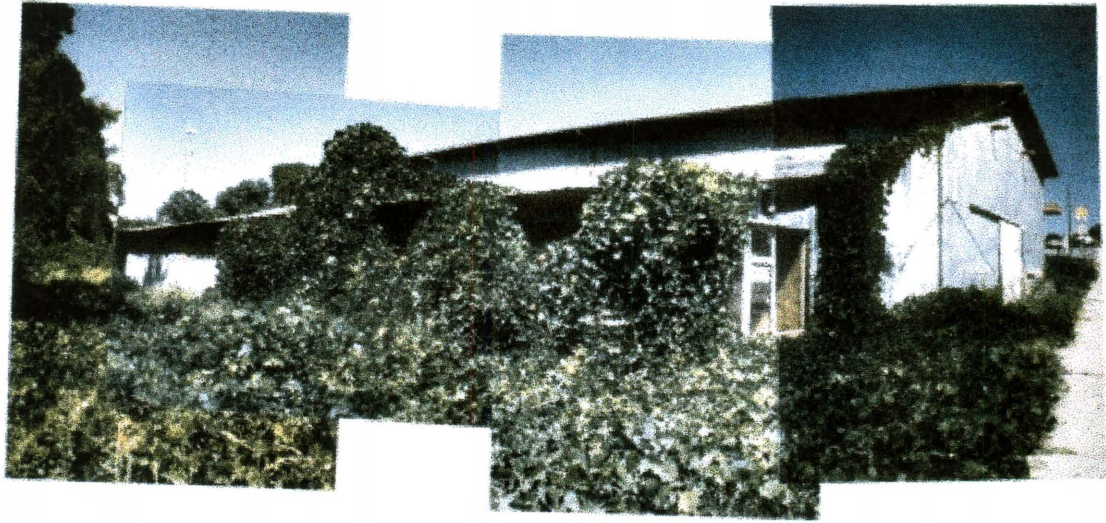






Seneca, SC





Seneca, SC





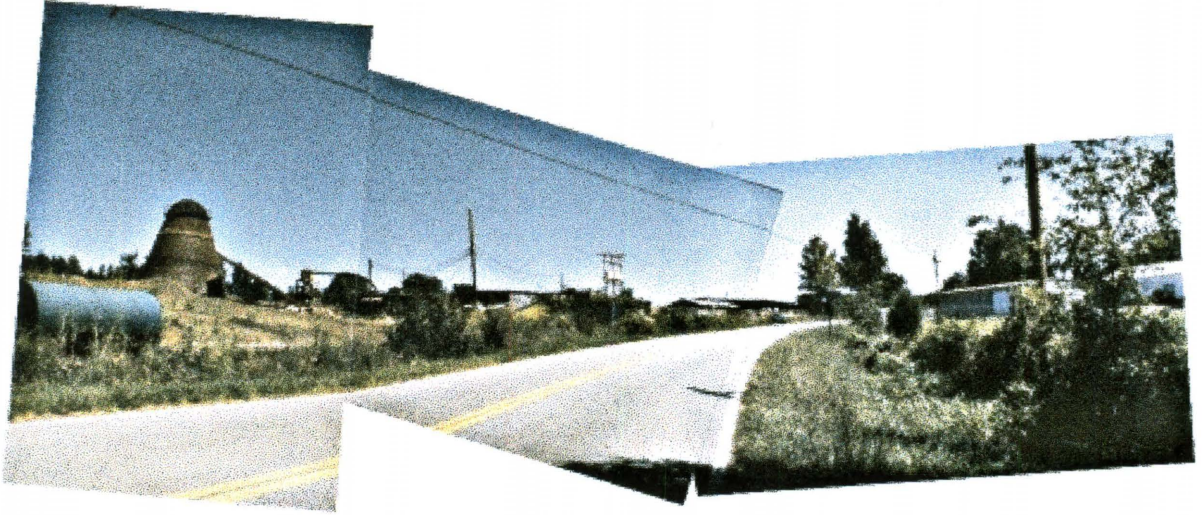
Seneca, SC - Southern tradition of storing containers underneath a shed exhibited.





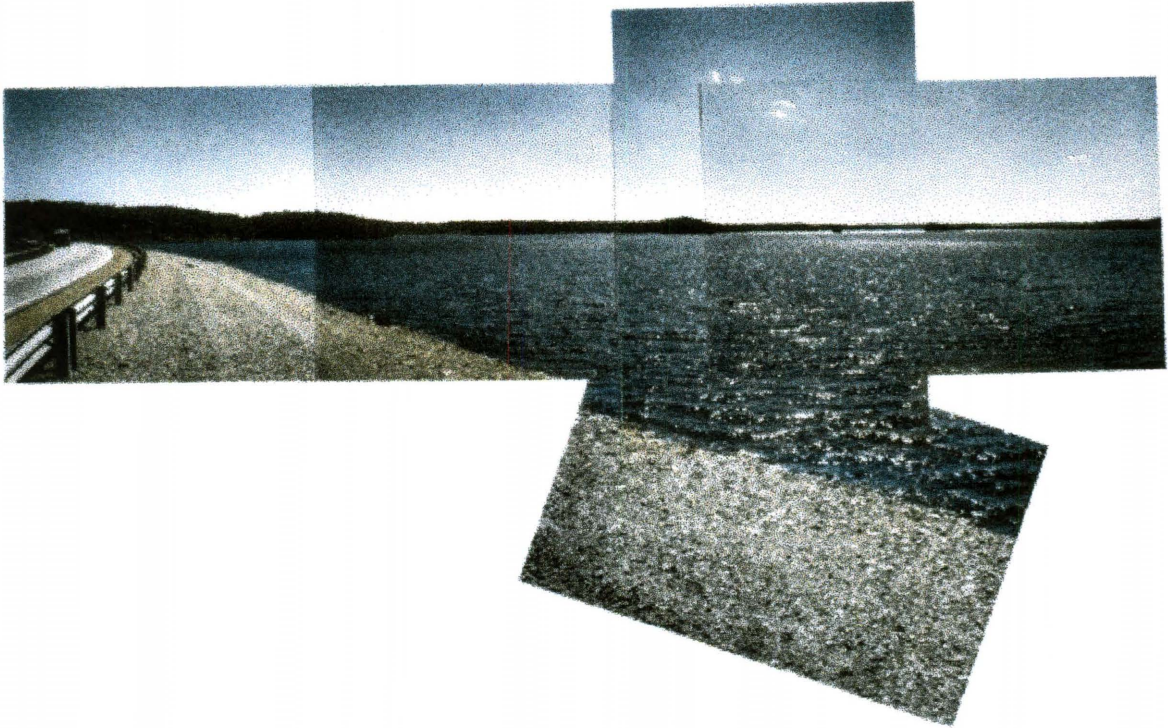
Richland, SC - Timber harvesting is still a viable industry in the upstate.





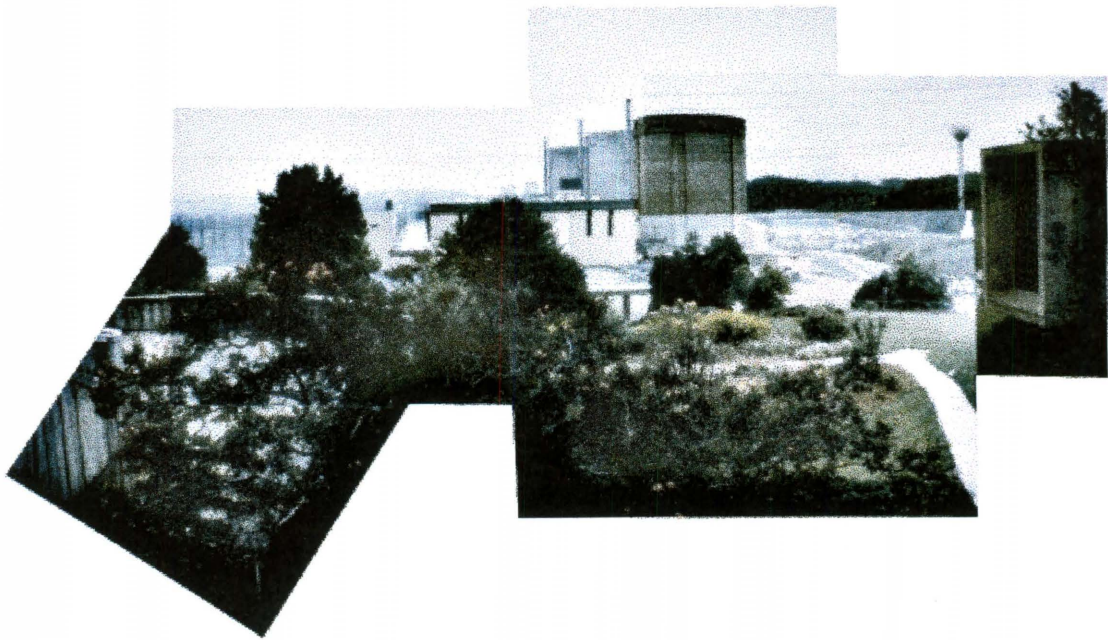
Richland, SC





Seneca, SC - Part of South Carolina's "Freshwater Coast", Lake Keowee was formed in the 1970's by damming the Seneca River.



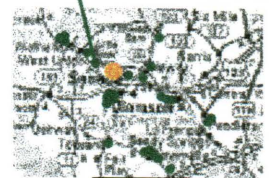


SC Hwy 130 - Oconee Nuclear Site uses Lake Keowee for cooling its three reactor cores.

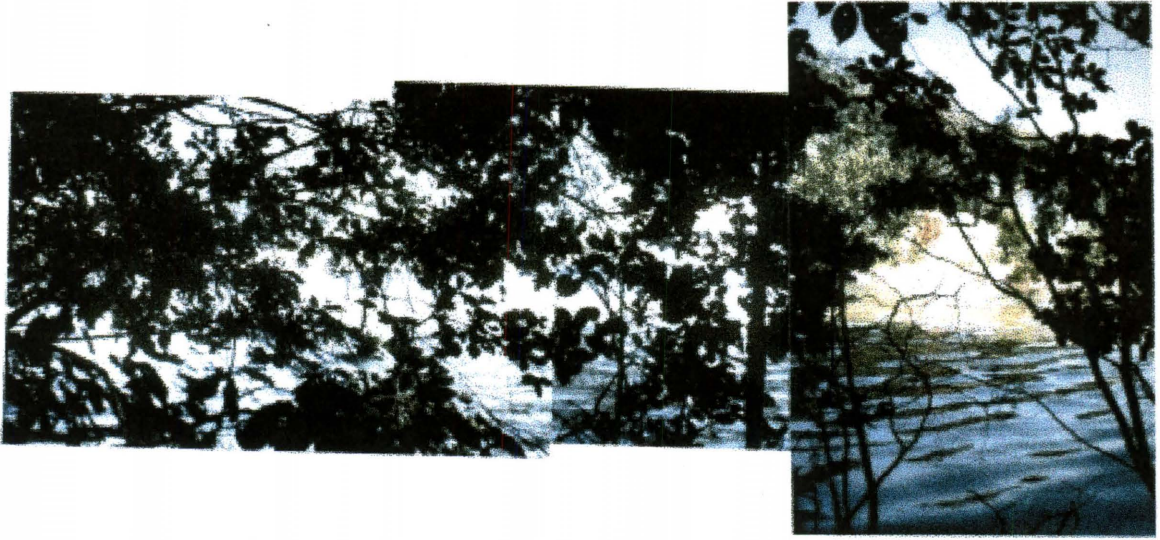




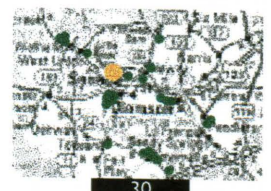
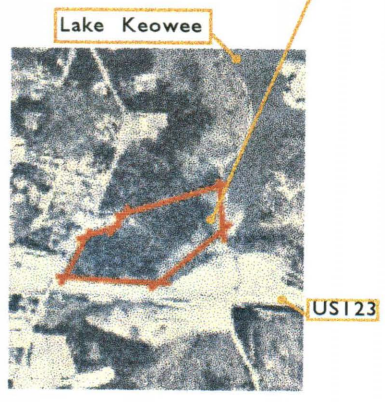
West Union, SC - Tenant House where Orange and Pearl Machen lived prior to building their own home in Seneca.

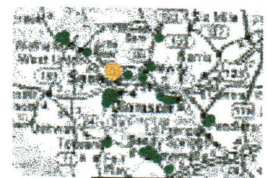
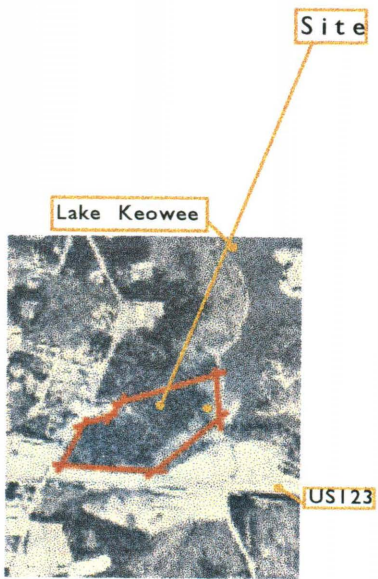
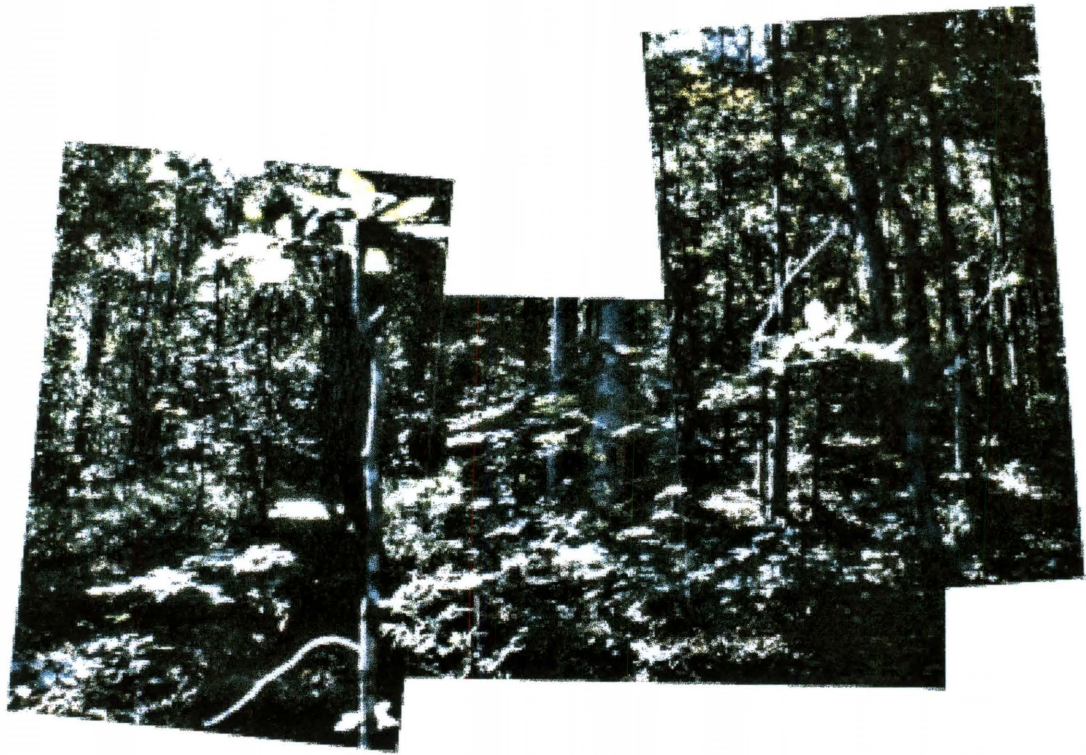


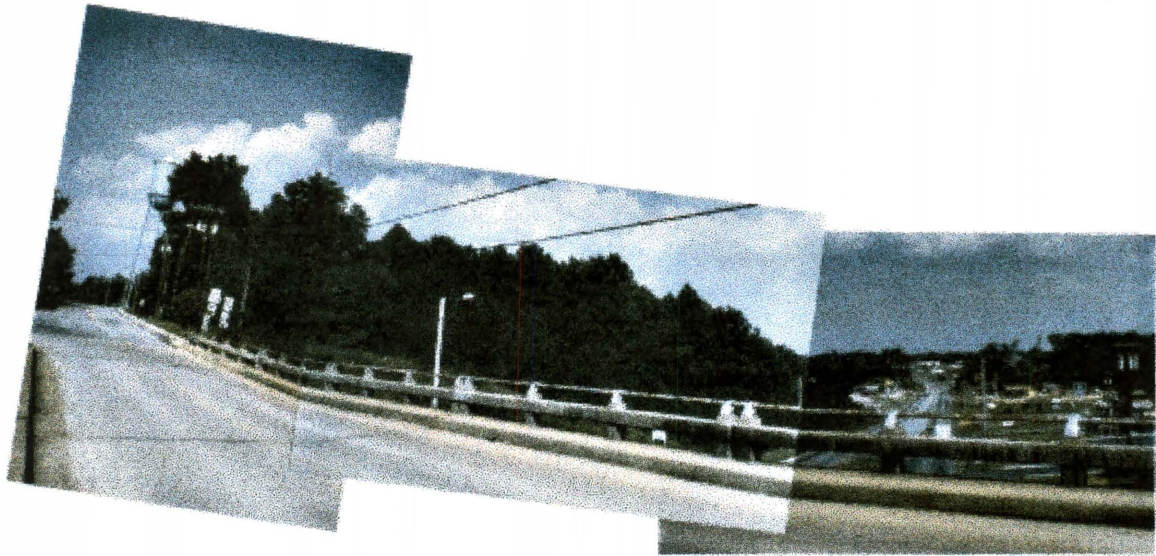




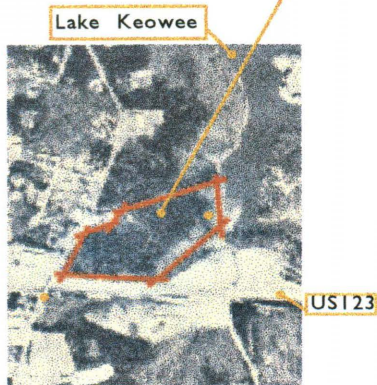
Seneca, SC - Lake Keowee as seen from the site.

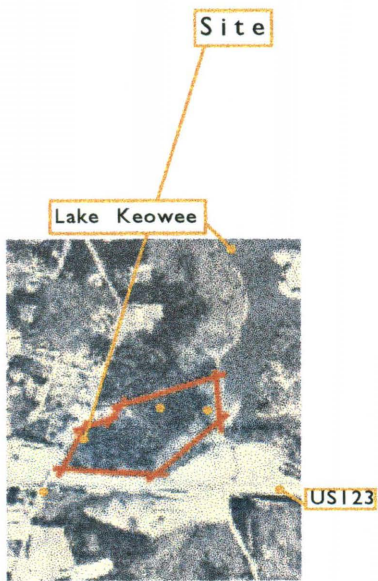
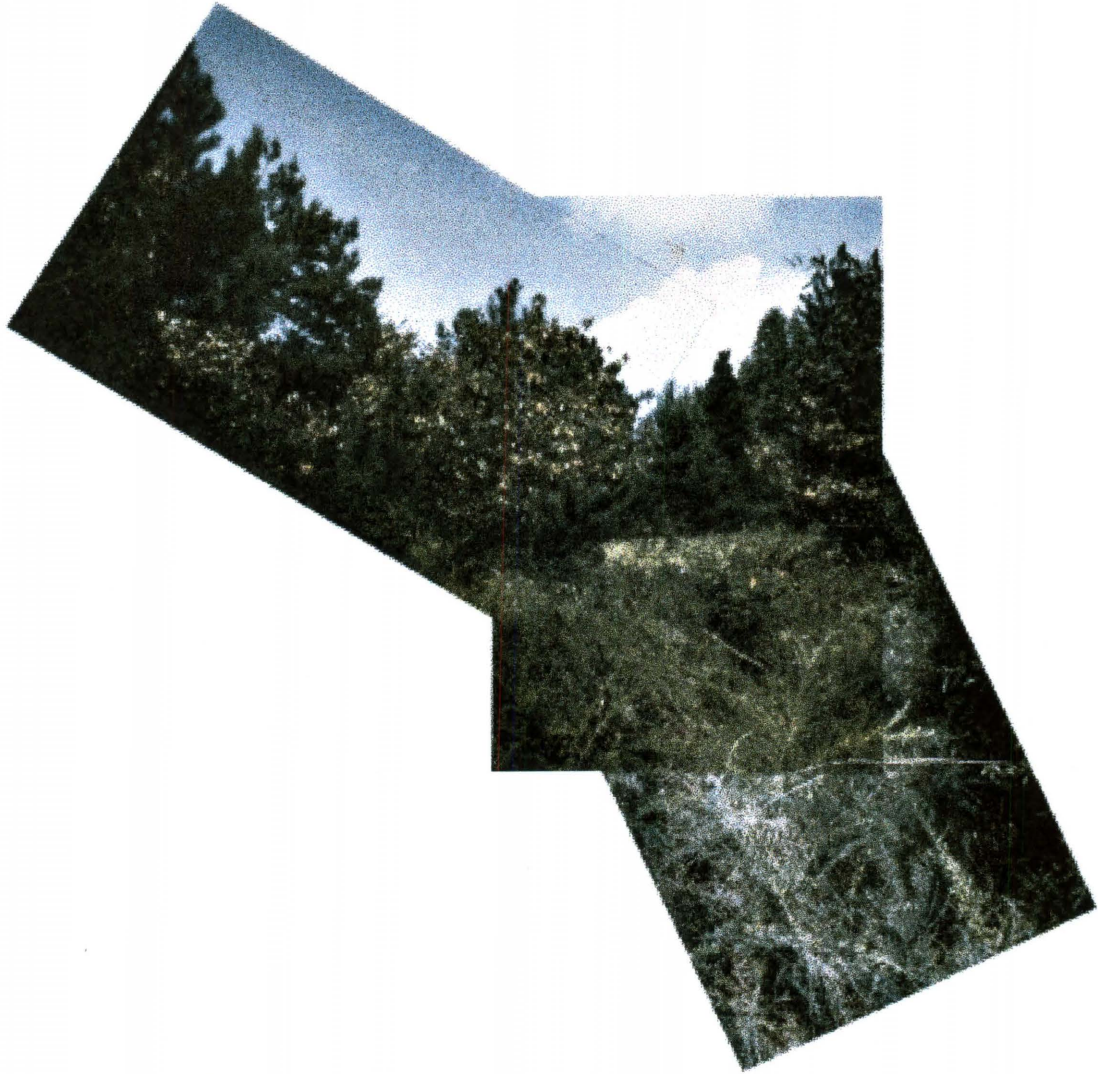


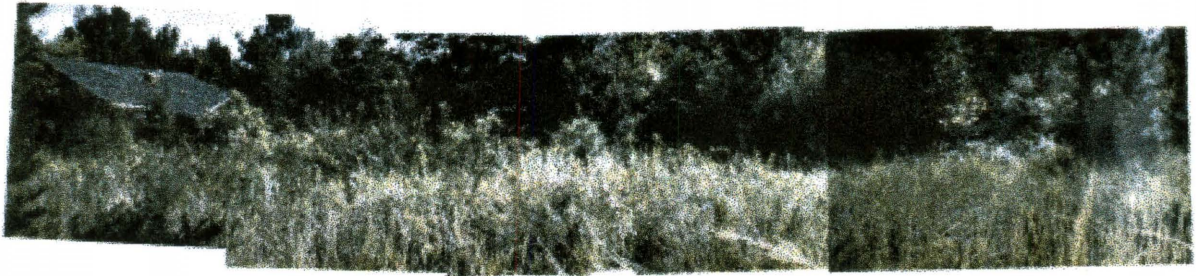




Site - Site & US123 from Northampton Rd.





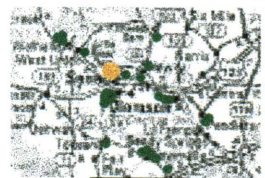


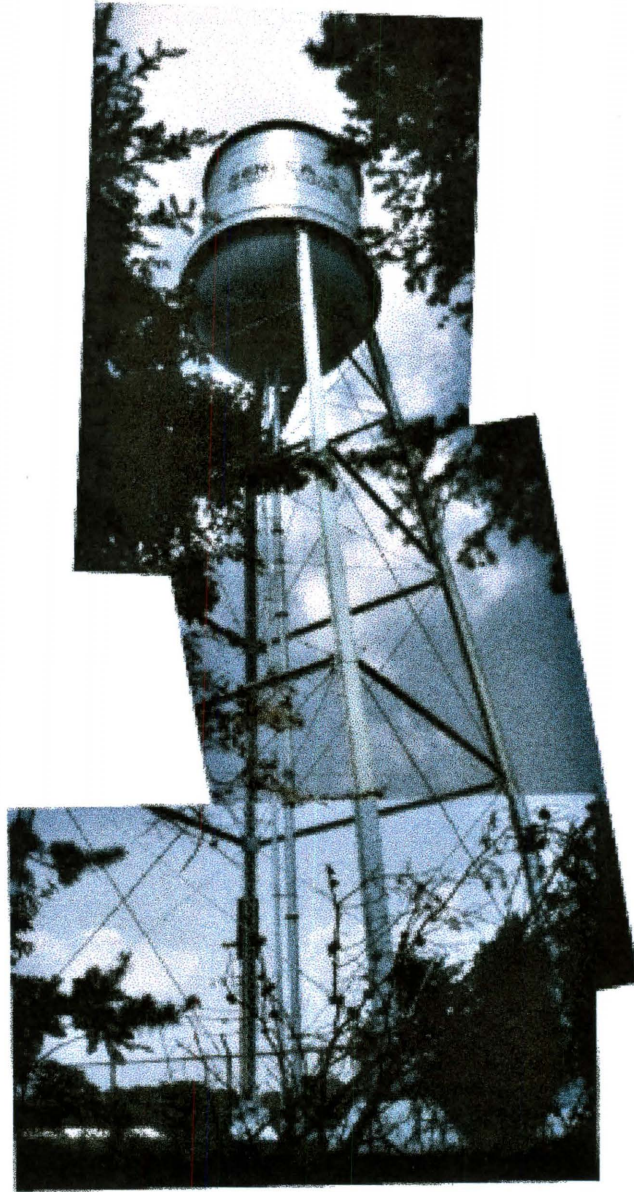
Site - The Old Homeplace.

Lake Keowee

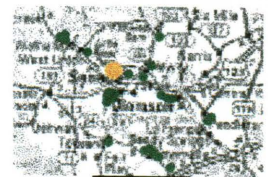


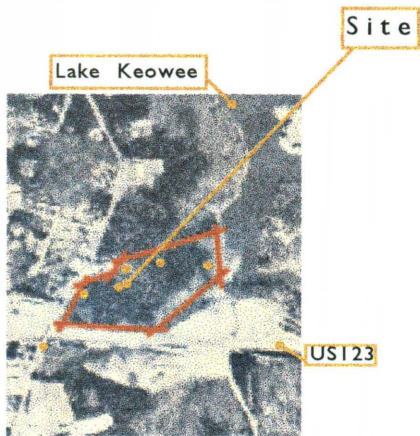
US123

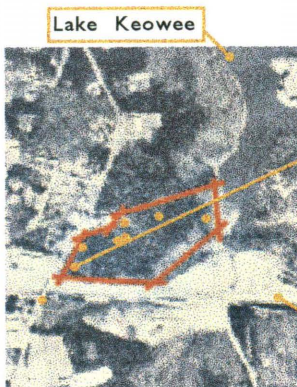
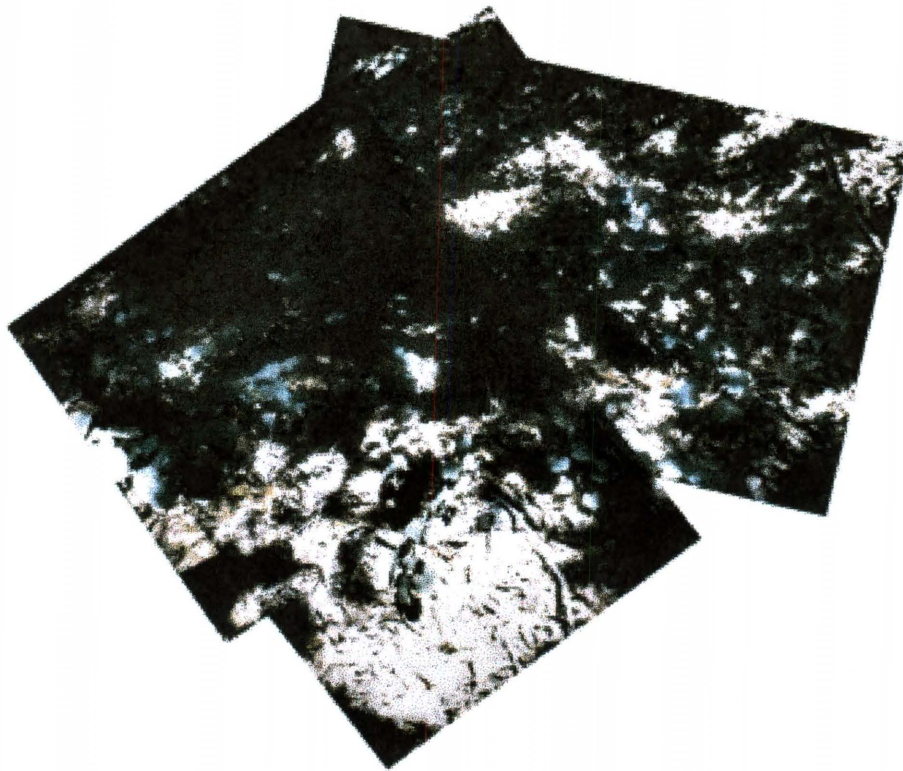




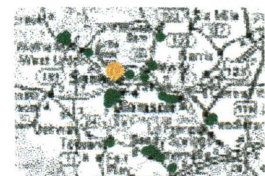
Site - Water Tower at property edge.



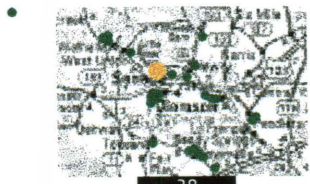
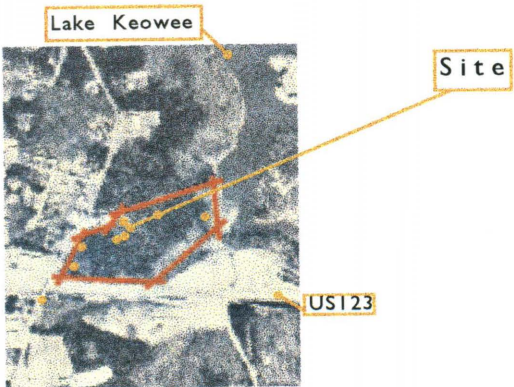


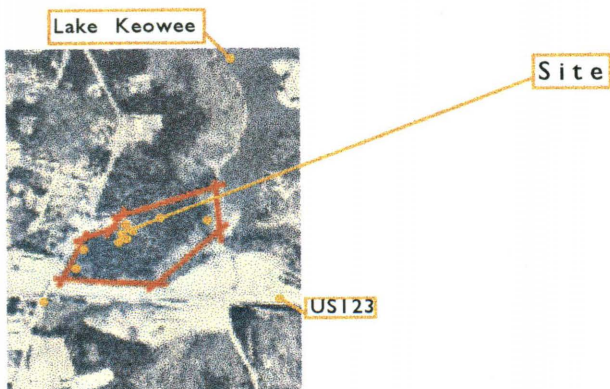


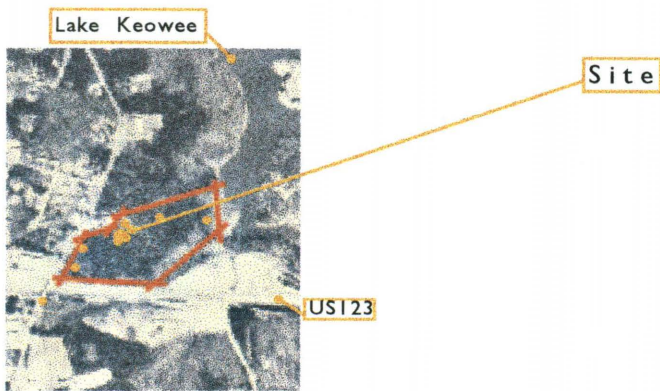
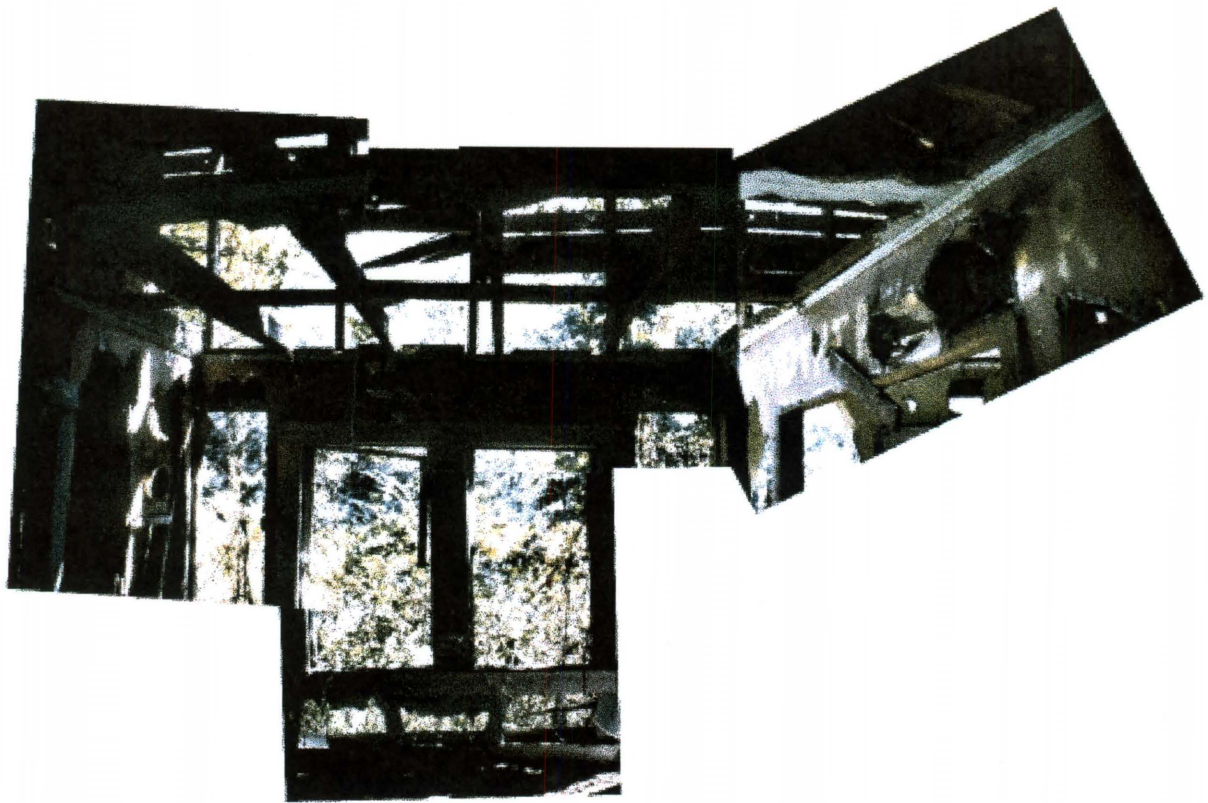
Site - Underneath the brush lay stones that mark the foundation of the former residence of Lafayette Machen.









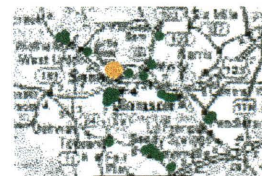




Lake Keowee

Site

US123





Lake Keowee



Site - Ruin.

US123



# ***Selling the Upstate***

Real estate in upstate South Carolina has become a hot commodity. The I-85 Growth Belt experienced at 4.7% growth in population from 1990 to 1995, ending up around 930,000 for the six county area. By 2010, over a million are projected to call this region home. The Greenville-Spartanburg MSA shows a median 3 bedroom house price of \$97,000, compared to \$110,511 for the nation. However, a 7.8% increase in housing value since 1995 shows GSP to be ahead of the nation which is back at 4.2%. So while housing may be cheaper, it is gaining value at a higher rate. Investing cheaply and reaping rewards can happen quickly. Realtors in the upstate have determined that the hot price ranges are the \$75-110,000 range, and the \$150-225,000 range. There is a good mix of new and resale homes as well. Lake properties can list anywhere from \$150,000 to over \$1,000,000 depending upon acreage, water frontage, the neighborhood, and the house itself. Resales of over \$700,000 are not uncommon.

New homeowners include those who have been brought from other parts of the country and the world due to the business boom in the upstate. Airline pilots, factory workers, engineers and a myriad of other types of workers commute throughout the Growth Belt. Oconee County experiences an overall loss of 2,500 people during the course of the

business day due to the commuting differential between those entering and leaving the county for work. Most workers go to Pickens, Greenville, and Anderson Counties.

The secondary home market has been bolstered in recent years by the affluence experienced in Atlanta. Many of those reaping the financial rewards of the "New South" have been buying properties farther and farther out of Atlanta. As property values have risen in locations like Gainesville, those seeking weekend getaway spots have targeted the relatively inexpensive land of upstate South Carolina. Those who cannot afford the prices at the more commercialized Lake Lanier near Atlanta may be able to find something reasonable on Lake Keowee or Hartwell, which are only one hour farther away.

Relocation has become a big business, with many publications available explaining how and why to move to South Carolina. Atlantans who have moved from the city to the suburbs, then to surrounding towns like Duluth and Alpharetta are making further leaps to places like Blairsville, GA and the upstate. Keowee Key on Lake Keowee was initially seen as a retirement community, but has now diversified its population. Northern retirees that traditionally targeted Florida as their ideal destination are now looking at the Carolinas. Some are even moving from Florida in search of more cheaper land and taxes, a milder climate with four seasons, and less congestion.

With the introduction of Lake Keowee in 1971, lakefront property has become some of the most sought after real estate in the

region. The major landholders in the area are Crescent Resources, a subsidiary of Duke Power, and Keowee Key. Crescent Resources are currently marketing residential tracts in “communities” such as Emerald Pointe, East Shores, Marina Pointe, North Harbour, South Cove Landing, Lakeside Pointe, Pinnacle Pointe, and the Summit. Lots with waterviews are less expensive than waterfront lots, but a large number of the lots are waterfront. Lot sizes vary from .5 acres to a full acre. The Summit and Emerald Pointe offer conveniences like community swimming pools and cabanas. Waterview lots start at \$35,000, and waterfront lots begin at \$75,000. Mariner and Pinnacle Pointes are a bit more spartan, with lot prices beginning at \$25,000 for waterviews and \$65,000 for waterfront. Of course, these are the starting prices. Most of these tracts are offered through the open bid process, where three bidders offer a price. If more than one offers full price, the bidding escalates until one offers more than the other. Premium lots in some of the neighborhoods can go for as much as \$250,00 for the lot alone. When the properties were first put on the market last October, a small turnout was expected due to bad weather. Not even an electrical storm could deter people from turning out. 26 of the 123 tracts were sold that first day before lunch, and all were sold at full price or better. Lots that attracted enough attention to exceed full price usually do so by 15-20%. Such comforting phrases as “Architectural guidelines and protective covenants preserve the integrity of the



landscape and the value of each home,” and “all Crescent communities feature attractive stone entryways” signal to the buyer the type of investment that can be made here.

Keowee Key advertises itself as a “secured, residential community” of 1,800 near Salem, South Carolina on Lake Keowee. It is the largest development of its kind on the lake, encompassing approximately 1,600 acres. Within the complex is the private marina and Keowee Key Country Club with tennis, golf, swimming, and fitness center. A conference center for meetings and gatherings allows visitors to experience the bliss that is secured living. The population has been diversified a bit, with retirees only accounting for 75% of the population according to employees. Houses and condominiums are available for short stays at the conference center. In all, there are around 2,200 units of housing at Keowee Key, but only 300 are condos. The remaining 1,900 are single family homes. Occupation of the homes varies from year-round residents to summer or winter guests, or occasional visitors.

#### **Sources**

Discussions with realtors and employees of Crescent Resources and Keowee Key.

Knight, Hara T. 1995 *Oconee County Economic Profile*. Greenville, SC: SC Appalachian Council of Governments, 1995.

Promotional Material from Crescent Resources and Keowee Key.

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Real estate in upstate South Carolina has become a hot commodity. The 1985 Growth Belt experienced a 4.7% growth in population from 1990 to 1995, ending up around 930,000 for the six county area. By 2010, over a million are projected to call this region home. The Greenville-Spartanburg MSA shows a median 2-bedroom house price of \$97,000, compared to \$110,000 for the nation. However, a 7.8% increase in housing value since 1995 shows GDP to be ahead of the nation which is back at 4.2%. So while housing may be cheaper, it is gaining value at a higher rate. Investing, flipping and reselling can happen quickly. Builders in the upstate have determined that the hot price ranges are the \$75-110,000 range, and the \$150-225,000 range. There is a good mix of new and resale homes as well. Lake properties can list anywhere from \$150,000 to over \$1,000,000 depending upon acreage, water frontage, the neighborhood, and the house itself. Resales of over \$700,000 are not uncommon.

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The secondary home market has been bolstered in recent years by the affluence experienced in Atlanta. Many of these

**Crescent offers 80% financing @ 6.5% fixed, amortized over 25 years to balloon in 10 years on any of their properties**

Parents with children at Clemson are opting to purchase houses or condos for their children instead of paying rent at apartments

**SOLD**

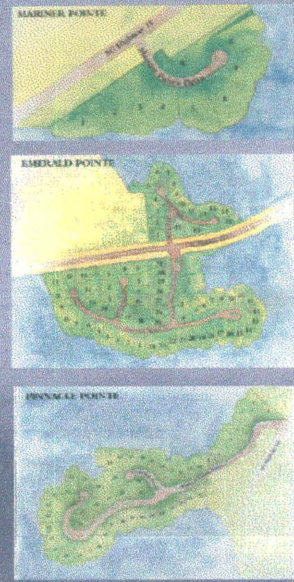


or as much as \$250,000 for the lakefront. When the properties were first put on the market last October, a slow turnout was expected due to bad weather. Not even an electrical storm could deter people from turning out. 26 of the 232 tracts were sold that first day before lunch, and all were sold at full price or better. Lots that attracted enough attention to exceed full price usually do so by 15-20%. Such comforting phrases as "Architectural guidelines and protective covenants preserve the integrity of the landscape and the value of each home," and "all Crescent communities feature attractive stone entryways" signal to the buyer the type of investment that can be made here.

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Keowee Key - a beautiful lakefront property



Crescent Resources - the "Keowee Key"

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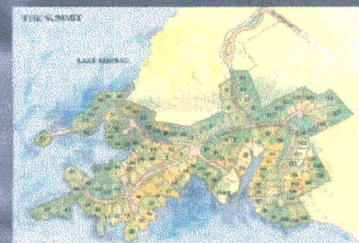
Relocation has become a big business, with many publications available explaining how and why to move to South Carolina. Atlantans who have moved from the city to the suburbs then to surrounding towns like Duluth and Alpharetta are making further leaps to places like Blakely, GA and the upstate. Keowee Key on Lake Keowee was initially seen as a retirement community but has now diversified its population. Northern retirees that traditionally targeted Florida as their ideal destination are now looking at the Carolinas. Some are even moving from Florida in search of more cheaper land and taxes, a milder climate with four seasons, and less congestion.

With the introduction of Lake Keowee in 1971, lakefront property has become some of the most sought after real estate in the region. The major landholders in the area are Crescent Resources, a subsidiary of Duke Power, and Keowee Key. Crescent Resources are currently marketing residential tracts in "communities" such as Emerald Pointe, East Shores, Marina Pointe, North Harbour, South Cove Landing, Lakeside Pointe, Pinnacle Pointe and the Summit. Lots with water views are less expensive than waterfront lots, but a large number of the lots are waterfront. Lot sizes vary from .5 acres to a full acre. The Summit and Emerald Pointe offer conveniences like community swimming pools and beaches. Water view lots start at \$35,000, and waterfront lots begin at \$75,000. Marina and Pinnacle Pointe are a bit more expensive, with lot prices beginning at \$25,000 for water views and \$65,000 for waterfront. Of course, these are the starting prices. Most of these tracts are offered through the open bid process, where three bidders offer a price. If more than one offers full price, the bidding escalates until one offers more than the other. Premium lots in some of the neighborhoods can



Keowee Key - a beautiful lakefront property

Mild tax burden and climate are drawing retirees away from traditional destinations like Florida



# Keowee-Toxaway Complex

The Keowee-Toxaway Complex is a project created by Duke Power. It occupies over 100,000 acres in Oconee and Pickens Counties in South Carolina, and Transylvania County in North Carolina. The project consists of two man-made lakes (Jocassee and Keowee) that were formed from the damming of the Keowee River, and was completed in 1975. Keowee Hydro Station and Jocassee Pumped Storage Hydro Station were the initial dams used to form the lakes and harness the power of the water for power. Construction on these plants began in the 1960's.

Also included in the complex is the Oconee Nuclear Station, one of the nation's most efficient reactors. Construction began in 1967, with Oconee Unit 1 coming online July 15, 1973. Oconee Units 2 & 3 followed suit in 1974. Sub surface water is drawn from Lake Keowee as a tertiary cooling source for the reactor core. That warmer water is returned to the surface of the lake. ONS has proved to be a success for Duke Power. In 1983, Unit 2 had produced more electricity than any other nuclear station in the nation and set a new world record for continuous operation of a light-water reactor. Having cost only \$500 million to build, Oconee Nuclear Station paid for itself in eight years time.

Bad Creek Hydroelectric Station opened in 1991 after a decade of construction. A pumped-storage station, Bad Creek uses the

7,500 acre Lake Jocassee as a lower reservoir and its own 360 acre pond as an upper reservoir. Water is pumped from the lower to the upper pond during off-peak hours. During hours of peak usage, water flows from the upper reservoir to the lake via a Power Tunnel that allows the Station to harness the power of the water as it negotiates its nearly 1,200 foot drop in elevation from one reservoir to the other. Although pumped-storage costs more than it saves, it is effective when used at the correct time and replaces more costly and wasteful means of energy production (coal).

Duke Power amassed approximately 100,000 acres of land to create this complex. Lake Keowee covers over 18,500 acres and Lake Jocassee covers over 7,500 acres. After introducing a body of water to the former Keowee river, 300 miles of shoreline appeared around Lake Keowee - instant lakefront property! 1,000 acres and over 3 miles of shoreline were donated to the State of South Carolina for a state park. Three county parks inhabit lakefront property as well.

Duke Power's development arm, Crescent Resources, is in charge of all of the excess land outside of the one-mile radius zone surrounding ONS. **Watershed Protection Areas** occur around 13 streams near Lake Jocassee. Rare and unique biological communities, plants, waterfalls, fish populations, and water quality are essential components of these mountain streams. **Scenic Protection Areas** buffer the view from Lake Jocassee. At least 300 feet wide, the buffer extends to the ridgelines adjacent

to the lakefront. Behind these buffers, clear cutting is allowed in the **Timber Management/Wildlife Areas**. Replanting of pines and hardwoods replenish the lands that are largely hunting grounds as well. Similarly, **Timber Management/Multi-Use Areas** allow harvesting of trees, but are also possible future areas of residential/recreational development. **Recreation Zones** include a Hiking trail around Lake Jocassee, totaling 43 miles. The trail crosses timberland, but is protected by a buffer. Lake access occurs at nine different points on Lake Keowee, three of them the county parks. Boat launches are available at Devil's Fork State Park for Lake Jocassee.

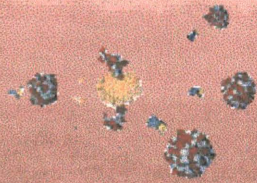
Residents and visitors alike enjoy the lakes that are part of what is known as South Carolina's "Freshwater Coast." Lake Keowee Marina is the only public marina, with Keowee Key having its own private marina. Sailing, water skiing, fishing, swimming, and even scuba diving are just some of the activities one can observe or perform during a visit to Lake Keowee.

#### **Sources**

Promotional Material from Duke Power.

*Keowee-Toxaway Project: Summary of Selected Topics*. Fifth Ed. Duke Power Company

# Keowee-Toxaway Complex



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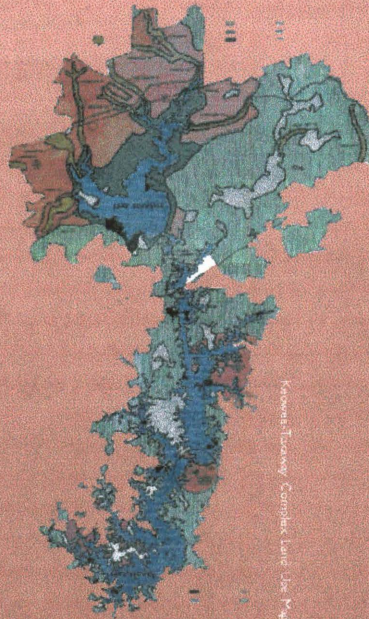
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Oconee Nuclear Site paid for itself in eight years (saved \$500 million)



Keowee-Toxaway Complex built the 'Big Dog'



Reactor Control Room

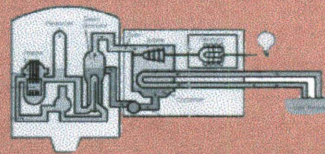
Jocassee. Rare and unique biological communities, plants, waterfalls, fish populations, and water quality are several components of these mountain streams. **Scenic Protection Areas** buffer the view from Lake Jocassee. At least 300 feet wide, the buffer extends to the ridgeline adjacent to the plant site. Behind these buffers, clear cutting is allowed in the **Timber Management/Wildlife Areas**. Replanting of pines and hardwoods replenish the lands that are largely hunting grounds as well. Similarly, **Timber Management/Multi-Use Areas** allow for cutting of trees, but are also possible future areas of residential/recreational development. **Recreation Zones** include a hiking trail around Lake Jocassee, totaling 43 miles. The trail crosses timberland, but is protected by a buffer. Lake access occurs at nine different points on Lake Keowee, three of them the county parks. Boat launches are available at Devil's Fork State Park for Lake Jocassee.

Residents and visitors alike enjoy the lakes that are part of what is known as South Carolina's "Trachwater Coast." Lake Keowee Marine is the only public marina with Keowee Key having its own private marina. Snelling, water skiing, fishing, swimming and even scuba diving are just some of the activities one can observe or perform during a visit to Lake Keowee.

When operating at full capacity, Oconee saves the equivalent of 27,000 tons of coal per day



Oconee Nuclear Station



Reactor Diagram

Approximately 55,000 people live within a 10-mile radius of ONS, including the citizens of Clemson and Seneca



Bad Creek Hydroelectric Station

The Keowee-Toxaway Project generates more than 3,000 Megawatts of electricity from nuclear and hydroelectric plants

# I-85 Growth Belt

Situated in the foothills of the Blue Ridge mountains between Sun-Belt growth centers Atlanta and Charlotte is the Greenville-Spartanburg-Anderson MSA (Metropolitan Statistical Area). The MSA consists of Greenville, Spartanburg, Anderson, Pickens, and Cherokee counties, excluding Oconee and Laurens counties, which are considered along with the MSA as **the I-85 Growth Belt**. The growth belt refers to the areas in South Carolina that are home to US Interstate 85 which runs from Alabama to Virginia.

Recent business growth in the region has been phenomenal. Over the last 10 years, Greenville alone has had over \$4 billion in announced capital investment, Spartanburg having over \$3 billion. With German automaker BMW locating its first North American plant between Greenville and Spartanburg, "GSP" caught the attention of the nation and the world.

Expenses are low in South Carolina, which is a major selling point for the state and the region. Union representation is the second lowest in the country. Manufacturing hourly wages average \$10.08 in South Carolina. The state "enjoys" the 5th lowest Workman's Compensation insurance rate at \$2.91 per \$100. The state enjoys the 6th lowest per capita income tax burden, \$1562 compared to \$1801 in Georgia, \$2226 in

California, \$2519 in New Jersey, and \$3267 in New York. At a 5% rate, Corporate income taxes are low as well. In 1995, *Site Selection Magazine* ranked the state third in the nation in new and expanded global facilities, and fourth in attracting new manufacturing plants. In 1994, South Carolina announced 81 new manufacturing facilities. Large investments will allow one to negotiate with counties regarding a fee-in-lieu of property taxes. Manufacturing, distributing, and corporate headquarters enjoy five year county property tax moratoriums. No inventory taxes, local income taxes, intangible taxes, wholesale sales tax, value-added taxes, or unitary taxes on worldwide profits exist in South Carolina. No wonder South Carolina is the second fastest growing state in the Southeast.

Access to the nation and to the world has been a selling point for the region. Being positioned between Atlanta and Charlotte has given the Growth Belt a share of the prosperity experienced in the "New South." The twin cities straddle the crossroads of I-85 and I-26, which runs from Asheville, North Carolina to the city of Charleston. The Port of Charleston is the second largest deep water container port on the East Coast and the most preferred on the South Atlantic and Gulf coasts. The state is within 750 miles of 66% of the United States population.

Manufacturing is the dominant force in the area. The Greenville-Spartanburg-Anderson MSA has the largest portion of its work force involved in manufacturing of any area in the country (30%). Textile companies,



like Milliken, have traditionally been the major role players of the region, but other industries as varied as Michelin Tires and General Electric Co. have facilities in the area. BMW's plant has accounted for over \$800 million in capital investment and 1,700 jobs. Michelin recently announced a \$100 million expansion, providing 300 additional jobs, bringing their total to over 2,000 jobs. In fact, the Michelin plant is the largest tire manufacturing facility in the world. Over the next five years, Michelin will invest over \$500 million in expansion that will be limited to South Carolina and bring their employment close to 11,000. Other major manufacturers in the area include Hoechst-Celanese, Cryovac, Kohler Company, AMOCO Fabrics and Fibers, Adidas America, Kemet Electronics, Lockheed Aeromod, Bausch & Lomb. Service industries include Flagstar Food Prep, Bi-Lo, Winn-Dixie, Duke Power, and First Union Bank.

Despite being home to such globally recognizable firms like Michelin, Hitachi, and BASF, it was the BMW deal that put GSP on the map. The importance and size of this deal cannot be stressed enough. In order to ensure the German company would chose South Carolina over Nebraska, then Gov. Carrol Campbell through business and political ties was able to amass 1000 acres of land through 130 separate parcels near GSP Airport in less than three months. The airport has undergone a \$50 million expansion in order to allow jumbo jets from Germany to bring machinery and parts to South Carolina. Once the \$200 million expansion is complete, the plant will

account for approximately 1.5 million square feet of space accommodating 2000 employees. Annual payroll is estimated to be over \$70 million by that time. 85,000 applications were received for those 2000 jobs in an area with 3.4% unemployment as compared to 5.3% for the nation.

And the repercussions of such a move are still being felt. At least 19 companies have located in the region since the BMW plant was announced. German companies like Alfmeir and Bomoro in Greenville, A. Berger, Stankiewicz International, and Zuena Staerker in Spartanburg are trying their hands at business in the Upstate. Even such rural sites as Fountain Inn and Piedmont are attracting customers. These foreign investors have accounted for \$350 million in capital investments. French and Japanese firms have come as well. At least five or six more firms are in the process of moving to the Growth Belt. Construction has definitely received a shot in the arm from this process. Even the Port of Charleston three hours away will reap benefits from the plant. Although the plant will make automobiles for North America, the majority of the product will be exported to over 100 countries, a first in the United States.

#### **Sources**

Appalachian Council of Governments Homepage

Greenville Chamber of Commerce Homepage

Spartanburg Area Chamber of Commerce Homepage

Kanter, Rosabeth Moss. "Thriving Locally in a Global Economy." *Harvard Business Review* Sep/Oct (1995): 151-160.

# Greenville/Spartanburg and the I-85 Growth

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all of the Pepto-Bismol in the world is manufactured in Greenville

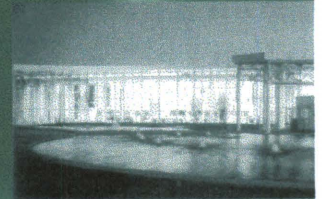


BMW Facility - Greenville, South Carolina

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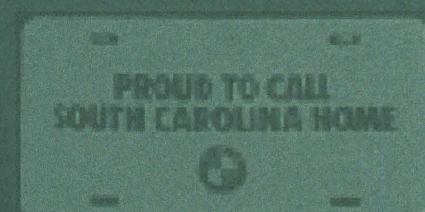
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Greenville has twice the national average of labor force employed by foreign firms

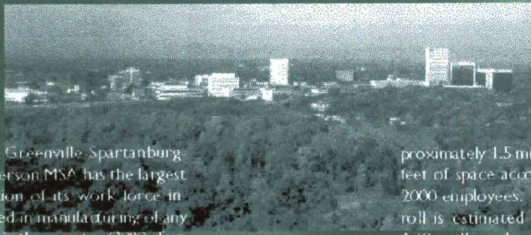
"Spartanburg is now the twin capitals of a growing metropolitan area and boasts the highest concentration of direct foreign investment in the South. So much of it. Get it? Los Angeles Times (November 1995)



Spartanburg, South Carolina

"The history of (the Spartanburg-Greenville) region's economic development is a lesson for business and community leaders seeking to understand what is required to achieve world-class status and bring local residents into the world economy." *World Class: Thriving in the Global Economy*, Dr. Rosabeth Moss Kanter, Harvard Business School. (Simon & Schuster, 1995)

# Growth Belt



Greenville, South Carolina

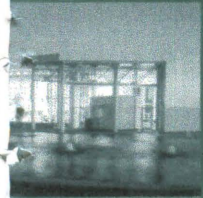
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Greenville's General Electric plant is the largest manufacturer of gas turbines in the world



Zentrum Showroom - BMW Facility

ing is now one of the capitals of a growing metropolitan area that has the highest concentration of direct foreign investment in the nation, "it German"

(November 16, 1994)



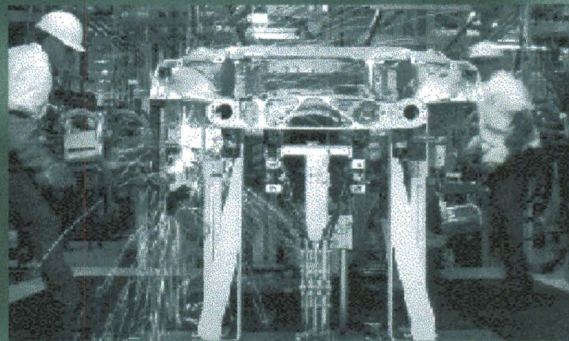
or business status to my." (er, 1995)

every drop of Bausch & Lomb contact lens and eye care solution used in the United States is manufactured in Greenville



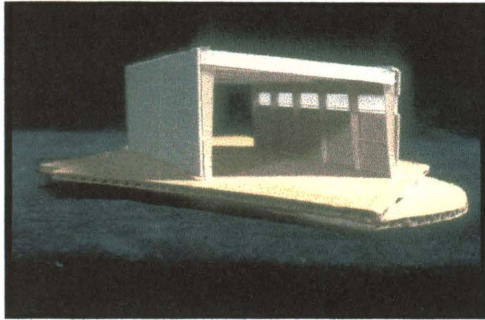
Parcel Center for the Area - Greenville

"The courtship of BMW was only the latest success for a region that has embraced the global economy like no other." Business Week Magazine (September 27, 1993)



Automobile assembly - BMW Facility Greenville, South Carolina

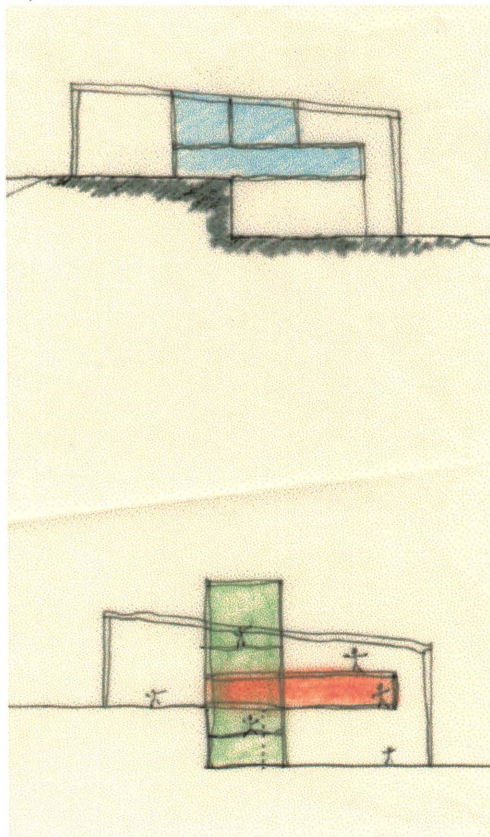
# Design Development



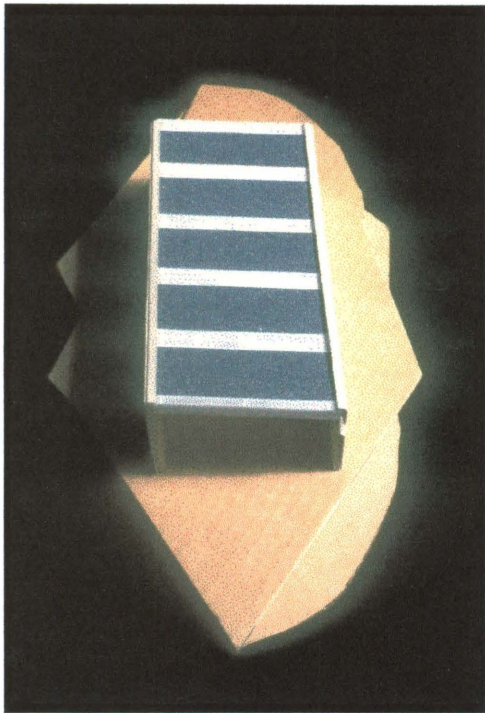
study model

Initial strategies for the proposal centered upon a mode of utilizing standard metal-building construction. By allowing the programs of administration, education, and manufacturing to exist within a single structure, connection could be implied.

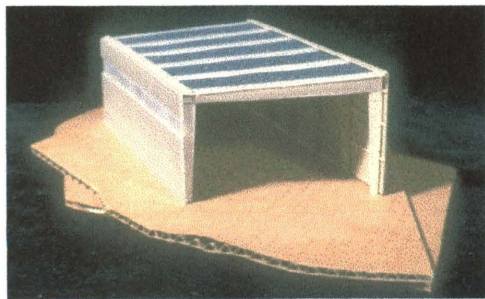
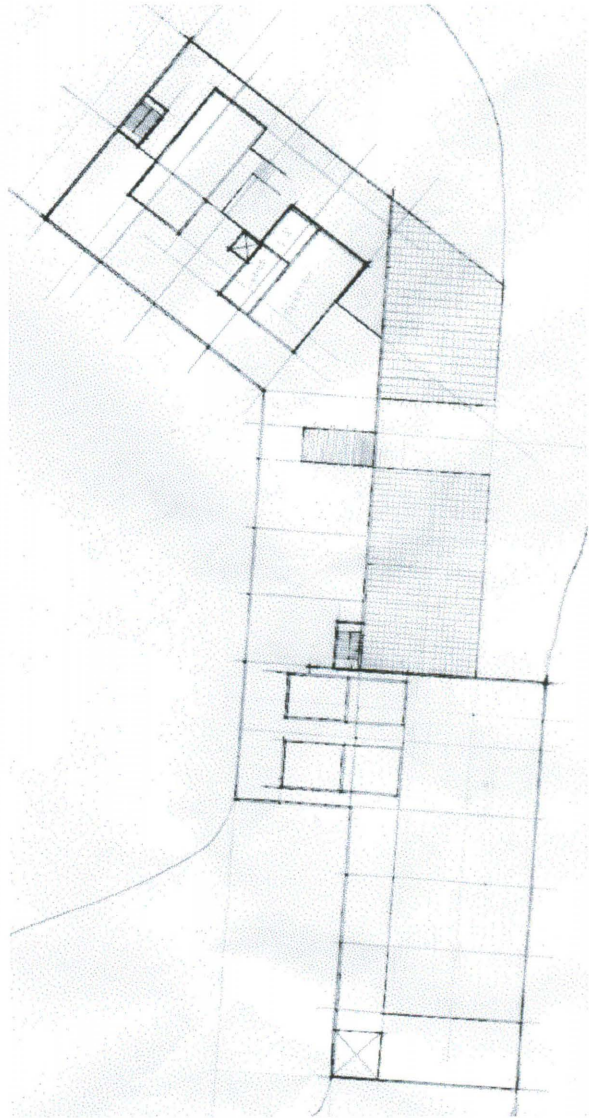
early sketches

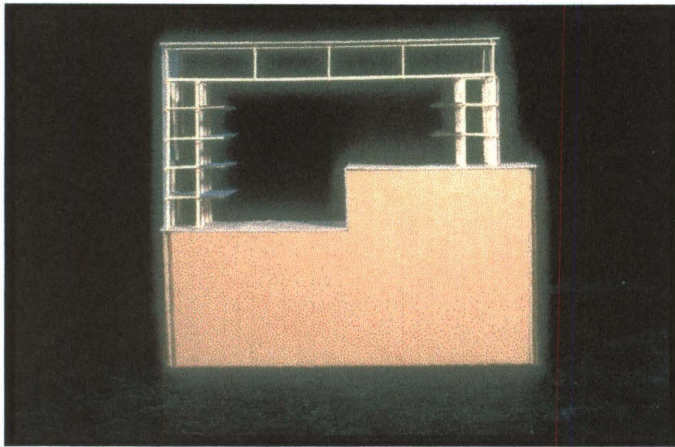


The topography of the site presented itself early on as a concern. The grade changes that occur throughout the site made stepping a necessity, and also allowed for differentiation within the confines of the shed.



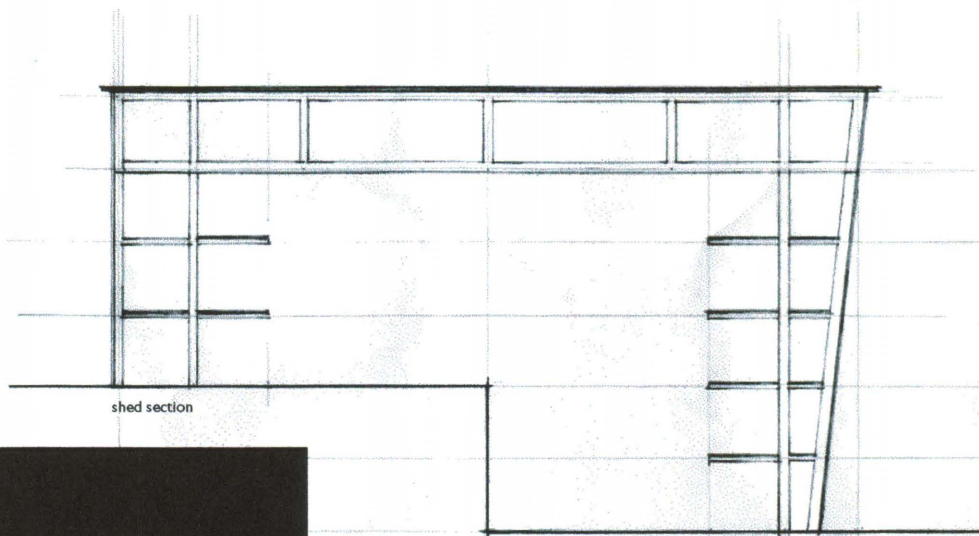
early scheme



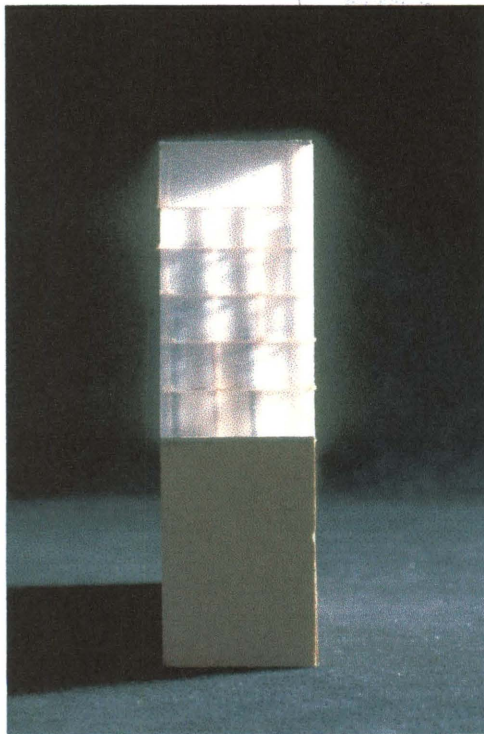


study model

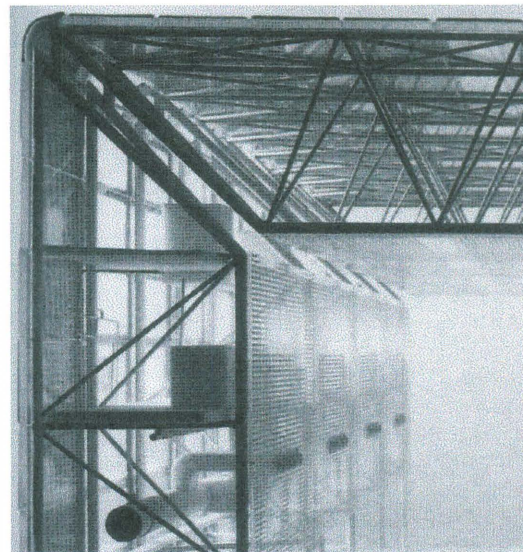
Elaborating on the standard shed, a thickening of the walls was implemented. Storage and services for the manufacturing and the structure itself were to be relegated to these areas, freeing the interior space. Sir Norman Foster's Sainsbury Center for Visual Arts in Norwich uses this technique.

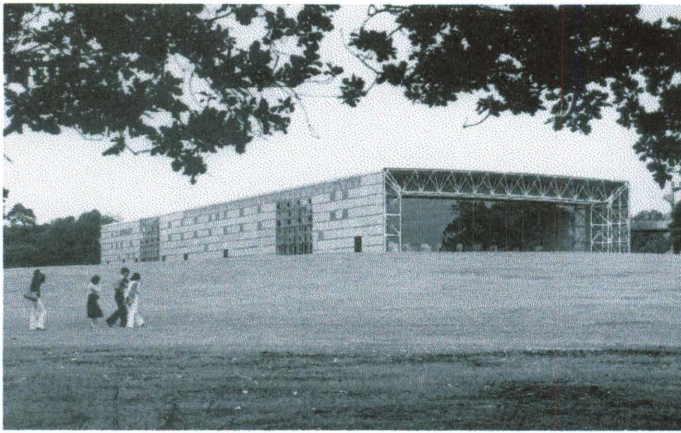


shed section

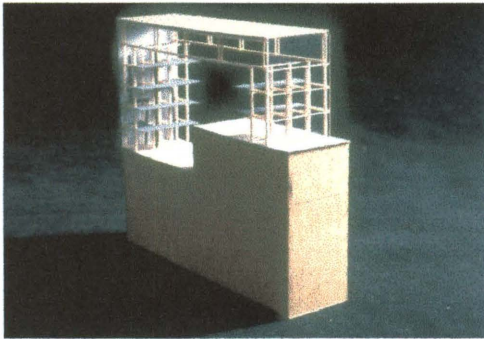


Foster and Associates: Buildings and Projects, p. 111 - detail model



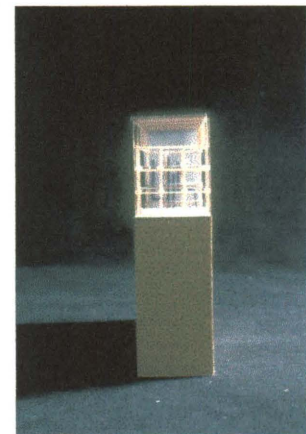
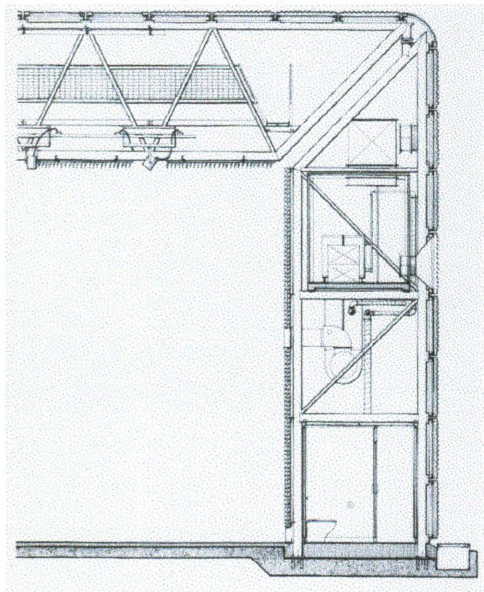


Foster and Associates: Buildings and Projects, p. 84

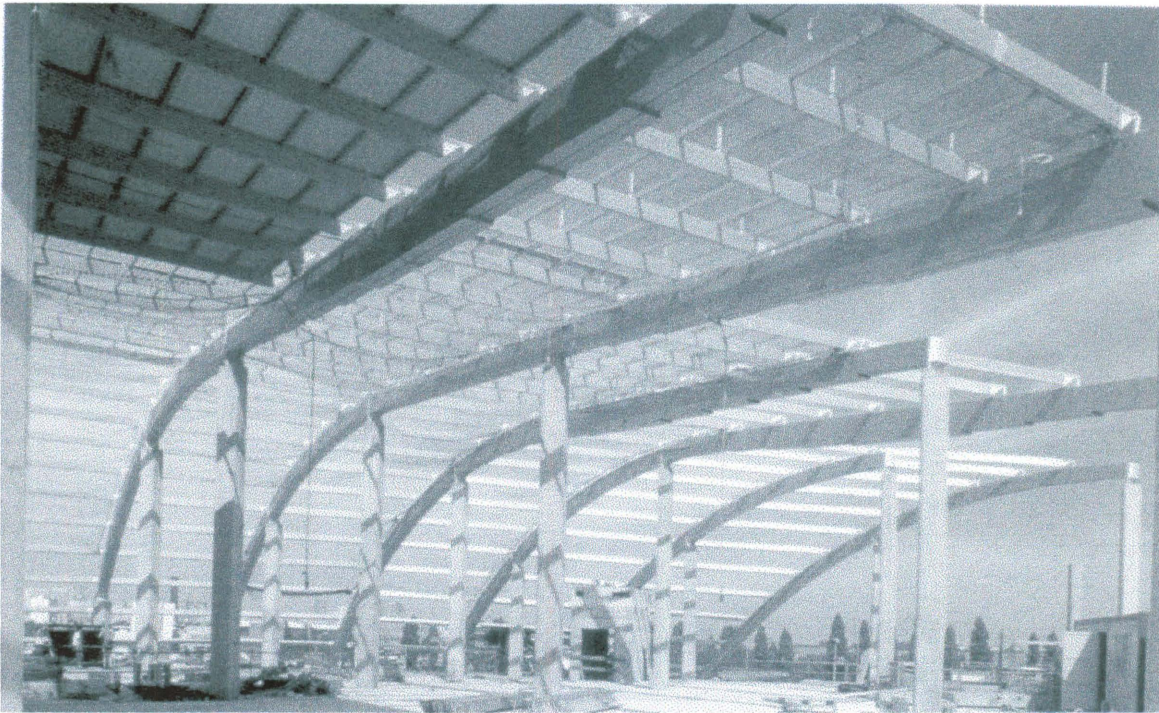


In the Sainsbury Center, Foster was able to sandwich the services between interior and exterior skins. The frame to which both “membranes” attach houses all of the services and assists in creating the void within by spanning the building with no interior columns.

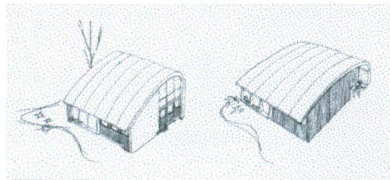
Foster and Associates: Buildings and Projects, p. 89 - detail section





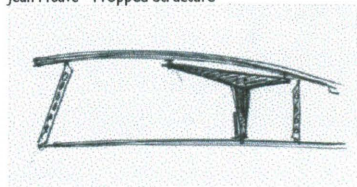


Bercy II Shopping Centre, Charenton le Pont, Renzo Piano: 1987-1994 - Construction

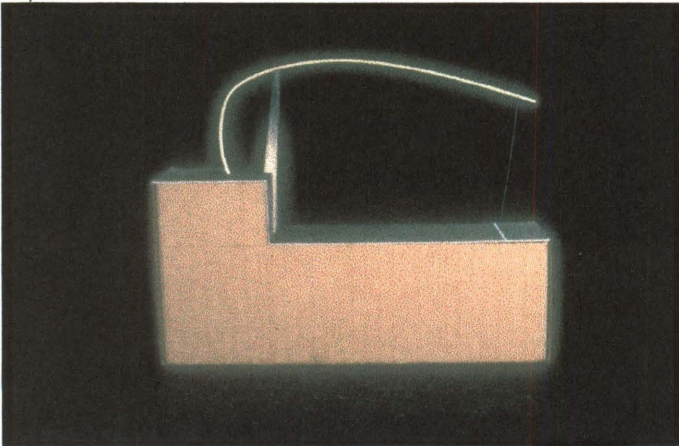


Jean Prouve - Shell Structures

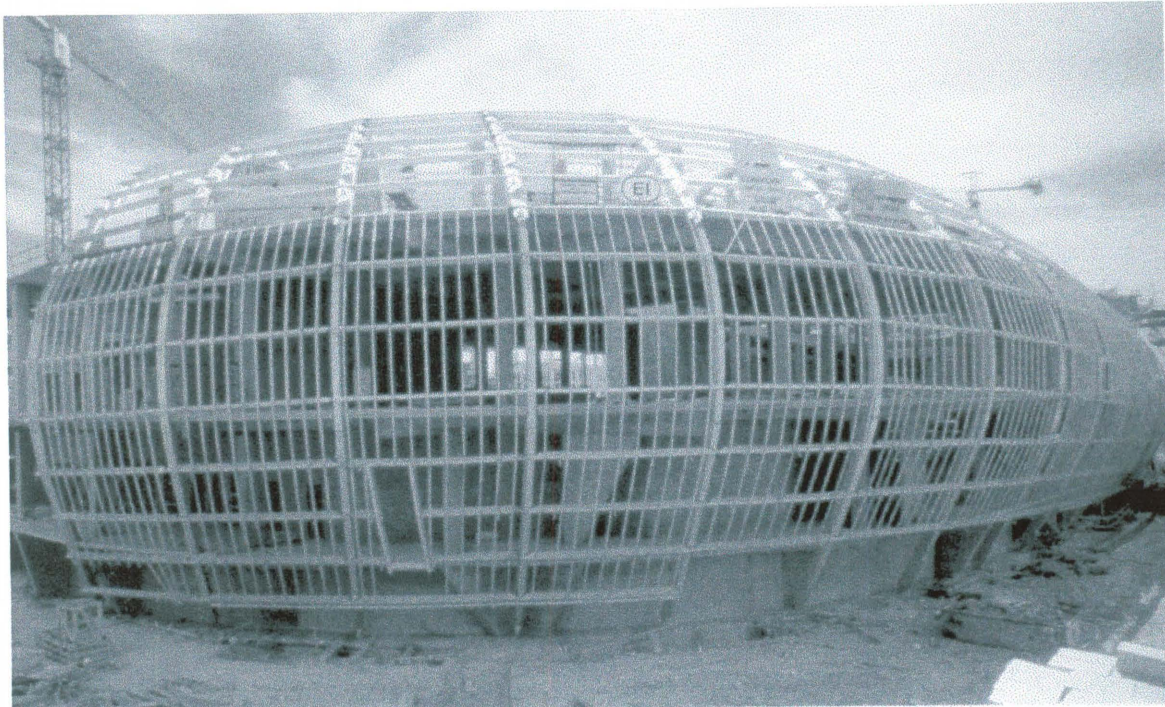
Jean Prouve - Propped Structure



study model

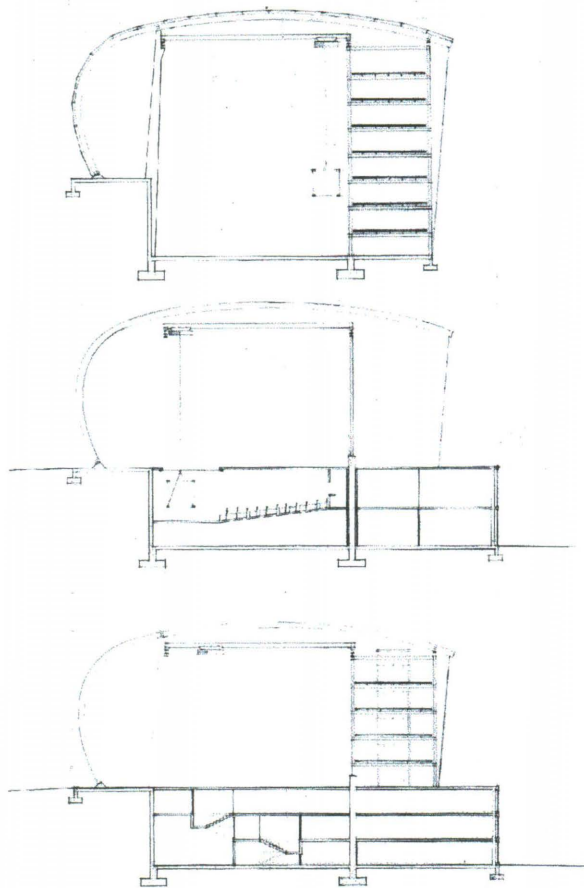


With prefabrication remaining a priority, a more provocative container was sought. The “architectural alphabet” provided by Jean Prouve for prefab construction in the 1950’s revealed the intelligence in simplicity that could be achieved using a controlled palette of forms.

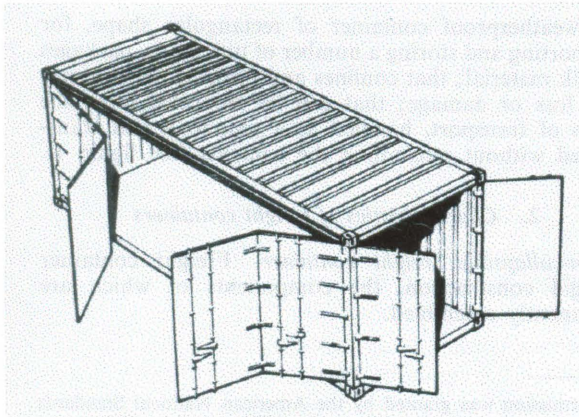


Bercy II Shopping Centre, Charenton le Pont, Renzo Piano: 1987-1994 - Construction

early sections

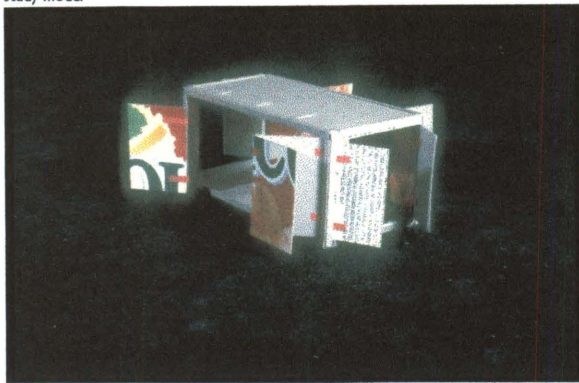


Piano's Bercy II Shopping Center in Paris used a glue-laminated structure sheathed by a metal panel system. Using glulams within this facility was particularly appealing since timber harvesting remains an economic entity in the upstate of South Carolina.

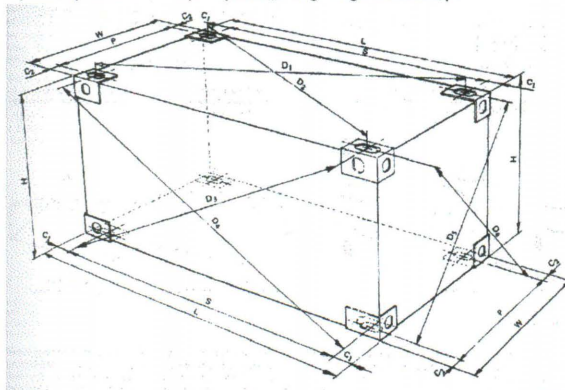


Physical Requirements of Transport Systems for Large Freight Containers, p.2

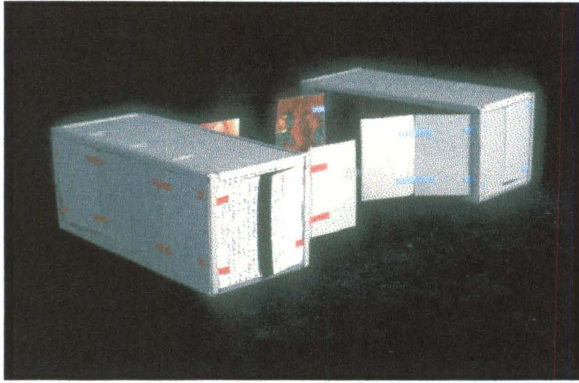
study model



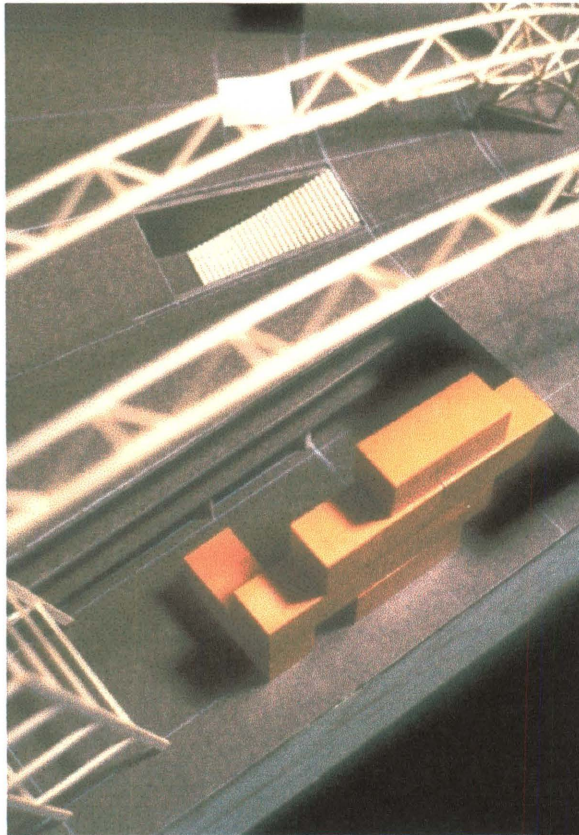
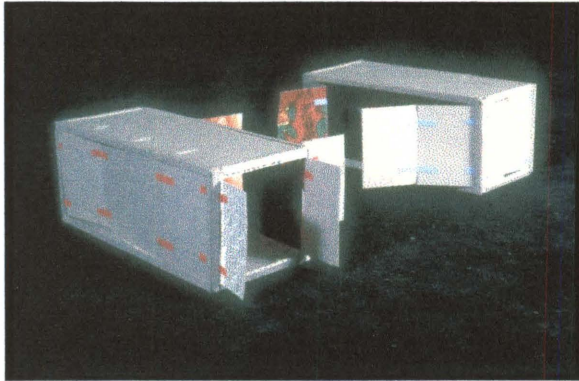
Physical Requirements of Transport Systems for Large Freight Containers, p.2



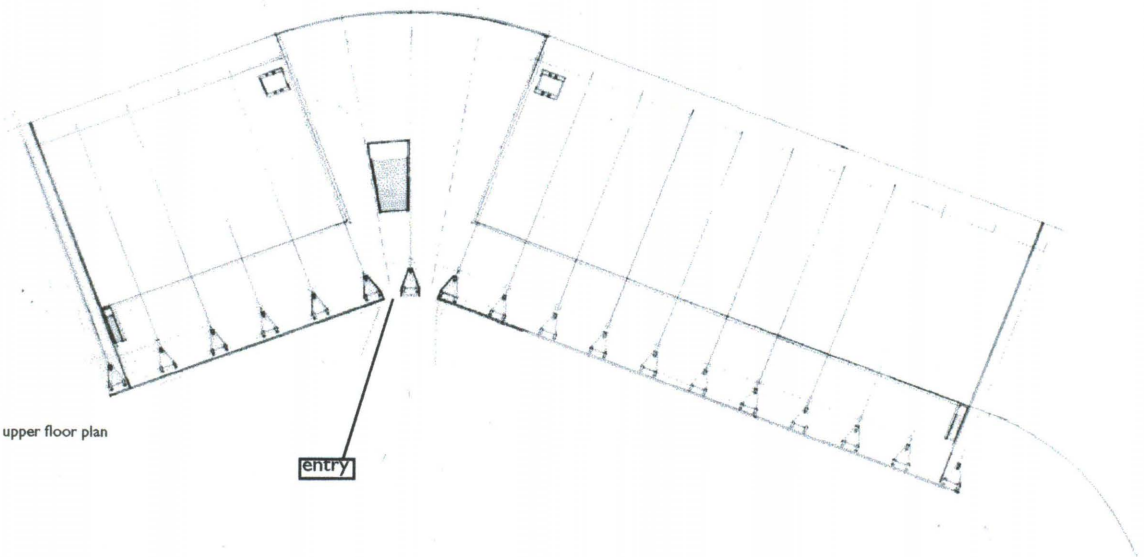
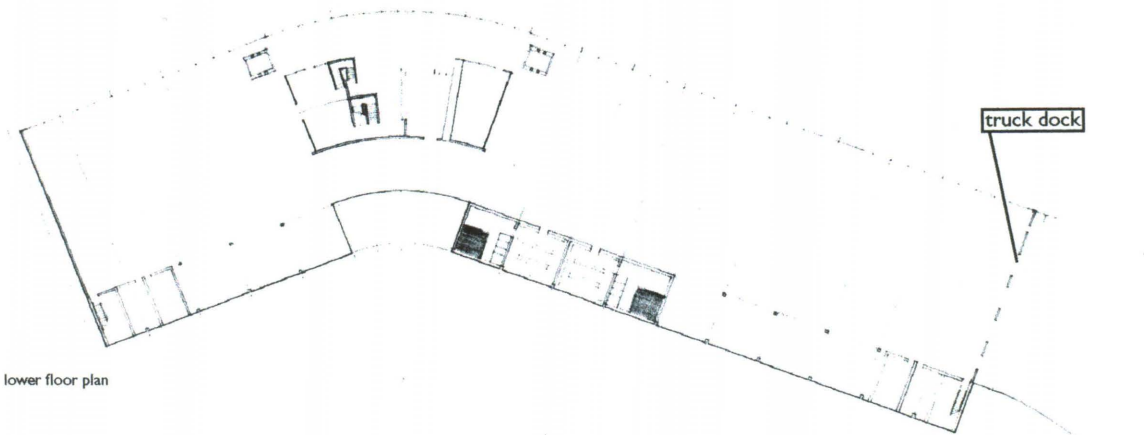
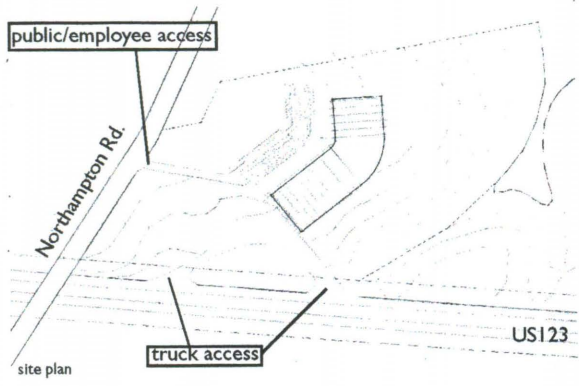
Within the shed, an amalgam of shipping containers are to be used as the ever-changing space of office and classroom. Using the single girder crane that runs the length of the facility, the containers can be moved and rearranged to accommodate the changing modes and configurations of production that occur within the facility.

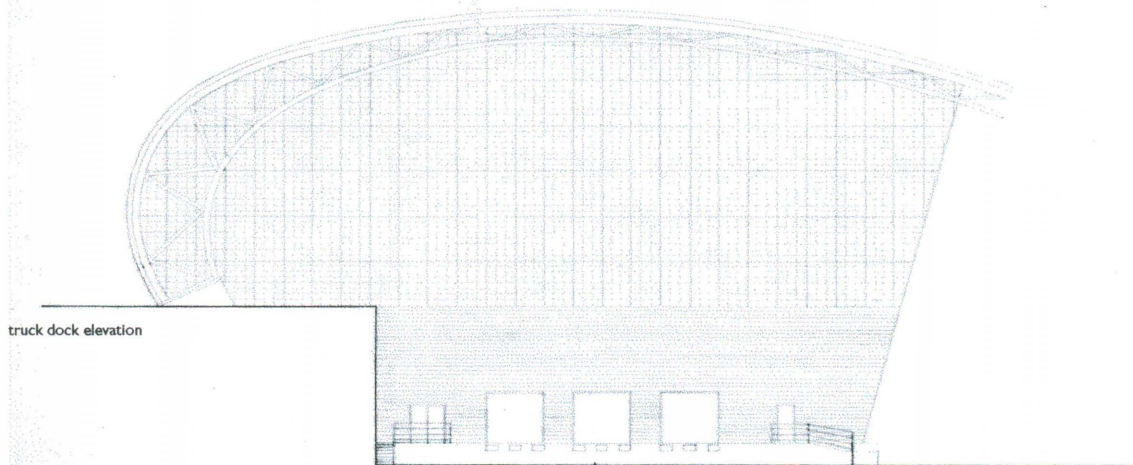
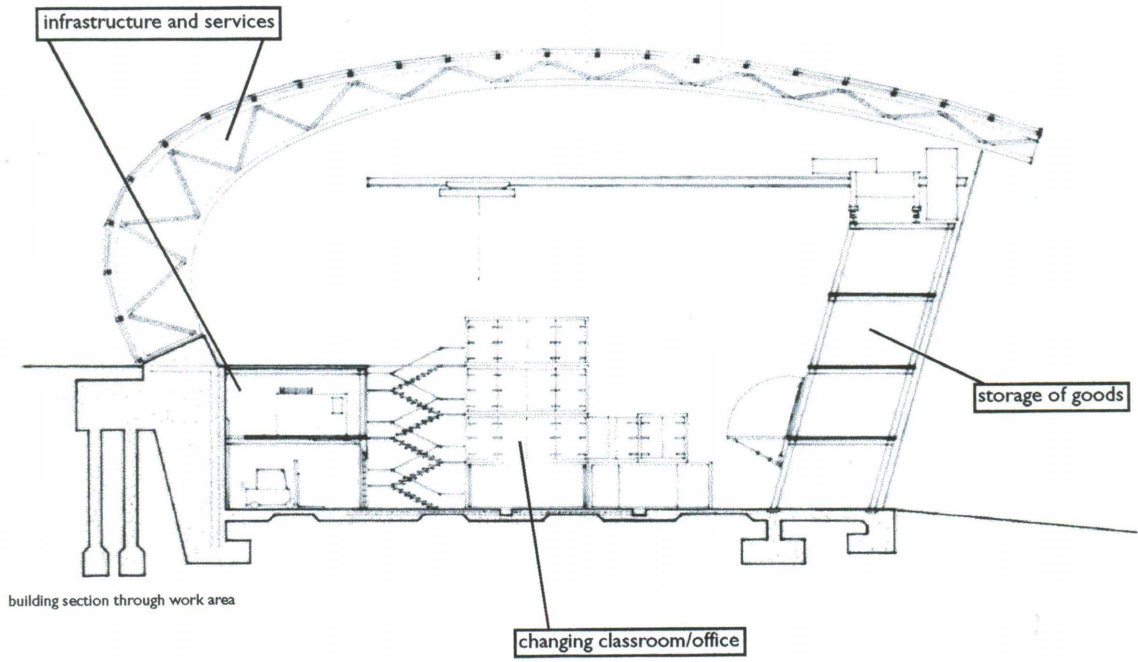


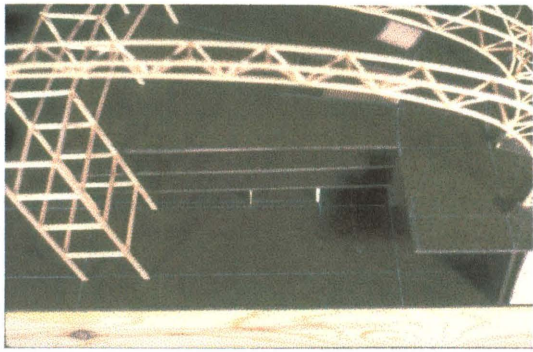
Proximity plays a key role within the placement and configuration of the containers. By using the doors as openings or dividers, the containers can begin to define the space surrounding their enclosure, thus creating zones that blend the educational with the administrative components of the facility.



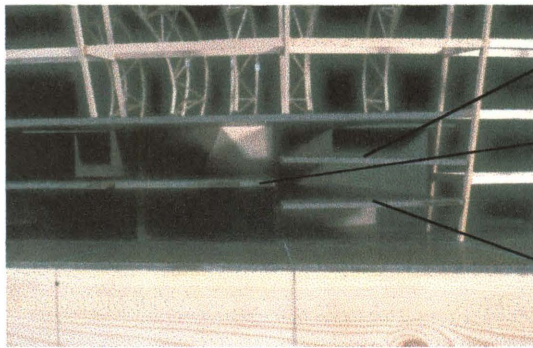
Due to their ability to be stacked, the shipping containers allow for vertical circulation in tandem with collapsible stairs.



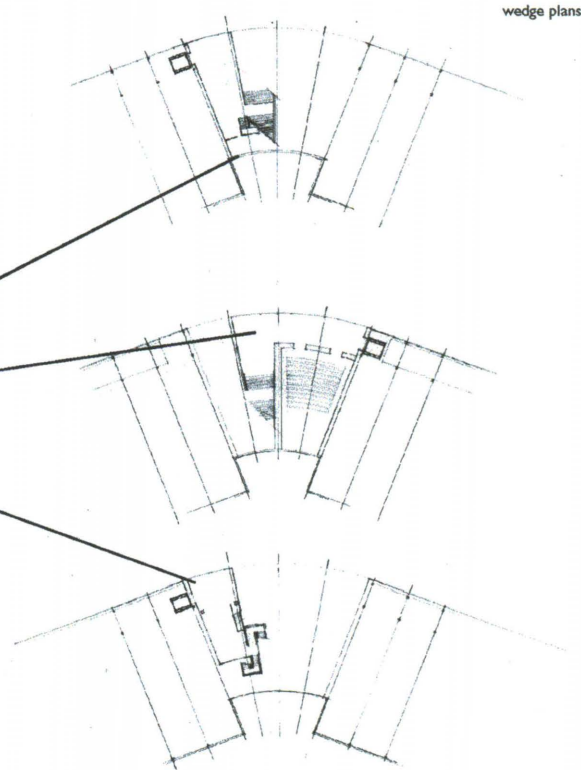
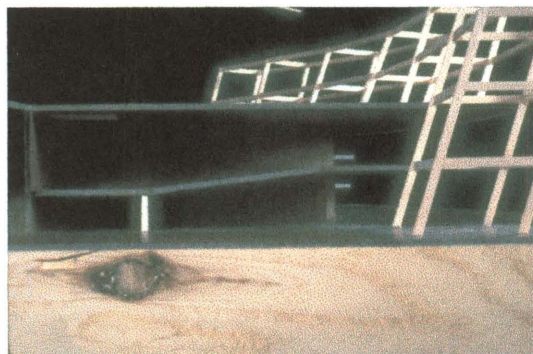


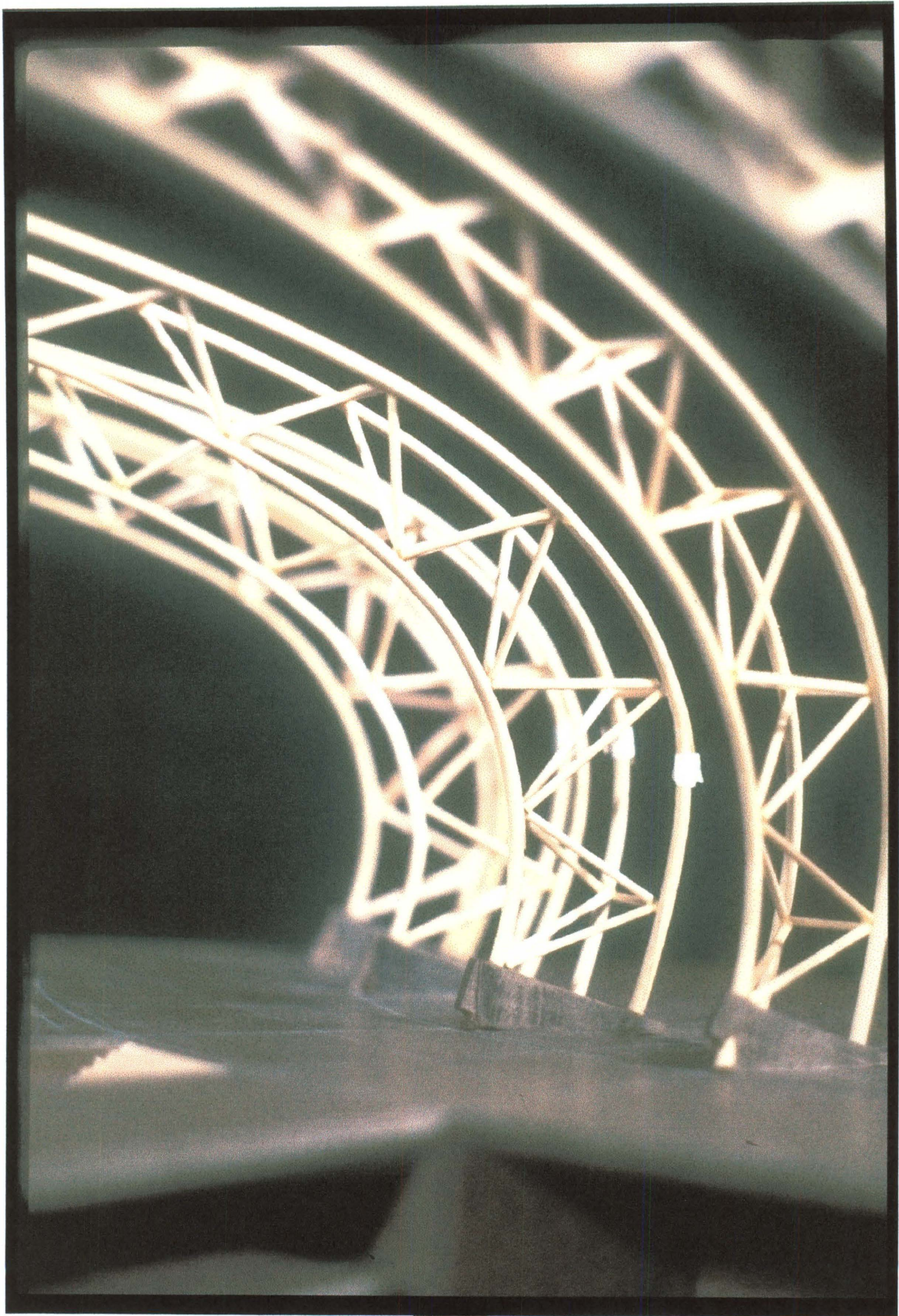


Occupying the curve of the building is a residual wedge that houses the permanent offices, auditorium, dining, medical offices, and conference/classrooms. The wedge is



separated into a 3 story office block and a two story space housing the auditorium and conference rooms. joining the two sides is an intermingling stair system that weaves its way from one part to the other









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Promotional Material from Realtors, Keowee Key, Crescent Resources, Duke Power, the State of South Carolina, et al.