Hermitage, Incorporated, Sigma Plant Camden, South Carolina

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Hermitage, Incorporated, Sigma Plant

A Terminal Project by
Roger Brent Hobgood,
College of Architecture,
Clemson University,
May, 1984
HERMITAGE, INCORPORATED, SIGMA PLANT
CAMDEN, SOUTH CAROLINA

BY

ROGER BRENT HOBGOOD

A terminal project submitted to the faculty of the College of Architecture, Clemson University in partial fulfillment of the requirements for the degree of Master of Architecture.

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DEDICATION

I dedicate this manuscript to my wife, Betsy, and my son, Ben, for their love, devotion, patience, sacrifice, support, and assistance during my five years at the College of Architecture, Clemson University.
ACKNOWLEDGEMENTS

I would like to thank the following people for their help, support, advice, and encouragement:

Mr. Michael Scronce, Project Manager, and Mr. Steve Ward, General Manager of Hermitage, Incorporated, for their permission to use company information in the performance of this terminal project. The project could not have been accomplished without this cooperation.

Dr. Fred Reed for his advice and counsel in helping me decide to enter the College of Architecture.

Dean Harlan E. McClure for accepting me into the Postbaccalaureate Program.

Dr. Broaddus Rutledge, School of Textiles, for his invaluable assistance throughout my work on this project.

Teoman Doruk for chairing my committee and giving me an encouraging word along the way.

Fritz Roth for his guidance and for not dissecting my manuscript!

Cam Scott, his beautiful wife, Lisa, and John Fallon for helping me "make it through the night" before my presentation.

Dr. Alfred P. (Hap) Wheeler for his carpentry assistance.

Carol Hood for her typing and the countless details she helped with.

Angie Bove, Bill Platts, Gil Stewart, and Richard Griffin for helping with all that pretype.
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PROBLEM STATEMENT

Hermitage, Incorporated, Camden, South Carolina, makes gauze and cheesecloth from 100% cotton fibers. The gauze is used for surgical dressings and dishcloths. The cheesecloth is used for cleaning, straining, and tree and plant protection. The present mill site has three manufacturing buildings. The largest and oldest building, built in 1910, has spinning and weaving operations. The next oldest building, circa 1950, has weaving only. The newest building is a bleachery, constructed in 1969.

Hermitage, Inc., is planning to build a new spinning and weaving plant nearby in order to:

1. make its production process flow more efficient and flexible,
2. house new high speed production machines thereby accommodating their vibrations,
3. provide necessary climate control conditions,
4. comply with OSHA's cotton dust standards,
5. provide good working conditions for its employees.

These conditions cannot be met with the present buildings. Company officials have determined that it is more economical to build a new plant than to modernize the old one.

I met with Hermitage's management personnel in the fall of 1983 to seek approval in using their proposed plant as a terminal project. They agreed to provide all the necessary information. The terminal project deviates from Hermitage's actual project in that a bleachery and additional warehouse space are included in the design. It is a bale to finished product operation.
Camden, South Carolina
CAMDEN, SOUTH CAROLINA

The City of Camden lies in the gently rolling hills of central South Carolina along the Wateree River. The population of Camden is approximately 8,000. It is the county seat of Kershaw County, population approximately 39,000. The state capital, Columbia, is only thirty miles to the southwest. Interstate 20 is only one mile away, and forty miles east is Interstate 95. Camden is easy to get to and from because of its proximity to these main highways. Charleston, to the south, the State's busiest port, and Greenville to the northwest, the hub of the upstate, are within a three-hour drive of Camden.

Camden enjoys a temperate climate with an average temperature of 63°F. The average growing season is 219 days.

Several industries are located in the greater Camden area including a DuPont plant which is the largest employer in Kershaw County. Camden is also famous for being one of America's finest thoroughbred race horse centers.

Camden is the oldest inland town in South Carolina. In 1730, King George II of England decreed a township be located on the Wateree River. In 1734, Fredericksburg Township, the name first given to Camden, was laid out. It was a natural center for trade and navigation. The river provided direct access to the port of Charleston.

The first settlers included English, French, Scotch, and Irish. Quakers from Ireland settled along the river around 1750. Samuel Wyley was the leader of this group. He became the colonial agent who dealt with the Catawba Indians in the area. The Quaker Meeting House and graveyard were established around 1759 on a spot within Camden's present Quaker Cemetery.
In 1758 Joseph Kershaw arrived from Charleston. He built a store within the present city limits on a spot he named Pine Tree Hill. Kershaw became one of the first community leaders. The county is named for him. Kershaw built a beautiful home on a hill overlooking the town shortly before the Revolutionary War. During the war, the British used the house as its headquarters during their occupation of the area.

Ten years later, in 1768, Fredericksburg was renamed Camden, in honor of Charles Pratt (Lord Camden) who was a champion of colonial rights in the British Parliament.

Camden fell to the British, led by Lord Cornwallis, in 1780. Camden served as the principle supply post for all British operations in the South for that year. Two major Revolutionary War engagements were fought in the area because of the strategic importance of Camden to the British. They were the battle of Camden in 1780 and the battle of Hobkirk Hill in 1781. Because British losses were so heavy at Hobkirk Hill, they evacuated Camden, destroying some of their fortifications as they left.

After the Revolution, Camden emerged as one of the most prosperous towns in the interior of South Carolina. It benefitted from its location at the upper end of the trade route from Charleston. In 1802, Camden was larger than Columbia. The introduction of the cotton gin made cotton king, replacing wheat as the staple crop.

In 1813, the city was gutted by fire. The citizens rebuilt beautiful, solid buildings that are today included in a tour of historic sites in Camden. Robert Mills designed many of the homes and churches at that time. He, of course, is famous for designing the Washington Monument.
During the Civil War, Camden was an important storehouse for the Confederacy and a treatment center for the wounded. President Lincoln's brother-in-law, Dr. G. R. C. Todd, was one of the physicians there. He and his wife, a Camden native, are buried in the Quaker Cemetery just south of town. The community contributed no less than six generals to the confederate cause.

By 1885, Camden was a winter community for wealthy Northerners. The inherent beauty, accessibility, and pleasant climate drew them to winter cottages along the Wateree River. A common interest among these wealthy winter residents was horses. This interest in horses shaped Camden into much of what it is today. Across the turn of the century and into the 1930's, money, culture, and anything equestrian were pumped into the county. Camden became a leader in thoroughbreds.

Today, Camden has one of the most complete horse training facilities in America. There are five training tracks, over three hundred stalls, and a variety of layouts for steeplechasers. Springdale Race Course is one of the few remaining grass tracks in the country. It is the site of two prestigious steeplechases, The Carolina Cup in the spring and The Colonial Cup in the fall. Top thoroughbreds from all over the world participate. These horse races are also social events, drawing 30,000 people to the area to party as well as to watch the races.

Camden's economic well-being does not rely solely on horses. It enjoys a broadbased economy. DuPont has two major plants in the area. There is a thriving timber industry. Several textile plants are located there. Other important industries include egg production, transportation, and construction companies. One major transportation company relocated its general offices in Camden.
The Kershaw County educational system is one of the top public school systems in the state. There are also four private schools in the county. Most major religious denominations are represented in Camden. Many of the church buildings are architecturally significant. Our Lady of Perpetual Help Catholic Church is a beautiful example of Spanish Gothic architecture. The Bethesda Presbyterian Church has been completely restored true to its 1820 construction.

Restoration continues on a section of town known as "Historic Camden." The Kershaw-Cornwallis house has been reconstructed with the help of the University of South Carolina Department of Anthropology and Archeology. Documents from the past are housed in the Camden Archives, a 1915 vintage building. It is owned by the city solely to help people do genealogical research and work with historical documents.

Cultural opportunities are available thanks to the Fine Arts Center of Kershaw County. The 150-year old Douglas-Reed House has been restored and holds displays, work spaces, and offices of the Fine Arts Center. Each spring there is a very popular MAD Festival (music, arts, and drama). It includes evening music and drama, noontime chamber music, outdoor jazz, and a sidewalk art show and sale.

Recreational activities abound in and around Camden. Besides the famous horse races, there are polo games, fox hunts, and hound field trials. The Wateree River and nearby Wateree Lake provide boating, swimming, skiing, and fishing. In August of each year, a costumed historical pageant, The Revolutionary War Field Days, commemorates the Battle of Camden.

Camden is a classic combination of history and horses.
Points of Interest, Camden, S.C.:
Court House

Points of Interest, Camden, S.C.:
City Hall
Haiglar Tower

Kershaw-Cornwallis House (Historic Camden)
The largest industrial employer in Kershaw County is the DuPont May plant. DuPont has been part of the economy for 33 years. It employs approximately 3,300 people, sixty percent from within the county. This plant was the first Orlon plant in the world. In 1968 it began production of carpet fiber and in 1971 it began producing Dacron polyester. The annual property tax for this DuPont plant is $1.5 million. The annual payroll is in excess of $50 million.

Skyline Manufacturing Company is the second largest employer in Kershaw County with 950 workers. It has been a part of the community since 1954. The company manufactures a complete range of children's sportswear. Its annual payroll is about $10 million. Most of the workers live within ten miles of the plant.

The Kendall Company is a subsidiary of the Colgate-Palmolive Company. It is a leading manufacturer of health and hygienic products for hospitals and consumers. Woven and nonwoven fabrics are also produced. Kendall's annual sales are over $750 million. In the Camden area, Kendall operates two facilities, the Bethune Plant and the Wateree Plant.

The Bethune Plant began operation in 1956 with a 329.4 thousand square foot facility. Additions in the 1960's and 1970's have increased the plant size to over a half million square feet. The Kendall-Bethune Plant employs approximately 900 people from a thirty mile radius of the plant. The annual payroll exceeds $13 million.

The Bethune Plant is becoming Kendall's largest hospital products producing plant. Products manufactured include surgical dressings, Kerlix bandage rolls, and nonwoven Telfa pads. The plant also assembles
and packages disposable hospital drapes and it sterilizes the hospital products which are finished at the plant. In addition, bleaching, dyeing, and finishing of cloth from other Kendall plants is done here. Cloth diapers are also produced.

Kendall's Wateree Plant had its beginnings at the turn of the century. The plant began operations in 1901 with 12,500 spinning spindles and 300 looms. Bales of cotton were processed into high quality print fabric. H. P. Kendall purchased the mill in 1916. It was the first southern Kendall mill, and it became the cornerstone of the company's Weaving Division.

The plant now has 30,000 spinning spindles and 182 air jet weaving looms. Over 200 million yards of gauze fabric are produced annually. The gauze is converted into numerous hospital products by other Kendall plants. These include Curity gauze, sponges, Kerlex gauze pads, and surgical sponges. There are approximately 330 employees. The annual hourly payroll is $5 million.

The Wateree Plant is direct competition for Hermitage Mills. They produce the same product; hence, they need the same type employees.

Wateree Textile Corporation has been in the community since 1974. It is a subsidiary of one of Japan's largest companies. It employs about 100 people with an annual payroll of $1.5 million. It manufactures a polyester and nylon taffeta which is used as a lining fabric mainly in women's garments.

This was the first plant in America built especially for water jet weaving. It operates seven days a week and sends its products all over the nation. The plant can produce 300,000 yards of material in a week.
Industry in Kershaw County with Number of Employees per Location

Industry in Camden, S.C. with Number of Employees per Location
HISTORY OF THE TEXTILE FACTORY

Eighteenth Century

The textile factory originated in England in the middle of the Eighteenth Century. It grew out of cottage workshops when a change occurred in the iron industry. Abundant coal was substituted for scarce wood charcoal as a fuel. This was a result of Abraham Darby's discovery of making coke from coal in the early 1730's.³

In 1740 a method of steel making was developed that led to the beginning of the Industrial Revolution. The textile trade was at the forefront. By 1784 iron was used in textile machinery on a wide scale. Sir Richard Arkwright's invention of spinning machines and Cartwright's power loom made it necessary to move from cottages to factories to house the large machinery.⁴

The buildings themselves followed the development of different kinds of power. The early factories were of loadbearing brickwork or masonry with timber roofs. They had very wide window openings. They were located in rural areas next to rivers from which they derived their motive power. Steam power brought about buildings of brick and metal (at first, iron; later, steel) with small window openings.⁵

Nineteenth Century

The self acting spinning frame was developed at the turn of the century (1801). It became necessary to provide long rooms to set frames parallel to the long dimension of the factory. The widespread adoption of production machinery was dominant in the United States. This helped offset the small labor force available. Factories were multi-storied to maximize use of machinery, power, and valuable urban space.
One of the earliest examples of an industrial community was in Hornstable, New Hampshire, 1810-1820. 6

The most distinguished architect-engineer of the early Nineteenth Century was John Rennie. Rennie produced cast-iron structures. The use of cast iron as a building material was a vital step forward compared to the building methods of the Eighteenth Century. 7

Zorgraves produced the first wrought-iron joists in 1845. James Bogardus built what came to be known as the "American type" building. It has iron columns and glass for the exterior instead of structural walling. The Harper Brothers building in New York by Bogardus (1854) is an excellent example of functional design. It used a system of cast-iron and flanged wrought-iron beams and cast-iron facade. 8

The American Factories of the Civil War era had flat and undisguised brick walls. Many of the New England textile factories were built like this. Reinforced concrete buildings came into being around the turn of the century. The old wood and masonry buildings were demolished to make way for the new buildings. 9

Twentieth Century

Many of the textile factories of the early 1900's were still built of wood because of the abundant supply of timber. In the Twentieth Century, new textile factories have generally been built as extensive one-story buildings. Light roof trusses have been used in spans of 40 to 80 feet. The factories have moved from the cities back to open country. The land is less expensive and there is abundant road transportation.

As the century has progressed, steel-framed buildings have slowly replaced the wood and masonry buildings of the late 1800's. Today,
reinforced concrete is being used along with prefabrication techniques in concrete construction. 10

Controlled climate within these buildings has improved working conditions. Most companies did not install new climate equipment until required by law; for example, the OSHA regulations.
1700's Animal Power, First Phase of Expansion of Cotton Industry

1750 - Arkwright's Principle
1780 - Loadbearing Brick Factory

1801 - Salford Twist Mill. Frames were set parallel to long dimensions of the factory.
1850 - Factory at St. Louis. The "American Type" Building by James Bogardus.

A Modern Textile Plant
HISTORY OF HERMITAGE, INCORPORATED

Hermitage, Incorporated, in Camden was established in 1890 as the Camden Cotton Mill. It is located on the site of McRae's flour and grist mill. The three-story mill was constructed to manufacture grey cloth. The company was organized by prominent Camden citizens, and the mill started with 10,000 spindles, 300 looms, and 150 employees. Things did not run smoothly. There were five presidents in fifteen years.

In 1905 the factory was sold to a new organization and incorporated as the Hermitage Cotton Mill. H. G. Carrison was president, and C. H. Yates was secretary. The name Hermitage came from the name of an area farm which had taken its name from "The Hermitage", Andrew Jackson's home in Nashville, Tennessee.

Around 1906, 1907, Reuben B. Pitts came to Camden as bookkeeper for the company. He was a native of Laurens, South Carolina, and a graduate of Furman. During the next twenty years, improvements were made and company fortunes increased.

In 1910, Mr. Pitts was made president. Charles H. Zemp became bookkeeper in 1920. In 1926, the mill had 16,000 spindles, 390 looms with electric drive, and 250 employees. About 3,500 bales of cotton were processed annually. By 1937 Mr. Pitts had purchased the entire common stock of Hermitage.

Hermitage sold its entire product of woven cotton cheesecloth to Parke-Davis for some seventeen years, until 1947. After World War II, Hermitage sold its cloth to International Cellucotton Products company, a subsidiary of Kimberly-Clark.

The three sons of Reuben Pitts became associated with the business after the war. Hermitage remained a family-owned and operated business until 1980.
A three-story addition was built in 1946. It contained 13,000 square feet allowing an increase in the number of spindles to 20,000 and the number of looms to 460. In 1948, another three-story building was constructed. It almost doubled the size and capacity of Hermitage Cotton Mill. The building was attached to the old plant. This increased the looms to 806 and the spindles to 40,000. At one time Hermitage purchased between 4,000 and 6,000 bales of cotton locally.

In 1952, Hermitage Cotton Mill bought controlling interest in the Marsales Company of New York. This was a hospital-oriented selling house with two finishing plants in Niantic, Connecticut.

By 1954, Hermitage Mills owned 16,000 acres, including a 500-acre lake. Over one-million dollars' worth of cotton was being bought from farmers in Kershaw and neighboring counties. Two million dollars a year were going into Camden's economy because of Hermitage Mills.

A new weave shed was constructed in 1958. During the sixties sales grew to about ten million dollars per year. By 1979, Hermitage, Inc., had sales of twenty million dollars.

In 1980, the Pitts family sold Hermitage to Inmed Corporation, a medical supply company. Inmed wants to re-invest profits to modernize in order to compete with overseas markets, especially Taiwan.

Today, Hermitage, Inc., produces cheesecloth and surgical gauze for home and industrial use. About one-third of its output is converted into surgical dressings. Hermitage employs about 425 people. It processes over five million pounds of cotton into over one hundred million yards of cloth a year.
Hermitage's Present Buildings and Parking Facilities:
Main Building

Hermitage's Present Buildings and Parking Facilities:
Parking Lot
Hermitage's Present Buildings and Parking Facilities:
Side Addition to Main Building

Hermitage's Present Buildings and Parking Facilities:
Bleachery
Manufacturing Process: Opening

Manufacturing Process: Picking
Manufacturing Process: Carding

Manufacturing Process: Drawing
Manufacturing Process: Roving

Manufacturing Process: Spinning
Manufacturing Process: Winding

Manufacturing Process: Warping
Manufacturing Process: Slashing

Manufacturing Process: Weaving
Products of Hermitage, Incorporated
GROUND FLOOR

WINPING
WARPPING
SLASHING

PROD. FLOW
ROVING-DRAW-CARD-PICK-OPENING
ALL WEAVING

FIRST FLOOR
SECOND FLOOR

ALL SPINNING
BUILT: 1948
STEEL COLUMNS
WOOD FLOORS
ALL 3 STORIES

BUILT: 1910
WOOD COLUMNS
WOOD FLOORS
ALL 3 STORIES

1946
NO COLS.
CONC.-G.
W/D-1&2

N
SITE REQUIREMENTS

Although Hermitage, Inc., owns 1,341 acres, the site requirements limit the choice to a few locations within the property. The site requirements are:

1. Must be large enough area to accommodate a 200,000 sq. ft. building and any future expansions of the plant.

2. Terrain should be as flat as possible.

3. Location of site should not interfere with future residential areas around Hermitage Mill Pond.

4. Must be located near an existing road for easy access by car and large truck.

5. Site should be near existing mill facilities. (Some of the old mill buildings will be used as warehouses when the new plant is in operation. This will reduce the expense of travel between the two locations.)

6. Should be good views to and from the site.

7. Should have enough trees around site to buffer plant noise during construction.

8. Location should not be in proximity to any residential or business area adjacent to Hermitage's property.

9. Site should not be located within the 100-year flood zone.

Three site locations were considered:

Site Number One - located south of the pond's canal between S. C. Highway 34 and Hermitage Mill Pond. This fulfilled all of the requirements except two. It is too near the pond and could hurt residential expansion around that area. It is within a 100-year flood zone.

Site Number Two - located north of East York Street and south of the pond's canal. The area is too small for future plant expansions, and it is located within a 100-year flood zone.

Site Number Three - located south of East York Street between present mill facilities and S. C. Highway 34. This meets all the requirements except that it is within a 100-year flood zone.
Despite being in a flood zone, site number three was chosen as the best location for the new plant. Special construction will accommodate any flooding of the site.
SITE ANALYSIS

The site is located on East York Street. Its east side is at the intersection of East York and South Carolina Highway 34. Its west side is within one-half mile of Hermitage's present facilities. The site's dimensions are 2,100 feet by 800 feet.

It was chosen because of its terrain, location, and present ownership. It is the flatest area within Hermitage's 1,341 acre property dropping only ten feet from the front of the site to the back. The proximity of the present mill buildings is beneficial because of their future use as warehouses, employee recreational center, and community workshops. Movement to and from the site will be facilitated by widening East York Street and reconstructing the intersection at South Carolina Highway 34.

Vegetation on and around the site consists of hardwoods, pines, and scrub growth. With minimum clearing, these will act as a buffer during construction and operation of the new plant. In addition, many of the trees will be preserved for their aesthetic qualities.

Hermitage Mill Pond is one-half mile north east of the site. Present scrub growth between the pond and the site will be removed to provide a view of the pond area.

The site is within a 100-year flood plain. As a precaution, flood-gates have been installed at the juncture of Hermitage Mill Pond and its drainage canal to the Wateree River. When flood conditions are forecast, the gates are opened to lower the pond's level. This allows it to accommodate more water during flooding. As a result, the pond and canal do not overflow and the site and surrounding area are not flooded. For further protection, the structure on the site can have raised construction and have surrounding berms.
Present Zoning Map of Camden, S.C.

Climate and Circulation at Site. Note 100 Year Flood Area.
Natural Physical Features of Site

Neighborhood Context
CASE STUDIES

A spinning and weaving plant is similar to many other industrial plants as to production process flow. Raw material arrives at one end, goes through a manufacturing process, then the finished product is shipped out the other end. Usually a linear process flow is the most desirable. Some manufacturers improvise on this by using a process flow that follows the shape of the letter U. This way the receiving and shipping departments can be adjacent and a dock is needed at only one side of the building. Also, access roads are kept to a minimum.

A more sophisticated variation of the U-shaped flow is to revolve it around a core comprised of production service areas. Some of the services in these areas are supervisors' offices, maintenance shop, laboratory, quality control testing room, training room, toilets and lounges. Future plant expansions occur in directions away from the core areas.

The following case studies were selected because of their solutions to design problems of core area, U-shaped process flow, parking, construction material and technique, and daylighting.
Steam and Gas Turbine Plant

Architects: Caudill, Rowlett, Scott, and Lockwood
Owner: Westinghouse Electric Corporation
Location: Round Rock, Texas
Structural System: Prefabricated, prepainted steel frame

Comments: An example of a production space with a service core area. This is a 240,000 square foot building that has a straight-forward, square plan for its production area. To reduce heat transfer through the exterior walls of the totally air conditioned spaces, the production area has no windows. The executive offices and employee facilities are contained in a separate, lower unit. That unit is visually integrated into the larger mass by being partially surrounded by it.

A glass enclosed court at the union of the high and low elements is both a relief from the windowless production spaces and a pleasant meeting place for all the plant's employees. Lunches, coffee breaks, and meetings occur here in an environment that is visually connected to the outdoors.
Plan of Westinghouse Steam and Gas Turbine Plant
Clothing Factory

Architect: Ulrich Franzen
Owner: Barkin, Lewin and Company, Incorporated
Location: Long Island, New York

Structural System: Production building is a steel frame with non-load bearing walls of slab concrete. The office block is a steel frame with glass curtain walls.

Comments: An example of a U-shaped production process flow. The entire manufacturing process from raw cloth to the finished article (women's coats) is contained under one roof. The flow pattern is efficient and there is a practical integration of all departments. Automation and mechanical production aids are employed extensively. Storage capacity is adequate.

These conditions were created by systematically planning the flow of materials from the delivery of the raw materials to the shipping of the finished coats. Following this, the actual space requirement of the building was calculated. The results were a fifty percent saving in space and a thirty percent saving in production time during manufacture, as compared with the old works.31
Plan of Barkin, Lewin & Company, Inc. Clothing Factory
Industrial Building with Rentable Workspaces

Architect: H. A. Maaskant
Owner: Unidentified
Location: Rotterdam, Holland
Structural System: Reinforced concrete framework
Comments: Parking garages are laid out in the basement of the main building of this complex. The garages are reached from the south via ramps. From the garage or from an on site street, one can gain access to the building by stairs or elevator. These are located in open platforms which link the auxiliary building with the main building.32
Section A-A

Section of Industrial Building
Medical Equipment Building

Architects: Holabird and Root
Owners: Hollister, Incorporated
Structural System: Steel frame
Comments: This building houses three separate but related functions: the manufacturing part, the warehousing part, and the office part. A controlled climate is required for the manufacturing and warehousing areas. Since this does not technically require much glass or natural light coming in, there are minimal openings to the outside. Vertical ribbons of glass, visible to the side of each column, provide these openings. They also mark the seam between the building's brick surfaces and bring the columns into relief. Even though they are small in surface area, these windows aid in maintaining employee morale by providing a visual link to the outdoors.

A lot of glass is used in the offices, dining area, and the building's entrance. This divides the building into distinct elements and easily identifies the public and office areas.33
Column with Adjacent Windows
Folding Carton Plant and Office Building

Architects: Skidmore, Owings and Merrill
Owner: Container Corporation of America
Location: Carol Stream, Illinois
Structural System: Steel frame with exterior walls of concrete block and precast concrete panels

Comments: A 320,000 square foot plant whose functional considerations govern the structural design. The huge size of the building made the choice of an economical structure very important. Spans are as long as possible, and the design of the outer walls was influenced by the requirement that the plant had to be fully air conditioned.

The architects performed cost analyses of alternative solutions with different spans and with different structural systems of steel and precast reinforced concrete. They also investigated six different types of outer wall. The following structural system was finally chosen.

1. A roof composed of 1½" galvanized steel deck, vapor barrier of plastic sheets, insulation and plastic sheet roofing,
2. Roof structure of steel joists, steel braces of twelve-foot centers and steel cross girders,
3. Steel columns,
4. Floor consisting of compacted fill on grade and six inch thick reinforced concrete slab,
5. Drilled caissons, two-foot diameters,
6. Bell shaped foundations with five foot diameters.
Forty foot square bays are used for the steel frame work and the ceiling height is twenty-six and one-half feet. The outer walls consist of the following:

1. Inside skin made up of two-inch insulation, vapor barrier, and eight inch concrete block.

2. On the outside, ten foot wide precast, prestressed channel slabs with reinforced edges.34
Outer Wall Construction of Folding Carton Plant
THE PROGRAM

The Sigma Plant houses every production process between the receipt of a bale of cotton to the shipment of the finished product of gauze/cheesecloth. A continuous in-line production flow is required with adequate staging areas between processes. The latest machinery, techniques, and material-handling equipment are used. Production service rooms are in proximity to the particular production area they support. Design of the building allows for expansion of production and office areas.

The mechanical system provides heating and air conditioning for the entire plant. Special humidification and lint filtration systems are required for the production areas. Air temperature and humidity are individually controlled in specific production departments. Lighting is appropriate to office or production tasks.

Personnel have a clean, comfortable environment with easy access to work stations. Rest areas are close but removed from production areas. The cafeteria and lounges have natural light and outdoor contact. Lockers and showers are provided for those employees whose work requires them to bathe and change clothes at shift's end.

Visitors to the plant are able to tour the production departments by way of a visitors' gallery. This protects them from injury and does not interrupt the circulation patterns of production personnel.

Employee and visitors' parking is underneath the production and office sections of the building. There are 390 parking spaces.

The central section around which the administrative offices revolve contains a replica of Sir Richard Arkwright's spinning frame. It was a principle patented by him in 1769. It contains a water wheel that turns
a series of gears and rollers to spin yarn. A drawing of the machinery may be seen in this manuscript under History of the Textile Factory.
1. PRODUCTION PROCESSES AND DESCRIPTIONS

1. **Process:** Receiving dock
   
   **Description:** Receives incoming bales of cotton. Bales unloaded from truck trailers by forklift trucks equipped with hydraulic clamps. Dock accommodates all trailer sizes.

2. **Process:** Bale warehouse
   
   **Description:** Temporary storage for incoming bales. No storage racks. Bales stacked end on end two tiers high. Stacking and unstacking performed by forklift trucks with clamps.

3. **Process:** Blow room
   
   **Description:** Bales opened, cleaned, and blended by following method:
   
   A. **Machine:** Automatic bale opener
      
      **Operation:** Cotton bales broken into fiber tufts (stock) and air fed via duct to dust extractor.
      
      **Machine Size (LxWxD):** 37.7 ft. x 16.9 ft. x 9.0 ft.
      
      **Brand and Model No.:** Rieter, 'Unifloc', Model Al
   
   B. **Machine:** Dust extractor
      
      **Operation:** Dust, dirt, and short fibers removed from fiber tufts. Stock air fed via duct to monocylinder cleaner.
      
      **Machine Size (LxWxD):** 4.0 ft. x 2.0 ft. x 9.0 ft.
      
      **Brand:** Reiter
C. Machine: Monocylinder cleaner
   Operation: Enhanced clearing of stock without damage to fibers. Air fed via duct to 'Unimix' cleaning and blending machine.
   Machine Size (LxWxD): 4.9 ft. x 3.6 ft. x 7.5 ft.
   Brand and Model No.: Rieter, Model B 4/1

D. Machine: 'Unimix' cleaning and blending machine
   Operation: Opening of tufts and additional cleaning of stock. Blending of long and short fibers. Air fed via duct to ERM cleaner.
   Machine Size (LxWxD): 20.5 ft. x 5.2 ft. x 13.0 ft.
   Brand and Model No.: Rieter, Model B 7/3

E. Machine: ERM cleaner
   Operation: Final cleaning and opening of stock before carding process. Air fed to flock feeder.
   Machine Size (LxWxD): 5.2 ft. x 3.3 ft. x 13.0 ft.
   Brand and Model No.: Rieter, Model B 5/5

F. Machine: Flock Feeder
   Operation: Feeding of stock in controlled amounts to card machines via air ducts.
   Machine Size (LxWxD): 5.2 ft. x 3.3 ft. x 13.0 ft.
   Brand: Rieter
4. **Process:** Carding

**Description:** Fibers disentangled and positioned parallel to one another. Stock (sliver) run (doffed) into spring loaded, thirty-inch diameter cans. Cans pushed to breaker drawing.

- **No. of Cards:** 12
- **Card Size (LxWxD):** 18.3 ft. x 0.5 ft. x 6.8 ft.
- **Brand and Model No.:** Marzoli, C 41

5. **Process:** Breaker drawing

**Description:** Eight slivers blended (or doubled) and reduced by drafting to one sliver. This sliver doffed into sixteen-inch diameter cans. Cans pushed to finisher drawing.

- **No. of Machines:** 3
- **Machine Size (LxWxD):** 31.6 ft. x 9.8 ft. x 7.3 ft.
- **Brand and Model No.:** Platt Saco Lowell, Versamatic DG

6. **Process:** Finisher drawing

**Description:** Eight slivers from breaker drawing blended (or doubled) and reduced by drafting to one sliver. This sliver doffed into sixteen-inch diameter cans. Cans pushed to open-end spinning.

- **No. of Machines:** 3
- **Machine Size (LxWxD):** 21.6 ft. x 9.8 ft. x 7.3 ft.
- **Brand and Model No.:** Platt Saco Lowell, Versamatic DG

7. **Process:** Open-end spinning

**Description:** Sliver from finisher drawing drafted and twisted into yarn. This yarn wound onto plastic or cardboard cones. Cones of yarn automatically doffed into 3 ft. x 4 ft. x 3 ft. metal truck at one end of each spinning frame. Yarn used in
weaving goes through warp spinning process. Weft yarn used in weaving comes from filling spinning process. Differences in the two processes are the amount of twist and yarn build on cone. Yarn trucks pushed to next process. Warp yarn goes to warping. Filling yarn goes to weaving.

No. of Spinning Frames: 7 warp; 7 filling
Machine Size (LxWxD): 69.8 ft. x 7.9 ft. x 8.3 ft.
Brand and Model No.: Platt Saco Lowell, Type 887

8. Process: Warping

Description: Cones of yarn removed from yarn truck and placed on creel (frame work for holding 308 cones). Threads (ends) withdrawn from creeled cones and wound onto section beam by warper machines. Long lengths of ends placed parallel to one another on beam. Full beams manually rolled out of warper. Taken to slashing by hoist.

No. of Warpers and Creels: 2
Creel Size (LxWxD): 35 ft. x 15 ft. x 8 ft.
Warper Size (LxWxD): 8.5 ft. x 7.5 ft. x 4.5 ft.
Spacing Between Creel and Warper: 15.0 ft.
Brand: West Point


Description: Yarn ends transferred from four section beams to one loom beam. Ends immersed in size bath during transfer. Size, a gelatinous film-forming substance, protects, strengthens, and lubricates ends for weaving process. Full loom beams removed by hoist and placed on dolly. Dolly pushed to weaving.
No. of Slashers: 3
Machine Size (LxWxD): 46 ft. x 6 ft. x 6 ft.
Allow 4 ft. over machine for exhaust hood
Brand: West Point


Description: Loom beam manually rolled from dolly into position in loom. Cones of filling yarn placed in loom. Fabric formed by interlacing of warp and filling ends. Rolls of fabric manually rolled from loom onto dolly. Dolly pushed to batching.

No. of Looms: 250
Machine Size (LxWxD): 13.1 ft. x 5.9 ft. x 6.3 ft.
Arrangement of Machines: Front to front and back to back.
Allow 2.5 ft. for weaver's alley between looms in front to front position.
Allow 4.0 ft. for warp alley between looms in back to back position. 2.0 ft. minimum distance between looms placed end to end.

Brand and Type: Toyoda, Air Jet Loom

11. Process: Batching

Description: Roll of cloth loaded into batcher with hoist.
Cloth rewound onto perforated stainless steel beam. Weaving defects and stains removed. Beam of cloth taken to bleaching by hoist.

No. of Batches: 4
Batcher Size (LxWxD): 12.0 ft. x 8.5 ft. x 6.0 ft.
Brand: Ford, Elliott and White, Inc.
12. **Process:** Twin kier bleaching

**Description:** Beam of cloth loaded into kier by hoist. Cloth bleached by circulation of bleaching solution through perforated beam and cloth at selected pressures and temperatures. Beam of cloth taken to drying by hoist.

No. of Twin Kier Bleaching Machines: 2

Machine Size (LxWxD): 16.5 ft. x 12.0 ft. x 5.0 ft.

Brand: Gaston

13. **Process:** Drying

**Description:** Beam of cloth loaded into dryer by hoist. Cloth passed over twelve, steam-heated metal cylinders. Cloth wound on cardboard tubes in roll sizes easily moved by hand. Cloth rolls placed on dolly and pushed to plying and cutting.

No. of Dryers: 3

Dryer Size: 15.0 ft. x 10.0 ft. x 16.5 ft.

Allow 3.0 ft. above dryer for exhaust hood.

Brand: Fort, Elliott, and White, Inc.

14. **Process:** Plying and Cutting

**Description:** Cloth roll placed in portable reel over spread table. Cloth unwound and spread over long dimension of table. Cloth doubled back upon itself until desired number of layers (plys) obtained. Layers of cloth cut to desired sizes by portable electric knife. Some stacks of cloth placed on conveyor to packaging. Others, to be hemmed, placed on dolly and pushed to sewing.

No. of Spread Tables: 2

Table Size: 20.0 ft. x 6.0 ft. x 3.0 ft.

Brand: Made in plant's maintenance shop
15. **Process:** Sewing  
**Description:** Pieces of cloth sewn around edges to prevent fraying. Cloth placed on conveyor to packaging.  
No. of Sewing Machines: 2  
Machine Size: 4.0 ft. x 2.0 ft. x 2.5 ft.  
Brand: Any reputable make.

16. **Process:** Packaging  
**Description:** Cloth pieces automatically placed into plastic bags. Bags placed into cardboard boxes. Boxes placed into shipping carton. Carton taken to finish warehouse via conveyor.  
No. of Packaging Machines: 4  
Machine Size: 4.0 ft. x 2.0 ft. x 2.5 ft.  
Brand: Any reputable make.

17. **Process:** Finish warehouse  
**Description:** Temporary storage for cartons to be shipped. Storage racks four tiers high. Cartons placed and removed by forklift trucks equipped with side winder belt action.

18. **Process:** Shipping dock  
**Description:** Cartons of finished cloth loaded into truck trailer by forklift trucks. Cartons shipped to designated customers.
11. Staging areas (temporary storage between processes, no required number of square feet per area) for following items:

1. Unopened bales of cotton in blow room
2. Full cans from carding
3. Empty cans for use in carding
4. Full cans from drawing (breaker and finisher)
5. Empty cans for use in drawing
6. Full cone trucks from spinning
7. Empty cone trucks for use in spinning
8. Empty cones for use in spinning
9. Empty cones from warping
10. Full section beams from warping
11. Empty section beams to be used in warping
12. Full loom beams from slashing
13. Empty loom beams to be used in slashing
14. Rolls of cloth from weaving
15. Rolls of cloth from batching
16. Beams of cloth from bleaching
17. Dollies of cloth rolls from drying
18. Empty dollies for use in drying
19. Plastic bags, boxes, and cartons used in packaging
20. Pallets for use at shipping dock.
III. Production Space Requirements (includes machine sizes, staging areas, circulation routes, and allowances for material handling equipment):

<table>
<thead>
<tr>
<th>Area</th>
<th>Square Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Receiving dock</td>
<td>2,500</td>
</tr>
<tr>
<td>2. Bale warehouse</td>
<td>12,500</td>
</tr>
<tr>
<td>3. Blow room</td>
<td>7,500</td>
</tr>
<tr>
<td>4. Carding</td>
<td>6,250</td>
</tr>
<tr>
<td>5. Drawing (Breaker and Finisher)</td>
<td>6,250</td>
</tr>
<tr>
<td>6. Spinning (Warp and Filling)</td>
<td>22,500</td>
</tr>
<tr>
<td>7. Warping</td>
<td>12,500</td>
</tr>
<tr>
<td>8. Slashing</td>
<td>10,000</td>
</tr>
<tr>
<td>9. Weaving</td>
<td>55,000</td>
</tr>
<tr>
<td>10. Batching</td>
<td>2,500</td>
</tr>
<tr>
<td>11. Bleaching</td>
<td>2,500</td>
</tr>
<tr>
<td>12. Drying</td>
<td>2,500</td>
</tr>
<tr>
<td>13. Plying and Cutting</td>
<td>1,250</td>
</tr>
<tr>
<td>14. Packaging</td>
<td>1,250</td>
</tr>
<tr>
<td>15. Finish warehouse</td>
<td>12,500</td>
</tr>
<tr>
<td>16. Shipping dock</td>
<td>2,500</td>
</tr>
</tbody>
</table>

Total Production Area 160,000
IV. Production Service Areas, Lounges, Cafeteria, and Administrative Offices - Space Requirements:

<table>
<thead>
<tr>
<th>Area</th>
<th>Square Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bale warehouse office</td>
<td>300</td>
</tr>
<tr>
<td>2. Maintenance dock</td>
<td>600</td>
</tr>
<tr>
<td>3. Maintenance department</td>
<td>2,100</td>
</tr>
<tr>
<td>4. Maintenance office</td>
<td>300</td>
</tr>
<tr>
<td>5. Supply room</td>
<td>1,200</td>
</tr>
<tr>
<td>6. Employee waiting room</td>
<td>1,300</td>
</tr>
<tr>
<td>7. Laboratory</td>
<td>800</td>
</tr>
<tr>
<td>8. Quality control room</td>
<td>750</td>
</tr>
<tr>
<td>9. Training room</td>
<td>1,200</td>
</tr>
<tr>
<td>10. First aid room</td>
<td>650</td>
</tr>
<tr>
<td>11. Parts room (weaving)</td>
<td>650</td>
</tr>
<tr>
<td>12. Compressor room (weaving)</td>
<td>1,300</td>
</tr>
<tr>
<td>13. Finish warehouse office</td>
<td>300</td>
</tr>
<tr>
<td>14. Bleaching office</td>
<td>300</td>
</tr>
<tr>
<td>15. Weaving office</td>
<td>300</td>
</tr>
<tr>
<td>16. Warping office</td>
<td>300</td>
</tr>
<tr>
<td>17. Spinning office</td>
<td>300</td>
</tr>
<tr>
<td>18. Slashing office</td>
<td>300</td>
</tr>
<tr>
<td>19. Toilets and locker rooms (2 rooms)</td>
<td>2,100</td>
</tr>
<tr>
<td>20. Regular toilets</td>
<td>850</td>
</tr>
<tr>
<td>21. Lounges (2)</td>
<td>2,900</td>
</tr>
<tr>
<td>22. Cafeteria</td>
<td>7,500</td>
</tr>
<tr>
<td>23. Administrative offices</td>
<td>6,000</td>
</tr>
</tbody>
</table>

Total 32,300

2.5% allowance for corridors, stairs and elevators:
\[0.025 \times (160,000 + 32,300) = 4,800 \text{ sq. ft.}\]
V. Mechanical System Description

All-air, single duct system. Air heated when passed over coils containing hot water supplied by a boiler. Air cooled when passed over coils containing cold water supplied by a cooling tower and chiller. The air temperature is controlled by adjustable dampers in the duct and by regulation of water flow to heating and cooling coils. Separate dampers and coils required for different plant zones.

The building’s heating load has been calculated to be 232,880 BTU/hr. Two boilers and a fan room are required to meet this load.

The building’s cooling load is 625 tons. A cooling tower, a chiller room, and a fan room are required for this load.

Mechanical System Requirements:

<table>
<thead>
<tr>
<th>Area</th>
<th>Square feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Boiler room (2 boilers) and fan room</td>
<td>1,300</td>
</tr>
<tr>
<td>2. Cooling tower (26 ft. x 21 ft. x 13 ft.)</td>
<td>546</td>
</tr>
<tr>
<td>3. Chiller room and fan room</td>
<td>1,254</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3,600</td>
</tr>
</tbody>
</table>

The boiler room is located on the first level. The cooling tower and chiller are located on the third level.
SECTION A-A

SECTION B-B

SECTION C-C

BUILDING SECTIONS
FOOTNOTES

1 Information taken from brochures and maps provided by Greater Kershaw County Chamber of Commerce, Camden, South Carolina, 1983.

2 Information taken from brochures provided by Greater Kershaw County Chamber of Commerce, Camden, South Carolina, 1983.


5 Munce, pp. 2-7.

6 Ibid., pp. 3-5.

7 Ibid., p. 6.

8 Ibid., p. 7.

9 Ibid., p. 9.


11 Robert Kennedy and Thomas Kirkland, Historic Camden, (Columbia, South Carolina, 1926), p. 33


14 Kennedy and Kirkland, p. 34.


16 Ibid.

17 Ibid.

18 Ibid.

19 Ibid.

20 Ibid.

21 Ibid.


24 Ibid., (February 2, 1954).

25 Ibid., (May 1, 1967), p. 5B.

26 Ibid., (October 22, 1980).

27 Ibid.

28 Ibid.

29 Chronicle-Independent, p. 17.


32 Ibid., pp. 340-341.


BIBLIOGRAPHY


"Georgia Firm Buys Hermitage; Bill Pitts Returns to Run Company," Camden Chronicle, (October 22, 1980).


Information from brochures. Greater Kershaw County Chamber of Commerce, Camden, South Carolina, 1983.

Kennedy, Robert and Thomas Kirkland. Historic Camden. 1926.

