GARVINDESIGNGROUP

USC LECONTE COLLEGE FEASIBILITY STUDY

Architectural Narrative

Garvin Design Group has developed this narrative in concurrence with the MEP Feasibility Study prepared by RMF Engineering for LeConte College. The RMF Study recommends a complete MEP renovation of the existing building consisting of the following:

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A new HVAC system using a system of 4 central station air handling units (AHU's) will be located in the attic with variable air volume terminal units to be located above the ceilings in the spaces they will serve. New shafts from the attic to the first floor will be required in several locations to route the supply and return air ducts.

Part of our Study is to show locations for these duct shafts in areas that will maintain the aesthetics of the existing structure; To accommodate the installation of the new HVAC system as well as other new systems that will occupy the space above the ceilings, the existing suspended acoustical ceilings on all floors will be removed in their entirety and replaced with new ceilings after the MEP work is completed.

A complete renovation of the Plumbing system is recommended as the existing fixtures are not IBC/ANSI code compliant. All piping should be replaced due to the aged condition of the existing piping.

Part of our Study is to provide for new chase walls for toilets and domestic water/sanitary sewer vertical piping stacks; new toilet partitions, screens, floor and wall finishes.

A complete renovation of the Electrical distribution system is recommended including replacement of all interior branch wiring for receptacles, equipment, lighting, as well as replacement of all existing lighting fixtures with new LED fixtures with lighting controls. A new fire alarm and detection system will be provided.

Part of our study is to provide for new pathways in existing walls to accommodate the new wiring distribution systems as required and to provide areas for new IT rooms per floor.

Facility Renovation Recommendations

The following is a list of potential renovations that will enhance the appearance of the existing building and address some of the IBC/ANSI code related deficiencies that are found throughout the facility:

Building Exterior

Cleaning of exterior appurtenances; painting of stucco finish, metal cornices/fascia and all exterior trim/downspouts. The exterior stucco finish is in need of repair in several places. Repair stucco finish as needed. Replace existing steel frame windows with new aluminum frame windows to match the replacement windows installed under a previous renovation. Remove plywood panels glazed in windows and install new glazing. Remove all thru-wall hvac window units and install new glazing.
Remove existing aluminum storefront entrances and replace with new aluminum storefront entrances.

Elevator

The existing elevator is not IBC/ANSI code compliant. Provide a new 3500 lb. hydraulic MRL (twinpost above ground) code compliant elevator in a new orientation in plan. Provide new elevator shaft to accommodate the larger size of the elevator. Provide cut out of concrete slabs with supporting steel framing for the new openings. Provide new shaft wall construction on each floor as required.

Stairs

Existing stair handrails are not IBC/ANSI code compliant as the handrails are only on one side of the stair. Provide new wall mounted handrails at each stair run at both stairwells.

Interior Finishes

Existing interior finishes are poor condition with outdated colors and materials. Due to the MEP renovation and the partition work associated with it, there will be a significant amount of new partitions installed. Provide painting of all existing walls that remain and all new partitions installed as part of the MEP renovations. Replace all existing flooring and base with new materials. Provide carpet tile in classrooms, offices, and corridors. Provide vinyl tile flooring in appropriate spaces. Provide ceramic tile floors, base, and wall tiles in toilets and janitor closets. Provide new suspended acoustical tile ceilings in all spaces due to work associated with the MEP renovation.

Doors and Hardware

Most all of the existing doors have knobs that are not compliant with IBC/ANSI codes. Most all of the existing doors are far past their rated life and are in poor condition. Replace all existing doors and replace existing hardware with new code compliant hardware and lever sets. Provide fire-rated doors at stairwells and other rated openings.

Signage

There is some new signage in the building, but most spaces do not have the code compliant signage that is required. Provide a complete IBC/ANSI code compliant signage system throughout the building.

ACM Abatement

The known ACM's in the building are: joint compound in drywall partitions; 9x9 floor tiles; black mastic under floor tiles; residual black mastic on flooring; black duct mastic; olive duct mastic; pipe insulation; black mastic on pipe insulation and transite pipe. Provide complete abatement of all ACM materials throughout the building prior to start of any renovation work.

USC LECONTE COLLEGE FEASIBILITY STUDY

EXECUTIVE SUMMARY

RMF has reached the following conclusions assuming that the facility will undergo a major renovation:

- The building chilled water system pumps are approaching their anticipated service life and should be considered for replacement in a building renovation.
- The building steam system is past its anticipated service life and should be replaced. The Condensate return system is new and can be reused if the size matches the new building services requirement.
- The building heat exchanger and heating water distribution pumps are past their anticipated service life and should be replaced.
- The building HVAC system is past its anticipated service life and should be replaced.
- The building electrical service and gear is past its rated life and needs to be replaced.
- The building does not have a fire sprinkler system that covers the entire occupied portions of the building; it only covers the basement generator room.
- Fire alarm and detection coverage is lacking and does not meet current code.
- The building does not have a USC Standard IT closet.

Recommendations for improvements:

- The campus chilled water system is located immediately outside the building and is suitable for reuse. Provide new chilled water distribution pumps in a new mechanical room in the facility.
- The existing incoming campus steam service also immediately outside the facility and is appropriate for use in the proposed renovation. A new steam-to-hot water heat exchanger and heating water distribution pumps are required. Reuse of the new duplex condensate return pump is possible.
- The renovation will require new HVAC systems. Due to the load profile and spatial constraints, RMF recommends the use of a system of 4 central station air handling units (AHU's) with variable air volume terminal units for zone control.

- The renovation will require a totally new electrical distribution system from the vault to the building and new branch wiring within the building to serve receptacles, equipment, lighting, etc. The current 1200 Amp bus duct secondary feeder and all existing interior electrical distribution will be demolished.

- A building fire protection system, if required, will necessitate a new incoming water service sized for the fire flow demand. At this time, the need for a fire pump is unknown, but for purposes of this analysis, a fire pump will require a separate fire pump room and a source of emergency power (generator).

- A new fire alarm and detection systems shall be provided to serve the renovated facility.

- A new IT Room per floor should be provided to allow for telecommunication cabling and equipment to serve the renovated facility.

SECTION 1-INTRODUCTION

INTRODUCTION

The narrative is not an exhaustive analysis of all the potential issues affecting the LeConte Building, but focuses on the concerns with the mechanical, electrical, and plumbing issues that would be affected by a building renovation.

EXISTING SYSTEMS AND EQUIPMENT-GENERAL

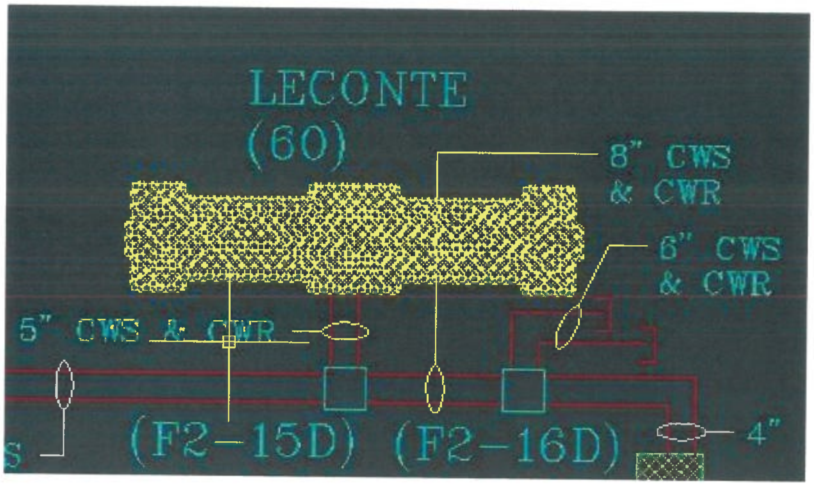
An analysis of any facility must begin with a basic understanding of the systems and operations.

The facility was constructed in approximately 1951. At that time, the building was not provided with any air conditioning and was heated with steam radiators. Between 1963 and 1970, the facility underwent a series of renovations that added heating and air conditioning via fancoil units. Additionally, in the series of renovations that occurred in the 1960's, small air handling units were added to provide code required ventilation air to the facility.

The facility program has always been classroom and offices and the facility continues to provide classroom and office space for USC. However, the laboratory function that was part of the building in the 1960's has been abandoned and there is no longer any fume hood usage in the facility although the fume hood fans and duct infrastructure remains.

BUILDING CHILLED WATER SYSTEMS

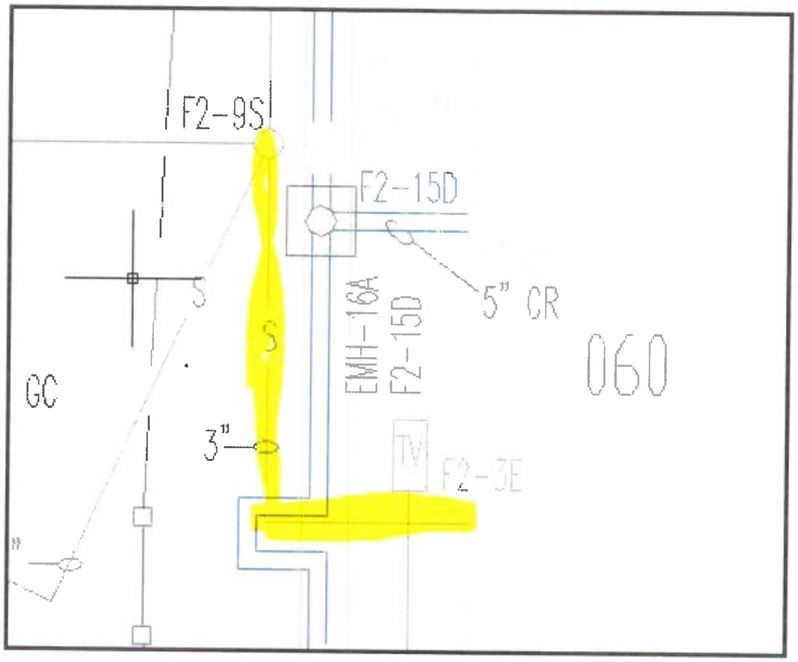
The facility is connected to the campus chilled water distribution system via a 5" chilled water supply and return water connection from vault F2-15D. The chilled water enters the building in the basement mechanical room.



Two chilled water distribution pumps (CWP-1 and CWP-2) are located in the small mechanical equipment room (MER). These pumps are piped in parallel and circulate chilled water to the air handling units (AHU's/FCU's) in the facility. The pumps were installed in 1995.

BUILDING HEATING WATER SYSTEM

The facility is connected to the USC Campus steam system. Steam enters the facility in the basement, where a steam to hot water heat exchanger (H/X) creates building heating water.



Two heating water distribution pumps (HWP-1 and HWP-2), of differing manufacturer, piped in parallel, circulate the heating water to the air handling unit heating coils.

The building steam condensate is returned to the campus system via a duplex condensate receiver/pump located in the basement.

AIR HANDLING SYSTEMS-GENERAL

The facility utilizes a combination of individual fancoil units (FCU's) coupled to dedicated outdoor air delivery air handling units.

The fancoil units provide zone temperature control and are located throughout the facility. The dedicated outdoor air delivery AHU's are located in the building attic and provide supply air to the facility via ductwork in the hallways.

AIR HANDLING SYSTEMS-FANCOIL UNITS (FCU'S)

The individual rooms in the facility are provided with space conditioning, heating and cooling, via fancoil units. In general, the FCU's are 4-pipe units meaning they have a heating coil and a separate cooling coil. Both the coils are connected to a building wide heating supply and return system and a building wide chilled water supply and return system using 3 way valves for unit control. The FCU's are 100% recirculation and do not introduce any outdoor air into the spaces.

In most cases the FCU's are well beyond their anticipated useful life and while most are operating due to the facility maintenance staff's efforts, appear to need more maintenance than would be anticipated.

AIR HANDLING SYSTEMS-DEDICATED OUTDOOR AIR SYSTEMS (DOAS)

Due to the fact that the FCU's do not introduce any code required Outdoor Air for the facility, a Dedicated Outdoor Air Supply (DOAS) system was added to the building in 2007. This system is comprised of two DOAS units, located in the attic, serving outdoor air to the spaces via new fabric ductwork.

DOAS-1 (labeled OAU-1) is a Des Champs model PV-W12P-WPR. DOAS-2 (labeled OAU-2) is also Des Champs model PV-W12-P-WPR.

Each unit has a capacity of supplying approximately 13,500 cfm of outdoor to the space in a dehumidified condition.

Both units draw in outdoor air from intake louvers at the roof line and relieve excess building pressure through louvers on the opposite side of the building.

AIR HANDLING SYSTEMS-EXHAUST AIR SYSTEMS

At one point in the facilities operation, it housed fume hoods. There is currently no fume hood usage in the facility, however the infrastructure, fans and chases are still in the attic. All of this has been abandoned and is no longer used. Much of the ductwork is labeled as Transite.

TOILET EXHAUST SYSTEM

The Toilet exhaust for the facility is routed back to the DOAS system in the attic. There is no dedicated toilet exhaust fan or system.

FIRE PROTECTION

The building has no fire protection sprinkler system in any area except the generator room in the basement. The rest of the facility is not sprinklered.

The building has a fire standpipe system connected to two individual hose stations on each floor. The hose stations are located in the hallways and not in the stairwells.

The pressure at the stop of the standpipe is approximately 44 psi. The hose cabinets do not have fire hoses provided.

PLUMBING

Typical of most academic facilities, the building has restrooms located on all floors of the building. The fixtures are a mix of original installation types and fixtures that have been replaced over the life of the facility. It is clear that many of the restrooms are not ADA Accessible nor have ADA Accessible fixtures. Examples of non-ADA fixtures are shown below.

ELECTRICAL

The LeConte Building is fed from an exterior electrical vault located between LeConte and Petigru Buildings. The vault contains (3) 333 kVA transformers. The transformers feed the LeConte, Petigru, Davis and Observatory Buildings. An outage to the transformers would affect all the buildings. According to USC, no capacity issues exist.

A 1200 Amp secondary bus duct feeds 120/208 Volt secondary from the transformers to the LeConte Building. The bus duct terminates in a main service entrance panelboard. Ahead of the main circuit breaker, an existing 400 Amp tap feeds the Davis Building. All equipment and feeders have exceeded the industry standard 30 year life expectancy. For the most part, all electrical devices and branch circuiting are original to the building. There are some newer 1995 panels from the mechanical renovation.

A shared diesel emergency stand-by power generator located on the exterior feeds the LeConte server room and the Davis Building.

SECTION 2-LOAD CALCULATION

LOAD CALCULATION

In order to determine the HVAC load for the facility, RMF performed load calculations using the Carrier Hourly Analysis Program version 4.9. RMF understands that there are many providers of Load Calculation software, each of which requires multiple user inputs and assumptions, and that the accuracy of any load calculation is dependent on many engineering judgments. RMF utilized the actual building construction for all exterior wall components based on existing drawings. Engineering judgement and field investigation information were used for the existing roof and window compositions. We used our engineering judgment and field notes for internal loads.

The following data summarizes the information used in the preparation of the heating and cooling load.

CODES AND STANDARDS

The following sections detail the design criteria used to calculate the system requirements to meet code. The basis for this this study is that all mechanical systems will be designed to comply with the following adopted codes and standards (in place at the time of the study):

- 2015 International Building Code (IBC) with SC modifications
- 2015 International Mechanical Code (IMC) with SC modifications;
- 2009 International Energy Conservation Code (IECC)
- ASHRAE Standards and Handbooks

DESIGN CRITERIA

Similar to the codes and standards, the following design criteria are the basis of design for the spaces.

Outdoor Ambient Conditions

The cooling and dehumidification design values are based on 0.4% annual cumulative frequency of occurrence and the heating design values are based on 99.6% annual cumulative frequency of occurrence. Climate data is for Columbia, SC as indicated in the 2013 ASHRAE Handbook – Fundamentals.

	Cooling	Dehumidification	Heating
Design Temperature, Dry Bulb	97.0°F	82.0°F	22.0°F
Design Temperature, Wet Bulb	75.4°F	77.2°F	--
Mean Wind Speed	8.8 MPH	8.8 MPH	4.2 MPH
Prevailing Wind Direction	240°True	240°True	270°True

Indoor Design Conditions

A.

	Summer	Winter
Classroom	74°F DB/50% RH	70°F DB
Office	74°F DB/50% RH	70°F DB
Electrical and mechanical rooms	85°F DB (Note 1)	60°F DB (Note 1)
Elevator Machine Rooms	Note 2	Note 2

i. Note 1: Rooms less than 60-sf with no heat producing equipment, such as transformers and electronic panels with data processing boards, will be conditioned with transfer air.

ii. Note 2: Rooms will be provided with an independent direct expansion (dx) fan coil unit to protect against the overheating of electrical equipment. Indoor design condition shall be as required by the equipment manufacturer's recommendations.

Ventilation Criteria

For the purpose of our loads, RMF utilized ASHRAE 62.1 (2007) Table 6-1 to determine the ventilation rates. The second floor configuration with theater seating was used to calculate the required ventilation because it has the highest population density.

	CFM/person	CFM/square foot
Classroom	10	0.12
Office	5	0.06
Corridors	-	0.06
Electrical and mechanical rooms	-	0.06
Elevator Machine Rooms	-	0.12

Occupancy

Occupancies were determined by the following:

	Occupancy/Square Footage
Office	1 person/110ft^2
Small Classroom	1 person/100ft^2
Large Classroom	35 people/1000ft^2

Pressurization Criteria

All public toilet rooms and janitors' closets should be negative with respect to the corridor and internal occupied zones.

Building Operating Schedule

The building operating schedule is assumed to be based on normal office hours.

Internal Heat Gains

Mechanical and electrical room loads are assumed to be 2.5 watts/square foot.

Envelope Load Criteria

Building skin/conduction loads are based on the architectural wall, roof, and window constructions as obtained from the actual construction and existing drawings.

Lighting Power Densities

Lighting loads were based on the minimum design requirements of ASHRAE 90.1 (2007) Table 9.6.1.

	Watt/square foot
Classroom	1.4
Office	1.1
Electrical and mechanical rooms	1.5
Restroom	0.9
Stairs	0.6

SECTION 3-SYSTEM ANALYSIS

ISSUES: LACK OF BLDG INSULATION,

HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS-GENERAL

The majority of the MEP systems were installed in 1995. The anticipated service life as identified by ASHRAE has been exceeded for all building systems and a wholesale replacement would be anticipated at this time due to age.

ASHRAE recommends that an anticipated maximum service life for this type of equipment as follows (ASHRAE 2015 Handbook-HVAC Applications, Table 37.4). At the end of the anticipated maximum service life, the equipment is at the point where replacement is required.

Designation	Age (years)	ASHRAE Service Life (years)	Replace (yes/no)
FCU's	Varies, 20+	15	Yes
DOAS-1	10	15	No
DOAS-2	10	15	No
CHP-1	10	10	Yes
CHP-2	10	10	Yes
HWP-1	15+	10	Yes
HWP-2	15+	10	Yes

LOAD CALCULATIONS/ANALYSIS

Load calculations were done to verify the load on the facility including the code required ventilation air. The new supply air for the anticipated facility Program as identified by the Owner, is approximately 90,000 CFM.

COOLING SYSTEMS

To serve the new cooling load, the USC campus chilled water is the preferred source. With this option, new chilled water pumps would be provided along with a hydraulic de-coupler.

HEATING SYSTEMS

The campus steam system would remain in use for the facility, and a new steam to hot water heat exchanger would be provided along with new heating water distribution pumps. The new heat exchanger would be located in the mechanical equipment room. Additionally, two new heating water pumps will be provided for heating water distribution in the facility. The existing duplex electric condensate return pump can be reused.

AIR HANDLING SYSTEMS

Due to the anticipated occupancy expected in the facility during usage, a new air handling system should be provided. The system of distributed fancoils would be replaced with a more central air handling system. The building air handling capacity requirement is approximately 90,000 cfm with 20,000 cfm of outdoor air. It is suggested that this load be distributed over three air handling units, each of which is 30,000 cfm or over four, each with a capacity of 22,500 cfm. Having more Ahu's is a benefit to the project as it will allow for a phased renovation of the facility instead of a building shut down. The AHU's would be located in the attic mechanical room. This location would allow proper access to the AHU's

This new AHU system will be coupled to variable air volume terminal units that will be provided to condition the spaces and provide zone control.

The air handler components would include the following: outdoor air intake/mixing box, MERV 8 filter, MERV 13 filter, cooling coil, supply fan, sound attenuator, and discharge.

An alternate system using a dedicated outdoor air system (DOAS) coupled to distributed sensible cooling AHU's was also investigated. This system option was not preferred for many reasons. First, the additional space requirements necessary for the added DOAS equipment would not fit into the building attic.

Regardless of the HVAC system type and location, the new duct routing will be carefully coordinated with the existing structure so that the aesthetics of the facility are maintained true to the historical nature of the building. New shafts would be required at three locations in the facility so that the supply air from each AHU can be routed down the building to the floors.

For the floor duct distribution, new duct mains would serve individual terminal units located in each zone.

ELECTRICAL SYSTEMS

An entirely new electrical distribution system will be required for the renovated building.

Based on a building that utilizes campus chilled water and steam, the following is a list of the unitary electrical loads utilized for preliminary sizing of the electrical service and distribution system based on a classroom type building.

LOAD TYPE	VA/SF
Lighting	2.0
Receptacle Load	2.0
IT and A/V Load	0.5
Mechanical	7.0
TOTAL	**11.5**

The building is approximately 17,700 square feet. Applying the unitary loads above results in an estimated connected load of 203 kVA. Estimating (1) 30 Hp elevator and (1) 40 HP fire pump (if required) brings the total connected load to 273 kVA.

Based on the calculated load, the main panelboard will be rated 1200 Amps at 208/120 Volt, 3 phase, 4 wire. A new 1200 Amp feeder from the vault will be installed. The National Electrical Code requires service entrance feeders to be underground or encased in 2" of concrete. In order to provide a new service entrance feeder an exception to this rule must be obtained from OSE or a disconnecting means placed on the exterior.

From the main panelboard, feeders and 208Y/120 volt branch panels will be provided throughout the floors to serve lighting, receptacles, and equipment. Panelboards will be provided with copper bussing.

If a fire pump is required then an emergency standby diesel generator will be required to provide a second source of power per code. A 125 kW will be provided to serve the fire pump and life safety egress lighting.

All new LED lighting will be provided with lighting controls compliant with ASHRAE 90.1 and The International Energy Conservation Code 2015.

A fire alarm and detection system will be provided to bring the building up to current code coverage and USC standards. A speaker annunciation type system will be provided.

FIRE PROTECTION SYSTEMS

If the facility is required to have a fire protection system, a new electric fire pump is assumed to be needed due to the need for a standpipe system. A fire flow test would be required to confirm this assumption.

The fire suppression system would cover all occupied spaces in addition to the attic space.