MARY ERSKINE BUILDING
MEP ASSESSMENT REPORT

FOR

DEBRA J. DOCKERY, ARCHITECT, P.C.

Report
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CLCE Project # 25-022

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Executive Summary

The Mary Erskine building in Seguin, Texas is a three-story 22,000 square foot facility that previously functioned as a primary school. The facility was constructed in 1914, and has seen some mechanical, electrical and plumbing updates over the years. The HVAC for the first floor is served by five split systems, and the second and third floors are served by four packaged rooftop units. There is plumbing to support restrooms on the first and third floors, as well as limited fixtures in the rest of the building such as a teacher break room, nurse's office, and art room. The building appears to be fully sprinkled, with a fire department connection on the north side of the building.

Many of the HVAC equipment has missing or damaged components and are not compatible with the most current refrigerants. Most of the ductwork, above-ceiling equipment, and fans were not able to be safely accessed for observation. Air devices such as supply diffusers and exhaust grilles were in varying condition, with many appearing damaged. Plumbing within the walls was not able to be observed, however pipes that were visible appeared in good shape. Heating and cooling load calculations were performed to ensure the installed HVAC systems are sufficiently sized for the application. The results are provided in Appendix A of this report.

The first floor's HVAC system is and comprised of five DX split systems utilizing outdoor air conditioners and vertical indoor air handlers with gas heat. Each air handler was marked as serving multiple rooms, and each classroom had a thermostat in it, suggesting there was a zone damper that allowed the classrooms to adjust cooling and heating per room. A controls cabinet for the five split systems was found in the basement mechanical room. The second and third floors are both served by two packaged DX rooftop units, for a total of 4 rooftop units. There did not appear to be any centralized control system for the packaged units, so it is assumed that each individual classroom zone is operating independently and the packaged unit is only controlling on duct pressure and discharge temperature.

The plumbing fixtures on the first and third floor vary in size and condition. While lavatories are serviceable, the water closets and urinals are recommended to be replaced to full adult sizes and to be ADA compliant. There are electric hot water heaters at each floor that appear to be missing parts or wiring.

Based on observations of the site, it is recommended that the entire mechanical system be replaced with new equipment, ductwork, insulation, controls, and air devices. It is also recommended to replace all plumbing fixtures to full-sized ADA compliant fixtures and to add men's and women's gang restrooms to the second floor.

Electrically, the building is served by a 208Y/120V 500kVA utility transformer, which is likely to be sufficient for the renovation. The electrical distribution equipment appears to be dated from 1990 to 2000. The main switchboard was unable to be opened during the site visit. Based on the age of the equipment, it is recommended to replace the electrical distribution equipment and feeders. The new layout of the building and HVAC renovations will also likely require a reconfiguration of the distribution system. Additionally, this will allow for a more efficient electrical design that requires fewer pieces of equipment that can be consolidated to one area, instead of placed throughout the facility.

Lighting appeared to be fluorescent. It is recommended to replace all fixtures with LED lighting to improve the lighting quality and power efficiency of the building. The lighting controls will also need to be brought up to current energy code during in rework of the existing lighting system.

Limitations

This report is based upon observations of the visible and apparent conditions of the HVAC systems during a limited visit and limited drawings furnished to our office. While care has been taken in the reporting of the observations, the observations contained in this report are of a limited nature. Thus, no warranty or guarantee is expressed or implied in this report with respect to the installation or performance of the equipment. No sampling or testing was performed. Equipment on roofs, scaffolding, above the ceiling or anywhere else that was not safe to access were not inspected.

The recommendations expressed are based on the opinions of CL Consulting Engineers, LLC. and are not intended as a critique of the original engineering design. Factors affecting original design decisions, including budget limitations, construction constraints, and owner design input, are not reviewed.

Condition Terms Used

Throughout the report, the terms *good*, *fair*, and *poor* are used to describe equipment. Where these terms are used, they are intended to be understood as follows - equipment in *good* condition is not expected to require replacement in the next ten years, equipment in *fair* condition should be anticipated to require replacement within the next five years, and equipment in *poor* condition shows signs of malfunction or disrepair and should be replaced as soon as possible.

Observations

Classrooms

Mechanical

The air devices in the classroom were of varying conditions and layouts, with many being dented or otherwise weathered. Each classroom had a wall-mounted thermostat. Due to the equipment being disassembled it was not possible to verify if the existing ductwork and air balance was sufficient for each room.

Electrical

The devices appear dated. Some devices appear to have been added at a later date, and have surface mounted raceway providing power to the receptacles. There is an isolated grounding system in place for some of the receptacles. This can be left intact, but is not required. Optionally, the devices and face plates can be replaced and the raceways moved to inside the walls to freshen up the space.

Restrooms

Mechanical

The air devices in the restrooms were of varying conditions and layouts, with many being dented or otherwise weathered. Due to the equipment being disassembled it was not possible to verify if the existing supply or exhaust airflows were sufficient.

Plumbing

The piping behind the walls or underneath the floor were not able to be observed . It is not known the condition of the domestic water pipe or the sanitary sewer pipe in those locations. The piping that was exposed to feed the fixtures looked to be in good condition. Some lavatories had only cold water service and some had cold and hot water. The lavatory and faucets looked outdated and not ADA compliant.
The water closets and urinals were in poor to fair condition. However, many were not sized for adults. The fixtures also were not ADA compliant.

Electrical

The devices appear dated. Optionally, the devices and face plates can be replaced to freshen up the space.

Corridors/Stairwells

Mechanical

The air devices in the corridors were of varying conditions and layouts, with many being dented or otherwise weathered. It was not clear how these spaces were zoned or what equipment it shared with other spaces.

Plumbing

Drinking fountains were observed on each floor. These were in poor condition and were not ADA compliant. No split level fountains or bottle fillers were found.

Electrical

The devices appear dated. Optionally, the devices and face plates can be replaced to freshen up the space.

Air Conditioning Systems

DX Split Systems

The five DX split systems serving the first floor are comprised of residential-grade indoor air handling units in vertical configuration with natural gas heat paired with an outdoor air conditioner. The nameplates of the air handlers were not accessible to read, however based on the outdoor air conditioner the units appear to be manufactured in 1991. The units are charged with refrigerant R-22, which is no longer permitted to sold in new equipment and is increasingly hard to service.

Indoor Air Handling Units

The five indoor air handling units serving the first floor spaces are all located in a mechanical room and mounted on a wooden platform that also serves as a plenum for return air and outside air to mix before the inlet of the air handling units. An outside air duct is routed from outdoor louvers and discharges into the return air mixing box. Supply air ducts rise vertically out of the top connection of the air handlers up to above ceiling and become unobservable for a short distance. Insulation could not be verified on this section of ductwork.
Gas piping is routed from to each individual air handler for heating purposes. An open duct is routed to the mechanical room for common combustion air, and flue gas is vented out of the air handlers through PVC pipe. It is not clear the routing of the vent pipe or its termination location.

Outdoor Air conditioners

The outdoor air conditioners are mounted to concrete pads just outside of the building in between the main building and gym. The units were observed to be in poor condition and had components missing. The nameplates showed all were the same 5-ton model and manufactured in 1991.

Packaged Rooftop Units

A total of four packaged Rooftop Units (RTUs) were installed on the roof of portions of the first floor, with two on the northeast corner and two on the northwest corner. Each RTU has gas piping routed to it for reheat. Supply and return duct come out horizontally from the unit, and run up along the side of the building into penetrations on the second and third floor. The duct does not appear to be insulated or protected from the elements. While not being able to be observed directly, it was noticed from observations that pieces were missing from the RTUs. The exterior cabinets looked weathered as well.

Calculations

Heating and cooling load calculations were performed to estimate the size of equipment needed to condition the building. The calculations account for the construction of the building including insulation, windows, building dimensions, internal loads of office equipment, lighting, and human occupancy, minimum ventilation load, and external heat gain/loss.

The indoor environmental design criteria is as follows:

a) Cooling Set Point: 75°F
b) Heating Set Point: 70°F
c) Humidity Set Point: 50% RH +/-5%

The outdoor environmental design criteria is as follows:

a) Summer: 100°F DB/78°F WB.
b) Winter: 28°F

Results of the calculations show that the required cooling for the building would be 103 tons. It should be noted that the calculations were made treating each floor as a “block” rather than trying to create specific zones within each floor.

Floor	Calculated Cooling Req’s (Tons)	Calculated Heating Req’s (MBH)	Calculated Supply Airflow (CFM)
Floor 1	39	200.3	13,242
Floor 2	26.8	148.1	10,406
Floor 3	37.5	213.0	12,862

Recommendations

Mechanical

Based on observations of the site, it is recommended that the entire mechanical systems serving the building be replaced. The following options would be feasible:

<u>Option 1: Replace in kind</u>

This option would involve removing the existing mechanical equipment and replacing with new, similarly functioning equipment. The existing split systems would be replaced with new variable capacity heat pumps. The indoor vertical air handlers would be replaced with higher efficiency fan models.

Outdoor packaged rooftop units would be replaced with new units with variable capacity compressors. The units would have higher efficiency and variable flow fans. New variable air volume terminal units with electric reheat would be installed to accommodate new zoning and occupancies.

Ductwork would be inspected and replaced as needed, and air devices would be replaced. A centralized control system using wireless controllers would be installed to control all mechanical equipment.

<u>Option 2: New centralized chilled water system</u>

This option would take advantage of using the center yard in between the buildings as a mechanical yard. A central air cooled chiller would be placed at ground level between the building and the gym, and feed chilled 44° F water to the building from the north. The split systems serving the first floor would have their outdoor units and indoor units removed. The indoor units would be replaced with a chilled water cooled air handler to condition the air, and feed new single duct VAV air terminals with electric reheat. Each zone would have a VAV air terminal and be able to vary its cooling and airflow or switch to heating as needed.

Similarly, on the second and third floors the existing RTUs and VAVs would be removed. Each floor would have its own chilled water air handler and feed new single duct VAV air terminals with electric heat. Each zone would have a VAV air terminal and be able to vary its cooling and airflow or switch to heating as needed. Ideally the air handlers would be indoors for aesthetics of a historical building and maintainability. However, the air handlers can also be placed on the existing equipment supports outside.

Ductwork would be inspected and replaced as needed, and air devices would be replaced. A centralized control system using wireless controllers would be installed to control all mechanical equipment.

Plumbing

It is recommended that the plumbing sanitary and domestic water lines be scoped by a plumber to check for pipe integrity for potential reuse. Any new piping will be copper for the domestic water and PVC for sanitary and vent. All existing fixtures are recommended to be removed and replaced with new fixtures, along with ADA-compliant options. Each floor is recommended to have its own new 10 gallon electric water heater.

Electrical

Based on observations of the site, it is recommended that the electrical distribution equipment and feeders be replaced. It is also recommended the at the lighting fixtures and controls be replaced. Additionally, the fire alarm system appears to be dated. Some work will be required to cover the new building layout. It is recommended to replace the fire alarm system to ensure full functionality. Electrical devices appear dated. They can remain, but device/wall plate replacement and raceway relocation is recommended to improve the aesthetics of the new spaces.

Conclusion

The existing building mechanical equipment, ductwork, and plumbing fixtures should all be replaced immediately. The current equipment is old enough or missing enough components to warrant not repairing, and should be replaced with energy-efficient systems. Plumbing fixtures should be updated for the new occupancy and be ADA compliant. A new HVAC controls system should be installed to optimize energy usage and occupancy comfort.

Appendix A: Heating and Cooling Load Calculations

System Checksums

By .

RTU-1 — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK / CLG SPACE PEAK

COOLING COIL PEAK					CLG SPACE PEAK	
Peaked at Time:	Mo/Hr: 8 / 15				Mo/Hr: 8 / 17	
Outside Air:	OADB/WB/HR: 99 / 80 / 127				OADB: 97	
	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads						
Skylite Solar	0	0	0	0	0	0
Skylite Cond	0	0	0	0	0	0
Roof Cond	0	14,452	14,452	3	0	0
Glass Solar	59,395	0	59,395	13	67,960	23
Glass/Door Cond	27,082	0	27,082	6	26,306	9
Wall Cond	45,236	22,331	67,567	14	51,909	17
Partition/Door	0		0	0	0	0
Floor	0		0	0	0.00	0
Adjacent Floor	0.00	0.00	0.00	0.00	0.00	0.00
Infiltration	0		0	0	0	0
Sub Total ==>	131,713	36,783	168,496	36	146,176	48
Internal Loads						
Lights	30,062	0	30,062	6	30,062	10
People	108,000	0	108,000	23	60,000	20
Misc	18,118	0	18,118	4	15,387	5
Sub Total ==>	156,179	0	156,179	33	105,449	35
Ceiling Load	6,349	-6,349	0	0	6,899	2
Ventilation Load	0	136,993	136,993	29	0	0
Adj Air Trans Heat	0		0	0	0	0
Dehumid. Ov Sizing			0	0		
Ov/Undr Sizing	0		0	0	43,367	14
Exhaust Heat		-2,100	-2,100	0		
Sup. Fan Heat			7,847	2		
Ret. Fan Heat		0	0	0		
Duct Heat Pkup		0	0	0		
Underflr Sup Ht Pkup			0	0		
Supply Air Leakage		0	0	0		
Grand Total ==>	294,241	165,327	467,415	100.00	301,890	100.00

HEATING COIL PEAK

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Mo/Hr: Heating Design			
OADB: 28			
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-6,817	3.13
Glass Solar	0	0	0.00
Glass/Door Cond	-38,661	-38,661	17.75
Wall Cond	-48,369	-71,195	32.68
Partition/Door	0	0	0.00
Floor	-13,313	-13,313	6.11
Adjacent Floor	0.00	0.00	0.00
Infiltration	0	0	0.00
Sub Total ==>	-100,343	-129,986	59.67
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-11,535	0	0.00
Ventilation Load	0	-84,036	38.58
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-5	-5	0.00
Exhaust Heat		3,816	-1.75
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-7,632	3.50
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-111,884	-217,844	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.0	90.0
Ra Plenum	74.3	64.9
Return	77.3	53.8
Ret/OA	77.3	53.8
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.4	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	16,417	4,925
Terminal	16,417	4,925
Main Fan	16,417	4,925
Sec Fan	0	0
Nom Vent	1,895	1,895
AHU Vent	1,895	1,895
Infil	0	0
MinStop/Rh	4,925	4,925
Return	17,270	5,779
Exhaust	853	853
Rm Exh	875	875
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	11.5	38.5
cfm/ft²	1.86	0.56
cfm/ton	421.47	
ft²/ton	226.13	
Btu/hr·ft²	53.07	-22.74
No. People	240	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB/WB/HR °F	Enter °F	Enter gr/lb	Leave DB/WB/HR °F	Leave °F	Leave gr/lb
Main Clg	39.0	467.4	335.2	13,242	77.3	64.1	71.3	54.5	52.1	55.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	39.0	467.4								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	8,808		
Part	0		
Int Door	1		
ExFlr	445		
Roof	866	0	0
Wall	6,391	981	15
Ext Door	126	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-189.4	4,925	54.5	90.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-10.9	16,417	53.8	54.5
Reheat	-77.5	4,925	54.5	69.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-200.3			

System Checksums

By .

RTU-2 — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK / CLG SPACE PEAK

Cooling Coil Peak — Peaked at Time: Mo/Hr: 8 / 15; Outside Air: OADB/WB/HR: 99 / 80 / 127

CLG Space Peak — Mo/Hr: 8 / 17; OADB: 97

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads						
Skylite Solar	0	0	0	0	0	0
Skylite Cond	0	0	0	0	0	0
Roof Cond	0	0	0	0	0	0
Glass Solar	55,739	0	55,739	17	60,701	26
Glass/Door Cond	25,096	0	25,096	8	24,377	10
Wall Cond	39,274	19,746	59,020	18	45,160	19
Partition/Door	0		0	0	0	0
Floor	0		0	0	0.00	0
Adjacent Floor	0.00	0.00	0.00	0.00	0.00	0.00
Infiltration	0		0	0	0	0
Sub Total ==>	120,108	19,746	139,854	43	130,238	55
Internal Loads						
Lights	26,413	0	26,413	8	26,413	11
People	50,400	0	50,400	16	28,000	12
Misc	17,771	0	17,771	6	15,041	6
Sub Total ==>	94,585	0	94,585	29	69,454	29
Ceiling Load	3,794	-3,794	0	0	4,171	2
Ventilation Load	0	81,718	81,718	25	0	0
Adj Air Trans Heat	0		0	0	0	0
Dehumid. Ov Sizing			0	0		
Ov/Undr Sizing	0		0	0	33,427	14
Exhaust Heat		-250	-250	0		
Sup. Fan Heat			6,166	2		
Ret. Fan Heat		0	0	0		
Duct Heat Pkup		0	0	0		
Underflr Sup Ht Pkup			0	0		
Supply Air Leakage		0	0	0		
Grand Total ==>	218,487	97,420	322,073	100.00	237,290	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design; OADB: 28

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	0	0.00
Glass Solar	0	0	0.00
Glass/Door Cond	-35,788	-35,788	23.41
Wall Cond	-42,431	-62,723	41.03
Partition/Door	0	0	0.00
Floor	0	0	0.00
Adjacent Floor	0.00	0.00	0.00
Infiltration	0	0	0.00
Sub Total ==>	-78,218	-98,510	64.44
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-8,807	0	0.00
Ventilation Load	0	-48,687	31.85
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-4	-4	0.00
Exhaust Heat		580	-0.38
OA Preheat Diff.		0	0.00
RA Preheat Diff.		0	0.00
Additional Reheat		-6,243	4.08
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-87,030	-152,864	100.00

TEMPERATURES

	Cooling	Heating
SADB	54.8	90.0
Ra Plenum	73.6	65.4
Return	76.0	55.8
Ret/OA	76.0	55.8
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.4	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	12,770	3,831
Terminal	12,770	3,831
Main Fan	12,770	3,831
Sec Fan	0	0
Nom Vent	1,098	1,098
AHU Vent	1,098	1,098
Infil	0	0
MinStop/Rh	3,831	3,831
Return	12,919	3,980
Exhaust	149	149
Rm Exh	875	875
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	8.6	28.7
cfm/ft²	1.65	0.50
cfm/ton	475.79	
ft²/ton	288.34	
Btu/hr·ft²	41.62	-19.13
No. People	112	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB/WB/HR °F	Enter °F	Enter gr/lb	Leave DB/WB/HR °F	Leave °F	Leave gr/lb
Main Clg	26.8	322.1	247.4	10,406	76.0	62.8	66.8	54.3	52.0	56.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	26.8	322.1								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	7,739		
Part	0		
Int Door	1		
ExFlr	0		
Roof	0	0	0
Wall	5,668	924	16
Ext Door	42	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-148.1	3,831	54.3	90.0
Aux Htg	0.0	0	0.0	0.0
Preheat	0.0	0	0.0	0.0
Reheat	-61.0	3,831	54.3	69.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-148.1			

System Checksums

By .

RTU-3 — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK / CLG SPACE PEAK

Cooling Coil Peak — Peaked at Time: Mo/Hr: 8 / 17; Outside Air: OADB/WB/HR: 97 / 76 / 104

CLG Space Peak — Mo/Hr: 8 / 17; OADB: 97

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads						
Skylite Solar	0	0	0	0	0	0
Skylite Cond	0	0	0	0	0	0
Roof Cond	0	132,227	132,227	29	0	0
Glass Solar	60,256	0	60,256	13	60,256	22
Glass/Door Cond	24,666	0	24,666	5	24,666	9
Wall Cond	44,604	17,992	62,596	14	44,604	16
Partition/Door	0		0	0	0	0
Floor	0		0	0	0.00	0
Adjacent Floor	0.00	0.00	0.00	0.00	0.00	0.00
Infiltration	0		0	0	0	0
Sub Total ==>	129,527	150,219	279,746	62	129,527	47
Internal Loads						
Lights	26,505	0	26,505	6	26,505	10
People	50,400	0	50,400	11	28,000	10
Misc	27,447	0	27,447	6	24,717	9
Sub Total ==>	104,353	0	104,353	23	79,222	29
Ceiling Load	23,627	-23,627	0	0	23,627	9
Ventilation Load	0	61,890	61,890	14	0	0
Adj Air Trans Heat	0		0	0	0	0
Dehumid. Ov Sizing			0	0		
Ov/Undr Sizing	0		0	0	43,163	16
Exhaust Heat		-3,645	-3,645	-1		
Sup. Fan Heat			7,622	2		
Ret. Fan Heat		0	0	0		
Duct Heat Pkup		0	0	0		
Underflr Sup Ht Pkup			0	0		
Supply Air Leakage		0	0	0		
Grand Total ==>	257,507	184,836	449,965	100.00	275,540	100.00

HEATING COIL PEAK

Mo/Hr: Heating Design; OADB: 28

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-51,142	23.45
Glass Solar	0	0	0.00
Glass/Door Cond	-36,135	-36,135	16.57
Wall Cond	-42,758	-59,487	27.27
Partition/Door	0	0	0.00
Floor	0	0	0.00
Adjacent Floor	0.00	0.00	0.00
Infiltration	0	0	0.00
Sub Total ==>	-78,893	-146,764	67.29
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-25,001	0	0.00
Ventilation Load	0	-48,206	22.10
Adj Air Trans Heat	0	0	0
Ov/Undr Sizing	-48	-48	0.02
Exhaust Heat		3,857	-1.77
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-26,959	12.36
Additional Reheat		0	0.00
Underflr Sup Ht Pkup		0	0.00
Supply Air Leakage		0	0.00
Grand Total ==>	-103,942	-218,120	100.00

TEMPERATURES

	Cooling	Heating
SADB	55.3	90.0
Ra Plenum	81.6	58.8
Return	82.8	52.4
Ret/OA	82.8	52.4
Fn MtrTD	0.1	0.0
Fn BldTD	0.1	0.0
Fn Frict	0.4	0.0

AIRFLOWS

	Cooling	Heating
Diffuser	15,252	4,575
Terminal	15,252	4,575
Main Fan	15,252	4,575
Sec Fan	0	0
Nom Vent	1,087	1,087
AHU Vent	1,087	1,087
Infil	0	0
MinStop/Rh	4,575	4,575
Return	15,603	4,926
Exhaust	351	351
Rm Exh	675	675
Auxiliary	0	0
Leakage Dwn	0	0
Leakage Ups	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	7.1	23.8
cfm/ft²	1.96	0.59
cfm/ton	406.74	
ft²/ton	207.11	
Btu/hr·ft²	57.94	-27.42
No. People	112	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	37.5	450.0	392.4	12,862	82.8	64.4	63.7	54.8	52.5	56.9
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	37.5	450.0								

AREAS

	Gross Total	Glass ft²	Glass (%)
Floor	7,766		
Part	0		
Int Door	1		
ExFlr	0		
Roof	7,766	0	0
Wall	5,710	942	16
Ext Door	0	0	0

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-174.5	4,575	54.8	90.0
Aux Htg	0.0	0	0.0	0.0
Preheat	-38.5	15,252	52.4	54.8
Reheat	-70.5	4,575	54.8	69.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-213.0			

Appendix B: Photographs

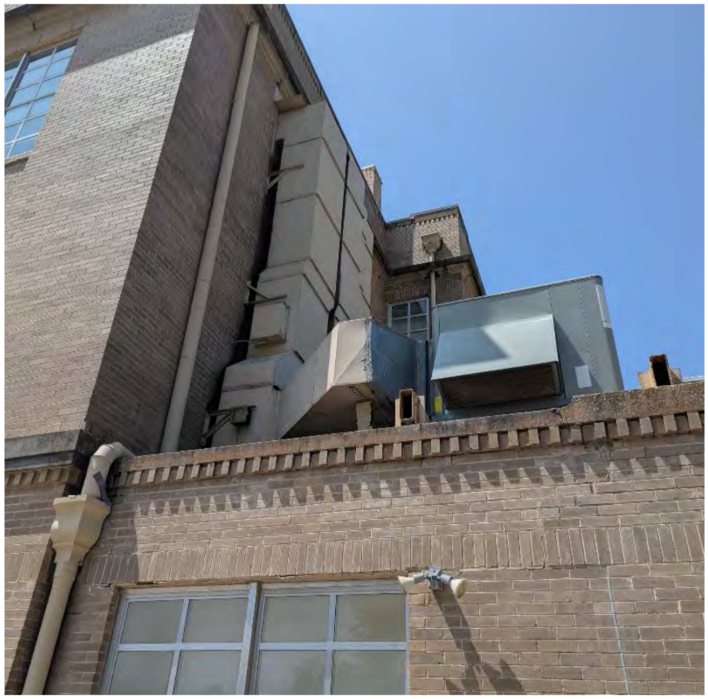

Figure 1. Packaged RTUs as seen from ground level

Figure 2. Packaged RTUs as seen from indoor space

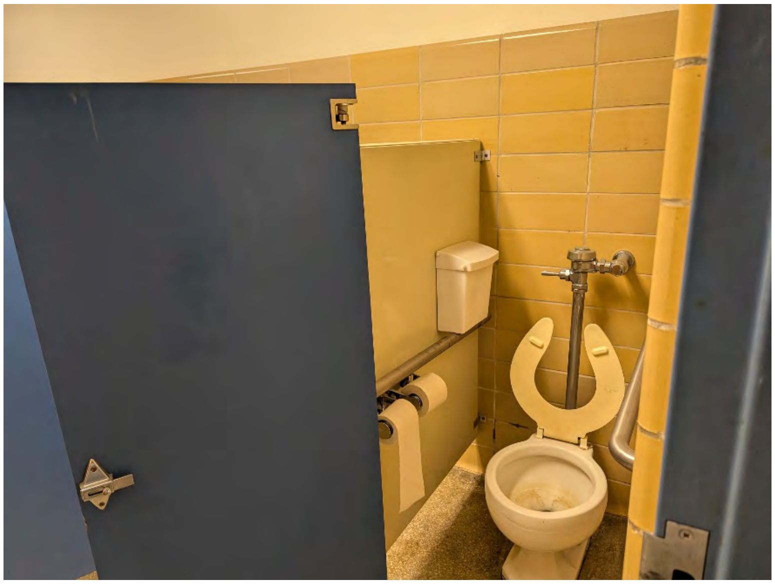

Figure 3.Typical water closet

Figure 4. Typical restroom layout

Figure 5. Typical drinking fountain

Figure 6. First floor controls cabinet

Figure 7. First floor vertical air handlers

Figure 8. Various ducts tied to vertical air handlers

Figure 9. Second floor standalone control thermostat

Figure 10. First floor outdoor units in mechanical yard

Figure 16. Utility transformer

Figure 17. Panelboard nameplate showing a date of 1990

Figure 83. Typical wall showing orange isolated ground receptacles and surface mounted raceway

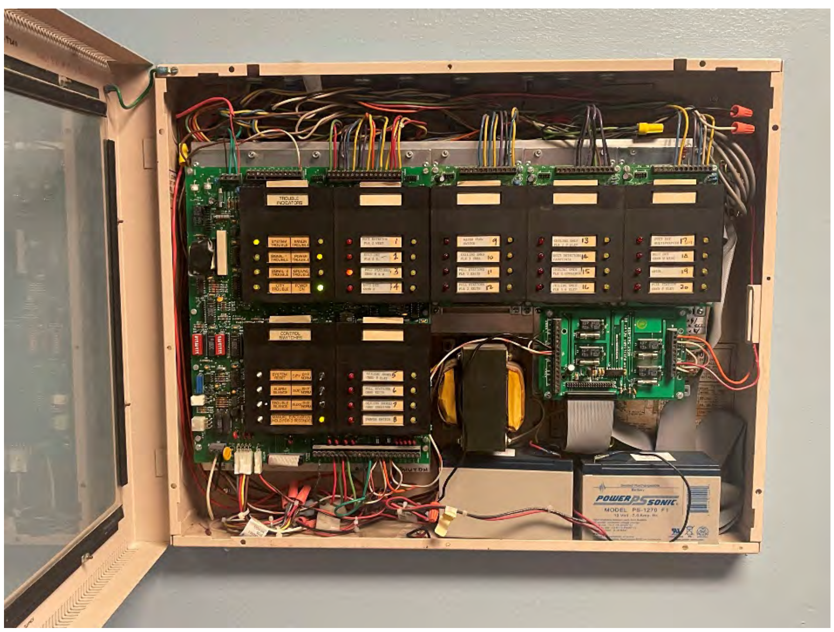

Figure 14. Existing fire alarm control panel