FACILITY AUDIT REPORT

STANLEY J. ARONOFF LABORATORY

318 West Twelfth Avenue

#131

ARONOFF LABORATORY

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EXECUTIVE SUMMARY

Aronoff Laboratory was built for department and sponsored research laboratories and office space for the College of Biological Sciences. Construction for the five-story building with ground floor and penthouse was started in 2001. Occupancy for the 107,593 GSF building was granted in June 2003. The Twelfth Avenue shop occupies the north end of the ground floor while an equipment room is located on the south end. Roof, window and wall leaks have been plaguing this building since it was occupied and is still being investigated. High-pressure superheated steam feeds two heating hot water heat exchangers and a steam generator for the domestic water, deionized water and building humidification. The hot water heat exchanger system has not worked properly since placed in service. The heating hot water is occasionally overheating causing problems with the distribution system and is still being investigated. A sight glass on the steam generator fractured and the room filled with steam. This reveled problems with the control system that has been corrected.

Since the faculty and staff have occupied the building several design and construction related issues have come to light and are in the process of being addressed.

PROJECTS

Proposed Maintenance Projects		
Corrective Maintenance Projects	**Budget**	**Control #**
1. Seal the concrete block parapet walls on the roof.	$ 5,000	08312
Building Improvement/Addition projects:		
1. Install pressure-reducing valves and heat exchanger control valves to control the heat exchanger at lower temperature to save energy and reprogram DDC controls.	$ 35,000	08313
2. Replace leaking pressure relief valves on the hot water heating distribution system and correct system overpressure.	$ 5,000	08314
3. Install 875 GPM hot water heat exchanger pumps or different control parameters to prevent overheating.	$ 40,000	08315
4. Install water treatment on the city water line to the humidifiers to control the scale to save in yearly maintenance.	$ 6,000	08316
5. Install a screen wall at the northwest entrance.	$ 5,000	08317
Component Replacements expected within the next 5-10 years		
1. None		
Total cost for Component Replacements		
Total Cost for Projects	**$ 96,000**	

Minor Maintenance Projects (<$5,000	
Project	**Work Request#**
1. Caulk openings in the counterflashing and parapet wall that have opened up.	405437
2. Install door sweeps on the interior east vestibule double door.	405438
3. Refurbish and reseed the lawn on the north side of the building.	425255

Renovation Projects in Process or Completed		
Project	**Cost**	**Project #**
none		
Total Renovation Projects Completed		

GENERAL BUILDING INFORMATION

Building Name and Number: Stanley J. Aronoff Laboratory, #131

Building Address: 318 West Twelfth Avenue

Year of Construction: 2001 - 2003

Investment: $24,554,262

Building Size: *(based on data from The Office of Facilities, Planning and Development, University Space Inventory System, 9/8/04):*

<table>
<tr><td colspan="3">Gross Square Feet: 107,593</td></tr>
<tr><td colspan="2">Net Square Feet: 95,622</td><td rowspan="2">Structure 11,971 S/F</td></tr>
<tr><td>Assignable Square Feet: 57,613</td><td>Mechanical/Common S/F: 38,009</td></tr>
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Estimated Replacement Cost: $26,261,000 (*assigned September, 2004, by The Office of Facilities Planning and Development, in the University Space Inventory System)*

Replacement Cost per Gross Square Feet: $244.08

Current Use: *(based on data from The Office of Facilities Planning and Development, University Space Inventory System, 9/8/04)*

Department	Instruction & Support	General Admin	Sponsored Research	Department Research	Plant Operation	Mechanical/ Common	Total
College of Biological Sciences	14.0%	5.5%	24.8%	12.1%	0.0%	0.0%	56.4%
Business & Finance	0.0%	0.0%	0.0%	0.0%	3.9%	0.0%	3.9%
Common Areas	0.0%	0.0%	0.0%	0.0%	0.0%	21.4%	21.4%
Mechanical	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	15.0%
Toilets	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	3.3%
Total	14.0%	5.5%	24.8%	12.1%	3.9%	39.7%	100.0%

Type of Construction: Precast concrete and Masonry Skin

Number of stories/basement: Five (5) with a ground floor and penthouse

Air Conditioning (Percentage): 100% *(source: The Office of Facilities Planning and Development. Auditor noted approximately 10% of the building is not treated)*

Wheel Chair Accessibility: From the east or west side of the building to the corridor and elevators.

Number of Exit Stairways: Two (2)

Number of Exits: Five (5)

Area Shop Responsibility: Twelfth Avenue Shop

Overall Building Condition: Satisfactory (*The Office of Facilities Planning and Development, in the University Space Inventory)*

ASBESTOS SURVEY (1986): Asbestos containing materials were not identified since this building was completed in 2003.

HEATING

Source: McCracken Power Plant
System: Hot Water
Steam Feed: 3" HPS to 055M from 12th Avenue
Building Heating Water: 6" in room 055M from heating heat exchanger

HVAC CONTROL SYSTEM

DDC with electronic and pneumatic operators

VENTILATION SYSTEM

VAV systems and powered exhaust

COOLING

Building: 100% Air Conditioned
2—Trane R-134a Screw, 426-ton in room 055M
1—Trane R-22 Screw, 110-ton in room 055M
1—Trane R-22 Scroll, 60-ton in room 055M

ELECTRIC

Source	Size(KVA)	Primary/Secondary	Switchgear location & Main Distribution
102/206	1500	13,200/480/277	060M East Side
102/206	1500	13,200/208/120	060M East Side

PLUMBING

Water: 8" to room055M; 6" to fire; 4" to domestic
Gas: 4" MPG to room 055M; 3" LPG to labs
Steam Meter: 3" in room 055M
Domestic Hot Water: 2.5" DHWS, 1.5" DHWR room 055M
Compressed Air: ½" in room 055M

SEWERS

Type	4 inches	6 inches	8 inches	10 inches
Storm				2
Sanitary			1	

Combined Storm/Sanitary: No

METERS

Gas: 4" east side of building
Water: 4" in room 055M
Electric: in room 060M

FIRE ALARM SYSTEMS

Fire Alarm: main panel room 065M
Remote panel location: at west entrance
Fire Pump: 750 GPM room 055M
Sprinkler Valve: room 055M
Horns/Strobes: in halls and rooms

BUILDING REPORTING SYSTEMS

Remote reporting system: [ ] MDI, [X] LENEL
Panel location(s): in room 0065M
Systems Monitored: [X] Fire Alarm, [X] Card Access, [X] Security, [X] Door,
[ ] Elevator, [X] HVAC, [ ] Environmental Alarms
Data Sent to: [ ] Local, [X] Department of Public Safety, [X] Service Center, [X] Key Control
Other Reporting Systems: Monitor HVAC equipment to Building Automation Shop

ELEVATORS

Type	Manufacturer	Weight	Size	Equipment/Controls
Passenger/Freight	Dover	5,000#	72" x 105"	room 600M
Passenger/Freight	Dover	2,500#	66" x 80"	room 600M

Emergency Generator

Type	KW	Volt	Location	Monitor
Kohler	275 KW	480 Volt	055M	West entrance
Kohler	275 KW	480 Volt	055M	West entrance
Kohler	275 KW	208 Volt	051M	West entrance

History

Aronoff Laboratory was built for office space, department and sponsored research laboratories for the College of Biological Sciences. Construction of the five-story building with ground floor and penthouse was started in 2001. Occupancy for the 107,593 GSF building was granted in June 2003.

Roof and wall leaks have been plaguing this building since it was occupied. Some leaks are still active and are being investigated. High-pressure superheated steam feeds two heating hot water heat exchangers and a steam generator for domestic water, deionized water and building humidification. The hot water heat exchanger system has not worked properly since placed in service. The heating hot water is overheating occasionally causing problems in the distribution system and is still being investigated. The sight glass on the steam generator fractured and the room filled with steam. This reveled problems with the hardware and control system that has been corrected.

The five-story building with ground floor and penthouse was built on Twelfth Avenue east of the parking garage. The Twelfth Avenue shop occupies the north end of the ground floor and an equipment room is located on the south end. A covered walkway on the third floor connects Aronoff Laboratory to the Twelfth Avenue Parking Garage. Several glass window wall systems spanning various floors accent this building at stairwells and corner offices. Precast concrete panels cover the entire south and west walls and accent ground floor walls on the east and north. The remainder of the building is enclosed with brick and aluminum trim. Four chillers were installed to supply chilled water throughout the year.

Foundation

The foundation of this building has a ground floor reinforced concrete floating pad that supports the building structure. This building has a perimeter drainage system that ties into a duplex sump on the northwest corner just north of the parking garage. The sump pumps with the motor mounted on the pump discharges to the storm line above the sump. A similar duplex sanitary sump located on the northeast corner of the building with the motor mounted on the pump discharges to the sanitary line above the sump.

Columns & Beams

The above-grade structural components of this building consist of reinforced precast concrete columns and beams that support the reinforced precast concrete floors up to the roof level. The structural components of the penthouse consist of a concrete block wall with a reinforced precast concrete deck that supports the roof. Columns were extended above the roofline to support the precast concrete screen walls.

The third floor bridge to the parking garage consists of steel columns that support the steel beams and metal deck with concrete floor that support columns, beams, metal deck, insulation and roofing. These form the basic skeletal components of this five-story building with ground floor and penthouse.

There are no major signs of settlement or movement in the building foundation or structural columns and supports.

Exterior Walls

The exterior walls consist of a precast concrete veneer installed on concrete block or brick installed on metal studs with sheathing and insulation. Openings in the brick for windows, window walls and entrance doors are accented with precast panels or brick on head, jambs and sills. The northeast stairwell is enclosed with a window wall from the first to the fifth floor that ties into the storefront glass lobby. Building trim has precast concrete, aluminum or brick with varied colored shades or recessed banding. The exhaust and fresh air intake louvers are located in the west and north wall at the ground level. The brick parapets on concrete block with aluminum parapet caps are in good condition. The drawings required that the exposed concrete block parapet be sealed with water repellant. This does not appear to have been done and needs to be completed.

The exterior wall of the penthouse consists of aluminum veneer panels on concrete block walls. The exterior of the third floor bridge to the parking garage consists of glass window walls with aluminum spandrel panels and an aluminum-paneled soffit. The roof screen walls have reinforced precast concrete panels that are supported by reinforced precast concrete columns.

The exterior masonry brick is in good condition. Control and expansion joints were originally installed and caulked and appear to be in good condition. There have been some reports of wall leaks at windows, louvers, the weep course or at changes of material that is being investigated at this time. There have been questions raised as to the type of and the installation of counterflashing used at these locations.

Exterior Windows and Doors

The windows of this building have aluminum frames with rubber thermal breaks that are attached to the building structure. The frames consist of rails or jambs, a header and a sill. Larger windows have mullions that divide the unit into smaller sections, which have fixed panes of double-glazed glass or spandrel panels. The fixed glass panels are set in the aluminum openings with rubber gaskets and aluminum retaining-strips. Pivoting double glazed windows are installed on the north, south and east sides of the building.

The window wall system has aluminum frames with rubber thermal breaks that are attached to the building structure with aluminum mullions that divide the unit into smaller sections. Fixed panes of double-glazed glass or spandrel panels are installed with rubber gaskets and aluminum retaining strips.

It was reported that some windows leak during driving rainstorms. The contractor is reviewing the installation of the windows in question.

Exterior Doors

The northeast entrance next to the stairwell has two sets of aluminum double doors with glass inserts that are installed in storefront glass walls that form a glass vestibule. There are two aluminum double entry doors with glass inserts in the storefront wall on the south side of the vestibule that accesses the first floor lobby.

Two aluminum double doors located at the west dock access the trash room and the hallway to the elevator. A ten-foot steel double door located at the south end of the west wall accesses the equipment room. One aluminum exit door with glass inserts on the south side accesses one building stairwell. The northwest double doors to the elevator open violently

when the wind catches them, a windscreen wall needs to be installed just north of these doors.

There are two aluminum double doors with glass inserts at the northeast garage entrance and two wood double doors with magnetic holders at the building side of the walkway. There are automatic openers on the east and west doors.

Roofing & Flashing

The roof surfaces over the main building, the third floor walkway, the first floor northeast entrance canopy and the south door canopy consists of modified bitumen roll roofing installed with hot modified asphalt. The flat roof over the northwest dock canopy is EPDM reinforced rubber roofing flashed into the building with aluminum flashing.

The columns were extended above the roofline to support the precast concrete screen walls. The column and screen wall flashing has shop and field-fabricated aluminum caps and counter-flashing at the walls and columns. A reglet with counter flashing was used at some locations while a caulked flat flashing pinned to the concrete was used around column bases. The drawings called for through-the-wall flashings in the concrete block parapet walls to be counterflashed to the roof SBS base. The through-the-wall flashings were not installed; instead a modified two-piece reglet was installed with a caulked joint. A few openings in the flashing sealant at the parapet wall were observed that need to be recaulked to prevent possible water leakage. Field caulk joints at parapet walls and columns have caulked joints that should be checked and repaired if necessary yearly to preserve the integrity of the flashing. Fall protection anchors were installed on the upper roof near low parapets.

The roofs and flashings are 2 years old and are in good condition; however, several repairs have been made to flashings and roof lap joints. When it rains, water leaks through flashings or roofing to the precast concrete roof deck and exits at open joints above the ceilings. This is happening in many areas of the building and is being investigated by the architect and corrected by the contractor.

Roof Drainage

The flat roof drainage system has cast-iron roof drains attached to interior cast iron pipe that discharges to the underground storm system. There are scuppers installed in the perimeter parapet walls that discharge water from the main roof should a drain become stopped up.

Partitions & Doors

The perimeter walls of this building are enclosed with concrete block at stairwells and select walls or metal studs with sheathing, insulation and drywall. Concrete block, brick or metal studs with drywall form interior walls in halls and rooms.

The first floor lobby opens to the elevators and an open stairwell on the northeast corner. Aluminum accent trim on railings, ceilings and windowsills accent the lobby and stairwell. The second through fifth floor corridors, offices and laboratory layout are similar. The corridor walls have brick at the elevator core, metal storefront walls at department offices, painted wall surfaces and vinyl baseboards.

Restroom walls have ceramic tile up to the ceiling. Equipment room walls have painted concrete block or drywall to the ceiling. The partitions and walls are in good condition.

Interior Doors

Wood doors in metal frames are predominate in this building. There are some wood doors in aluminum frames with glass window walls at department offices. Wood doors in steel frames are used at offices and labs. Wood or steel firedoors in steel frames are used at various mechanical rooms, halls and stairwells off finished hallways. Some hall doors are held open with door magnets that release the doors to shut when the fire alarm is activated. Several doors to secure areas have special keys or electronic locks. Steel firedoors in steel frames are used at ground floor mechanical rooms. The wood, metal and firedoors in this building are in good condition.

Floor Finishes

The first floor entrance vestibule, stairwell and lobby floor have slate-colored ceramic tile flooring. There is carpet in offices and vinyl composition tile in pedestrian and common areas. The second through fifth floor halls and labs have resilient vinyl composition tile and vinyl composition tile. Some floors in the halls to the labs appear wavy and may have an uneven concrete underlayment. The floors in the restrooms have ceramic tile floors. The exit stairs and landings are metal framed with concrete fill and rubber stair treads, vinyl tile on landings and aluminum handrails on steel railings. The ground floor equipment rooms have exposed concrete floors that have been sealed with a clear sealant and there is epoxy sealant on the floors in the penthouse.

The floors throughout the building are in good condition and have been well maintained. When the restroom floors are washed water leaks down through the concrete floor leveler and the precast concrete flooring and exits to the restroom below. This is happening in many areas of the building and needs to be investigated by the architect and corrected by the contractor.

Ceilings & Finishes

The ceilings in most rooms consist of a suspended aluminum 2x4 or 2x2 grid with 2x4 or 2x2 mineral fiber ceiling tiles and 2x4 or 2x2 lay-in fluorescent lights. The ceilings in halls and labs consist of a suspended aluminum 1x4 and 2x4 grid with 1x4 and 2x4 mineral fiber ceiling tiles and 1x4 lay-in fluorescent lights. The ceilings in common halls between labs are open to the piping and HVAC boxes above. The ceilings on the first floor, conference rooms and the elevator lobbies have a suspended steel grid with painted drywall ceilings with recessed lighting.

The mineral fiber tile ceilings are in good condition. Some ceiling tiles need to be replaced where leaks have occurred.

Conveying

There is a Dover passenger/freight elevator and a Dover passenger elevator serving this building. The elevators have a cab that is moved from floor to floor by a traction cable-driven system powered by a variable speed AC motor and reduction gearbox. The elevator controls use electronic direct-digital controls that operate the motor, brake, solenoids, floor levelers, doors and position lights. The elevator has a speakerphone for emergency communication and an emergency fire recall system to bring the elevators to a predetermined floor.

The elevators meet present ADA accessibility guidelines and fire codes. The elevators were operating and maintenance records did not indicate any problems with the elevators over the past year.

Plumbing

The major plumbing systems include domestic cold, hot water, gas, standpipes and sprinkler systems, sanitary, storm drainage and an acid waste system. All plumbing systems appeared to be in good condition and functioning at this time.

City water enters the building on the north side of room 055M through an 8" ductile cast iron pipe. A 6" water line with galvanized victaulic pipe feeds the fire protection system. A 4" line feeds the building domestic cold-water service through a 4" meter, backflow preventer, a house booster pump and copper piping. The domestic cold and hot water piping has copper pipe with spin-in tees and appears to be in good condition.

The domestic hot water heating system, in room 055M, consists of two 395 gallon tanks with low-pressure steam heat exchangers, a mixing valve, a hot water return circulating pump and controls that appeared to be operating properly.

The building sanitary waste and vent piping has no-hub cast iron pipe with waste and vent fittings and appears to be in good condition. The building sanitary drain discharges to a buried sump, located on the northeast side of the building, with duplex sanitary pumps that discharge to a sanitary line above.

The interior roof drainage piping has no-hub cast iron pipe and appears to be in good condition. The building footer drains discharge to a buried sump, located on the northwest side of the building north of the garage, with duplex sump pumps that discharge to a storm pipe above.

The 4" natural gas line enters the building on the east side of room 055M through a meter and pressure-reducing valve. The natural gas piping has steel pipe with welded or screwed fittings and appears to be in good condition. The natural gas serves the emergency generators and the laboratories.

Glass pipe and fittings were used on the aboveground acid waste and vent piping. The acid waste discharges to an above ground neutralization tank with limestone chips that discharges into a monitored PH tank before entering the sanitary sewer line located at the north side of room 055M.

The laboratory services include domestic cold and hot water, tempered water, deionized water, natural gas and compressed air. All systems appeared to be in good condition and functioning. The laboratory acid waste system and service systems did not appear to have any problems.

The restrooms have wall-mounted water closets and urinals with flush valves and wall-mounted lavatories with faucets. The restroom fixtures are in good condition. There are dual wall-mounted electric water coolers located on each floor near the restrooms. There was adequate water pressure at the faucets and fixtures on all of the floors. There were several work requests to repair clogged toilets, broken toilet seats and automatic flush valves.

Fire Protection

A 6" ductile cast iron pipe feeds the fire protection systems through a victaulic-coupled galvanized steel pipe to the backflow preventer. Piping after the backflow preventer uses victaulic-coupled steel pipe that feeds the 750 GPM fire pump, stairwell standpipes with 2.5" fire department hose connections, the wet-pipe building sprinkler system, a pre-action sprinkler system in equipment rooms and a dry-pipe sprinkler system with an air compressor in the penthouse. The wet standpipes and sprinkler systems in the building and the dry-pipe penthouse sprinklers are fed from the alarm valve in room 055M. Portable fire extinguishers are located throughout the building.

Heating

A 3" high pressure 22,890 #/hr (pound-per-hour) steam line that feeds Aronoff Laboratory is tapped into the steam main located on Twelfth Avenue. The 185 Psig superheated steam feeds a lead or lag 13,390 #/hr heating hot water heat exchanger and a 75 Psig 9,500 #/hr steam generator in room 055M. Medium pressure steam from the generator feeds two water stills in room 600M and a single 75/10 Psig pressure reducing station that feeds the two domestic hot water heaters and four air-handling unit humidifier heaters in room 055M.

The sight glass hardware on the steam generator failed in the fall of 2004 causing the room fill with steam. The sight glass was repaired, some new controls were installed and new operating procedures implemented.

The installed heating system consists of a lead heat exchanger supplied with 185 Psig superheated steam that heats the building heating water producing 12,885 MBTUH of heating capacity. The heating water is heated 30-degrees to a leaving water temperature of 180-degrees. Return heating water is pumped through the heat exchanger to a common supply line with a constant volume 700 GPM pump. A variable-speed 1,010 GPM building heating water pump supplies the heating coils in the air-handling units, hot water reheat coils, fan coil units at entrances and unit heaters. In-line constant speed pumps supply heating water to each of the air-handling units' heating coils. The heating system was operating at minimum capacity at the time of the site visits.

Steam Side

The lead heat exchanger is supplied with 185 Psig superheated steam that passes through a 3,350 #/hr and 10,050 #/hr capacity control valve or through a 3,350 #/hr temperature-sensing proportional control valve. Condensate from the heat exchanger drains through a closed circuit receiver to a 185 Psig steam powered condensate return pump with a large steam trap and check valve downstream of the pump. The receiver has a thermostatic trap that removes non-condensable gasses from the receiver.

The installed heat exchangers were designed (per the submittals) to condense 13,390 #/hr from a 580-degree inlet temperature to a 381.8-degree condensing temperature with 874 GPM of heating water, a 30-degree temperature rise and a 180-degree leaving water temperature. First, the installed heat exchanger heating hot water pumps are rated at 700 GPM or 80% of the heat exchanger designed output. At this output, the discharge temperature will rise to 187.6-degrees with the 700 GPM pumps. Second, the heat exchanger was designed to condense from a 580-degree inlet temperature to a 381.8-degree condensing temperature at 185 Psig; however, if the exchanger operates at a lower pressure, say 15 Psig (the approximate pressure of the discharge line), another 1,829 MBTUH of heat must be removed. This increases the discharge temperature another 5.4-degrees to a final

leaving temperature of 193-degrees at the heat exchanger design. This represents a heat exchanger that is 43% larger than is required. Two 874 GPM heating hot water pumps should be installed or different control parameters should be set to prevent overheating.

The hot water heat exchangers have experienced sporadic overheating problems since the building was turned over to the university. The inlet and outlet heating hot water thermometers (0-240 degree) on both heat exchangers were broken from excessive heating water temperatures during the 2003 heating season. In the spring of 2004, a water temperature of 210-degrees was observed on several site visits indicating a problem still exists with overheating. At this time, it was noted that the lead heat exchanger was idling at 40 Psig with a 238-degree condensing temperature (a 286-degree temperature per steam properties should have been present). Calculations indicated large quantities of air (75% calculated) present in the heat exchanger. On several other site visits the heat exchanger pressure did not match the steam property condensing temperature indicating large quantities of air were still present in the heat exchanger.

Since the heat exchanger is about 43% larger than required, it is recommended that the 185 Psig steam be reduced to 10 Psig before entering the heat exchanger so that the heat exchanger can extract the maximum amount of energy. This would require two pressure reducing stations with the control valve sequence modified to a continuous proportional control. The two existing control valves on each heat exchanger could be used in the pressure reducing stations. The existing 3,350 #/hr temperature controller would need to be removed.

The existing main control valves were staged in one-third increments form closed to full opened instead of the quarter steps per OSU specifications. One of the control valves on the 2003 lead heat exchanger was leaking and was in the process of being replaced after one year of service. The control sequence to the existing OSU systems is to be changed to one-tenth increments form closed to full opened per valve or twenty steps for both valves. This may not solve the overheating problem of this oversized exchanger; therefore, the pressure should be reduced and the control valves should use proportional control.

On many occasions the condensate return line to the street was observed shaking as the hot condensate flashed in the return line. Also, the 185 Psig steam entering the condensate pump creates loud noises, shaking and extra wear and tear on the pump valve because of the 160 Psig differential pressure. A medium pressure steam line from the pressure reducing station should be installed to the condensate pump along with a pressure gage downstream of the pump steam trap and check valve. A temperature gage downstream of digital probe on the condensate drain line should also be installed. These would assist maintenance in determining proper pump operation and would assist to determine if air is present in the heat exchanger.

The heat exchanger should be piped with an equalization line from the high point of the heat exchanger to the receiver to bleed accumulated air to the receiver with the thermostatic trap. The drawings called for a vacuum breaker on the heat exchanger that was not installed. Most manufacturers recommend a vacuum breaker and thermostatic trap on the heat exchanger unless an equalization line is installed from the high point of the heat exchanger to the receiver to bleed the non-condensing gases.

All of these deficiencies can lead to poor hot water heating control and wasted energy when steam flashes in the condensate line. OSU specifications called for a 25 Psig backpressure valve to be installed on the receiver, which was not installed. This valve could limit the heat exchanger to a 25 Psig (267-degree) condensing temperature, it would waste energy each

time the heat exchanger over-pressurized and would not prevent hot condensate from flashing in the condensate return line. The pressure reducing stations to the heat exchangers would solve most of these problems.

Hot water Side

The two variable-speed 1,010 GPM heating water pumps supplies the heating coils in the air-handling units, hot water reheat coils, fan coil units at entrances and unit heaters (note: the sum of all the hot water coils in the building is 705 Gpm). The hot water heating system operates all year providing hot water to the VAV box reheat coils in the summer. A 110 gallon pressurized expansion tank is mounted above the pumps and piping. The expansion tank fills as the water temperature rises due to the water volume increase from a cold start. A makeup water valve with a pressure gage (designed at 50 Psig) is located near the expansion tank to replace water lost from pump seals and system leaks. The drawings called for a line-sized 60 Psig pressure relief valve to be installed at the inlet of each heat exchanger to relieve excess water from the system should the heating water overheat and the system volume exceed the design volume.

The 50 Psig makeup water pressure gage was reading 88 Psig with a water temperature of 140-degrees, indicating that the makeup valve has not been set properly. The line-sized 60 Psig pressure relief valve was replaced with a 2" 80 Psig pressure relief valve at each heat exchanger. The heating hot water relief valves were leaking continuously, indicated an over-pressurized system.

On one trip to the building, during the 2003-heating season, the inlet and outlet heating hot water thermometers (0-240 degree) on both converters were broken from excessive water temperatures and both relief valves were leaking continuously. Also, the condensate return line was observed to shake as hot condensate flashed in the line when the condensate was pumped.

A 210-degree water temperature was observed during several site visits in the spring of 2004 indicating a problem still exists with overheating. It was reported that the hot water expansion tank was flooded and that the pressure relief valve has been dumping water so often that it now needs to be replaced. The condensate return line was still shaking 1-2" as steam flashed in the line when the condensate was pumped.

Other problems with overheated water on the heating side not so obvious can include the possibility of overheated water flashing to steam at pump inlets, across coil control valves or in VAV box reheat coils. Excessive temperatures on pump and valve seals in the system and extra stresses on the piping system can cause premature system failures.

The engineers and designers told the 12th Avenue Shop that there were no problems; however, overheated water, air in exchangers, high condensing temperatures, steam flashing in the condensate return and broken thermometers in the supply and return lines were observed during various site visits and continue to occur. The contractor needs to verify that all items in the system are sized and set properly according to design including makeup water valve set to 50 Psig design (could be set at 40 Psig). Pressure relief valve design was 60 Psig and changed to 75 Psig and then again factory reset to 80 Psig. Install properly sized pressure relief valves. The contractor needs to verify that there are no seal leaks in the heating water system.

Cooling & Ventilation

Chillers

There are four chillers with year around chilled water capacity are located on the east wall of room 055M. Two 2002, Trane 426-Ton, R-134a, screw chillers supply chilled water to the main chilled water loop through a single primary constant-speed 853 GPM chilled water pump on each chiller. Two BAC 430-Ton cooling towers are located on the roof next to the penthouse that cools chiller condenser water. Each chiller has a 1,200 GPM condenser water pump that supplies condenser water to the cooling tower. One 2002, Trane 110-Ton, R-22, DX, screw chiller supplies chilled water to the main chilled water loop through a single primary constant-speed 221 GPM chilled water pump. One 2002, Trane 60-Ton, R-22, DX, scroll chiller supplies chilled water to the main chilled water loop through a single primary constant-speed 121 GPM chilled water pump. Two Trane direct expansion (60 and 110-Ton) low ambient air-cooled condensers located on the roof next to the south exhaust fan cools the hot refrigerant for each chiller.

Two variable-speed 1050 GPM chilled water pumps located in room 055M, supply chilled-water from the chilled water loop to the VAV air-handling units and several fan coil units. The total chilled water flow to the system is 1,837 GPM. There is a 12-degree delta-T across the chillers. The single primary constant-speed chilled water pumps produce a 30' head on the main chilled water loop that has a 10" de-coupler pipe with temperature sensors on the loop. Generally, the decoupling pipe is downsized for a higher velocity and sometimes incorporates a check valve to prevent short-circuiting of chilled water in the secondary loop. This decoupling or bypass line will need to be evaluated and modified if short-circuiting is detected.

Air Handling Units

The heating, cooling and ventilation systems located in room 055M consist of two VAV make-up air-handling units (AH-1&2) at 50,000 CFM each and two VAV air-handling units (AH-3&4) at 30,000 CFM each that serve the general building HVAC requirements. The air-handling units supply conditioned air to VAV boxes with hot water reheat coils and diffusers located in the various zones of the building. Sensors in the space control the VAV box and reheat coil. Laboratory rooms requiring room pressure control has a makeup air VAV box with a reheat coil controlled by sensors on the hood and in the room. The heating, cooling and ventilation systems were operating at the time of the site visits.

The building VAV air-handling units have hot water pre-heat coils, chilled water coils, 30% pre-filters, 95% efficient cartridge-filters, variable speed motors and steam box-humidifiers. The air-handling units' supply air fan discharges air into a spiral high-velocity duct that supplies air to VAV boxes with reheat coils located in offices, conference rooms and common spaces. A variable speed motor controller on the supply and return air fan adjusts the fans' air volumes delivered to the VAV boxes. A system of return-air ducts return air back to the air-handling units or to an exhaust air louver through the return air fan. A DDC thermostat located in the room modulates the VAV box cooling air and reheat coil to provide comfort air to the space.

The laboratory make-up air-handling units draw in 100% outside air. The air-handling units have hot water pre-heat coils with by-pass dampers, chilled water coils, 30% pre-filters, 95% efficient cartridge-filters, variably speed motors and steam box-humidifiers. The air-handling units' supply air fan discharges air into a spiral high-velocity duct that supplies air to the VAV boxes with reheat coils located in labs and rooms requiring make-up air. A

variable speed motor controller on the supply air fan adjusts the fan's air volume delivered to the VAV boxes. A DDC thermostat located in the room modulates the VAV box cooling air and/or reheat coil to provide comfort air and/or room pressurization to the space.

The cooling coils on AH-1, 2, 3 and 4 were designed at 92 Db & 73 WB per OSU specifications; however, ASHRAE recommends higher design wet bulb (Wb) temperatures for moisture removal.

The condensate drains from the cooling coil pans to the floor drain appear to have trap seals that are too shallow. The air-handling units condensate-drain on the floor in room 055M needs to have a deeper trap installed.

Low-pressure steam supply heaters in the steam-tank humidifiers that heats city water converting it to steam that feeds the humidifier discharge headers in the air-handling units. These humidifiers need to be cleaned at the beginning of each heating season to remove scale, mold, mildew and bacterial growth from the tank. The city water needs to be softened and filtered to remove contaminates that clog the water baths. The water baths could be removed and replaced with a steam humidifier valve using purified steam from the steam generator.

Controls for the heating and cooling systems have DDC controls with pneumatic, electronic and electric operators that are monitored at the Building Automation Shop through a Lenel panel in room 065M.

Exhaust

There are two sets of lab-hood exhaust fans located on the roof. One set of fans on the north end exhausts lab air through two 25,000 cfm fans; the other set of fans on the south end exhausts 25,000 cfm from each fan. The exhaust fans have modulating dampers at the roof enclosure and variable frequency drives that control the fans' airflow. Special lab hood exhaust systems use HEPA or charcoal filter systems to filter the air from these hoods before being exhausted to the outside. There are fans located on the roof that exhaust air from common areas, equipment rooms, conference rooms and restrooms.

Electrical Service & Distribution

The electric service has two 13,200 volt power sources, circuit number 102/206, from the Buckeye Substation. These circuits are connected to two high voltage 13.2 KV switches with fuses located on the east side of the building that control the circuit in use to the two transformers.

The active 13.2 KV switch feeds electric power through two 1500 KVA transformers in room 060M that decreases the voltage to a usable level. One 1500 KVA transformer and switchgear feeds 480/277-volt power to the MCC panels in room 050M and in room 600M and feeds power to the lighting distribution panels located throughout the building. The other 1500 KVA transformer and switchgear feeds 208/120-volt power to distribution circuits in room 060M and power to distribution panels located throughout the building.

Lighting & Power

The building has 32-watt fluorescent surface and recessed fluorescent tube light fixtures throughout the building. Entrance areas are illuminated with fluorescent recessed can

fixtures and ceiling hung and wall mounted fixtures. Some areas are illuminated with HID fixtures.

Each floor has individual circuit breaker panels for lighting and one or three phase receptacles. The circuit breaker panels have spare spaces to add more circuit breakers. Panel sizes vary throughout the building depending on the load. At about 27.8 watts per square foot the building appears to have an adequate power supply in all circuits. There are an adequate number of convenience outlets throughout the building. Some areas have extensive electrical and electronic equipment that are fed with an isolated ground power system.

Emergency Power

There are three emergency 275-KW generators located in room 050M and 051M that supply 600-KVA of emergency power to a 480/277-volt distribution panel and 300-KVA of power to a 208/120-volt distribution panel located in room 050M. Some chillers, pumps, air-handling units, exhaust fans and an elevator are on the emergency circuit. Some laboratory and support areas have electrical and electronic equipment that is fed with power from the emergency generator circuit. The exit lights and selected corridor lights are also connected to the emergency power circuit. A remote annunciation panel at the west entrance displays the generators system status.

Safety Standards

The building is equipped with a fire alarm system consisting of manual pull stations at exits and stairwells and smoke detectors that provide fire annunciation from the panel in room 065M to the horns and strobes located on all floors. A remote fire annunciation panel at the west entrance displays the system status. The fire annunciation panel is monitored by a Lenel panel in room 065M that reports system status to the Department of Public Safety in Blankenship Hall. The 750-GPM fire pump, wet standpipes, sprinkler systems to the building and the dry pipe to the penthouse sprinklers are fed from the valve in room 055M. There are 2.5" fire department hose valve connections located on the stairwell standpipes and portable fire extinguishers located throughout the building.

There are lighted exit signs at each exit, stairwell lighting and emergency/night lights located in the corridors, life safety systems, storm water pumps and sewage ejector pumps that are fed from the emergency panel located in room 050M.

Asbestos

Asbestos containing materials were not identified since this building was completed in 2002. Generally, buildings constructed during this time are basically asbestos free. In some cases, however, the use of asbestos containing materials in floor tiles, mastics, caulking, gaskets, lab hoods etc. could have been used. Consideration should be given to a survey of products that may potentially contain asbestos materials within the limits of the building and, if identified, should be removed during any renovation or repairs.

Perimeter

All of the sidewalks around the building are in good condition.

Plantings vary with newly planted trees and shrubbery beds on the north and east side of the building and flower beds at the northwest entrance. The grass areas on the north side of the building that were disturbed by the construction to the north needs to be reseeded.

Entrances to the building are well lighted, and area flood and street lighting appear to be distributed properly. The building signs are in good condition.

BUILDING EVALUATION SUMMARY

Building Number: **#131**

Facility Name: **Aronoff Laboratory**

Year Constructed: **2001-2003**

Building Size: **113,602 Gross Square Feet**

Replacement Cost: **$26,261,000** 1

Component Rating				
Building Component	**Building Component Percentage of Total Cost** 2	**Building Component Replacement Cost**	**Building Component Condition Value Multiplier**	**Building Component Current Value**
Foundation	7.60	$ 1,996,808	98%	$ 1,956,872
Columns & Beams	8.58	$ 2,253,089	98%	$ 2,208,027
Exterior Walls	6.18	$ 1,623,061	98%	$ 1,590,600
Ext. Windows & Doors	3.09	$ 811,544	98%	$ 795,313
Roofing & Flashing	5.76	$ 1,512,739	96%	$ 1,452,229
Partitions & Doors	7.96	$ 2,089,351	98%	$ 2,047,564
Wall Finishes	3.47	$ 911,204	97%	$ 883,868
Floor Finishes	4.49	$ 1,178,147	96%	$ 1,131,021
Ceilings & Finishes	5.33	$ 1,398,818	96%	$ 1,342,866
Conveying	2.10	$ 551,691	98%	$ 540,657
Plumbing	16.41	$ 4,310,402	98%	$ 4,224,194
Heating	6.51	$ 1,708,488	89%	$ 1,520,554
Cooling & Vent.	7.47	$ 1,961,198	95%	$ 1,863,138
Elect. Service & Dist.	1.29	$ 338,137	98%	$ 331,374
Lighting & Power	10.17	$ 2,669,536	98%	$ 2,616,145
Safety Standards	3.61	$ 946,788	98%	$ 927,852
TOTALS	100.00 3	**$ 26,261,000**	**97%**	**$ 25,432,274**

Overall Building Condition Rating = 97%
Overall FCI (Facility Condition Index) = 0.45% 4

FCI = Deferred Maintenance ($96,000)/Replacement Cost ($21,384,000) = 0.45%

1- Replacement Cost assigned September 2004 by the Office of Facilities Planning and Development in the University Space Inventory System. Replacement cost does include the furnishings and fixed equipment allocation.

2- Percent allocation of each building component was calculated from the Means Standard Construction Cost data for College Classroom Buildings.

3- The building component costs are rounded to four decimals to allow the Excel calculated building replacement cost to be displayed as reported by the Office of Facilities Planning and Development.

4- Facility Condition Index is [deferred maintenance]/[total replacement cost]. An excellent building is 5%. As the building reaches 16%, the building needs major attention. The goal at The Ohio State University is to have an FCI of 11% or lower.

Foundation

Refer to p. 9 for Narrative

Foundations Component Rating	$1,996,808 Component Replacement Cost	X	98% Condition Value Multiplier	=	$1,956,872 Component Value

	Footings	
n/a	Interior Footings/Piers	
n/a	Interior Footings/Bearing Walls	
n/a	Perimeter Footings	
n/a	Grade Beams	
n/a	Piles	
Satisfactory	Other	reinforced floating slab on grade
	Foundation Wall Materials	
n/a	Concrete cast-in-place	
n/a	Concrete Block	
n/a	Stone	
n/a	Brick	
	Waterproofing and Under-drain	
Satisfactory	Coating	against slab
Satisfactory	Membrane	
n/a	Board	
Satisfactory	Footer Drain Pipe	shown on drawings
	Slab on Grade	
n/a	Plain	
n/a	Reinforced	
	Ground/Basement Floor Slab	
n/a	Plain	
Satisfactory	Reinforced	
	Special Substructures	
Satisfactory	Reinforced floating slab	

Comments:

- None

Columns & Beams

Refer to p. 9 for Narrative

Columns and Beams Component Rating	$2,253,089 Component Replacement Cost	x	98% Condition Value Multiplier	=	$2,208,027 Component Value

	Columns and Beams	
n/a	Reinforced concrete	
Satisfactory	Precast concrete	
Satisfactory	Steel columns and beams	on bridge to garage
n/a	Fireproofing	
n/a	Wood	
n/a	Other	
	Floor Joists	
n/a	Concrete	
n/a	Steel Trusses	
n/a	Wood	
n/a	Other	
	Floor Decks	
n/a	Concrete Slab on load-bearing walls	
Satisfactory	Precast Slab	with lightweight concrete topping
n/a	Metal Deck w/concrete fill	
n/a	Wood	
	Roof Joists	
n/a	Concrete	
n/a	Steel Trusses	
n/a	Steel Joists	
n/a	Wood	
	Pitched Roof System	
n/a	Pitch	
n/a	Dormers	
n/a	Steel Rafters	
n/a	Wood Rafters	
n/a	Fireproofing	
n/a	Underlayment	
n/a	Insulation	
n/a	Ventilation	
	Flat Roof System	
Satisfactory	Slope	0.25" per foot
n/a	Concrete Deck	
Satisfactory	Precast Slab	lightweight concrete topping
n/a	Metal Deck w/concrete fill	
n/a	Metal Deck w/insulation	
n/a	Wood Deck	
n/a	Insulation	
n/a	Other	

Comments:

- Columns were extended above the roofline to support the precast concrete screen wall.

Exterior Walls

Refer to p. 10 for Narrative

Exterior Walls Component Rating	$1,623,061 Component Replacement Cost	X	98% Condition Value Multiplier	=	$1,590,600 Component Value

	Walls	
n/a	Concrete cast-in-place	
Satisfactory	Concrete precast	panels
n/a	Concrete Block	
Satisfactory	Brick Masonry	fired & glazed
Satisfactory	Veneer	precast concrete panels
n/a	Slab Veneer	
Satisfactory	Window/Curtain wall	first to sixth floor
Satisfactory	Metal Siding	insulated aluminum panels
Satisfactory	Other	louvers at ground level
	Wall Lintels Over Openings	
Satisfactory	Concrete precast	
n/a	Concrete cast-in-place	
n/a	Limestone	
n/a	Brick Masonry	
Satisfactory	Steel	
n/a	Wood	
Satisfactory	Other	bond beams
	Wall Trim	
n/a	Limestone	
Satisfactory	Brick	soldier, frieze and recessed
n/a	Marble	
Satisfactory	Fascia/Rake	aluminum panels
Satisfactory	Soffits	aluminum panels
n/a	Other	
	Finishes	
Satisfactory	Plain	
n/a	Stucco	
n/a	Paint	
n/a	Parging	
n/a	Exposed Aggregate	
n/a	Drivit	
Satisfactory	Other	prefinished
	Exterior Wall Backing System	
n/a	Concrete	
Satisfactory	Concrete Block	at stairwells and various rooms
n/a	Brick Masonry	
n/a	Ceramic Glazed Clay Tiles	
Satisfactory	Metal Studs	insulation and building wrap system
n/a	Wood Studs	

Comments:

- The walls behind the brick are constructed concrete block or gypsum board on metal studs, 6" batt insulation and 1" of insulation with a building wrap.
- There have been some reports of wall leaks at windows, louvers, the weep course or at changes of material that is being investigated at this time. There have been questions raised as to the type of and the installation of counterflashing used at these locations.

Exterior Windows & Doors

Refer to p. 10 for Narrative

Exterior Windows & Doors Component Rating	$811,544 Component Replacement Cost	X	98% Condition Value Multiplier	=	$795,313 Component Value

	Window materials	
n/a	Wood	
n/a	Steel	
Satisfactory	Aluminum	window frames
n/a	PVC	
n/a	Other	
	Windows type & number	
n/a	Double Hung	
n/a	Awning	
n/a	Casement	
Satisfactory	Pivoted	97 each
n/a	Sliding	
Satisfactory	Fixed	glass windows 96
n/a	Other	
	Window glazing	
n/a	Single pane	
Satisfactory	Double pane	on all windows
	Window Wall and/or Store Front	
Satisfactory	Store Front	at east entrance
Satisfactory	Vestibule	at east entrance
n/a	Single pane	
Satisfactory	Double pane	158 ea
Satisfactory	Insulated panels	aluminum 14 ea
Satisfactory	Spandrel panels	91 ea
Satisfactory	Other windows	10 ea
	Door Materials	
n/a	Wood	
Satisfactory	Steel	at dock and equipment room
n/a	Stainless Steel	
Satisfactory	Aluminum	exit and entrance doors
	Doors type & number	
Satisfactory	Vestibule	at east entrance 1
Satisfactory	Double	at east entrance 2
Satisfactory	Double ten foot	steel to equipment room 1 ea
Satisfactory	Double	to hall and receiving area room 2 ea
n/a	Single Exit	
Satisfactory	Stair Exit	at south stair exit 1 ea
n/a	Garage	
n/a	Special	
	Hardware	
Satisfactory	Automatic opener	
Satisfactory	Push bar openers with closures	
Satisfactory	Key Cards	

Comments:

- There were reports that some windows leak during driving rainstorms.
- The northwest double doors to the elevator open violently when the wind catches them, a windscreen wall needs to be installed just north of the doors.

Roofing & Flashing

Refer to p. 11 for Narrative

Roofing & Flashing Component Rating	$1,512,739 Component Replacement Cost	X	96% Condition Value Multiplier	=	$1,452,229 Component Value

	Roof Covering	
n/a	Built-up w/gravel [ ]asphalt [} Coal Tar [ ] Modified	
Satisfactory	Modified asphalt Roll	SBS 20,479 SF
Satisfactory	EPDM	on dock canopy 460 SF
	Flashing	
Satisfactory	Materials: [ ]CS [X]Galv [X] Al [X] EPDM [ ]SS [ ] PVC	
Satisfactory	Cap	341 LF
Satisfactory	Cap	screen wall cap 138 LF
Satisfactory	Counter	at parapet 1,311 LF
Satisfactory	Base	SBS 1,313 LF
Satisfactory	Base	EPDM 86 LF
Satisfactory	Reglet	in precast screen wall 384LF
Needs Attention	Modified Reglet	on concrete block wall 586LF
	Gravel Stop & Edge Strips	
Satisfactory	Type [X]SS [ ] Galv [ ]Al [ ] PVC	201 LF
	Drainage	
n/a	Gutters w/Exterior Downspouts	
Satisfactory	Scuppers w/o Exterior Downspouts	11 Ea
Satisfactory	Drains w/ Interior Storm Drains	19 Ea
Satisfactory	Emergency Overflow	over edge
	Parapets	
Satisfactory	Precast Concrete	to aluminum parapet cap
Satisfactory	Brick	to aluminum parapet cap
Satisfactory	Other	concrete block parapet backer
	Parapet Caps	
Satisfactory	Metal [ ]CS [ ]Galv [X]Alum [ ]CU [ ]PVC	586 LF
n/a	Limestone	
	Roof Accessories	
Satisfactory	Lightning Protection	
Satisfactory	Roof Curbs	
Satisfactory	Equipment Frames	
Satisfactory	Pitch Pockets	
Satisfactory	Fall protection	15 ea

Comments:

- The roof is 2 years old and is in good condition; however, leaks have been reported in various areas of the building and are being investigated by the architect and corrected by the contractor.
- Some leaks were noted in the work orders that have been repaired.
- The drawings called for through-the-wall flashings in concrete block parapet walls to be countered to the SBS base; the through-the-wall flashings were not installed. Instead, a modified two-piece reglet was installed on the concrete block with a caulked joint. A few openings in the counterflashing sealant at the parapet wall need to be recaulked to prevent possible leakage.
- The roof parapet concrete block backer was to be waterproofed and does not appear to have been completed. All parapet concrete blocks and concrete screen walls need to be sealed properly.
- The columns that extend above the roofline to support the precast concrete screen wall were flashed with a flush type pinned and caulked counterflashing.
- Styrene-Butadiene-Styrene (SBS) modified asphalt

Partitions & Doors

Refer to p. 11 for Narrative

Partitions & Doors Component Rating	$2,089,351 Component Replacement Cost	X	98% Condition Value Multiplier	=	$2,047,564 Component Value

	Partition Framing	
Satisfactory	Concrete Block/Brick	
n/a	Clay Tile Block	
n/a	Glazed Clay Tile Block	
n/a	Masonry	
n/a	Wood Stud	
Satisfactory	Metal Stud	with insulation
	Special partitions and Walls	
n/a	Demountable	
Satisfactory	Toilet	
Satisfactory	Screen Walls	
Satisfactory	Glass	
n/a	Gate	
Satisfactory	Other	storefront doors and side lights to halls
	Wall Material	
Satisfactory	Concrete Block	in stairwells and various areas
n/a	Plaster	
Satisfactory	Drywall	on metal studs throughout the building
Satisfactory	Glass	storefront windows to halls
n/a	Wood Trim	
n/a	Composite Paneling	
n/a	Acoustic Panels	
Satisfactory	Tile/Glazed	in restrooms
	Interior Doors & Frames	
Satisfactory	Met Door/Met Frame	equipment room doors
n/a	Wood Door/Wood Frame	
Satisfactory	Wood Door/Metal Frame	predominate throughout
Satisfactory	Glazing	
n/a	Roll-up	
n/a	Sliding	
Satisfactory	Other	wood doors in steel storefront window units
	Hardware	
Satisfactory	Door [ ]Knobs [X] Levers	
Satisfactory	Door Closures	
Satisfactory	Kick/Push Plates	
Satisfactory	Security & Detection	some door key cards
Satisfactory	Automatic Openers	
Satisfactory	Fire Door Magnets	on some hall doors

Comments:

- None

Wall Finishes

Refer to p. 11 for Narrative

Wall Finishes Component Rating	$ 911,204 Component Replacement Cost	X	97% Condition Value Multiplier	=	$ 883,868 Component Value

	Wall Finishes	
Satisfactory	Paint	
n/a	Vinyl Wall Coverings	
n/a	Prefinished Paneling	
n/a	Cork	
n/a	Wallpaper	
Satisfactory	Ceramic Glazed Tile	on waterproof drywall
n/a	Granite	
n/a	Stone	
Satisfactory	Trim & Wainscot	
n/a	Decoration	
Satisfactory	Glass	
Satisfactory	Other	sound attenuation panels

Comments:

- None

Floor Finishes

Refer to p. 12 for Narrative

Floor Finishes Component Rating	$1,178,147 Component Replacement Cost	x	96% Condition Value Multiplier	=	$1,131,021 Component Value

	Carpet	
Satisfactory	Rolled	predominate in offices
n/a	Tile	
	Concrete Topping	
Satisfactory	Clear Sealant	on ground floor equipment rooms
n/a	Anti-slip	
Satisfactory	Epoxy	penthouse floors
	Resilient	
Satisfactory	Vinyl Composition Tile	in halls and some rooms
n/a	Vinyl/Plastic Tile	
n/a	Asphalt Asbestos Tile	
n/a	Linoleum Tile	
Satisfactory	Resinous Vinyl Composition Tile	in labs
n/a	Cast Steel	
Satisfactory	Rubber	treads on open stairwells
	Ceramic Tile	
Satisfactory	Mosaic	
n/a	Quarry	
n/a	Pavers	
	Masonry	
n/a	Marble	
n/a	Granite	
Satisfactory	Slate	first floor
n/a	Brick	
	Terrazzo	
n/a	Marble	
n/a	Granite	
	Wood	
n/a	Tiles	
n/a	T&G Hardwood	
n/a	Planking	
	Pedestal	
n/a	Grills (n/a) Supply Air (n/a) Vent (n/a)	
	Base Molding	
Satisfactory	Vinyl	
n/a	Wood	
n/a	Terrazzo	
Satisfactory	Ceramic Tile	restrooms
Satisfactory	Masonry	to match first floor flooring

Comments:

- Some areas of the lab floors appear wavy and may have an uneven concrete underlayment.
- When the restroom floors are washed water leaks down through the precast concrete flooring and exits to the restroom below.

Ceilings & Finishes

Refer to p. 12 for Narrative

Ceilings & Finishes Component Rating	$1,398,818 Component Replacement Cost	X	96% Condition Value Multiplier	=	$1,342,866 Component Value

	System Type	
Satisfactory	Exposed	in equipment rooms and lab halls
Satisfactory	Applied to Structure	
n/a	Suspended Stud	
Satisfactory	Suspended Steel Grid	drywall
Satisfactory	Suspended Aluminum Grid	
n/a	Suspended Sealed Grid	
n/a	Suspended Concealed Spline	
	Materials	
Satisfactory	Drywall	in several locations
n/a	Plaster	
Needs attention	Mineral Fiber Board	predominate throughout
n/a	Fiberglass Board	
n/a	Cementitious Fiber Board	
Satisfactory	Metal Pan Tile	
n/a	Other	
	Finishes	
Satisfactory	Paint	
Satisfactory	Pre-finished Paint	
n/a	Pre-finished Vinyl	
n/a	Pre-finished Fabric	
n/a	Other	
	Openings & Inserts	
Satisfactory	Air Distribution	
Satisfactory	Lighting Fixtures	
Satisfactory	Access Panels	
Satisfactory	Sprinklers	
Satisfactory	Smoke Detectors	
n/a	Speakers	
n/a	Skylights	
Satisfactory	Other	motion light detectors

Comments:

- Several tiles are stained from water leaks and need to be replaced.

Conveying

Refer to p. 12 for Narrative

Conveying Component Rating		$551,691 Component Replacement Cost	X	98% Condition Value Multiplier	=	$540,657 Component Value
	Elevator #1					
Satisfactory	Number					One Dover cable
Satisfactory	Type					Passenger
Satisfactory	Speed					350 FPM
Satisfactory	Capacity (lbs.)					2,500 lbs.
Satisfactory	Dimensions					66"x80"
Satisfactory	Door Operation	[X]Center		[ ]To Side		
Satisfactory	Accessible Codes					
Satisfactory	Fire Codes					
	Elevators #2					
Satisfactory	Number					One Dover cable
Satisfactory	Type					Passenger/Freight
Satisfactory	Speed					350 FPM
Satisfactory	Capacity (lbs.)					5,000 lbs.
Satisfactory	Dimensions					72"x105"
Satisfactory	Door Operation					
Satisfactory	Door Operation	[X]Center		[ ]To Side		
Satisfactory	Accessible Codes					
Satisfactory	Fire Codes					
	Lifts and Hoists					
n/a	Number					
n/a	Type					
	Moving Stairs and Walks					
n/a	Number					
n/a	Type					
	Conveyors					
n/a	Number					
n/a	Type					

Comments:

- The elevators are ADA compliant and meet fire codes.

Plumbing

Refer to p. 13 for Narrative

Mechanical & Plumbing Component Rating	$4,310,402 Component Replacement Cost	x	98% Condition Value Multiplier	=	$4,224,194 Component Value

	Services Available			
Satisfactory	Cold Water			8" to 4" domestic and 6" fire in room 055M
Satisfactory	Backflow Valve			6" in room 055M
Satisfactory	Backflow Valve			4" in room 055M
Satisfactory	Hot Water			2.5" in room 055M
Satisfactory	Natural Gas			4" MP in room 055M
Satisfactory	Compressed Air			1/2" room 055M
Satisfactory	Other			2" DI water in room 600M
	Piping & Fittings			
Satisfactory	Cast Iron			water supply, sanitary and storm
Satisfactory	Copper Pipe			domestic water piping
Satisfactory	Copper Tubing			control air
Satisfactory	Steel			standpipe, sprinklers, steam and gas
Satisfactory	Galvanized Steel			to fire pump
Satisfactory	Laboratory			glass and polypropylene on acid waste
	Water Heaters			
n/a	Gas			
Satisfactory	Steam Heat exchanger & Tank			2.5" DHW & 1" HWR
Satisfactory	Tank			two 395 gal tanks
n/a	Steam Instantaneous			
	Drainage			
Satisfactory	Storm Drains			2 @ 10" to west
Satisfactory	Sanitary Drainage			1 @ 8" San waste to the north
Satisfactory	Floor Drains			
Satisfactory	Sewage Pumps			duplex northeast side of building
Satisfactory	Sump Pumps			duplex northwest side of building
	Fixtures (Number)			
Satisfactory	Water Closets			32
Satisfactory	Urinals			10
Satisfactory	Lavatory Sinks			20
Satisfactory	Kitchen Sinks			5
Satisfactory	Service Sinks			6
Satisfactory	Showers			2 ea and 17 emergency showers
Satisfactory	Electric Water Coolers			double spout 6
Satisfactory	Neutralization and PH Tank			1 ea.
	Sprinkler Systems			
Satisfactory	Wet			throughout the building
Satisfactory	Dry			in penthouse
Satisfactory	Preaction			generator and electrical rooms
n/a	Carbon Dioxide			
n/a	Halon			
	Standpipe Systems			
Satisfactory	[X]Wet [X]Dry			
Satisfactory	Fire Hose Valve	[X] 2.5"	[ ]1.25"	in stairwells
n/a	Valve cabinets			

Comments:

- None

Heating

Refer to p. 14 for Narrative

Mechanical & Heating Component Rating	$1,708,488 Component Replacement Cost	X	89% Condition Value Multiplier	=	$1,520,554 Component Value

	Heat Source:	
Satisfactory	Central Plant Steam	3" HPS & 2" CR
	Condensate Return:	
Needs attention	[ ] Condensate Pump [X] Pressure Pump	185 Psi operating pressure
	Pressure Reducing Station:	
Satisfactory	[ ] 1/3 - 2/3 [X] Single	70/10 Psi @ 9,500 #/hr steam generator
	Local Heat Source:	
Needs attention	70 Psi Steam Generator at 9,500 #/hr	humidification and domestic hot water
	Condensate Return:	
Satisfactory	[X] Condensate Pump [ ] Pressure Pump	2 @ 15 GPM & 90 Psi
	Heating System Type:	
Needs attention	Hot Water	8" heating hot water
Satisfactory	Warm Air	
	System Delivery:	
Needs attention	Number/Capacity: Hot Water HEX	2 @ 13,392 MBH
Needs attention	Number/Capacity: Primary HW Pumps [ ] VFD	2 @ 700 GPM
Satisfactory	Number/Capacity: Secondary HW Pumps [X] VFD	2 @ 1,010 GPM
Satisfactory	Number/Capacity: Coil HW Pumps [ ] VFD	4 @ 100-140 GPM
	Delivery Control Type:	
Satisfactory	[ ] Pneumatic [X] Electric [ ] Electronic [X] DDC [ ] DDC Monitor	
	Air Handling Units:	
Satisfactory	Make-up Air [X]Preheat [ ]Heating [ ]Reheat	
Satisfactory	Variable Volume Air [X]Preheat [ ]Heating [ ]Reheat	
	Humidifiers:	
Needs attention	Type/Capacity [X]Box [ ]Steam	2-109 #/hr
Needs attention	Type/Capacity [X]Box [ ]Steam	2-1,110 #/hr
	Air Filters:	
Satisfactory	Pre-filter 30% [ ]DDAHU [X]MUAHU [X]VAVAHU [ ]CAV	
Satisfactory	Filter 95% [ ]DDAHU [X]MUAHU [X]VAVAHU [ ]CAV	
	Space Equipment:	
Satisfactory	Convectors	
Satisfactory	Unit Heaters	in equipment rooms and dock
Satisfactory	Reheat Coils	on VAV boxes
Satisfactory	Fan Coil Units	some VAV boxes
Satisfactory	VAV Boxes	VAV throughout building
Satisfactory	CAV Boxes	on hoods
Satisfactory	2-Pipe Fan Coil	at entrances
	Air-handling Units Control Type:	
Satisfactory	[X]Pneu [X]Electric [X] Electronic [X]DDC [ ]DDC Upgrade	
Satisfactory	Compressed Air	in room 055M
Satisfactory	Variable Frequency Drive [} DDAHU [X} VAV [ ] CAV	

Comments:

- There was no desuperheater or pressure reducing valves installed in this system.
- There were reports that the two heat exchangers overheat the heating water and that hot condensate flashes in the condensate return line when pumped. The designers say that there are no problems; however, overheated water at low demand, high condensing temperatures, steam flashing in the condensate return and broken thermometers in the supply and return heating water lines were noted during several site visits.

- Overheated water temperatures on the hot water side causes the expansion tank fill and the pressure to rise. About 88 Psig was observed at the expansion tank exceeding the 50 Psig design operating pressure causing the pressure relief valve CV-1 to leak.
- Observations indicated large quantities of air present in the heat exchanger.
- The steam generator sight glass failed requiring new parts and new operating procedures.
- The city water needs to be filtered and softened to remove contaminates that clog the water baths or the water baths removed and replaced with a steam valve using purified steam from the generator.

Cooling & Ventilation

Refer to p. 17 for Narrative

Cooling & Ventilating Component Rating	$1,961,198 Component Replacement Cost	x	95% Condition Value Multiplier	=	$1,863,138 Component Value

	System/Capacity				
Satisfactory	Water				
Satisfactory	Other				two year-around water chillers
	Chillers Capacity/Refrigerant/Manufacturer				
Satisfactory	Scroll				one Trane, R-22, 60-ton chiller, DX air cooled
Satisfactory	Screw				two Trane, R-134a, 426-ton chillers
Satisfactory	Screw				one Trane, R-22, 110-ton chiller, DX air cooled
	Condenser Side Cooler				
Satisfactory	Type/Capacity	[X] CW	[ ] DX		2-430 ton BAC towers
Satisfactory	Type/Capacity	[ ] CW	[X] DX		2-Trane LAC cooled condensers
	Condenser Water Pumps				
Satisfactory	Number/Capacity	[ ]VFD			two-1,200 GPM @ 80’
	Primary Chilled Water Pumps				
Satisfactory	Number/Capacity	[ ]VFD			two-853 GPM @ 30’
Satisfactory	Number/Capacity	[ ]VFD			one each - 120 & 220 GPM @ 30’
	Secondary Chilled Water Pumps				
Satisfactory	Number/Capacity	[X] VFD			two 1,050 GPM @ 65’
	Chilled Water Controls				
Satisfactory	[ ] Pneumatic	[X] Electronic	[X]DDC		
	Air Handling Units				
Satisfactory	Make-up Air	[X] CW	[ ]DX		[X]HUMID
Satisfactory	Variable Air Volume	[X] CW	[ ]DX		[X]HUMID
	Air-handling Unit Controls				
Satisfactory	[X] Pneumatic	[X] Electronic	[X] Electric		[X] DDC
	Room Thermostats/Box Control				
Satisfactory	[X] Electric	[X] DDC	[ ]Pneumatic		[X]Electronic
	Distribution Boxes				
Satisfactory	VAV	[X] FC	[X] REHEAT		
Satisfactory	CAV	[ ] FC	[ ] REHEAT		hood exhaust control
Satisfactory	Fan Coil	[X] FC	[X] REHEAT		chilled water
	Control Systems				
Satisfactory	[X]Pneumatic	[X] Electric	[X] DDC		[ ] DDC Upgrade
Satisfactory	Compressed Air				in room 055M
Satisfactory	Variable Frequency Drive		[ ]DDAHU		[X]VAV
	Fans				
Satisfactory	Exhaust equipment				one toilet, four ventilation
Satisfactory	Lab Exhaust				4 exhaust fans, 25,000 CFM ea
Satisfactory	Lab Exhaust				1 special lab exhaust fan
Satisfactory	Re-circulating				2 return air fans

Comments:

- There is a 12-degree delta-T across the chillers in the main chilled water loop.
- The single primary constant-speed chilled water pumps produce a 30' head on the main chilled water loop with a 10" decoupled pipe and temperature sensors on the loop. Generally the decoupling line is sized for a slightly higher velocity and may incorporate a check valve to prevent short-circuiting of chilled water in the secondary loop. This decoupling or bypass line needs to be evaluated and modified if short-circuiting is detected.
- The cooling coils were designed at 92Db/73Wb per OSU specifications; however, ASHRAE recommends higher wet bulb (Wb) temperatures for moisture removal.

Electrical Distribution

Refer to p. 18 for Narrative

Electrical Distribution Component Rating	$338,137 Component Replacement Cost	X	98% Condition Value Multiplier	=	$331,374 Component Value

Service							
Substation	[X] Buckeye	[ ] McCracken Power Plant					
Primary Voltage	[X] 13,200 Volts	[ ] Volts					
Switch Gear Circuit No.	102/206						
Transformer							
Manufacturer	Type	KVA	Secondary/Voltages	Room			
Siemens	Air	1,500	480/277	060M			
Siemens	Air	1,500	208/120	060M			
Distribution System							
Motor Control Center (MCC) Room 055M and Room 602M							
Panel board	[X] Fused	[ ] Circuit Breakers					
Voltage	[X] 480/3	[ ] 277/3	[ ]208/3	[ ]240/1			
Amperage	[ ]1200A	[ ] 800A	[X] 600A	[ ]400A	[X]200A		
Lighting Room 060M							
Panel board	[X] Fused	[X] Circuit Breakers					
Voltage	[ ] 480/3	[X] 277/3	[X] 208/3	[ ] 240/1			
Amperage	[X] 800A	[X] 400A	[ ] 250A	[X] 200A	[ ] 150A	[ ] 100A	
Building Power Room 060M							
Panel board	[X] Fused	[X] Circuit Breakers					
Voltage	[ ] 480/3	[ ] 277/3	[X] 208/3	[ ] 240/1			
Amperage	[ ] 800A	[ ] 400A	[ ] 250A	[X] 200A	[ ]150A	[ ]100A	
Isolated Ground Power Room 060M							
Panel board	[ ] Fused	[X] Circuit Breakers					
Voltage	[ ] 480/3	[ ] 277/3	[X] 208/3	[ ] 240/1			
Amperage	[ ] 400A	[ ] 250A	[X] 200A	[ ] 150A	[ ] 100A		
Conduit and wire							
Conduit	[X] Steel	[ ] Aluminum	[ ] PVC	[X] Flexible			
Conductor	[X] Copper	[ ] Aluminum	[ ] MIT				
Wire	[X] PVC Cover	[ ] Romex	[ ] Armored Cable(BX)				
Emergency System							
[ ]Battery backup Room							
[X]Emergency Panel Room 050M and 051M							
[ ]UPS Room							
Emergency Generator							
3 ea-300 KVA or 275KW, 2 @480V, 1 @ 208V							

Comments:

- None

Lighting & Power

Refer to p. 18 for Narrative

Electrical Lighting & Power Component Rating	$2,669,536 Component Replacement Cost	x	98% Condition Value Multiplier	=	$2,616,145 Component Value

	Lighting (lamp type)				
n/a	Fluorescent 40 watt				
Satisfactory	Fluorescent 32 watt				and 26W
Satisfactory	Fluorescent Can				entrances and lobbies
n/a	Incandescent				
Satisfactory	[X] HID [ ] Mercury [ ] HPS		[X] Metal Halide		
Satisfactory	Low Voltage (12V)				wall illumination
	Lighting Levels				
Satisfactory	Halls				
Satisfactory	Rooms				
Satisfactory	Mechanical Rooms				
	Fixture Condition				
Satisfactory	Fixtures				
Satisfactory	Bulbs				
Satisfactory	Fixture Lens				
	Receptacles & Switches				
Satisfactory	Wall Outlet 20A				
Satisfactory	GFIC Breakers				
Satisfactory	Switches				
Satisfactory	Cover Plates				
	Special				
Satisfactory	Lightning Protection				
Satisfactory	Alarm	[X] Environ	[X] Security	[X] Doors	
Satisfactory	Telecommunication	[X] Phones	[X] Data	[ ] Cable TV	
Satisfactory	Communication Panel:	[ ] MDI	[X] LENEL	[X] DDC	
Satisfactory	To:	[ ] Local	[X] Building Automation Shop		
Satisfactory	Fiber Optics				
Satisfactory	Security				

Comments:

- None

Safety Standards

Refer to p. 19 for Narrative

Safety Standards Component Rating	$1,470,616 Component Replacement Cost	X	98% Condition Value Multiplier	=	$1,441,204 Component Value

	Exits – Stair Construction			
n/a	Concrete			
Satisfactory	Steel			with concrete fill
Satisfactory	Wood			
Satisfactory	Number of Exit Stairs			2
Satisfactory	Number of Other Exits			5
	Fire Rating			
Satisfactory	Construction Type II			
	Building Height	96.5 feet, five stores including ground floor and penthouse		
	Extinguishing Systems			
Satisfactory	Portable			
Satisfactory	Standpipe			in stairwells
Satisfactory	Sprinklers			100% coverage
n/a	Gas Suppression			
	Detection & Alarm Systems			
Satisfactory	Annunciator Panel		065M with remote panel at west entrance	
Satisfactory	Pull Stations			
n/a	Bells			
Satisfactory	Horns			
Satisfactory	Strobes			
Satisfactory	Smoke Detectors			
Satisfactory	Halls			
Satisfactory	Elevators			
Satisfactory	Rooms			
Satisfactory	Equip Rooms			
Satisfactory	Ducts			
	Building Reporting Systems			
Satisfactory	Remote Panel:	[ ] MDI	[X] LENEL	
Satisfactory	To:	[X] Service Center [X] Security	[X] Department of Public Safety [X] Key Control	
	Lighting Systems			
Satisfactory	Exit Signs	[ ] BATTERY	[X] EMC	
Satisfactory	Exit Lighting	[ ] BATTERY	[X] EMC	
Satisfactory	Emergency Lighting	[ ] BATTERY	[X] EMC	
Satisfactory	Emergency Generator			3 @ 300 KVA
n/a	Other			

Comments:

- None

Perimeter Refer to p. 19 for Narrative		
	Building Access	
Satisfactory	Driveway	west
Satisfactory	Loading Dock	west
	Sidewalks--concrete	
Satisfactory	Front	east
Satisfactory	Sides	north and south
Satisfactory	Rear	west
	Steps	
n/a	Front	
n/a	Side	
Satisfactory	Rear	to dock area
Satisfactory	Ramp	to dock area
	Lawn and Landscaping	
Satisfactory	Lawn	
Satisfactory	Shrubs	
Satisfactory	Trees	
n/a	Undesirable Insect	
Satisfactory	Bedding Material	
Satisfactory	Watering System	hose bibbs
	General Site Information	
Satisfactory	Signage	
Satisfactory	Address Identification	
Satisfactory	Security Lights	
Satisfactory	Street Lights	
Satisfactory	Drainage	
Satisfactory	Storm Drains	

Comments:

- None

BUILDING AUDIT METHODOLOGY

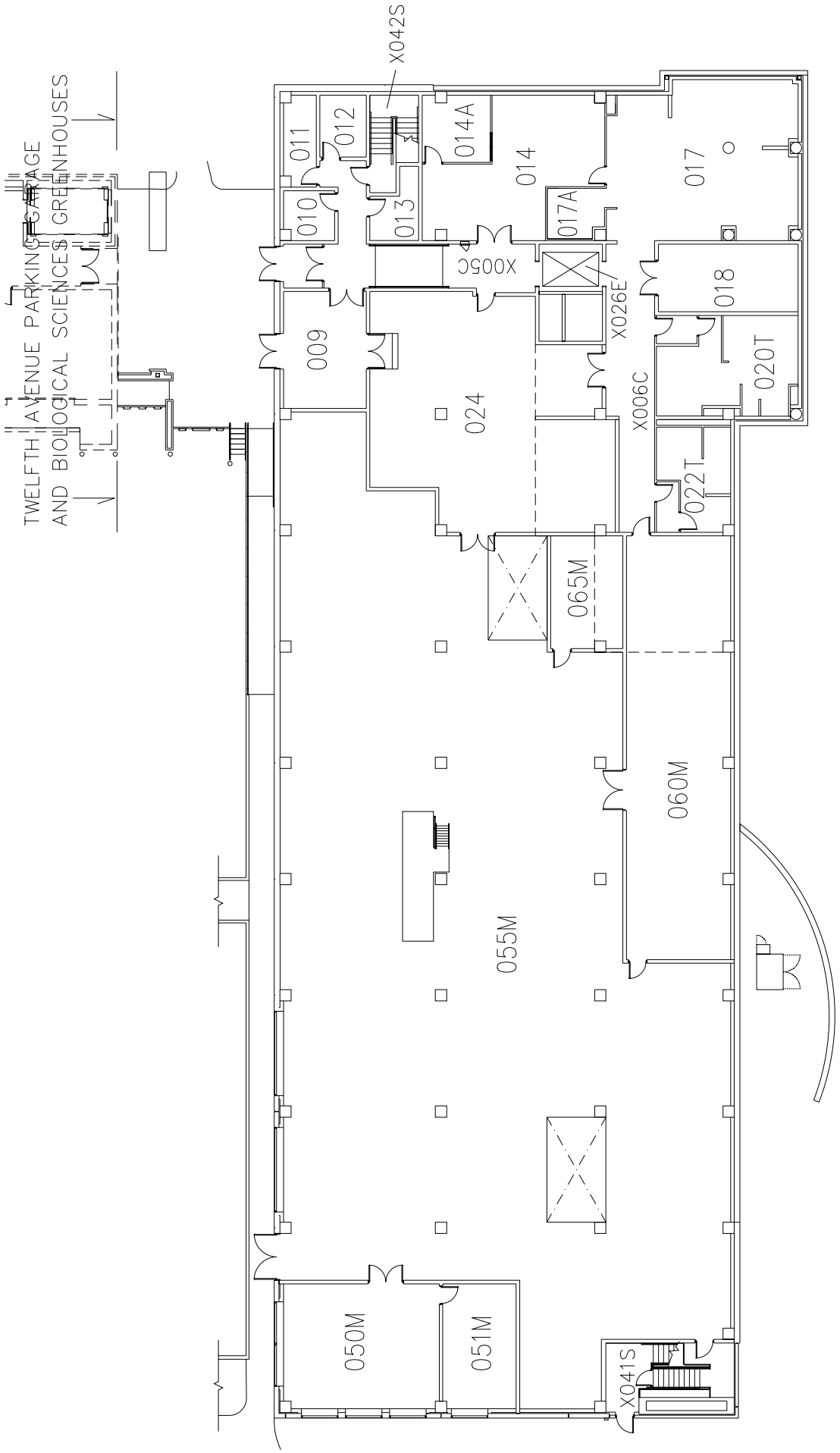
1) BUILDING AUDIT PROGRAM OBJECTIVE
   To provide a building inventory, including maintenance deficiencies that currently exist, for the 136 OSU buildings audited that the Department of Physical Facilities has fiscally responsibility for. These audits will be used to establish repair and renovation projects, to prepare budget cost estimates for these projects for determining overall levels of required maintenance funding.
2) BUILDING AUDIT APPROACH. A five-step procedure is used to meet the program objectives:
   a) Collect historic workorder and drawing data on each building.
   b) Interview building coordinator and shop personal.
   c) Perform an exterior and interior building inspection.
   d) Complete building evaluation forms.
   e) Prepare budget cost estimates for deferred maintenance and building improvement projects.
   f) Issue written report for hard copy and web page distribution.
3) DATA ORGANIZATION
   The data collected is stored by hard copy with field notes in a building file established for each building. The audit report costs data is stored in a projects database that allows retrieval of specific data as needed. The "Building Evaluation" forms contain ratings for the condition of each building component and a description of any deficiencies for those components. The "Building Information" sheets provide data on the utilities to the buildings and the type of building systems found in each building.
4) COST ESTIMATES
   Costs are for budgeting purposes only and are based on the Means Standard Construction Cost data, auditor experience, industry sources and OSU project cost data. Costs are reported current to the year of the audit. The building component values assigned in the "Building Evaluation" forms are not cost estimates. These values are calculated from the replacement cost provided by Facilities Planning and Development for each OSU building. The building replacement cost is allocated to each building component to provide an estimated value for each component. Project cost estimates will vary from the building component values in most situations because of scope of work, demolition and removal, material handling and site limitations that occur in building component replacement projects.
5) DATA USAGE
   Repair and Renovation Projects provided to assist in the budgeting process for the Department of Physical Facilities. Building Evaluations provided to give a numeric rating for each building on campus quantifying its percentage of deficiency.
6) LIMITATIONS
   a) All inspections are visual and do not include physical tests, instrument measurements, sampling, or monitoring.
   b) Only random typical offices or laboratories are entered. Typical spaces are deemed to be representative of average conditions throughout each building.
   c) The scope of the analysis does not include complete OSHA, energy, or physically impaired ADA access study. Buildings and components are inspected for condition and general safety requirements rather than specialized code conformance.
   d) It is assumed that the State of Ohio Division of Factory and Building Inspection at the time of construction approved the buildings inspected. The recommendations listed in the reports are not an attempt to bring these existing buildings up to present-day code standards. Rather, the intent is to restore components to original conditions and to upgrade the buildings in a reasonable manner in regard to occupant safety.
   e) Cost estimates are in current year dollars and include contractor mark-ups, construction administration costs, and architectural/engineering costs where applicable. Escalation factors must be applied for future work. Combining of projects should serve to decrease costs. These estimates are strictly for purposes of budgeting, and final pricing will be required when the specific scope of work for the project is defined.
   f) The building inspections are defined as follows:
      i) Includes:
         (1) General repainting and redecorating.
         (2) Replacement of building system components.
         (3) Ongoing maintenance, replacement and renovation projects.
         (4) Exterior building walls and attached items.
         (5) Sidewalks and driveways to all entries and ramps outside the buildings.
         (6) The program needs of the using department are assumed satisfied, unless specified.
      ii) Excludes:
         (1) Blinds, drapes, light bulbs, and movable furniture.
         (2) Fixed equipment inside the buildings that is installed and maintained by a specific academic department or using agency.
         (3) Utility lines supplying the buildings.

      No consideration has been given to anticipate any changes in current occupant use or space needs.

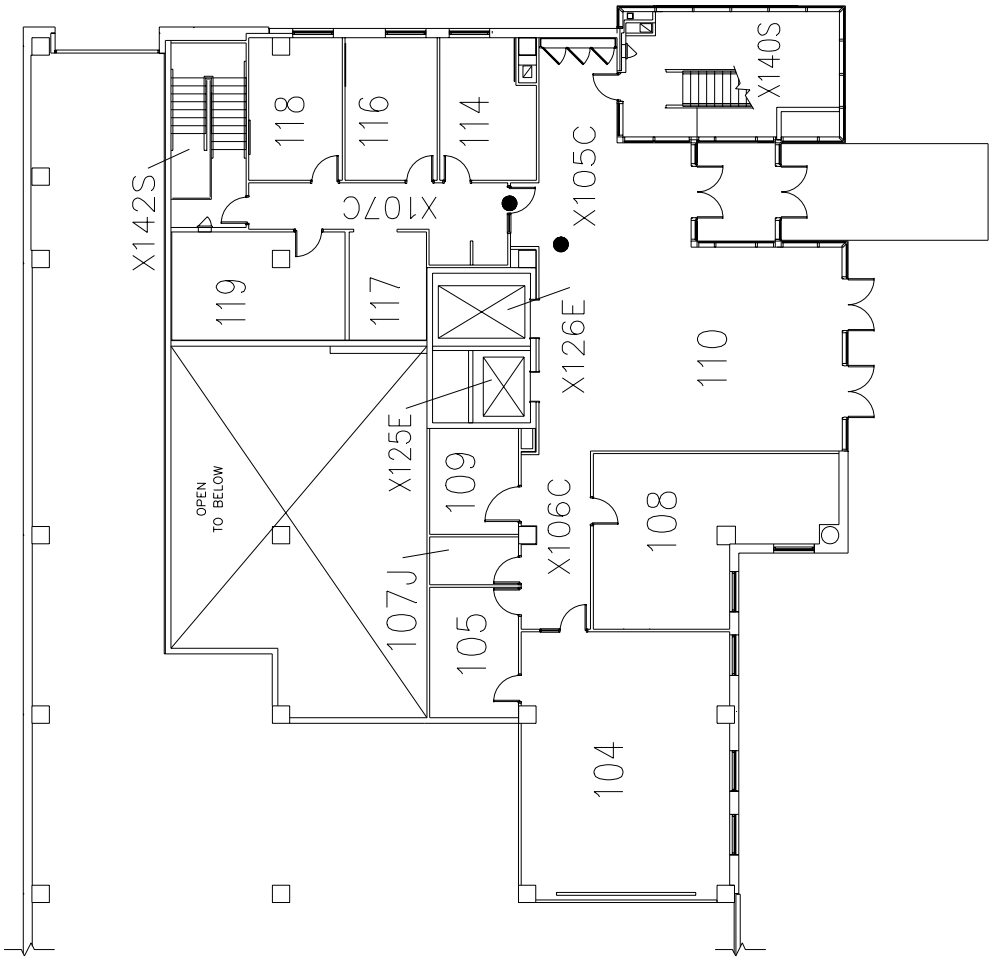
ABBREVIATIONS

A/C	Air Conditioning
AHU	Air Handling Unit
ATT	Attention
BLDG	Building
BUR	Built Up Roof
CAV	Constant Air Volume
COND	Condensate Water
DDAHU	Dual Duct Air Handling Unit
DDHV	Dual Duct High Velocity
DHWH	Domestic Hot Water Heater
DHWR	Domestic Hot Water Return
DHWS	Domestic Hot Water Supply
DHWT	Domestic Hot Water Tank
DX	Direct Expansion Air Conditioner
EWC	Electric Water Cooler
Environ	Environmental
FPM	Feet Per Minute
GPM	Gallons Per Minute
HID	High Intensity Discharge Light
HPS	High Pressure Steam (125 PSI)
HVAC	Heating, Ventilating and Air Conditioning
KV	Kilovolts
KVA	Kilovolt Amps
KW	Kilowatts
LC	Liquid Cooled
LF	Lineal Feet
LPG	Low Pressure Gas
LPS	Low Pressure Steam (15 Psi)
MBTUH	Thousand British Thermal Units per Hour
MCC	Motor Control Center
MPG	Medium Pressure Gas
MPS	Medium Pressure Steam (50 Psi)
MZ	Multi-Zone
MZCV	Multi-Zone Constant Volume Air Handling
N/A	Not Applicable
#/hr	Pounds per Hour
PSI	Pounds per Square Inch
Psig	Pounds per Square Inch Gage
RM	Room
RTU	Roof Top Unit (Heating or A/C)
S/P	Stand Pipe
SAT	Satisfactory
SBS	Styrene-Butadiene-Styrene Modified Roofing
SF	Square Feet
SR	Steam Return Line
SS	Steam Supply Line
SY	Square Yards
TR	Terminal Reheat
V	Volts
VAV	Variable Air Volume

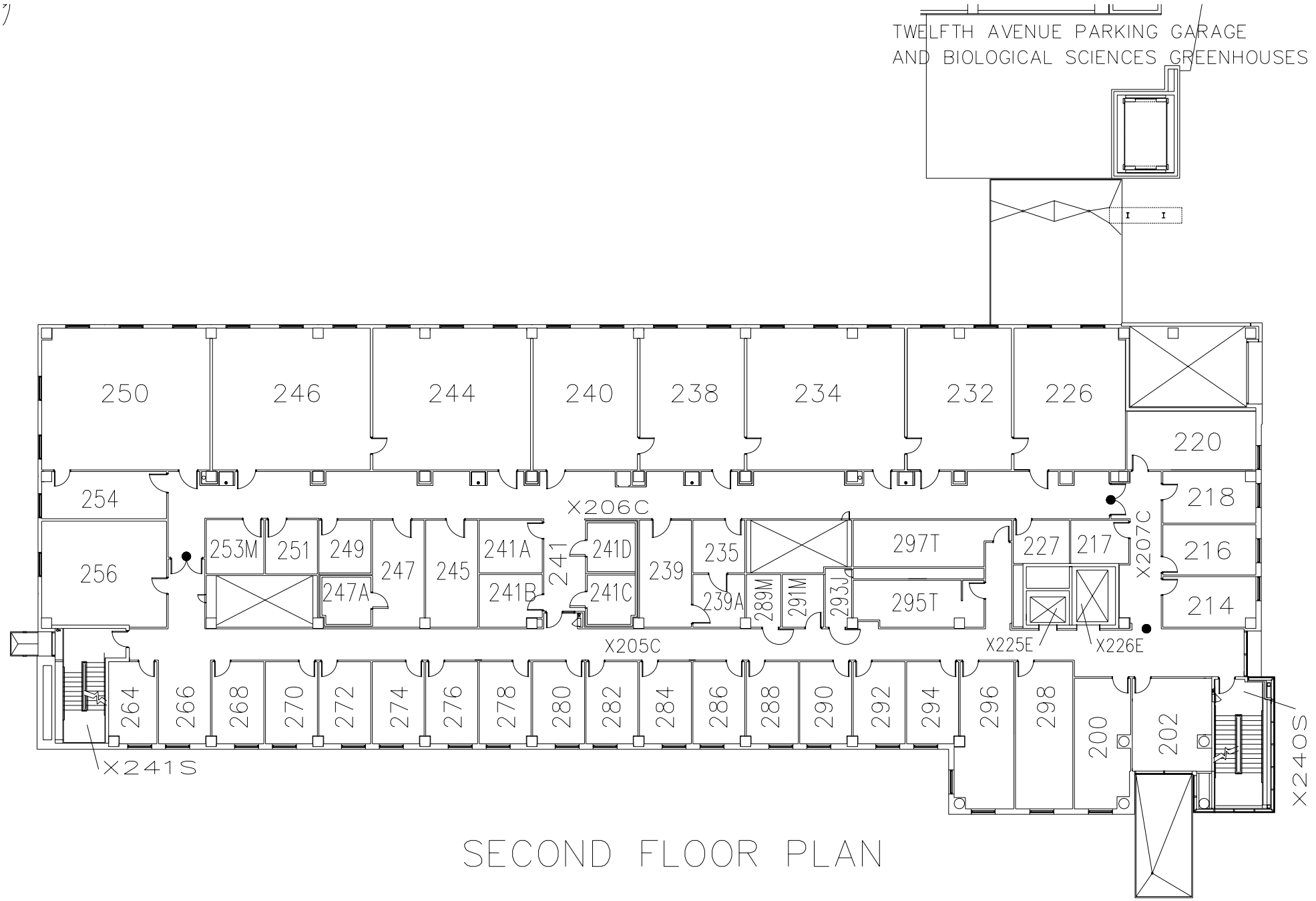
Reduced Scale Building Floor Plans



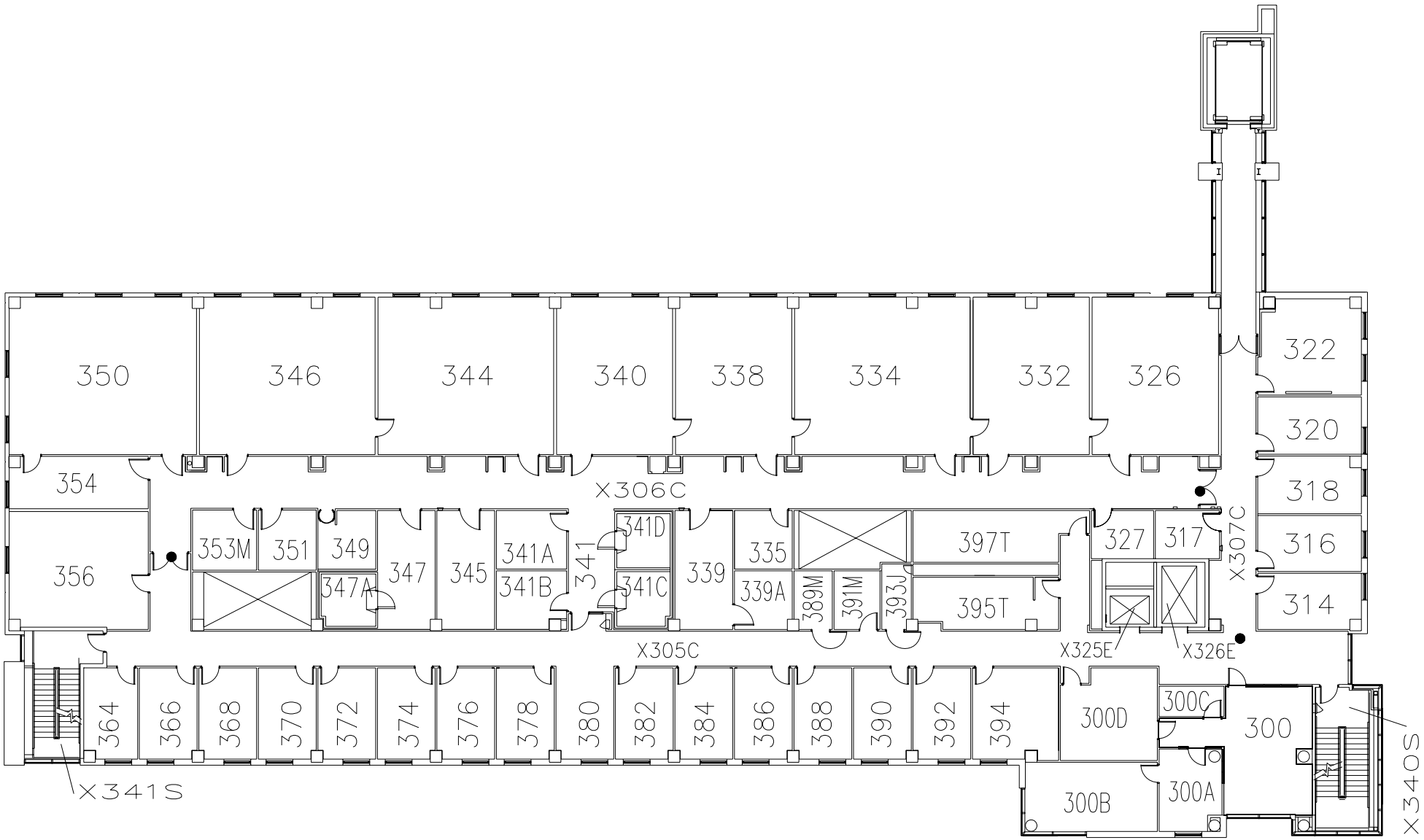
GROUND FLOOR PLAN



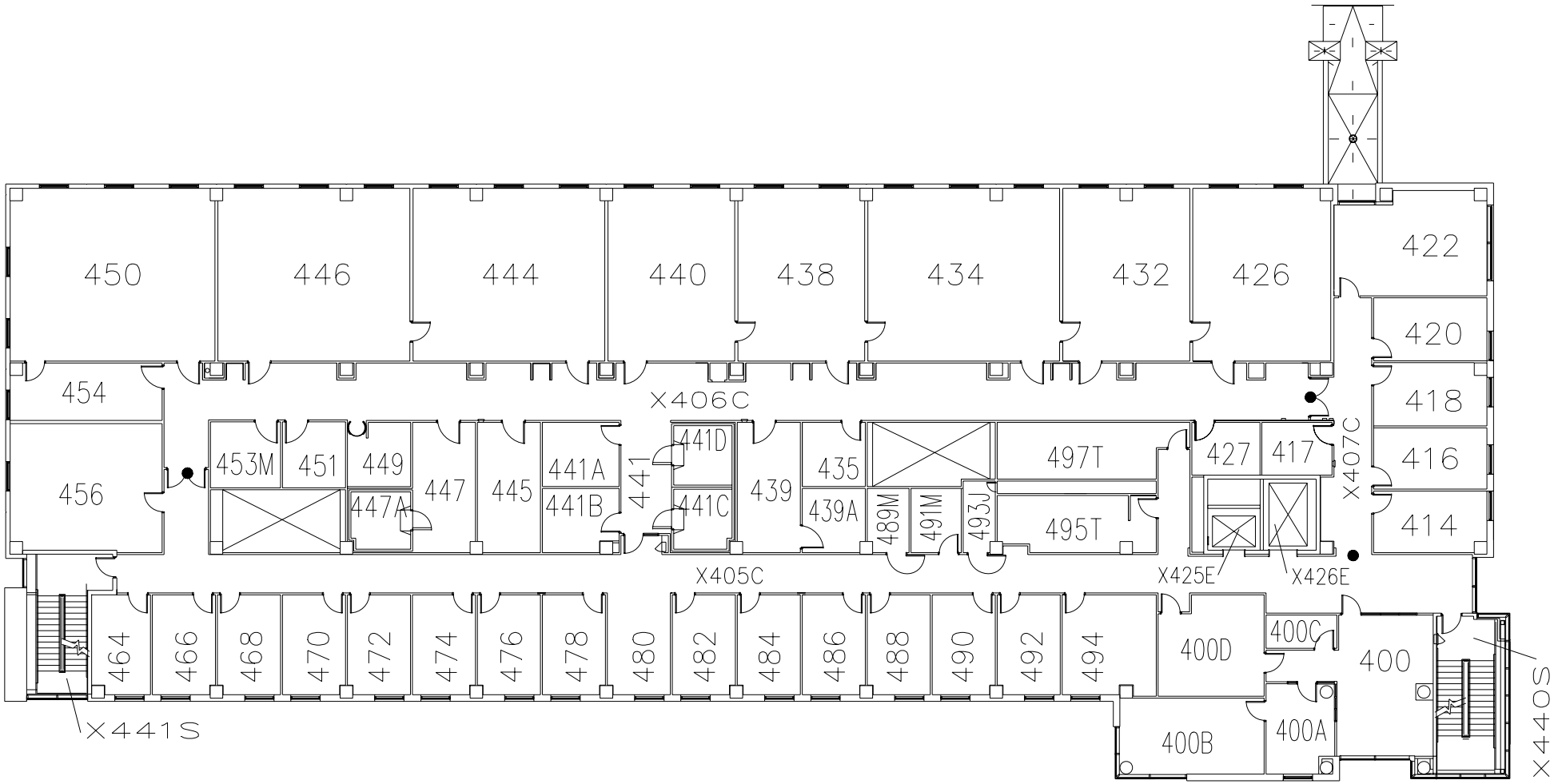
FIRST FLOOR PLAN



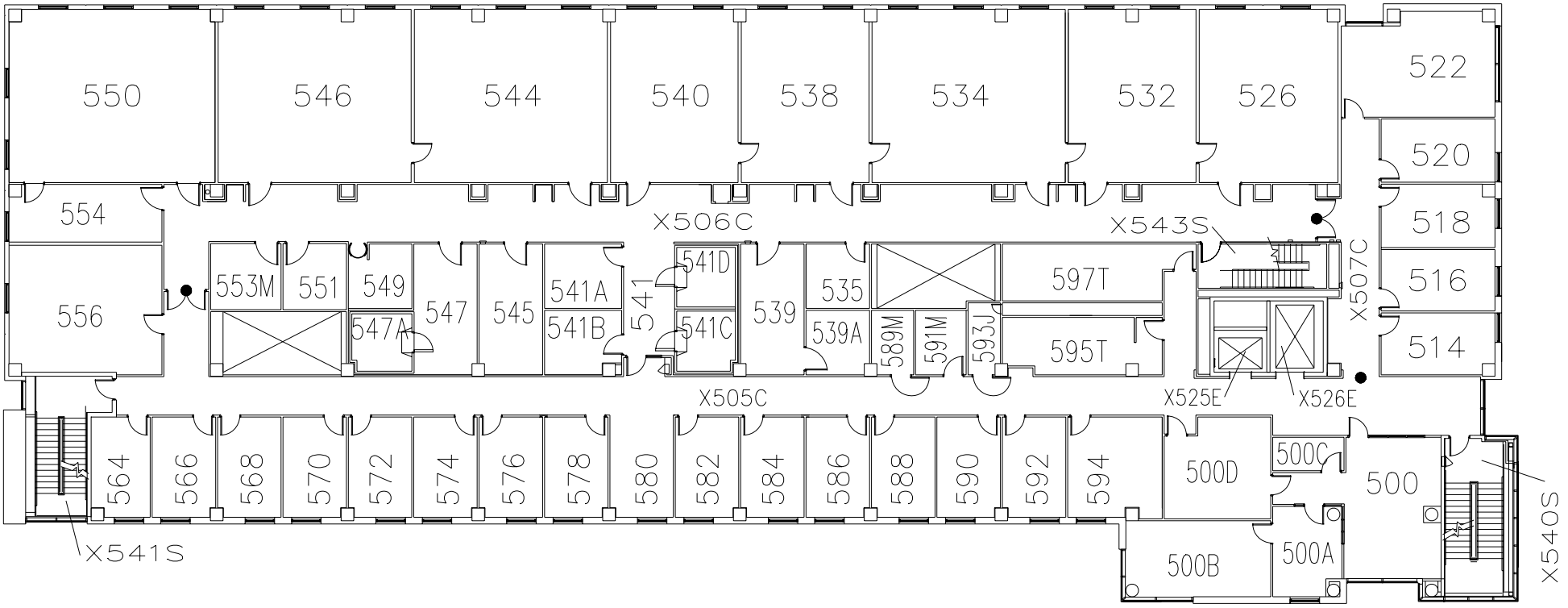
SECOND FLOOR PLAN



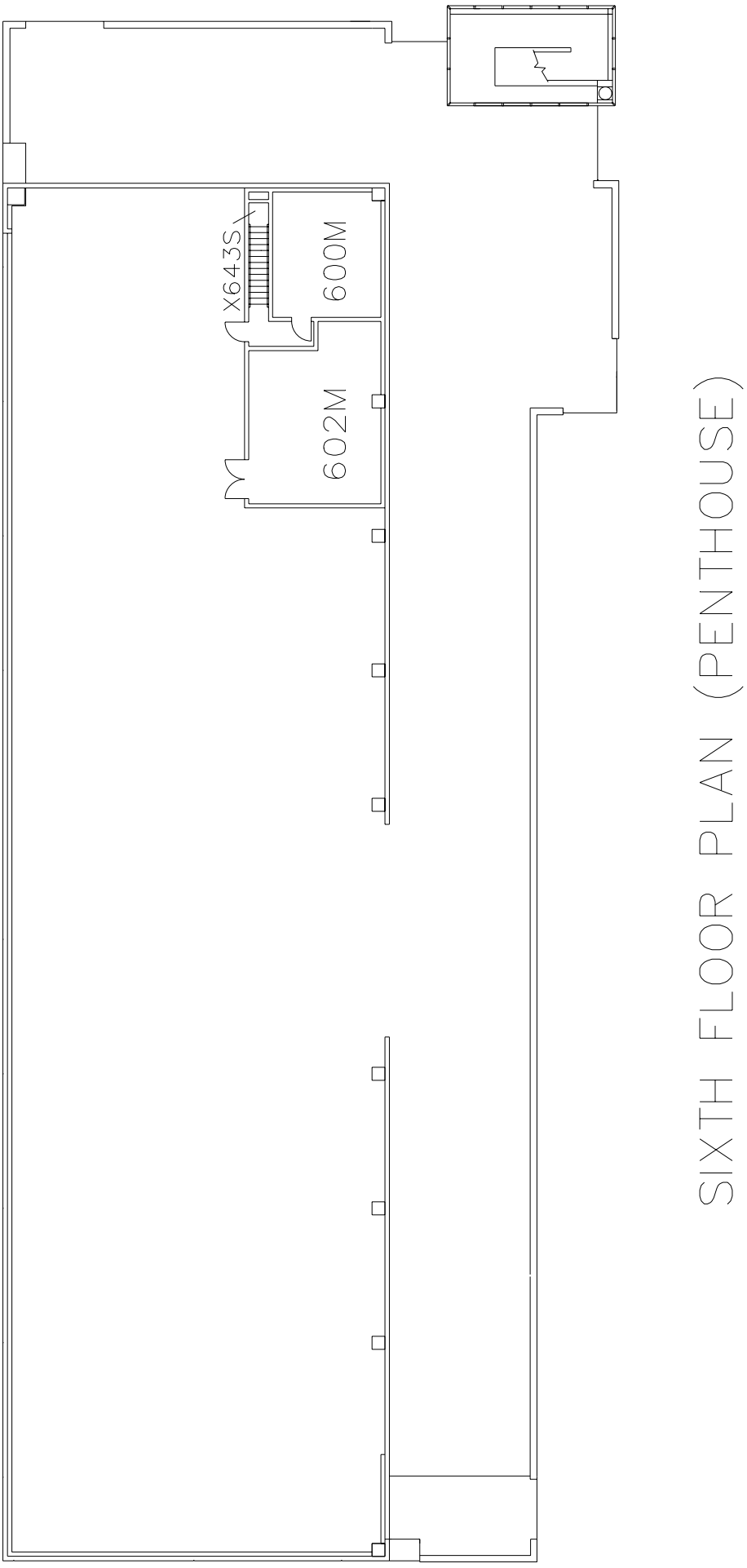
THIRD FLOOR PLAN



FOURTH FLOOR PLAN



FIFTH FLOOR PLAN



SIXTH FLOOR PLAN (PENTHOUSE)