Appendix B: Analysis of Mechanical and Electrical Systems

ANALYSIS OF

Mechanical and Electrical Systems

For

Haverford Township Library
1601 Darby Road
Havertown, PA 19083

prepared by:

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Date: March 6, 2003

INTRODUCTION

This report is based on a site visit and discussions with library personnel. A walk-through of the facility was conducted on January 21, 2003. Drawings of the original mechanical or electrical systems for the building were reviewed in conjunction with the site visit.

The library consists of an older stone structure originally built as a bank and a modern addition that was constructed approximately 30 years ago. The addition includes a mechanical room in the basement, which houses the majority of the mechanical and electrical systems. This report includes an assessment of the existing condition for each system

EXECUTIVE SUMMARY

The mechanical and electrical systems are generally original to the building and are past their expected useful lives in virtually all cases. The original systems and equipment were of high quality and generally remain functional. As time goes on the cost of maintenance and repair, the likelihood of emergency repairs, and operating difficulties can be predicted to increase. In addition significant opportunities exist to improve the operation of the building and reduce the energy consumption.

Specific areas of concern include the following:

- Rusting of electrical service equipment
- Deteriorated condition of the basement emergency distribution panel
- Out-of-date fire alarm system
- Uneven Heating and Cooling performance
- Failing insulation on HVAC and domestic water piping
- Liability from underground fuel oil storage tank
- Inadequate toilet room ventilation
- Condition of the cooling tower and appurtenances
- Outdated control systems
- Electrical panelboard manufacturer is no longer in business
- Inadequate light levels in many locations
- Inefficient light fixtures

To correct the deficiencies identified in this report and bring the building's mechanical and electrical systems up to an expected service life on the order of 25 years will require significant capital investment. Based on preliminary assumptions about the scope of work to be undertaken, the construction cost for the mechanical and electrical contractor's work would be in the $500,000 to $750,000 range. A phased approach to the work could be considered to permit continued occupancy of the facility and reducing the capital required each year, albeit with some significant shuffling of spaces and functions as the work is accomplished.

MECHANICAL SYSTEMS

HEATING VENTILATING AND AIR-CONDITIONING (HVAC)

System Description

The building is heated primarily by perimeter radiation and hot water heating coils in the supply air system. Convectors and radiation, in some cases with custom casework enclosures, are generally installed beneath the windows. Many of these sections of radiation include non-electric control valves. The building is served by a single cast-iron sectional boiler located in the basement mechanical room. The boiler is a Weil McLain model PL-788 – WF oil fired boiler rated for nominal 1200 MBH. Two in-line zone pumps, Bell and Gossett series 60, serve the existing and the new zones in the building. The boiler is reaching the end of its expected useful life and is presently in fair but serviceable condition. The condition of the piping could not be directly observed, but there is no evidence of significant leaks or reports of failures. There is some evidence of corrosion at the in-line pumps and valves in the mechanical room. The insulation is falling off in several locations. The condition of the custom casework enclosures varies widely throughout the library; in several locations the grilles have been damaged and are in need of repair. The run out piping is copper in most instances and appears to be in good condition.

The plans indicate a 6000 gallon underground fuel oil storage tank. The possibility of a leak in this tank presents a liability to the library as there is the potential to contaminate underground water supplies. Replacement of the tank with a modern double-walled fiberglass tank is indicated.

The building is cooled primarily by a chiller system with chilled water coils in the supply air stream. The Carrier Model LCH90W chiller is located in the basement mechanical room and, overall, is in poor condition, although it has no reported problems to prevent it from operating. The chiller is original to the construction and it includes a remanufactured compressor of unknown age. The compressor is in fair condition. The chiller is past its expected useful life and will need to be replaced in the near future. In addition the present chiller utilizes a great deal of electricity to produce cooling, when compared to chillers of similar capacity currently available on the market.

The cooling tower similarly is past its expected useful life and will need to be replaced in the near future. The cooling tower is a Marley tower model NC-6 and is located on the roof. The tower had been drained for the winter but the cold water fill line had ruptured. There is no heat trace or insulation on the cold water fill line. There is significant rusting of the disconnects and even spalling of the support steel for the tower. There is some rusting of the distribution basins at the top of the tower as well. Overall the tower is in poor condition. The condenser water system does include a water treatment component under a service contract. The condenser water pump is a base-mounted Bell and Gossett series 510 5 HP pump. It is past its expected useful life and is in fair condition.

The chilled water pump is also a Bell and Gossett series 510 5 HP pump. The chilled water pump insulation is falling off and due to the condensation on the exposed metal surfaces, the piping, pump, and accessories are rusting. The condenser water and the chilled water in the mechanical room are welded steel pipe and there were no reported problems or leaks. The insulation is falling off the distribution piping as well, as in some locations causing damage from dripping condensation.

The air distribution system for the building consists of two air handling units and a roof top unit. A modular air handling unit, York tag AH-1, is located in a small fan room on the second floor. The unit consists of a fan section, 4-pipe chilled water and hot water coils, and filter section. The fan is relatively noisy and the vibration isolation mounts do not appear to act effectively. The room is used as a plenum for the return air via a transfer grille. There is no fire damper in the wall opening.

A large built-in-place air handling unit, tagged AH-2, is located in the basement mechanical room. This is also a 4-pipe arrangement with fan, split chilled water coil, hot water coil, filter bank, plenum and return fan. There is an outside air-mixing chamber with a hot water unit heater inside, used to preheat the outside air. The filter bank, include primary filters and a bank of bag filters and they were relatively clean at the time of our visit. The return fan is an in-line Barry Blower fan. This unit serves the majority of the addition and the drawings indicate that there are VAV boxes to regulate temperature on a smaller zone basis. Some of the diffusers, for example in the reference area, have been taped over presumably to prevent excessive air delivery in that area.

The control system is a Powers pneumatic system and includes control panels at each air handler and the chiller. The system is supplied by a Quincy duplex air compressor with a Hankinson filter dryer. At the time of installation this was a high quality control system. With the advent of Direct Digital building automation systems, the pneumatic controls are out of date and a source of continuing calibration and maintenance problems. Some of the thermostats have been subject to physical damage. There have been reports of uneven heating and cooling and a lack of cooling capacity. These complaints may indicate calibration or individual control problems or problems with the overall heating and cooling systems. Further troubleshooting would be required to determine the extent of the difficulties.

A rooftop unit was added at some point after the original construction of the addition. This unit is a Carrier model 50 DJ0055 and appears to be dedicated to the computer center. It is in fair condition and although the age is unknown it only has an expected useful life of 15-20 years. This unit includes electric heat as a backup and would be very expensive to operate in heating mode.

A central toilet room exhaust is located on the roof. There have been complaints of insufficient exhaust from the toilet rooms. An upgrade to this system, possibly including dedicated exhaust from each toilet room, may be warranted.

The elevator machine room is separated from the mechanical room by a metal fence and a lay-in tile ceiling. Condensation from the piping above the ceiling has apparently dripped onto the tiles to the point of failure.

Expected Service Lives of System Components

COMPONENT	YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING EXPECTED SERVICE LIFE	CONDITION
Boilers	ORIG	35	NONE	FAIR
Circulating Pumps	ORIG	20	NONE	FAIR
Chiller	ORIG (Rebuilt compressor)	23	NONE	POOR
Cooling Tower	ORIG	20	NONE	POOR
Chilled Water Pump	ORIG	20	NONE	POOR
Air Handling Units	ORIG	25	NONE	FAIR
Rooftop Unit	UNKNOWN	15	NONE	GOOD
Exhaust Fans	ORIG	20	NONE	FAIR
Radiation and Convectors	ORIG	25	NONE	VARIES

Note: Estimated service lives of components and equipment, where applicable, are taken from the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) article entitled, "Owning and Operating Costs," in the 1995 HVAC Applications Handbook.

System Deficiencies Summary

1. Replace underground fuel oil storage tank.
2. Replace toilet exhaust system.
3. Replace existing controls with DDC (Direct Digital Control).
4. Repair/Replace circulation systems.
5. Replace all equipment including cooling tower, air handlers, pumps, etc.

PLUMBING

System Description

Generally domestic water distribution is copper piping and sanitary drainage is cast iron. Domestic water piping is concealed for the most part. The plumbing piping generally appears to be in serviceable condition and no leakage was noted. Insulation of the domestic water piping is missing in many locations. The domestic water service is nominally 1-1/2" size and the condition of the service from the main in the street cannot be determined.

Plumbing fixtures consist of tank-type wall-mounted water closets, wall-mounted lavatories with gooseneck faucets, and wall-mounted urinals with flush valves. All fixtures appeared to be in serviceable condition at the time of our visit.

Rainwater from the roof is collected by roof drains and carried by interior rainwater conductors to the public sewer. Virtually all of the roof drains have missing or broken strainer baskets.

Seepage and infiltration of ground water have been problems in the past. Sump pumps have been added over the years and are reported to presently keep up with the load. This is consistent with the reports of a spring running under the building. There is a duplex 1-1/2 HP sump pump located in the mechanical room, a separate simplex sump serving the areaway, and a small simplex pump located in the catacombs.

System Deficiencies Summary

1. Repair/Replace insulation systems.
2. Replace roof drain strainer.
3. Convert all sump pumps to duplex (addressing infiltration of storm water is preferred).

ELECTRICAL SYSTEMS

ELECTRICAL SERVICE AND DISTRIBUTION

System Description

Electrical service to the building is a 13.2 KV primary undergound electrical service from PECO Energy feeding a unit substation located in the basement and manufactured by Federal Pacific (FPE). The switchgear consists of a high voltage switch and fuses, 13.2KV to 208Y/120-volt transformer, current and potential transformers for metering, and a distribution breaker section. After a 1000 Amp main breaker, the 208/120-volt 3-phase secondary power is distributed to distribution panels located throughout the building. The chiller and AH-2 are served directly from the switchgear at 208 volts.

There is some rust at the base of the enclosure and evidence of standing water in the mechanical room of up to several inches. Distribution conduits are buried in the slab and their condition could not be determined. They may be compromised due to water infiltration at some point in time.

A sheet metal shield has been installed above the gear, ostensibly to protect it from any leakage from the expansion tanks above.

The distribution panels throughout the building are manufactured by Federal Pacific. Replacement breakers are, generally, no longer available. Many of the panels have no space left for additional breakers.

System Deficiencies Summary

1. Replace unit substation.
2. Investigate below slab conduits and reroute if required.
3. Replace all FPE panelboards.
4. Relocate expansion tanks away from unit substation.

LIGHTING

System Description

Lighting fixtures throughout the building are a mix of incandescent and fluorescent fixtures. The predominant light fixtures are 2-lamp T12 recessed fluorescent fixtures with acrylic lenses. In the two-story space (the old bank floor) the fixtures include HID downlights and track lights. Fluorescent cove lighting is provided in the reading room. Incandescent lighting remains in a few locations but many of the original downlight fixtures have been replaced over time. In the basement corridors, toilet room corridors, and throughout the library, the original downlight housings have been left in the ceiling with surface mounted fluorescent fixtures with wrap around acrylic lenses installed over the empty housings. Generally light levels are below the norm for library spaces, particularly in the stack areas.

There is significant opportunity for improved light levels and reduced energy consumption with upgrades to current light fixtures.

Aside from a couple of stand-alone battery pack fixtures, the emergency lighting is integrated with the building lighting. A Kohler 40 KW emergency generator is located in the basement and provides back-up power to the emergency lights. The emergency distribution panel located in the basement is seriously corroded to the point of imminent failure. Demonstration of proper emergency power system operation is a critical item.

Emergency lighting operation was not specifically observed during our visit. Testing of the emergency generator and observation of the appropriate light levels should be conducted once per month. Exit signs are generally provided to identify the egress paths and are in fair condition.

System Deficiencies Summary

1. Test emergency system and repair/replace as necessary.
2. Provide new lighting in all areas for improved performance and energy savings.

BRANCH CIRCUIT WIRING AND WIRING DEVICES

System Description

In general, receptacles are 3-prong grounded type receptacles.

In general, branch circuits are distributed mainly by use of armored (AC) and metal clad (MC) cabling or conduit systems. There is also some use of non-metallic (NM) cabling, which is only permitted in inaccessible protected locations in this type of building.

The cover was missing from distribution panel on the second floor in the air handler room. Based on observation at this panel, there do not appear to be separate grounding conductors installed for individual circuits.

System Deficiencies Summary

1. Replace all NM cable with MC cable.
2. Provide separate grounding conductors.
3. Provide TVSS for computer loads.

Expected Service Lives of System Components

COMPONENT	YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING EXPECTED SERVICE LIFE	CONDITION
Unit Substation	ORIG	25 YRS	NONE	POOR
Panelboards	ORIG	25 YRS	NONE	POOR
Distribution and Wiring	ORIG	25 YRS	NONE	FAIR
Lighting	ORIG	20 YRS	NONE	VARIES

FIRE ALARM AND DETECTION SYSTEM

System Description

This building is protected by an automatic fire detection and alarm system. The system consists of manual pull stations, audible (bell) alarms and smoke detectors. The condition of the fire alarm system could not be determined, however it is assumed to be original to the building with no evidence of any upgrades over the years. Devices are generally not located in all appropriate locations and are not ADA compliant.

System Deficiencies Summary

1. Provide devices to meet current codes.

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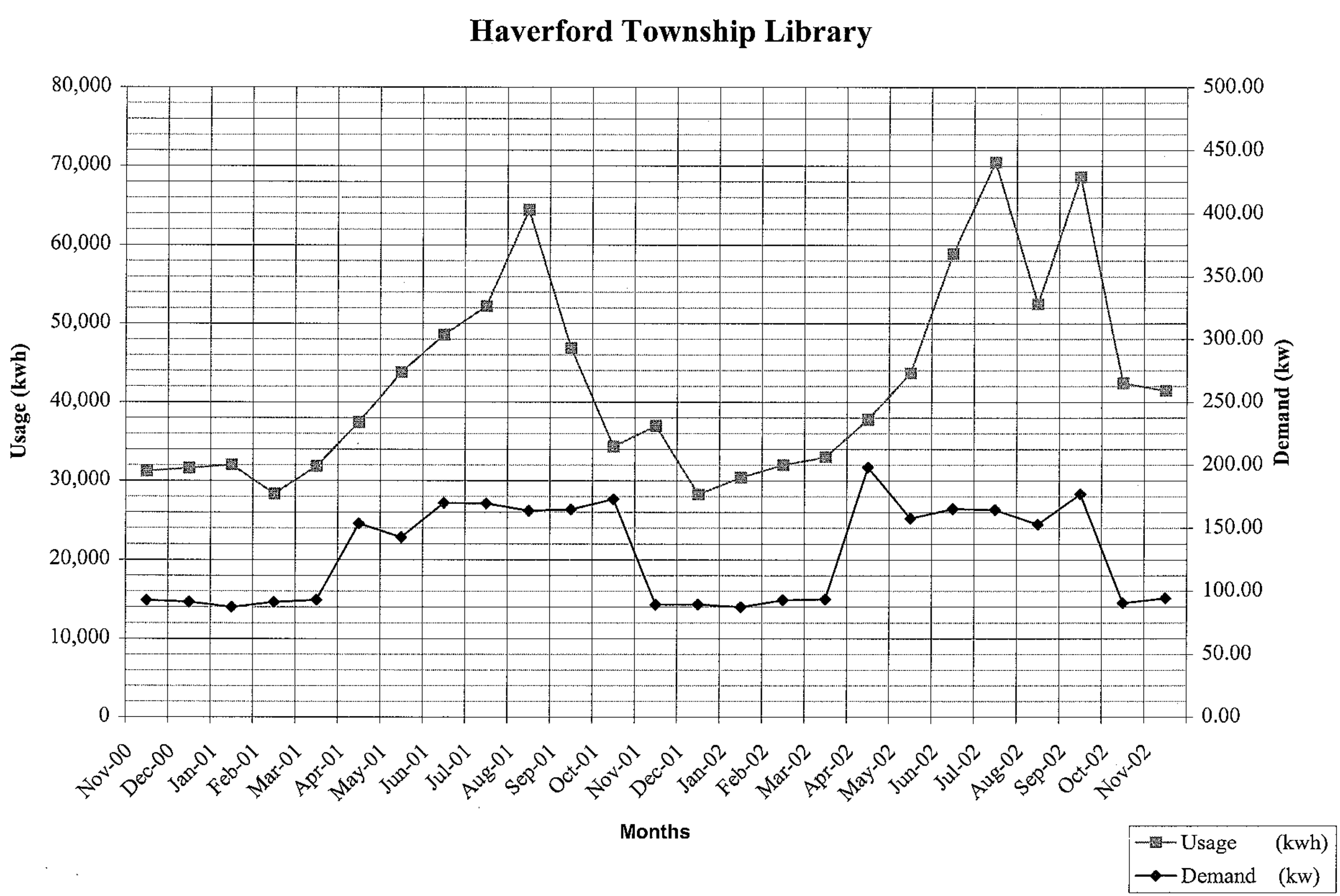
03-011\Docs\Conditions Report.doc


Haverford Township Library
Usage (kwh)
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Demand (kw)
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Nov-00
Dec-00
Jan-01
Feb-01
Mar-01
Apr-01
May-01
Jun-01
Jul-01
Aug-01
Sep-01
Oct-01
Nov-01
Dec-01
Jan-02
Feb-02
Mar-02
Apr-02
May-02
Jun-02
Jul-02
Aug-02
Sep-02
Oct-02
Nov-02
Months
Usage (kwh)
Demand (kw)

Date	Demand (kw)	Usage (kwh)	Power Factor (%)	Cost ($)	$/kwh
Nov-02	94.50	41,480	95.10	$ 4,189.30	0.1009957
Oct-02	90.80	42,410	94.50	$ 4,135.19	0.0975051
Sep-02	176.90	68,630	86.20	$ 7,363.15	0.1072876
Aug-02	153.10	52,530	87.40	$ 6,282.80	0.119604
Jul-02	164.60	70,500	88.10	$ 7,666.85	0.1087496
Jun-02	165.30	58,910	85.00	$ 6,944.29	0.1178796
May-02	157.80	43,690	86.80	$ 5,663.66	0.1296329
Apr-02	198.30	37,780	86.70	$ 5,227.21	0.1383592
Mar-02	93.90	33,010	94.40	$ 3,652.60	0.1106513
Feb-02	93.10	32,030	94.80	$ 3,567.86	0.1113912
Jan-02	87.50	30,410	94.80	$ 3,378.30	0.1110917
Dec-01	89.70	28,270	95.20	$ 3,163.34	0.1118974
Nov-01	89.40	36,990	94.90	$ 3,774.59	0.1020435
Oct-01	172.90	34,370	87.00	$ 4,562.54	0.1327477
Sep-01	164.80	46,880	87.60	$ 5,411.74	0.1154381
Aug-01	163.90	64,430	87.70	$ 7,177.59	0.1114014
Jul-01	169.50	52,230	88.20	$ 6,339.07	0.1213684
Jun-01	169.90	48,580	87.70	$ 6,070.21	0.1249529
May-01	142.90	43,790	87.90	$ 2,358.02	0.0538484
Apr-01	153.60	37,430	87.90	$ 2,026.50	0.0541411
Mar-01	93.20	31,870	97.10	$ 1,519.10	0.0476655
Feb-01	91.50	28,320	95.40	$ 1,400.90	0.0494668
Jan-01	87.50	32,010	95.50	$ 1,491.56	0.0465967
Dec-00	91.80	31,610	95.20	$ 1,284.77	0.0406444
Nov-00	93.10	31,250	96.40	$ 1,281.79	0.0410173
Total				**$ 105,932.93**	
Averages	**129.98**	**42,376.40**	**91.10**	**$ 4,237.32**	**0.0962551**

Appendix C:
Code Search Checklist

Zoning: The building lot is smaller than the required 2 acres for the institutional district and the building and impervious coverage exceeds the 20% allowed by the zoning code. The building is within height restrictions, but encroaches on the required front, side and rear yards or setbacks. The code requires over 290 parking spaces for patron use, while 16 are available. These are existing conditions that are "grand fathered", so remediation is not required.

Building: The building exceeds the allowable square footage for a building of this use group and has windows on the north façade, which are not allowed. These are existing conditions that are "grand fathered", so remediation is not required.

Accessibility: The facility has the one handicapped parking space required. The toilet rooms are not accessible and the elevator is not sized for wheelchair access. Any major renovations would require upgrades to meet these accessibility requirements.

CICADA

ARCHITECTURE PLANNING, INC.

Code Search Checklist:

Project: **Haverford Township Free Library**
Darby and Mill Roads
Havertown, PA

Client: *Haverford Township*
Cicada Project #:
Date: *01/07/03*

Governing Codes:

Zoning: *Haverford Township Zoning Code*

Building: *BOCA '93 (BOCA '96 used for this document)*
Mechanical: *BOCA '93 Mechanical Code*
Fire: *BOCA '93 Fire Prevention Code*
Plumbing: *BOCA '93 Plumbing Code*
Electrical: *BOCA '93 Electrical Code*

Accessibility: *Americans with Disabilities Act, Title II*
BOCA '93

Energy Code: *PA Act 222, Building Energy Conservation Act*

Zoning Requirements:

Zoning District: *INS Institutional District*

Building Use: *Public Library*

Lot Area: Allowable: *2 acres, minimum* Existing: *0.5123 acres*

Building Coverage:
Allowable: *20% maximum* Existing: *55%*

Principals:
Christopher Heaven, AIA
Mary Holland, AIA
Kurt Raymond, AIA

6122 GREENE STREET . PHILADELPHIA PA 19144 . TEL: 215-848-7810 FAX: 215-848-7815 . WWW.CICADAARCHITECTURE.COM

Minimum Depth of Front Yard:

Allowable:	*100 feet*	Existing:	*0 feet*

Minimum Width of Side Yards and Open Courts:

Allowable:	*50 feet*	Existing:	*0 feet*

Minimum Depth of Rear Yard:

Allowable:	*75 feet*	Existing:	*51 feet*

Height Regulation:

Allowable:	*35 feet**	Existing:	*33'-3"*

**1 foot of additional height permitted for every 2 feet set back from front, rear, and side yard setbacks to a maximum of 60 feet.*

Off-Street Loading Requirements

Required: *14 feet wide, 60 feet long*

Off-Street Parking Requirements: *(Article 182-707)*

Number Of Parking Spaces Required:	*1 space for each 60 s.f. of floor area devoted to patron use (293 spaces required, 16 spaces existing)*
Handicapped Persons Parking:	*1 required (1 space existing)*
Size, Access & Lighting Requirements:	*9' wide by 18' long, 162 s.f. minimum*
Screening / Landscaping Requirements:	

Signage Requirements:

General Provisions:

Watershed Issues:

Building Code Requirements:

Code Enforcement Officials: *Haverford Township Planning Commission*

Use Group: *A-3 Assembly (B-303.4)*

Construction Type: *Type 3B, unprotected, Noncombustible/Combustible (partially protected in basement)*

Fire District: *Haverford Township*

Is This Construction Type Allowed Within This Fire District?: *Yes.*

Building Height & Fire Area Limitations: *(Table B-503)*

Use Group	Construction Classification	Allowable Area s.f.	Allowable Height
A-3	*Type 3B*	*8,400 s.f.*	*2 stories, 30'*

Building Area:

Basement:	*11,732 s.f.*
First Floor:	*11,732 s.f.*
Second Floor:	*12,623 s.f.*

Are Increases to The Allowable Height and/or Floor Area Permitted?

With automatic sprinkler system:	*Increase height 1 story and 20' (B-504.2)* *Increase area 200% (B-506.3)*

Required Fire-Resistance Ratings: *(Table B-602)*

Item	Hourly Rating Req.
1. Exterior Bearing Walls	*2*
Exterior Nonloadbearing Walls	*2 (Table B-705.2)*
2. Fire & Party Walls	*2*
3. Fire Enclosure Of Exits	*2*
Shafts	*1*
4. Exit Access Corridor Partitions	*1 (B-1011.4)*
5. Dwelling Unit and Guestroom Separations	*1*
6. Smoke Barriers	*1*
7. Other Nonloadbearing Partitions	*0 (1 hr where protected)*
8. Interior loadbearing Members	*0 (1 hr where protected)*
9. Structural Members Supporting Wall	*0 (1 hr where protected)*
10. Floor Construction Including Beams	*0 (1 hr where protected)*
11. Roof Construction Including Framing 15' Or Less Above Flr.	*0 (1 hr where protected)*

Fire Resistant Materials and Construction:

Maximum Area of Exterior Wall Openings: *Not permitted on north façade; no limit on other facades. (Table 705.3)*

Finish Requirements: *(Table B-803.4)*

Required Exits and Passageways:	*Class I*
Corridors Providing Exit Access:	*Class I (lobby areas shall not be less than Class II)*
Rooms or Enclosed Spaces:	*Class II*

Fire Extinguisher and Alarm Equipment: *(Chapter 9)*

Sprinklers:	*Not required.*
Standpipes:	*Not required. (B-915.2)*
Fire Department Connections:	*Confirm location with Fire Department.*
Fire Alarm System:	*Not required. (B-918.4)*
Automatic Fire Detection:	*Not required. (B-919.4)*
Smoke Detectors:	*Not required. (B-920.3)*
Fire Extinguishers:	*Required per NFPA 10 unless sprinklered (Chapter 35)*

Means of Egress Requirements: *(Chapter 10)*

1. Maximum Length of Exit Access Travel: *(B-1006.5)*
   200 feet without sprinkler system
   250 feet with sprinkler system

2. Occupant Load: *(B-1008.1.2)*

   Actual Occupancy: max.
   Reading Rooms = 4778 s.f. / 50 s.f. per person = 95 persons
   Stack Area = 8370 s.f. / 100 s.f. per person =83 persons
   Assembly (Unconcentrated) = 4404 s.f. / 15 s.f. per person = 293 persons
   Business Area = 2175 s.f. / 100 s.f. per person =21 persons
   Mechanical/ Storage = 4094 s.f. / 300 s.f. per person = 13 persons
   Total Code Occupancy: 505 persons

3. Capacity of Egress Components: *(B-1009.2)*

   Without sprinklers: *Stairways = .3"/person*
   Doors/ ramps/ corridors = .2"/person
   With sprinklers: *Stairways = .2"/person*
   Doors/ ramps/ corridors = .15"/person

4. Number of Exits: *(B-1010.2 & 1010.4)*

   Minimum for Occupant Load: *3 Exits*

5. Exit Access Passageways & Corridors: *(B-1011.0)*

   Dead End Corridor Limit: *20 feet*
   Minimum Width: *44 inches*
   Corridor Fire Resistance Rating: *1 hour without sprinklers; 0 hours with sprinklers*

6. Stairways: *(B-1014)*

   Width: *44" min. (B-1014.3)*
   Projections into Stair: *Maximum 4½" below handrail height.*
   Headroom: *80" min.*
   Vertical Rise: *Maximum 12' between landings.*
   Risers-Maximum/Minimum: *7"/ 4"*
   Tread-Minimum: *11"*
   Nosings: *¾"-1¼" where tread depth < 11"*
   Doors: *32" clear width min.*

7. Ramps: *(B-1016.0)*

   Width: *44" min. (B-1016.2.1)*
   Projections into Ramp: *Maximum 3½" below handrail height.*
   Headroom: *80" min.*
   Vertical Rise: *Maximum 30" between landings.*
   Slope: *1:12 (1:8 if rise < 3"; 1:10 if rise < 6")*
   Handrails: *Not required where rise < 6"*
   Edge Treatment: *4" min. curb above walking surface.*

8. Means of Egress Doorways: *(B-1017.0)*

   Minimum Width: *32 inches clear*
   Door Hardware: *Maximum 48 inches above floor; shall swing in the direction of egress when serving occupant load of 50 or more persons. Panic hardware required (B-1017.4).*

9. Exit Signs & Lights: *(B-1023.0)*

   Location: *At all required means of egress.*

10. Means of Egress Lighting: *(B-1024.0)*
    Requirements: *Intensity at floor of 1 footcandle minimum, .2 footcandle at Use Group A with use of projectors. Emergency power source for1 hour duration required.*

11. Miscellaneous:

Accessibility Requirements: *(Chapter 11)*

1. Parking Facilities: *(B-1105.0)*
   Accessible spaces: *1 required*

2. Use Group Requirements: *(B-1107.0)*
   Use Group ?: *Services and facilities provided in areas not required to be accessible shall be provided on an accessible level and shall be made accessible. Wheelchair spaces shall be provided.*

Interior Environment: *(Chapter 12)*

1. Room Dimensions:
   Ceiling Height: *7' min.; 7'-6" at exit access and occupiable rooms.*
   Width: *7' min. in any dimension (except kitchen).*
2. Natural Light:
   Minimum Glazing Area: *8% of floor area.*
3. Ventilation: *Natural or mechanical ventilation shall be provided in every space intended for human occupancy.*

Roof and Roof Structures: *(Chapter 15)*

1. Fire Classification: *Class A or C*

Structural Loads: *(Chapter 16)*

1. Live Loads: *(Table 1606)*

Assembly Areas:	
Moveable seats:	*100 p.s.f.*
Lobbies:	*100 p.s.f.*
Corridors (1st Floor):	*100 p.s.f.*
Libraries:	
Reading Rooms:	*60 p.s.f.*
Stack Rooms:	*150 p.s.f.*
Corridors (above 1st Floor):	*80 p.s.f.*
Offices:	*50 p.s.f.*
Lobbies:	*100 p.s.f.*
Corridors:	*80 p.s.f.*
Public Rooms:	*100 p.s.f.*
Stairs:	*100 p.s.f.*
Storage Areas (light):	*125 p.s.f.*
Storage Areas (heavy):	*250 p.s.f.*

2. Roof Loads:

Minimum Live Load:

Flat or Rise < 1:3: *20 p.s.f.*

Tests or Borings Required:

Plumbing Fixture Requirements:

Water Closets:	*1 for every 125 males; 1 for every 65 females*
Urinals:	
Lavatories:	*1 for every 200 persons; 1 service sink required*
Bathtubs or Showers:	*None required.*
Drinking Fountain:	*1 for every 1,000 persons*
Laundry Tray:	*None required.*

Energy Conservation Requirements:

Other Applicable Codes:

Special Considerations:

Agency Reviews Required and Turnaround Times:

Zoning Review: *Haverford Township Zoning Hearing Board, walk-in review.*

Building Permit: *Haverford Township Planning Commission, walk-in review*

Review and Permit Fee Schedules:

Zoning Review:

Building Permit:

Expediters Used and Telephone #'s:

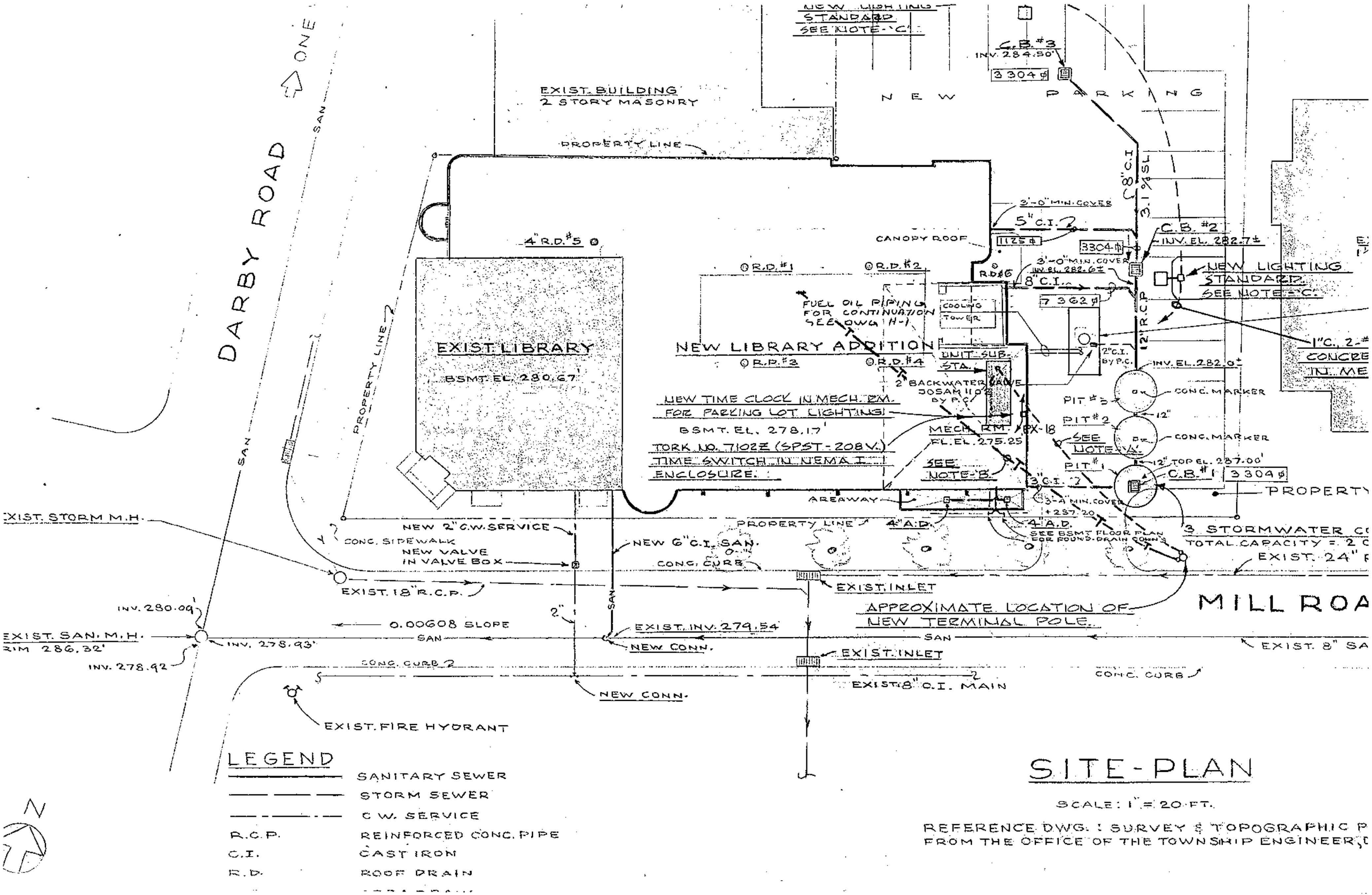
Appendix D: Building Plans

Site Plan

Basement Floor Plan

First Floor Plan

Second Floor Plan



SITE-PLAN

SCALE: 1" = 20 FT.

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HAVERFORD TOWNSHIP FREE LIBRARY
SITE PLAN

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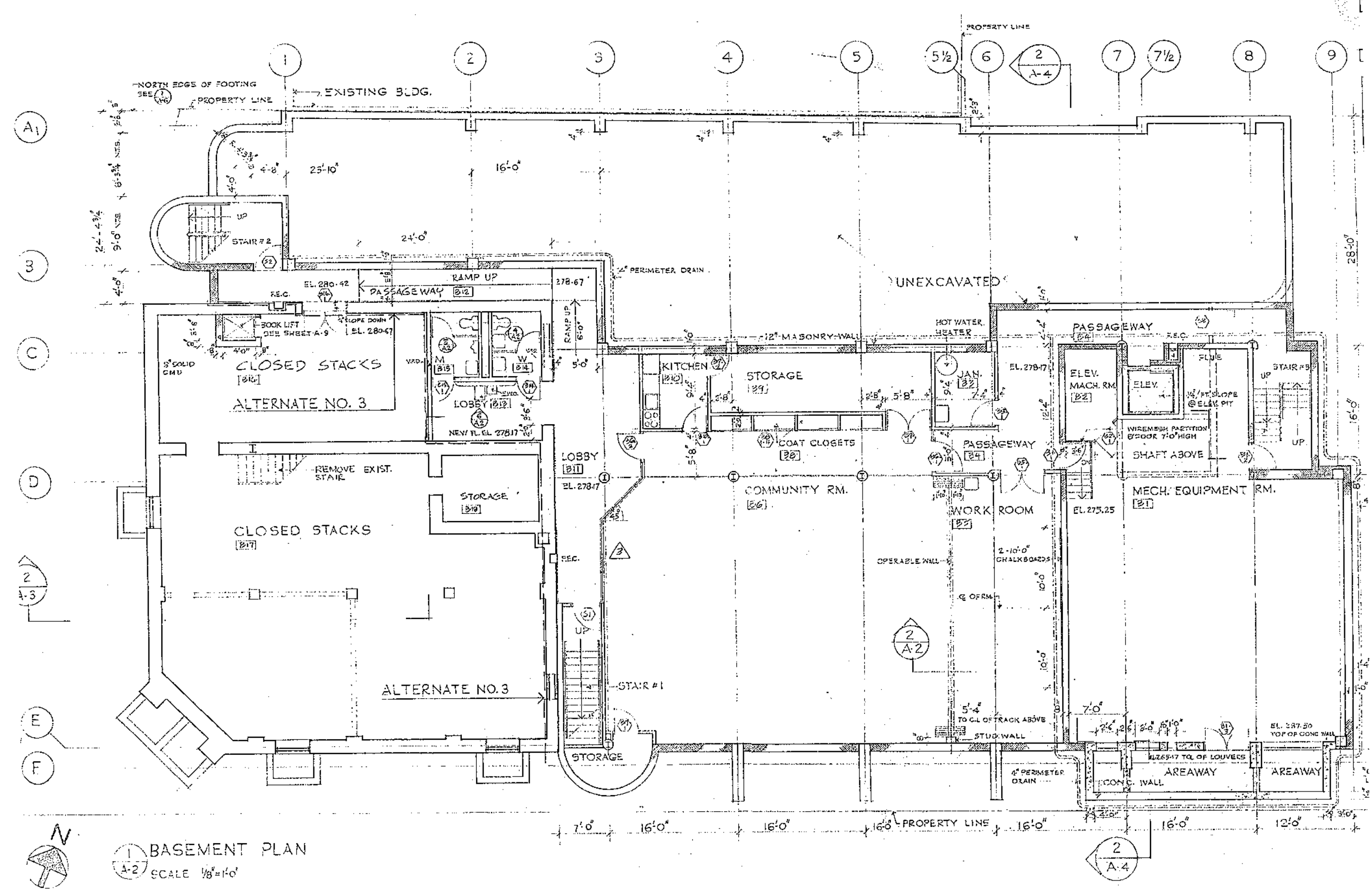

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BASEMENT FLOOR PLAN

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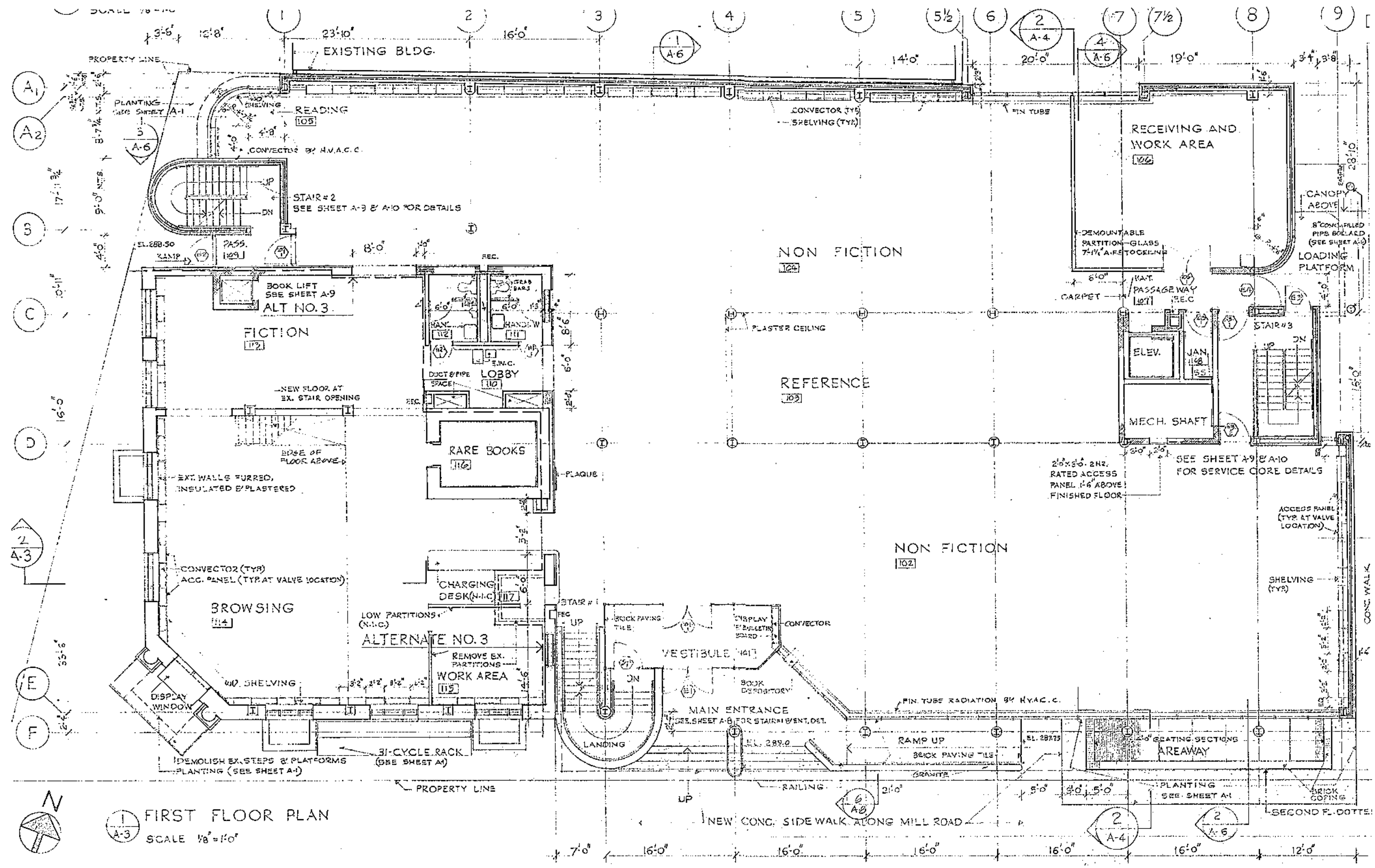

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FIRST FLOOR PLAN

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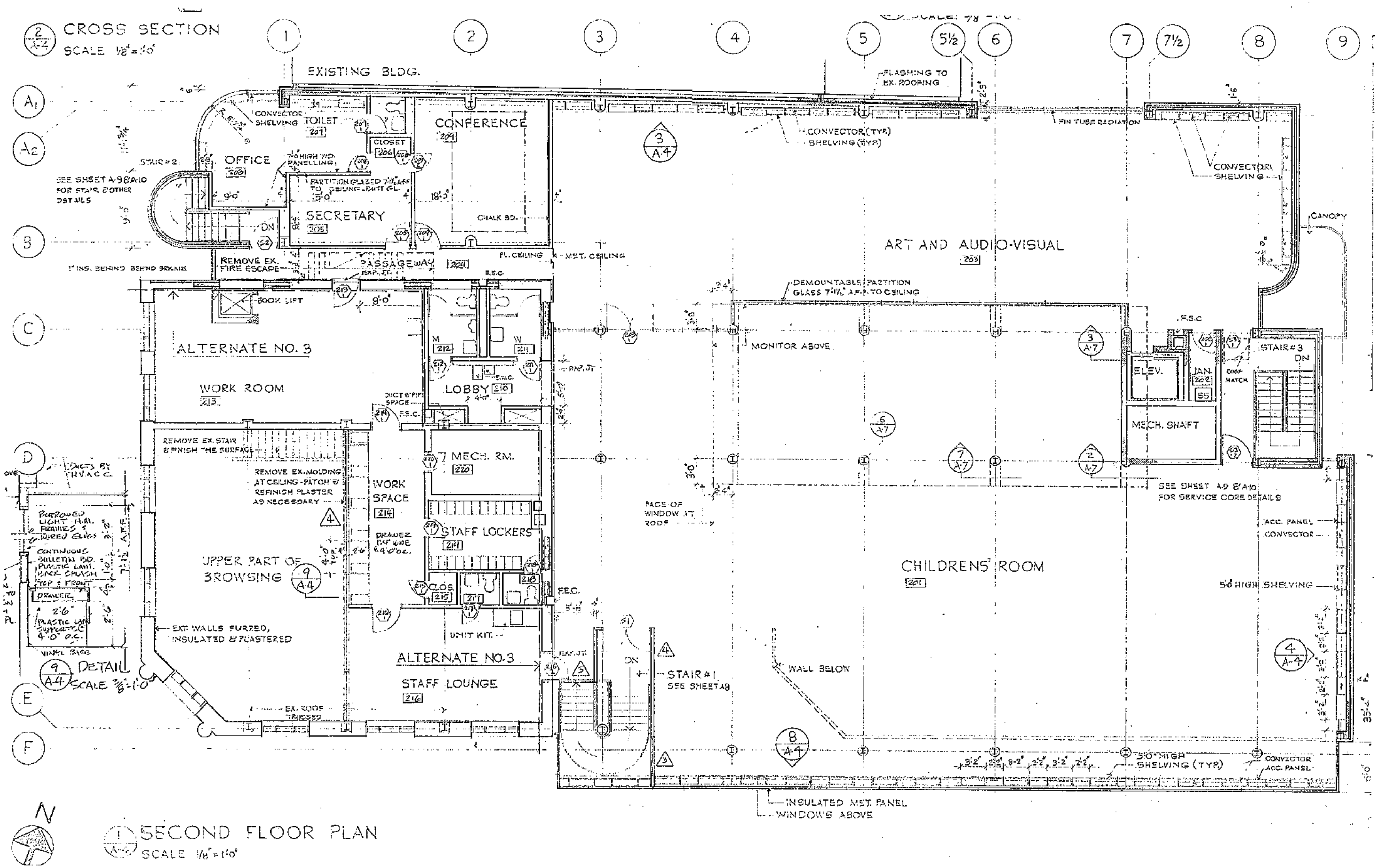

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SECOND FLOOR PLAN

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Appendix E:
Library Design Objectives

Conference Proceedings

65th IFLA Council and General Conference

Bangkok, Thailand, August 20 - August 28, 1999

Code Number: 130-103-E
Division Number: VI
Professional Group: Library Buildings and Equipment
Joint Meeting with: -
Meeting Number: 103
Simultaneous Interpretation: *No*

Designing Libraries to Meet Future Needs

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Paper

Introduction

The financial investment involved in the construction of a major library building is a commitment to a structure and its design that will probably have to serve the community for several decades. Under normal conditions, a new building should be designed based on the needs that might be realized over a period of at least twenty years. In reality, most buildings must serve for a much longer period of time. In order for the building to continue to function effectively, the structure and its layout must incorporate numerous elements of flexibility and adaptability.

The application of advanced technologies and new methods to deliver library services are changing daily. These changes impact on how library services are delivered, making it imperative that new structures address the matters of flexibility and adaptability in design and construction. These considerations range from such design issues as the elimination of unnecessary load-bearing walls to connectivity issues.

A vision of where libraries may be two, five and ten years from now is difficult, but an effort should be made to consider what issues may impact on the effective use of the library building in the future. Aside from the local librarian or other library representative responsible for overseeing the design and construction project, it is extremely advantageous to utilize a architectural firm that is knowledgeable in modern day library design. In selecting the architect, information about the experience of all interested firms and an expression of the firms' understanding of current library functions is crucial. If the firm that is selected does not come with this expertise, it is the responsibility of the library representative to educate those who will be preparing schematic design work.

A necessary tool for defining what should be incorporated in a new building and a vision of elements important to a long-term use of the structure is a written building program statement. Such a statement represents the library's instructions to the architect.

A well developed, thorough, written building program statement should be prepared with the input of the library staff that is involved in the daily operation of the library. No one else knows better the demands and desires of the library users. It can also be advantageous to employ the services of a library building consultant to evaluate needs and actually prepare the building program statement. The document should be prepared well in advance of advertising the library design project or competition.

Much can be learned from observing how other libraries have addressed the issue of planning a building to meet future needs in recently completed building projects. The IFLA Section on Buildings and Equipment is working to provide information on new library buildings on IFLANET. This can be used to identify and then contact libraries with buildings of comparable size or service programs that might provide information on how they dealt with design issues. The same kind of sharing of information is the focus of the Section's Plenary Session in Bangkok.

The libraries discussed in the papers presented include the following:

- The Richland County Public Library, Columbia, South Carolina, USA
- Zhejiang Provincial Library, Zhejiang Province, China
- City Library, the Hague, Netherlands

Incorporating Flexibility in Public Library Design: Application in a South Carolina USA Library

Planning for the new headquarters building of the Richland County Public Library in Columbia, South Carolina, USA, at the beginning of this decade, involved close attention to the design of a building that could be adapted for future use. More than thirty years had been spent trying to obtain the financial means for constructing a new library building or expanding the building constructed in 1952. The latter was inconceivable since it contained many barriers to adding additional space to the core building.

Columbia, South Carolina is located in the fast-growing southeastern region of the United States. It is the capital city for South Carolina, home to the largest university in the state, and the location of Ft. Jackson Military Base. The Library serves a local population of 300,000 with a metropolitan population of approximately one-half million people.

The headquarters building was opened in 1993. Between 1991 and 1993 this building and seven branch libraries were constructed simultaneously. All sites were chosen and all buildings designed to allow for tripling of the size of the footprint of any of the buildings.

The architect for the building was chosen on the basis of his understanding of library functions and needs in library building design. He, also, had the experience of designing more than ten successful public library buildings in the United States.

The building includes 242,000 square feet or approximately 27,000 square meters of space. The building is designed on four levels, each connected by elevators, escalators and stairs. It incorporates large open spaces that can be adapted for use as needs change.

Since libraries are specific use structures, design of a library building should allow form to follow function. The most important factor to our Library was that the building be designed from the inside out. While it was important to have an impressive building in its external and interior features, it was more important that the building function well as a library. We did not want a structure in which we had to place library functions and have to try to make them work. It had to work for library users and library staff alike.

Foremost in considerations in the modular design of the building were the matters of how the site and building could be used and adapted as changes occur in the delivery of library services and as new services are instituted. The following were given careful evaluation and study:

- The site acquired had to be adequate in size to allow horizontal expansion of the building, allowing for it to be tripled in size.
- Modular design was incorporated, allowing for uniform design and ease of building expansion if desired in the future.
- Load-bearing walls were eliminated except where absolutely necessary. This included exterior walls as well as interior. Two exterior walls can be knocked away, allowing for horizontal expansion of the building if needed in the future. Interior space can be readapted for use as desired and needed.
- The use of poured in place concrete construction provides the foundation necessary to add additional levels to the building if needed for future expansion.
- Lighting was designed on a modular layout that allows for placement of shelving, study tables, etc. in virtually any arrangement and layout. The lighting also eliminated the need for task lighting. Added value was the elimination of anything other than a minimal heating system for the building since the building is primarily heated by the electrical ceiling lights, computers and the energy generated by a very heavy flow of users. This is also a plus for task lighting if used as a secondary light source.
- Floor covering in all public areas and many office/staff areas is modular carpet tile. Carpet is used in American libraries to control sound, for ease in maintenance, and for environmental reasons. The carpet tiles allow the floor covering to be replaced when wear and soiling occur in areas. If walls are removed or added, matching carpet tile can be easily installed without having to replace large areas of floor covering.
- The primary source for telecommunications and energy distribution throughout the building is flat wiring. This is placed flat on the concrete floor surfaces underneath the carpet tile and run to the location where the power or telecommunications source is needed. If the equipment for which connectivity is needed is relocated or if additional equipment is added to a location, the carpet tile can be removed in the area and the flat wiring replaced to the area where needed. This can be accomplished without the need for an engineer and can be completed in a matter of minutes by a library operations assistant. The cost of flat wiring is competitive with more traditional methods of wiring.

The building has proven to be successful. In the first six years of occupying the building, changes, especially those related to upgraded technologies and new service programs, have occurred. Some of these changes have required that areas of the building be adapted to new uses. The flexibility incorporated in design elements has allowed these changes to occur without significant costs and without jeopardizing the integrity of the building.

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Note: A PC/PowerPoint presentation will follow on how spaces have been adapted within the building for a Library Business Service Center and computer training center and how other library advancements have been made over the past six years.

Latest Revision: *August 3, 1999*

High Performance Building **Guidelines**

City of New York
Department of Design
and Construction

April, 1999

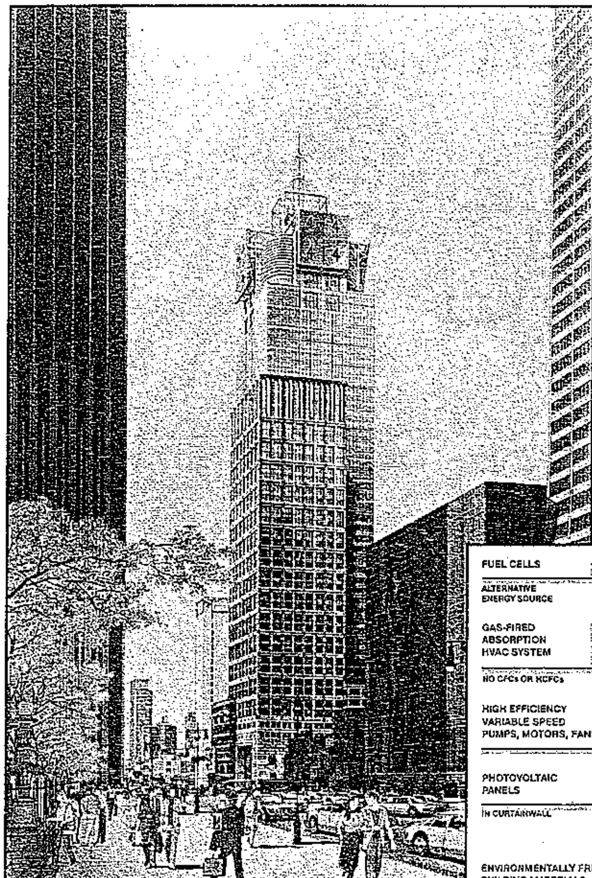
An Overview of High Performance Buildings

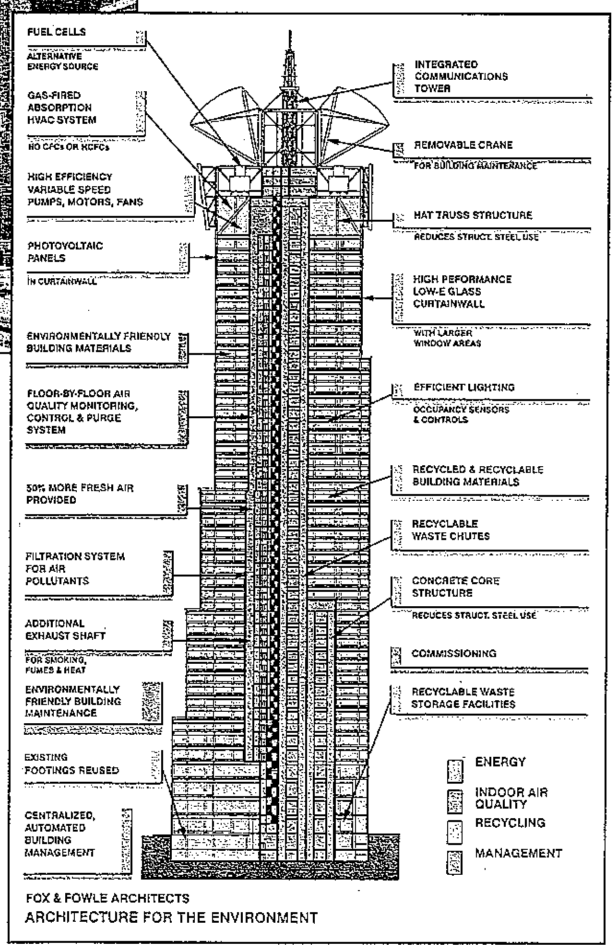
What is a 'high performance' building?

New achievers

Many successful new building projects are taking shape throughout the country today, calling into question the performance level of more typical construction endeavors, and prompting us to ask just how far our conventional buildings are falling short of the mark. At the head of the class are a series of energy- and resource-efficient projects that are reaping meaningful energy and cost savings along with important associated benefits. Buildings like the Federal Courthouse in Denver, a new U.S. Environmental Protection Agency facility in North Carolina, the Gap's new San Bruno, California, headquarters, Four Times Square (the Condé Nast building shown on this page), and the Natural Resources Defense Council and Audubon House renovations here in New York City (shown on the previous page) boast numerous value-added features, commonly known as 'green,' 'sustainable,' or simply 'high performance.'

> *"The great news is that enhanced environmental responsibility in high-rise construction does not have to significantly increase the cost of the project."*
>
> **Dan Tishman,**
> President, Tishman Construction,
> *Lessons Learned, Four Times Square*

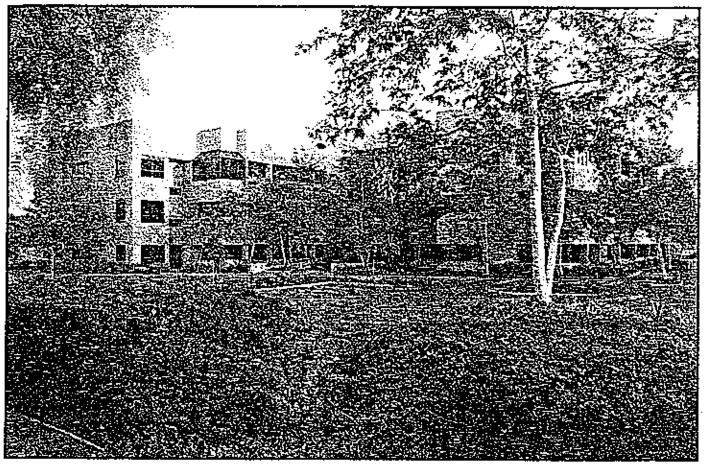




The Condé Nast Building
This 48-story tower at Four Times Square will be the first project of its size to adopt state-of-the-art standards for energy conservation, indoor air quality, recycling systems, and the use of sustainable manufacturing processes.
Fox & Fowle Architects

Basic objectives

Regardless of terminology, the objectives are the same. From project outset, these building owners, designers, and contractors actively committed to maximizing operational energy savings, providing healthy interiors, and limiting the detrimental environmental impacts of the buildings' construction and operation. As a consequence, they have also leveraged some compelling side benefits. The building occupants enjoy an improved sense of health and well-being that can be attributed to improved daylighting, quality high-efficiency lighting, and better indoor air. Some of these building owners have reported tangible increases in worker productivity. In many cases, these productivity gains have dwarfed the building's combined capital, operations, and maintenance cost savings.[6] These projects' collective successes allow us to pinpoint shortcomings in conventional building standards and construction methods, and to establish realistic, attainable goals.



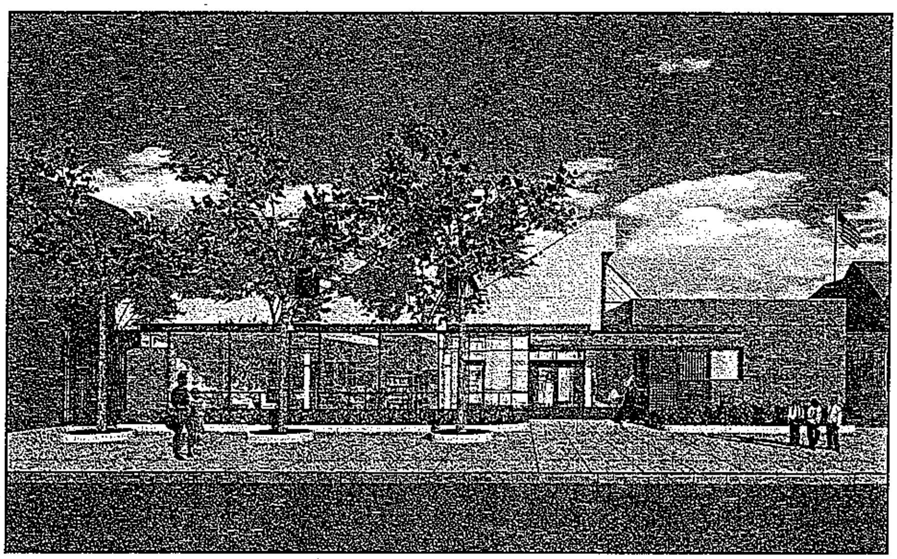
City of San Diego Ridgehaven Building
The City of San Diego, together with San Diego Gas & Electric, created a showcase for the economic and environmental benefits of green renovation in this upgrade of a 1980's commercial structure.
City of San Diego photo: Adam Saling

DDC high performance buildings – opportunities

DDC's client agencies deliver vital municipal services through such diverse facilities as libraries, cultural institutions, police and fire stations, and health and daycare centers. The various value-added features offered by high performance facilities will complement each agency's mission and enhance service delivery.

The annual energy cost for City facilities is approximately $400 million. By integrating these *Guidelines* into the facility renovation and new construction process, the City can capture operating savings that can then be redirected toward improving building maintenance or enhancing other municipal services. By incorporating environmentally sound materials and systems, improving indoor air quality and daylighting, the City will improve the value of its interior public spaces and realize indirect returns through improved health and well-being of City workers and other building occupants or visitors.

Because these other benefits are more difficult to quantify than direct energy savings, the real value of high performance buildings can be easily be underestimated by traditional accounting methods that do not recognize 'external' municipal and regional costs and benefits. High performance building cost evaluations should address, in some measure, the economic, social, and environmental benefits that accompany green buildings.
(See Part I: Measurable Benefits, p.20).



New South Jamaica Branch Library
A rendering of the first of several DDC showcase high performance projects, now under construction.
Stein White Architects, LLC

6. Romm, J.J., and Browning, W.D., *Greening the Building and the Bottom Line: Increasing Productivity through Energy-Efficient Design*, 1994.

High performance building features and benefits

The following design, construction, and operation activities can result in value-added public buildings. Direct, indirect, and 'external' benefits are also briefly identified and discussed.

☆ Energy Efficiency/Clean Energy Resources

Actions: Reduce energy use and demand through passive solar techniques and integrated building design. This process looks at optimum siting/orientation and maximizes the thermal efficiency of the building envelope (windows, walls, roof) while considering the interaction of the HVAC, lighting, and control systems. Integrated design uses daylight to reduce electrical demand, and incorporates energy efficient lighting, motors, and equipment. It encourages 'right-sizing' of mechanical systems to avoid higher first costs. Where feasible, renewable energy sources such as photovoltaic cells, solar hot water, and geothermal exchange are used in tandem with other low-emission technologies, such as fuel cells.

Benefits: Direct energy cost savings (fuel and electricity) and other life cycle savings yield a good rate of return based on the initial investment. Other external benefits include improved air quality from reduced fuel consumption (limiting nitrous oxide, sulfur dioxide, methane, and other gases that contribute to air pollution). Similarly, reducing the overall aggregate electrical load significantly reduces carbon dioxide emissions, the primary greenhouse gas implicated in global climate change.

☆ Improved Indoor Environment

Actions: Improve indoor air quality by eliminating unhealthy emissions – such as volatile organic compounds, or VOCs – from building materials, products, and furnishings, and through outside filtering and distribution techniques that control pollutants. Improve the thermal qualities and comfort levels of all occupied spaces. Maximize the use of controlled daylighting which can then be augmented by high quality artificial lighting. Provide good acoustic control. Wherever possible, offer occupant the ability to regulate their personal comfort.

Benefits: High performance facilities can help address a wide range of human resource concerns by improving *the total quality of the interior environment*. In addition, attention to building wellness today helps avoid future costs for correcting sick building syndrome. Such 'well building' design emphasis can improve occupant comfort, health, and well-being, in turn reducing employee absenteeism and turnover. The same benefits apply to the facility's public users.

☆ Source Reduction, Pollution Prevention and Recycling

Actions: Where equivalent in quality, cost, and performance, use green building materials and interior furnishings that are made from recycled or renewable resources, are themselves recyclable, and that have been manufactured in a manner least damaging to the environment. Implement construction and demolition (C&D) waste prevention/management strategies and selective site-sorting of materials for salvage, recycling, or disposal.

Benefits: These actions will prevent unnecessary depletion of natural resources and will reduce air, water, and soil pollution. They will also strengthen the market for recycled materials, and the manufacture of products with post-consumer content. Long-term, better C&D waste management can reduce waste disposal costs, ease stress on landfills, and minimize the cost of transporting waste to disposal facilities outside the City.

☆ Building Operations Resource Management

Actions: Design in ways that promote good building operations practices: conserve water using site- and facility-wide measures, create space for everyday waste recycling, and improve housekeeping practices through use of benign cleaning products and more efficient cleaning and maintenance protocols.

Benefits: Water conservation measures will help maintain New York City's water quality and avoid potential future costs by reducing overall loads on water filtration and treatment systems. More efficient cleaning and custodial protocols may increase productivity of custodial staff, while improved housekeeping measures will contribute to overall occupant health and well-being.

Reconciling economics and environmental concerns

> *"Then I say the earth belongs to each...generation during its course, fully and in its own right, no generation can contract debts greater than may be paid during the course of its own existence."*
>
> **Thomas Jefferson**

DDC's building projects – our libraries, firehouses, cultural institutions, daycare centers, courthouses, and other public facilities – bring a wealth of social and economic benefits to our communities. Yet in weighing these benefits, we should also be aware of how our buildings directly and indirectly contribute to environmental and human health problems. Few people in the building trades, let alone average citizens, fully realize the extent to which building construction and operation generates material waste and results in energy inefficiencies and pollution. These so-called 'externalized costs' do not show up on any balance sheet, meaning that the environment – and ultimately society in general – will be forced to absorb them. Every day, buildings squander valuable capital by wasting energy, water, natural resources, and human labor. Most of this waste happens inadvertently, as a result of following accustomed practices that often just meet, but fail to exceed, building codes. Progressive owners, manufacturers, and developers have begun to convert these liabilities into economic opportunities by adopting cost-effective new technologies, processes, and materials that dramatically reduce environmental impacts while increasing profitability.

Hidden costs of construction

As a nation, the price we pay for this sub-par performance ranges from **$10-60 billion** in combined health premiums, absenteeism, and annual productivity losses due to sick building syndrome and building-related illnesses

The hidden costs of construction include the adverse environmental impacts of construction-related activities. Today's design decisions have local, regional, and global consequences. According to the Worldwatch Institute, almost 40% of the 7.5 billion tons of raw materials annually extracted from the earth are transformed into the concrete, steel, sheetrock, glass, rubber, and other elements of our built environment. In the process, landscapes and forests are destroyed, and pollutants are released into the soil, water, and air. Twenty-five percent of our annual wood harvest is used for construction, which contributes to flooding, deforestation, and loss of biodiversity.[7]

Operating a building exacts an ongoing toll on the environment as well. Globally, buildings use about 16% of our total water withdrawals; here in the U.S. that amounts to about 55 gallons per person each day. Buildings consume about 40% of the world's energy production. As a consequence, buildings are involved in producing about 40% of the sulfur dioxide and nitrogen oxides that cause acid rain and contribute to smog formation. Building energy use also produces 33%, or roughly 2.5 billion tons, of all annual carbon dioxide emissions,[8] significantly contributing to the climate changes wrought by the accumulation of this heat-trapping gas.

Today, we are just beginning to understand the high cost of inefficient practices in yet another critical realm: our buildings' interior environments. The U.S. Environmental Protection Agency has ranked poor indoor air quality as among the top five environmental risks to public health, and claims that unhealthy indoor air (which may be two to eight times more contaminated than outside air) can be found in up to 30% of new and renovated buildings.[9] As a nation, the price we pay for this sub-par performance ranges from $10-60 billion in combined health premiums, absenteeism, and annual productivity losses due to sick building syndrome and building-related illnesses.[10]

Municipalities also pay indirect premiums for less efficient, traditionally built facilities. These buildings can impose unnecessary additional burdens on municipal services such as water supply and treatment and solid waste management, indirectly affecting local taxes and municipal budgets.

A 'no-regrets' action

Looking across the full spectrum of conventional building performance, it's clear that our design and construction practices are falling short of what could be achieved with even a small number of strategic, cost-effective corrections. Many industries have a growing appreciation that sound economic and environmental choices are not mutually exclusive, but instead are compatible to the point of being interdependent. This suggests that high performance building practices will be increasingly market-driven as the economic advantages of environmentally sound design and construction continue to gain industry recognition and support. Therefore, implementing these practices should be considered a 'no-regrets' policy initiative that results in economic gain while producing positive environmental results.

7. Roodman, D. M., and Lenssen, N. *A Building Revolution: How Ecology and Health Concerns are Transforming Construction*, Worldwatch Paper 124. March '95 p.22-25.
8. Ibid.
9. Lippiatt, B. and Norris, G. "Selecting Environmentally and Economically Balanced building Materials: National Institute of Standards and Technology Special Publication 888, Second International Green Building Conference and Exposition – 1995 (Gaithersburg, MD) NIST, 1995, 37.
10. Ibid p. 38

Well-integrated design and construction

A whole greater than the sum of its parts

An integrated or 'whole building' design approach requires thinking about the building and its site as a series of interlinked and interdependent systems, so that a single design refinement might simultaneously improve several building systems' performance. Like the domino effect, one refinement can trigger multiple savings or other benefits. For example, careful decisions on building shape and window placement that take into account both prevailing wind and sun angles, may not only enhance a building's thermal performance, but can also result in improved daylighting. These measures will reduce both heating and cooling loads, and in turn, could generate first cost savings achieved through downsizing HVAC equipment and reducing mechanical space requirements.

Using simple, time-honored techniques

High performance designs draw on principles used in much older building practices. As such, they rely on the manipulation of land features, building form, and exterior materials to manage the climate and get the most out of the materials at hand *before* invoking electrical and mechanical assistance from energy-driven heating, cooling, and lighting systems. High performance design also favors 'state-of-the-shelf' technology over sophisticated 'state-of-the-art' equipment. The preference for keeping equipment as simple and maintenance-free as possible is vital to the interests of client agencies, given their limited operating budgets.

Team design

High performance outcomes also demand a much more integrated team approach to the design process and mark a departure from traditional practices, where emerging designs are handed sequentially from architect to engineer to sub-consultant. A unified, more team-driven design and construction process brings together various experts early in the goal-setting process. This helps high performance buildings achieve significantly higher targets for energy efficiency and environmental performance.

A team-driven approach is, in effect, 'front-loading' of expertise. One or more facilitated workshops might involve the owner, design professionals, operators, and contractors (where possible) in a brainstorming session or 'partnering' approach that encourages cooperation in achieving high performance goals while breaking down traditional adversarial roles. During design development, frequent input from users and operators can accelerate progress, eliminate redundant efforts, engender commitment to decisions, reduce errors, and identify synergistic opportunities.

Innovative products and tools

An integrated building design process reexamines the use of traditional products or building assemblies, and identifies innovative technologies or green product and system alternatives that offer significantly improved environmental performance. These progressive design approaches can be further refined through the use of computer energy modeling. Energy modeling simulates the proposed design's response to climate and season. Designers can preview and improve the performance of interdependent features such as orientation, daylighting, alternative building shell design, and various mechanical systems. Energy modeling quickly evaluates cost-effective design options for the building envelope or mechanical systems by simulating the various alternatives in combination. This process takes much of the guesswork out of green building design and specification, and enables a fairly accurate cost/benefit forecasting.

> *"Discovering the DOE-2 model was invaluable. I can't imagine doing this kind of project without it ever again...With this technique, we can actually prove to our clients how much money they will be saving."*

Robert Fox,
Principal, Fox & Fowle,
architect of Four Times Square,
Lessons Learned, Four Times Square