Analysis
Pitkin Charter School
1501 Pitkin Avenue
Brooklyn, New York 11212

Client:
Cal Poly – Fire Protection Engineering California Polytechnic State University San Luis Obispo, CA 93407

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April
2017 Rev 3

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Keyword: Pitkin Charter School, Performance Based Design, Fire Dynamics Simulator (FDS), and Egress Analysis.

ABSTRACT

The Loew's Pitkin building is a renovation of a movie/stage theatre built in 1929. Over the next three decades the neighborhood declined and the theater closed in the Nineteen Sixties. The building was then a church for a while and then retail space with the theater auditorium empty. The building was finally abandoned in the Seventies and deteriorated until the early part of the next century. The School board of New York City took possession of the vacant structure and turned it into PS 159. It is a grade school serving grades from kindergarten to fifth grade and special education.

This building is a public grade school located in Brooklyn, New York. This report evaluates the prescriptive code requirements of the New York City building codes and standards in effect at the time of permitting in the year, 2007. The building is Six Stories with an occupied roof. The building does not have an occupied story (roof level) over Seventy Five Feet. This building does not meet the requirements of a High Rise building as defined in the New York City Building Code. The building is categorized as a non-combustible protected structure. It has separated mixed occupancy classifications consisting of Assembly, Education, Business, Storage, and Factory. This report will analyze one fire scenario of a Christmas tree in the multi-use space Gym Auditorium Cafeteria located on the Sixth floor for the performance base design requirement.

The prescriptive standards/codes used to evaluate the building are the New York City Building Code (IBC), New York City Fire Code (IFC), New York City Electric Code, and applicable standards from the National Fire Protection Association (NFPA). The report will analyze building code requirements to include height and area, fire resistance rating of structural components, unprotected opening requirements, separation distance, fire department accesses, fire extinguisher placement, egress components, Fire sprinkler, and fire alarm. The Performance based analysis was conducted using Fire Dynamic Simulator (FDS).

The fire scenario in this performance based analysis is a Christmas tree fire in the multipurpose room on the top floor. The requirements of tenability will be established: temperature, visibility and fractional effective dose. The time for egress from the multipurpose room will be calculated to obtain the required safe egress time (RSET). The smoke layer height has been calculated using FDS and the available safe egress time will be determined (ASET). A comparison of the two components will be done to determine if tenable environment lasts long enough for people to egress the multipurpose room.

There is one room that did not meet New York City building Code egress travel distance requirements. On the roof, a mechanical room located in the lower left hand corner did not meet the One Hundred foot travel distanced required for a single exit egress. There are three areas that did not meet the mean egress requirements for NFPA 101 the Life Safety Code; but, did meet the building code requirements. The kindergarten and first grade did not meet the requirement of being on level of exit discharge nor were they provided with an independent means of egress. The second grade is more than one story above exit discharge and was not provided with an independent means of egress.

The performance based analysis determined the Christmas tree fire scenario in the multipurpose room did create an untenable environment before the occupants left the room. The smoke layer descended below a level of seven foot before all of the occupants left the room failing the visibility requirement of tenability.

RECOMMENDATIONS

The installation of either a Mechanical or Natural Ventilation System would increase the time the smoke layer would take to reach a level of Seven feet allowing the visibility requirement of tenability to be met.

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Introduction

Description of the building

This project is an evaluation of an existing six story school building located in Brooklyn New York. The building has retail on the basement, first, and second floor. The other floors three thru six are education and contain typical rooms you would find in any Kindergarten thru 5th grade with special education, such as classrooms, offices, art and music. The sixth floor has classrooms and a multiple purpose room that serves as a gymnasium, cafeteria and assemble space. The roof has a playground making the roof an occupied floor level. This makes the building seven stories but does not exceed the Seventy Five foot requirement for a High rise building. This exempts the building form having a stair pressurization system but the education – assembly occupancy does require the building to have a public address system. Refer to figure 1 for a rendering of the building.

Figure 1 Picture of the PITKIN building.

Area usage of the PITKIN building by levels

The areas and uses of the levels being evaluated are shown in Table 1 below:

Table 1: Area usage of the Pitkin by levels

Level	Gross Floor Area (sq. ft.)	Occupancy Descriptions
Basement	22,820	Merchantville, Accessory Storage & Mechanical Rooms
Ground floor	22,820	Merchantville, Accessory Business, Accessory Storage & Mechanical Rooms
2ndFloor	17,350	Business
3rd Floor	12,953	Education, Accessory Business, Accessory Storage & Mechanical
4th Floor	13,480	Education, Accessory Business, Accessory Storage & Mechanical
5th Floor	13,875	Education, Accessory Business
6th Floor	14,519	Education, Business, Accessory Storage
Roof	3,961	Assembly, Accessory Mechanical Rooms

The floors will be discussed in further detail throughout the report.

Project Codes and Standards

The building in this report is reviewed using the following building code and standards:

New York City Building Code (NYCBC) – 2008 Edition
New York City Fire Code (NYCFC) – 2008 Edition
New York City Electric Code (EC) – 2008 Edition
New York City Pluming Code (PC) - 2008 Edition
New York City Department of Environmental Protection
NFPA 10 – Standard for Portable Fire Extinguishers Section 15-02 of Title 3 of the Rules of the City of New York (3RCNY §15-02)
NFPA 13 – Standard for the Installation of Sprinklers Systems – 2007 Edition
NFPA 14 – Standard for Installation of Standpipe and Hoses Systems – 2007 Edition
NFPA 20 – Standard for the Installation of Stationary Pumps for Fire Protection – 2007 Edition
NFPA 25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems – 2008 Edition
NFPA 72 – National Fire Alarm and Signaling Code – 2007 Edition

This part of the report is an architectural review of the building and the fire code impacts on the project. The main focus of the building critique will be using the NYCBC and NYCFC.

Report Objectives:

The purpose of this report is to evaluate various aspects of the egress & fire systems of the Pitkin Charter School in Brooklyn NY.

This report should be used in conjunction with the construction plans and life safety sheets. The life safety sheets will provide occupancy classifications, occupant loads, egress width and travel distance provisions.

The Pitkin Charter School was designed and built under the New York City Building Code. This report will also include a performance based analysis of the building. The fire scenario is identified later in this report that will evaluate the current building design egress capabilities.

For the prescriptive analysis I will start off with the requirements of the New York City Fire code. The requirements of chapter five Fire Operations Features will be first. Chapters seven, eight, nine and ten will be covered during the analysis of the building code since the requirements are similar due to the ICC format. I will conclude with chapter four emergency planning and preparedness.

Fire Services Features:

Fire Code Section 503 Fire Apparatus Access Roads: Refer to Figure 2 in Appendix A.

In FC Section 503 fire apparatus access roads requirement are stated. Buildings fronting on public streets shall comply with the requirements of FC 503.8.

The location of the Pitkin charter school complies with section 503 of the New York City Fire Code Fire Apparatus Access.

Fire Code Section 504 Access to Buildings and Roofs:

Building access shall be provided by an approved access walkway leading from fire apparatus access roads to exterior openings as required by the commissioner.

Exit and exit access doors shall comply with the requirements of Chapter 10 and the construction codes, including the Building Code. Exterior doors that have been rendered nonfunctional and that retain a functional door exterior appearance shall have a sign affixed to the exterior side of the door with the words THIS DOOR BLOCKED. Required department access doors shall not be obstructed or eliminated. Exit and exit access doors shall comply with the requirements of the Fire Code chapter 10 and the construction codes.

Stairway access to the roof shall be in accordance with FC Chapter 10 and the construction codes, including the Building Code. Such stairway shall be marked at street and floor levels with a sign indicating that the stairway continues to the roof.

Rooftop access and obstructions to rooftops of buildings 100 feet or less in height, shall be designed, installed, operated and maintained in accordance with this section and in a manner that

avoids or minimizes obstructions that impede firefighting operations. Where such building perimeter is 36 linear feet or greater, the required clearance openings may be contiguous, provided, however, that such contiguous openings shall not exceed 12 linear feet and shall be separated from other required clearance openings by a distance of not less than 12 linear feet.

At each rooftop perimeter access location, there shall be a safe landing area not less than 6 feet in any dimension, connected to the clear path required by FC504.4.4.

Fire Code Section 505 Premises Identification:
Per IFC Section 505 the premise identification must have an approved address number and place in a position where is plainly visible and legible from the street or road.

Fire Code Section 506 Key boxes:

Where access to or within a structure or an area is restricted because of secured openings or where immediate access is necessary for life-saving or firefighting purposes, a key box operable by a fire department standard key to be installed in an approved location.

Fire Code Section 510 Fire protection equipment shall be identified in an approved manner. Rooms containing controls for air-conditioning controls for air conditioning systems, sprinkler rises and valves, or other fire detection, suppression or control elements shall be identified for the use of the department. Approved signs required to identify fire protection equipment and equipment location, shall be constructed of durable materials, permanently installed and conspicuously posted.

This building has met the requirements of Fire service features as specified in chapter five of the New York City Fire Code. The report will next focus on occupancy classification and the required separation between occupancies.

Occupancy Classification, Separation and Building Height:

The IBC indicates the following occupancy classification for areas in the building, Table 2 below summarizes the occupant classifications found throughout level 1 to level 7:

Table 2: Occupancy classification

Use of Space/Area	Occupancy Classification
Stores	M
School Lobby (accessory)	B
Classroom	E
Multipurpose Room Play ground	A-3
Low hazard storage (accessory)	S-2
Gym, Assembly, Lunch room	A-1, A-2

Occupancy Separations:

This building is designed according to the non-separated occupancy provisions. The building does not need to comply with the occupancy separation table in IBC Table 508.3.3, but needs to comply with IBC Section 503 Allowable Height & Building areas and Table 508.2 Incidental use areas.

Building Code Section 508.3.2 Buildings or portions of buildings that comply with the provisions of this section shall qualify as non-separated occupancies.
508.3.2.1 Occupancy Classification. Non-separated occupancies shall be individually classified in accordance with Section 302.1. All code requirements shall apply to each portion of the building based on the occupancy classification of that space, except that the most restrictive applicable provisions of Section 403 and Chapter 9 shall apply to the entire building or portion thereof.

Building Code Section 508.3.2.2 the allowable height and area of the building shall be based on the allowable height and area for the main occupancy in accordance with Section 503.1. The height and area of any accessory occupancy shall not exceed the tabular values in Table 503, without height and area increases in accordance with Sections 504 and 506 for such accessory occupancies.

Building Code Section 508.3.1.3 states that no separation is required between an accessory occupancy and its main occupancy.

Building Code Section 508.3.2 states that buildings or portions of buildings that comply with the provisions of this section shall qualify as non-separated occupancies.

Building Code Section 508.3.3 states that no separation is required between non-separated occupancies.

Incidental Use Areas:

Building Code Section 508.2 incidental use areas shall comply with the provisions of this section. A space that is listed in Table 3 and is incidental to a main occupancy shall be considered an incidental use area. An incidental use area shall be classified in accordance with the main occupancy to which the use is incidental; or such area shall be classified in accordance with its actual occupancy and shall comply with Section 508.3 for mixed occupancies. 508.2.1.1 Fire protection requirements. Any additional fire protection requirements in Chapter 9 for an incidental use area shall be based upon the occupancy classification of the area's main occupancy.

Table 3: Fire barrier requirements for incidental use areas Table 508.2 NYCBC

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	2 hour; or 1 hour and provide automatic fire-extinguishing system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	2 hour; or 1 hour and provide automatic fire-extinguishing system
Refrigerant machinery rooms	1 hour or provide automatic sprinkler systems
Storage rooms over 100 square feet, except in R-3 occupancy	1 hour or provide automatic fire-extinguishing system
Waste and linen collection rooms over 100 square feet	1 hour or provide automatic fire-extinguishing system
Rooms utilizing the electrical installation standards for "information technology rooms" as per Section 645.1 of the New York City Electrical Code	As may be required by the New York City Electrical Code

Building Code Section 508.2.2, incidental use areas shall be separated or protected, or both, from all other occupancies in accordance with Table 508.2. 508.2.2.1 Construction. Where Table 508.2 requires a fire-resistance-rated separation, the incidental use area shall be separated from the remainder of the building by a fire barrier constructed in accordance with Section 706 or a horizontal assembly constructed in accordance with Section 711, or both. Where Table 508.2 permits an automatic fire-extinguishing system without a fire barrier, the incidental use area shall be separated from the remainder of the building by construction capable of resisting the passage of smoke. The partitions shall extend from the floor to the underside of the fire-resistance-rated floor/ceiling assembly or fire-resistance-rated roof/ceiling assembly above or to the underside of the floor or roof sheathing or sub deck above. Doors shall be self- or automatic closing upon detection of smoke in accordance with Section 715.4.7.3. Doors shall not have air transfer openings and shall not be undercut in excess of the clearance permitted in accordance with NFPA 80.

Building Heights, Areas, and Construction Type:

Building Code Section 503.1 and Table 4 of the IBC states the limitations on building heights and areas for a particular building based on construction type and occupancy. The requirements are based on the occupancy and construction type of the building. The Pitkin School is a Seven Story mixed occupancy building. Looking at IBC Table 4 the construction type of the building is **I-B** classification, which has an 160 FT height restriction unlimited area criteria for all occupancies except High hazard, storage and utility. Pay particular attention to the yellow shaded areas of the table.

Table 4 Allowable Height and Building Areas Table 503 of the NYC building Code

GROUP	STORIES (S) AREA (A)	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
		UL	160FT	65FT	55FT	65FT	55FT	65FT	50FT	40FT
A-1	S	UL	UL	6	3	6	3	6	3	2
	A	UL	UL	17,500	10,500	14,700	5,600	15,000	8,400	5,500
A-2	S	UL	UL	6	3	6	3	6	3	2
	A	UL	UL	17,500	9,500	14,000	5,600	15,000	8,400	5,500
A-3	S	UL	UL	6	3	6	3	6	3	2
	A	UL	UL	17,500	9,500	14,000	5,600	15,000	8,400	5,500
A-4	S	UL	UL	6	3	6	3	6	3	2
	A	UL	UL	17,500	9,500	14,000	5,600	15,000	8,400	5,500
B	S	UL	UL	6	3	6	3	6	3	2
	A	UL	UL	37,500	10,500	28,500	5,600	36,000	8,400	5,500
E	S	UL	UL	4	3	4	3	6	3	2
	A	UL	UL	26,000	10,500	23,500	10,500	25,500	8,400	5,500
M	S	UL	UL	6	3	6	3	6	3	2
	A	UL	UL	21,500	7,500	18,500	5,600	14,000	8,400	5,500
H-1	S	1	1	1	1	1	1	1	1	NP
	A	21,000	16,500	11,000	7,500	9,500	7,000	10,500	7,500	NP
H-2	S	UL	3	2	1	1	1	1	1	1
	A	21,000	16,500	11,000	7,500	9,500	7,000	10,500	7,500	3,000
H-3	S	UL	6	4	2	4	2	4	2	1
	A	UL	60,000	26,500	14,000	17,500	13,000	25,000	10,000	5,000
H-4	S	UL	7	5	3	5	3	5	3	2
	A	UL	UL	37,500	17,500	28,500	17,500	36,000	18,000	6,500
H-5	S	3	3	3	3	3	3	3	3	2
	A	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
S-1	S	UL	6	5	3	4	3	4	3	2
	A	UL	48,000	12,000	7,500	7,500	7,500	7,500	5,000	1,000
S-2	S	UL	UL	6	3	6	4	6	3	2
	A	UL	UL	15,000	10,000	10,000	8,500	10,000	8,400	5,500
U	S	UL	5	4	2	3	2	4	2	1
	A	UL	35,000	19,000	8,500	14,000	8,500	18,000	9,000	5,500

This building has met the requirements of chapter five for building heights and separation of incidental occupancies. The next topic for review is chapter six which covers the type of construction the building is erected to.

Building Construction

Building Code Section 602.1, buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five construction types defined in Sections 602.2 through 602.5. The building elements shall have a fire-resistance rating not less than that specified

in Table 601 and exterior walls shall have a fire-resistance rating not less than that specified in Table 602. Buildings constructed or altered inside the fire district shall further comply with Appendix D of the code.

Section D103.1 existing buildings located within the fire district. An existing building shall not hereafter be increased in height or area unless it is of a type of construction permitted for new buildings within the fire district or is altered to comply with the requirements for such type of construction. Nor shall any existing building be hereafter extended on any side, nor square footage or floors added within the existing building unless such modifications are of a type of construction permitted for new buildings within the fire district.

Construction Type:

Building Code Table 5, NYCBC 601, and Table 6, NYCBC 602, from the IBC give the prescriptive fire resistance rating for different building elements.

Table 5 Fire Resistance Rating Requirements for Building Elements Table 601 NYCBC

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A	B	A	B	HT	A	B
Structural frame Including	3	2	1	0	1	0	HT	1	0
Bearing walls Exterior, Interior	3 3	2 2	1 1	0 0	2 1	2 0	2 I/HT	1 1	0 0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction Including supporting beams and joists	2	2	1	0	1	0	HT	1	0
Roof construction Including supporting beams and joists	1½	1	1	0	1	0	HT	1	0

Table 6 Fire Resistance Rating Requirements for Exterior Walla Based on Fire Separation Distance
Table 602 NYCBC

FIRE SEPERATION DISTANCE	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H	OCCUPANCY GROUP F-1, M, S-1	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2, U
< 5	ALL	3	2	1
≥ 5 to< 10	IA Others	3 2	2 1	1 1
≥ 10 to < 30	IA,IB IIB,VB Others	2 1 1	1 0 1	1 0 1
≥ 30	ALL	0	0	0

The building has met the requirements of table54 601 NYCBC Fire resistance rating of building elements Table 6, 602 NYCBC fire resistance rating of exterior walls and appendix D. Please refer to figure 2 site plan in the appendix, for determination of separation distances.

This building has met the requirements of Chapter 6 types of construction with respect to occupancy and exterior fire separation distance. It has also met the requirements of Appendix D for modification to an existing building within fire districts. The next topic will focus on fire resistance rated construction of building elements, assemblies, requirements for openings and penetrations of rated building elements.

Fire Rated Construction

Section 701.1 this chapter shall govern the materials and assemblies used for structural fire resistance and fire-resistance-rated construction separation of adjacent spaces to safeguard against the spread of fire and smoke within a building and the spread of fire to or from buildings.

Section 704.8 the maximum area of unprotected or protected openings permitted in an exterior wall in any story shall not exceed the values in Table 7, NYCBC Table 704.8.

Table 7 Maximum area of exterior wall openings NYCBC (704.8)

CLASSIFICATION OF OPENING	FIRE SEPARATION DISTANCE (feet)							
	0 to 3	Greater than 3 and not more than 5	Greater than 5 and not more than 10	Greater than 10 and not more than 15	Greater than 15 and not more than 20	Greater than 20 and not more than 25	Greater than 25 and not more than 30	Greater than 30
Unprotected	Not	Not	10%	15%	25%	45%	70%	No Limit
Protected	Not	15%	25%	45%	75%	No Limit	No Limit	No Limit

The building does not exceed seventy percent based on a separation distance of 25 to 30 feet.

FIRE BARRIERS:

Building Code Section 706.1 Fire barriers used for separation of shafts, exits, exit passageways, horizontal exits or incidental use areas, to separate different occupancies, to separate a single occupancy into different fire areas, or to separate other areas where a fire barrier is required elsewhere in this code or the New York City Fire Code, shall comply with this section.

Building Code Section 706.3.1 Shaft enclosures shall have a fire resistance rating of the fire barrier separating building areas from a shaft in compliance with section 707.4.
Building Code section 706.3.5 incidental use areas shall have a fire barrier separating incidental use areas and shall have a fire-resistance rating of not less than that indicated in Table 508.2

SHAFT ENCLOSURES:

Building Code Section 707.2 states that openings through a floor/ceiling assembly shall be protected by a shaft enclosure complying with this section. Exceptions, does not connect more than two stories, is not part of the required means of egress system except as permitted in Section 1019.1, is not concealed within the building construction, is not open to a corridor on non sprinklered floors in any occupancy where such corridor is required to be fire resistance rated in accordance with Table 1016.1, is separate from floor openings serving other floors by construction conforming to required shaft enclosures.

Building Code Section 707.4 shaft enclosures shall have a fire resistance rating of not less than 2 hours where penetrating three stories or more and not less than 1 hour where penetrating fewer than three stories. The number of stories connected by the shaft enclosure shall include any basements or cellars, but not any mezzanines. Shaft enclosures shall be constructed as fire barriers in accordance with section 706. Shaft enclosures shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed 2 hours.
The building has met the requirements of sections 706 fire barriers and 707 shaft enclosures.

FIRE PARTITIONS:

Building Code Section 708 fire partitions shall comply with section 1016.1 of this code. Section 708.3 Fire resistance rating shall be 1 hour, with the exception of an interior corridor as permitted by Table 1016.1. Section 708.4 Continuity, Fire Partitions shall extend from the top of the floor assembly below to the underside of the floor or roof. If the partitions are not continuous to the deck, the space between the ceiling and the deck above shall be fire blocked or draft stopped in accordance with section 717.2.1 and 717.3.1 of this code. Exception, fire blocking or draft stopping is not required at the partition line in buildings equipped with an automatic sprinkler system installed throughout in accordance with section 903.3.1 or 903.3.1.2 of this code.
Building Code Section 708.5, where exterior walls serve as a part of a required fire resistance rated enclosure, such wall shall comply with the requirements of sections 704 for exterior walls and fire resistance rated enclosure requirements of section 708.3 shall not apply.
Building Code Section 708.6, openings in a fire partition shall be protected in accordance with section 715 of this code.
Building Code Section 708.7, penetrations through fire partitions shall comply with section 712 of this code.

Building Code Section 708.8, Joints made in or between fire partitions shall comply with section 713 of this code.
Building Code Section 708.9, penetrations by ducts and air transfer openings shall comply with sections 712 and 716 of this code.

The building has met the requirements of Section 708 Fire Partitions.

SMOKE BARRIERS:

Building Code Section 709.3 smoke barriers shall have a 1 hour fire resistance rating.
Building Code Sections 709.4 requires smoke barriers to form and effective membrane continuous from outside wall to outside wall and from slab to floor or roof deck above.

The building has met the requirements of Section 709 Smoke Barriers.

SMOKE PARTITIONS:

Building Code Section 710.2 requires smoke partitions to be constructed of noncombustible material. Glazing may be used if it is heat strengthen or tempered and shall comply with chapter 24 and shall be protected by a water curtain with sprinklers spaced 6 feet on center on each side of the glazing. Smoke partitions shall extend from the floor to the underside of the floor or roof deck above or the underside of the ceiling above where the ceiling membrane is constructed to limit the transfer of smoke. Section 710.5, openings shall be sealed to resist the free passage of smoke or be automatic closing upon detection of smoke. Section 710.5.1 does not permit louvers in doors that are part of smoke partitions. Section 710.6 requires the space around penetrating items and in joints shall be filled with an approved material to limit the free passage of smoke. Section 710.7 requires air transfer openings shall be provided with a smoke damper complying with section 716.32 of this code unless it is part of a smoke control system.

The building has met the requirements of section 710 Smoke Partitions.

HORIZONTAL ASSEMBLIES:

Building Code Section 711 Horizontal assemblies shall have fire resistance ratings complying with this section. Section 711.3 requires that the fire resistance rating and roof assemblies shall not be less than that required by the type of construction. Section 711.3.1 requires access doors in ceiling of fire resistance rated floor ceiling and roof ceiling assemble are tested in accordance with ASTME 119 and labeled. Section 711.4 continuity, assemblies shall be continuous without openings, penetrations or joints except as permitted by this section and sections 707.2, 712.4 and 713. Section 711.5, penetrations through fire resistance rated horizontal assemblies shall comply with section 712 of this code. Section 711.6, joints made in or between fire resistances rated horizontal assemblies shall comply with section 713. Section 711.7 Penetrations by ducts and air transfer openings shall comply with sections 712 and 716.

This building has met the requirements of section 711 Horizontal Assemblies.

PENETRATIONS:

Building Code Section 712.1.1 requires special inspection be done in accordance with chapter 17. Section 712.2 requires where sleeves are used the sleeves shall be securely fastened to the assembly being penetrated. The space between the sleeve and the item in the sleeve is protected according to this section.

Building Code Section 712.3.1 through penetrations of fire resistance rated walls shall comply with section 712.3.1.1 or 712.3.1.2 of this code. Exception allows for when the items penetration are metal pipes, conduits, the annular space between the penetrating item and the fire resistance rated wall shall be permitted to be protected as follows, in concrete or masonry walls where the penetrating item is a maximum 6 inch diameter and the opening is a maximum 144 square inches, concrete, grout, or mortar shall be permitted where installed the full thickness of the wall or the thickness required to maintain the fire resistance rating. Or, the material used to fill the annular space shall prevent the passage of flame and hot gasses. Section 712.3.1.1 fire resistance rated assemblies, shall be installed as tested in an approved fire resistance rated assembly. Section 712.3.1.2 through penetration fire stop system shall be protected by an approved penetration fire stop system installed as tested with ASTM E 814 or UL 1479.

Section 712.3.2 membrane penetrations shall be protected by a membrane penetration fire stop installed in accordance with section 712.3.1. Where walls and partitions are required to have a minimum 1 hour fire resistance rating, recessed fixtures shall be installed such that the required fire resistance will not be reduced. Exceptions of electrical steel outlet boxes or for listed electrical boxes do not exceed 16 square inches in area provided the total areas of such openings do not exceed 100 square inches for any 100 square feet of wall area. Outlet boxes on opposite walls shall be separated by a horizontal distance of not less than 24 inches or by solid fire blocking in accordance with section 712.1 or by protecting both outlet boxes by listed putty pads. Section 712.3.3 ducts and air transfer openings, penetrations of fire resistance rated wall by ducts and air transfer openings that are not protected with fire dampers shall comply with the section.

Section 712.4 horizontal assemble penetrations of a floor, floor/ceiling assembly or the ceiling membrane or a roof/ceiling assembly shall be protected in accordance with Section 707. Penetrations permitted by Exceptions 3 and 4 of Section 707.2 shall comply with sections 712.4.1 through 712.4.4.

Section 712.4.1 through penetrations of fire resistance rated horizontal assemblies shall comply with sections 712.4.1.1 or 712.4.1.2. Exceptions 1 by metal pipes or masonry through a single fire resistance rated floor assembly where the annular space is protected with materials that prevent the passage of flame and hot gasses subjected to ASTM E 119. Items with a maximum 6 inch nominal diameter shall not be limited to the penetration of a single fire resistance rated floor assembly provided the area does not exceed 144 square inches in any 100 square feet.

2, Penetrations in a single concrete floor by metal with a maximum six inch diameter provided concrete, grout or mortar is installed the full thickness of the floor or the thickness required to maintain the fire resistance rating. The penetrating items with a maximum 6 inch diameter shall not be limited to the penetration of a single concrete floor provided that the area of the penetration does not exceed 144 square inches.

3, Electrical outlet boxes of any material are permitted provided that such boxes are tested for use in fire resistance rated assemblies and installed in accordance with the tested assembly.

Section 712.4.1.1 fire resistance rated assemblies shall be installed as tested in the approved fire resistance rated assembly. Section 712.4.1.2 through penetrations of a firestop system shall be protected by an approved through penetration fire stop system installed and tested in accordance with ASTME 814 or UL1479.

Section 712.4.2 membrane penetrations that are part of a fire resistance rated horizontal assembly shall comply with Section 712.4.1.1 or 712.4.1.2. Where floor/ceiling assemblies are required to have a

minimum1 hour fire resistance rating, recessed fixtures shall be installed such that the required fire resistance will not be reduced.
Exceptions 1, membrane penetrations by metal or masonry penetrating items where the annular space is protected either in accordance with section 712.4.1 or to prevent the passage of flame or smoke. Such penetrations shall not exceed an aggregate area of 100 square inches in 100 square feet.
2, Membrane penetrations by listed electrical outlet boxes of any material have been tested for use in fire resistance rated assemblies and are installed in accordance with the instructions included in the listing.
3. The annular space created by the penetration of a fire sprinkler provided it is covered by a metal plate escutcheon plate.
Section 712.4.3 non fire resistance rated assemblies do not apply to this building and will not be covered. Section 712.4.4 ducts and air transfer openings do not apply to this building and will not be covered. Section 712.4.5 dissimilar materials do not apply to this building and will not be covered. Section 712.4.6 floor fire doors do not apply to this building and will not be covered.

This building has met the requirements of section 712 Penetrations.

FIRE RESISTANCE RATING JOINT SYSTEMS:

Building Code Section 713 installed in or between fire resistance rated walls or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire resistant joint system designed to resist the passage or fire for a time period not less than the required fire resistance rating of the wall, floor or roof in or between which it is installed. The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be protected in accordance with Section 713.4. Exceptions 2 is where floors have the joints protected by a shaft enclosure in accordance with section 707.

Building Code Section 713.4 where fire resistance rated floor or floor/ceiling assemblies are required, voids created at the intersection of the exterior curtain wall assemblies and such floor assemblies shall be sealed with an approved material or system to prevent the spread of fire. Such material or systems shall be securely installed and capable or preventing the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119. Height and fire resistance requirements for curtain wall spandrels shall comply with section 704.9

Building Code Section 714 the Fire resistance rating structural members and assemblies shall comply with the requirements for the type of construction and shall not be less than the rating required for the fire resistance rated assemblies supported.

Sprayed fire-resistant material (SFRM) was applied to obtain the fire resistance rating specified in table 601 for type 1B Construction. Refer to the Fire Proofing Submittal.

This building has met the requirements of sections 713 Fire Resistant Joint systems and 714 Fire Resistance Rating of Structural members.

OPENING PROTECTIVES:

Building Code Section 715 open protectives shall comply with the provisions of this code. Section 715.2 Fire resistance rated glazing labeled and tested as part of a fire resistance rated wall

assembly in accordance with ASTM E 119 shall not be required to comply with this section.
Section 715.3 Fire door and shutter assemblies shall be constructed of any material or assembly or component materials that conform to the test requirements of section 715.3.1, 715.3.2 or 715.3.3 and fire protection rating of Table 9 NYCBC 715.3. Fire door assemblies and shutters shall be installed in accordance with the provisions of this section and NFPA 80. Exception (1), is a Labeled protective assembly that conform to the requirements of this section or to UL 10A, UL 14B and UL 14C for a tin clad fire door assembly. Exception 2, Floor fire doors shall comply with Section 712.4.6

Table 9 Fire Door and Fire Shutter Fire Protection Ratings NYCBC Table 715.3

TYPE OF ASSEMBLY	REQUIRED ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATIN (hours)
Fire walls and fire barriers having a required fire resistance rating greater than 1 hour	4 3 2 1½	3 3 1½ 1½
Fire barriers having a required fire resistance rating of 1 hour: Shaft, exit enclosure and exit passageway walls Other fire barriers	 1 1	 1 ¾
Fire partitions: Corridor walls Other partitions	 1 1	 ¾ ¾
Exterior walls	3 2 1	1½ 1½ ¾

Building Code Section 715.3.2 other types of doors included swing elevator doors, shall be tested in accordance with NFPA 252 or UL 10B.
Building Code Section 715.3.3 Door assemblies in corridors and smoke barrier walls having a fire resistance rating in accordance with table 715.3 shall be tested in accordance with NFPA 252 or UL 10C. Glazing material in any part of the door assembly, including transom lites and sidelites, shall be tested in accordance with NFPA 257 in accordance with NFPA 257 in accordance with section 715.4. Fire door assemblies shall also meet the requirements for a smoke and draft control door assembly tested in accordance with UL 1784 with artificial bottom seal installed in accordance with UL 1784 with artificial bottom seal installed across the full width of the bottom of the door assembly.
Building Code Section 715.3.5 Fire door assemblies shall be labeled by an approved agency. The labels shall comply with NFPA 80, shall be permanently affixed to the door or frame.
Building Code Section 715.3.5.4 fire door frames shall have labeling showing the names or the manufacturer and the third party inspection agency.
Building Code Section 715.3.6 glazing material requiring fire protection rating conforming to the opening protection requirements in section 715.3 shall be permitted in fire doors assemblies. Section 715.3.6.1 size limitations on wired glass used in fire doors shall comply with Table 715.4.3. Other fire protection rated glazing shall comply with the size limitations of NFPA 80.
Building Code Section 715.3.6.2 Exit and elevator protective's shall be approved fire protection rated blazing and be located to furnish clear vision of the passageway or to the elevator or stairway.

Building Code Section 715.3.7 Fire doors shall be self-closing or automatic closing in accordance with this section. A latch shall be required on single fire doors and either leaves or pairs of side hinged swinging fire doors shall be provided with an active latch bolt that will secure the door when it is closed. Automatic closing fire doors shall be self-closing in accordance with NFPA 80. Section 715.3.7.3 Smoke activated doors shall be automatic closing fire doors installed in openings in walls required to fire resistance rated by table 508.2 by loss of power to the smoke detector or hold open device. Fire doors shall not have more than a 10 second delay before the doors start to close after the smoke detector is actuated.

This building has met the requirements of section 715 Opening Protectives.

DUCTS AND AIR TRANSFER OPENINNGS:

Building Code Section 716.1.1 ducts and transfer openings that penetrate fire resistance rated assemblies and are not required by this section to have dampers shall comply with the requirements of section 712.
Building Code Section 716.2 installation of fire dampers, smoke dampers, combination fire/smoke dampers and ceiling dampers located within air distribution and smoke control systems shall be installed in accordance with the requirements of this section and, the New York City Mechanical Code.
Building Code Section 716.3 dampers shall be listed and bear the label of an approved testing agency indicating compliance with the standards in this section. Fire dampers shall comply with the requirements of UL 555. Smoke dampers shall comply with the requirements of UL 555S. Fire protection rating of fire dampers shall have the minimum fire protection rating specified in Table10, NYCBC Table 716.3.1, for the type of penetration.

Table 10 Fire Damper Rating NYCBC Table 716.3.1

TYPE OF PENETRATION	MINIMUM DAMPER RATING (hours)
Less than 3 hour fire resistance rated assemblies	1.5
3 hour or greater fire resistance rated assemblies	3

Building Code Section 716.3.1.1 Fire damper actuating device shall meet the following requirements, the operating temperature shall be approximately 50°F above the normal temperature within the duct system, but not less than 160°F.

Building Code Section 716.3.2 Smoke damper ratings shall not be less than Class 2. Elevated temperature ratings shall not be less than 250°F. Section 716.3.2.1 smoke damper actuation method shall be done upon the actuation of a listed smoke detector(s) installed in accordance with section 907.10 and one of the following methods, as applicable. 1, where a damper is installed within a duct, a smoke detector shall be installed in the duct within 5 feet of the damper with no air outlets or inlets between the detector and the damper.

Building Code Section 716.4 accesses and identification of fire and smoke dampers, dampers shall be provided with an approved means of access, large enough to permit inspection and maintenance of the damper and its operating parts. The access shall not affect the fire resistance rating

of the assembly.

Building Code Section 716.5.2 fire barriers shall be provided with approved fire dampers installed in accordance with their listing. In addition, smoke dampers shall be installed in penetrations of public corridor wall in accordance with section 716.5.2.1.
Public corridors shall have a listed smoke damper designed to resist the passage of smoke at each point a duct or air transfer opening penetrates a public corridor wall constructed as a fire barrier. Exception 2 smoke dampers are not required in corridor penetrations where the duct is constructed of steel not less than .019 inch in thickness and there are no openings serving the corridor.
Building Code Section 716.5.3 shaft enclosures shall not be penetrated by ducts and transfer openings serving as an exit enclosure except as permitted by section 1019.1.2. Penetrations of shaft enclosures that are permitted to penetrate by ducts and air transfer openings shall be protected with approved fire and smoke dampers installed in accordance with their listing. Exception (2), IS penetrations that are tested in accordance with ASTM E 119 as part of the rated assembly. Exception (4), fire and smoke dampers shall not be required at a shaft where the shaft is acting as an extension of the mechanical equipment room that it serves and the shaft and mechanical equipment room maintain fire and smoke separation required by the greater of the two spaces from the occupied portions of the building and meet the requirements of section 707.11. Exception (7), smoke dampers shall not be required in exhaust ducts or shafts where the exhaust fan is maintained in operation during occupancy, such as in bathroom and toilet room exhaust.
Building Code Section 716.5.4 fire partitions having duct penetrations shall be protected with an approved fire damper in accordance with their listing except in occupancies other than Group H, and the following apply. The partitions are tenant separation and interior corridor walls in buildings equipped throughout with an automatic sprinkler system in accordance with section 903.3.1.1 or 903.3.1.2 and the duct is protected as a through penetration in accordance with section 712.
Building Code Section 716.5.5 smoke barriers shall have a listed smoke damper to resist the passage of smoke at each point a duct or air transfer opening penetrates a smoke barrier. Smoke dampers and smoke damper actuation methods shall comply with section 716.3.2.1

Building Code Section 716.6 Horizontal assemblies penetrated by ducts and air transfer openings of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected by a shaft enclosure that complies with section 707.

This building has met the requirements of section 716 Ducts and Transfer Openings.

CONCELAED SPACES:

Building Code Section 717 concealed spaces, having fire blocking and draft stopping shall be installed in combustible and noncombustible concealed locations in accordance with this section. Fire blocking shall comply with section 717.2. Draft stopping in floor/ceiling spaces and attic spaces shall comply with sections 717.3 and 717.4. The permitted use of combustible materials in concealed spaces of noncombustible buildings shall be limited to the applications indicated in section 717.5. Installations of fire blocking and draft stopping shall comply with the special inspection requirements of chapter 17.
Building Code Section 717.2 Fire blocking in combustible and not combustible construction, fire blocking shall be installed to cut off concealed draft openings and shall form an effective barrier between floors. Fire blocking shall be installed in the locations specified in sections 717.2.2 through 717.2.7.
Building Code Section 717.3 draft stopping in floors in combustible and noncombustible construction,

draft stopping shall be installed to subdivide floor/ceiling assemblies in the locations prescribed in sections 717.3.2 through 717.3.3. Section 717.3.1 draft stopping materials in noncombustible construction, draft stopping shall be of noncombustible materials.
Building Code Section 717.5 combustibles in concealed spaces in type 1 or 2 construction shall not be permitted. Exception 1, combustible materials installed in accordance with section 803.

This building has met the requirements of section 717 Concealed Spaces.

FIRE RESISTANCE REQUIREMENTS FOR PLASTER:

Building Code Section 718.1 the minimum Thickness of plaster used in a fire resistance rated system shall be determined by the prescribed fire tests, Section 718.3 in buildings of type 1 or 2 construction, plaster shall be noncombustible and applied directly on concrete of masonry.

This building has met the requirements of section 718 Fire resistance requirements for Plaster.

THERMAL AND SOUND INSULATING MATERIALS:

Building Code Section 719 thermal and sound insulating materials, including facings such as vapor retarders and vapor- permeable membranes, similar cov-erings, and all layers of single and multilayer reflective foil insulations, shall comply with the requirements of this section. Where a flame spread index or a smoke-development index is specified in this section, such index shall be determined in accordance with ASTM E 84.
Noncombustible construction insulating materials must either 1, pass a test for determining non-combustibility of elementary materials based on ASTM E 136 or have a flame spread index less than 25 or smoke development less than 50 and no continued progressive combustion in accordance with ASTM E 84. Section 719.1.1 insulating material used in noncombustible construction must either 1, satisfactorily pass a test for determining non-combustibility of elementary materials, based or the test procedures of ASTME 136 or, 2 have a flame and smoke index not greater than 25, 50.
Building Code Section 719.2 concealed installation of insulating materials in any type of construction shall comply with sections 719.1, 719.1.1 and 719.1.2 of this code.

This building has met the requirements of section 719 Thermal and Sound insulating materials.

PERSCRIPTIVE FIRE RESISTANCE:

Section 720 prescriptive fire resistance, the materials of construction listed in Tables 720.1.1, 720.1.2 and 720.1.3 shall be assumed to have the fire resistance ratings prescribed therein. Section 720.1.1 thickness of protective coverings materials required for protection of structural members shall not be less than set forth in table 720.1.1 except as modified in this section. Refer to Appendix A for requirements.

This building has met the requirements of section 720 Prescriptive Fire Resistance.

All of the applicable sections of chapter seven have been met. All components requiring fire resistance features have met or exceeded the requirements of the sections listed in chapter seven of the New York City Building Code. The next topic for analysis is chapter eight interior finishes.

BUILDING FINISHES

INTERIOR FINISHES:

Building Code Section 801.1 interior finishes shall limit the allowable flame spread and smoke development based on location and occupancy classification. Exception (1), materials having a thickness of less than 0.036 inch applied directly to a noncombustible or fire retardant treated wood substrate. Section 801.2 applications of combustible materials complying with the requirements of this chapter shall be permitted to be used as a finish for walls, ceilings, floors and other interior surfaces of buildings.

WALL AND CEILING FINISHES:

Building Code Section 803.1 interior wall and ceiling finishes shall be classified in accordance with ASTM E 84. Such interior finish materials shall be grouped in the following classes in accordance with their flame spread index. Class A Flame spread 0-25. Smoke development index shall range from 0-450 with the following restrictions, Exits, corridors 25. Rooms in which the net floor area per occupant is 10 square feet or less the smoke index shall be less than 100.
Building Code Section 803.5 interior finish requirements based on occupancy group shall have a flame spread index not greater than that specified in Table 11, NYCBC 803.5 for the group and location designated. Interior wall and ceiling finish materials, other than textiles, tested in accordance with NFPA 286 and meeting the acceptance criteria of Sections 803.2.1 and 803.2.2, shall be permitted to be used where a Class A classification in accordance with ASTM E 84 is required.
Building Code Section 803.9 acoustical ceiling system, the quality, design, fabrication and erection of metal suspension systems for acoustical tile and lay in panel ceilings in buildings or structures shall conform to the provisions of the chapter and other applicable of this code. Materials and installation of acoustical materials complying with the interior finish requirements of section 803 shall be installed in accordance with the manufacture's recommendations and applicable provisions for applying interior finish.

Table 11 Interior Wall and Ceiling Finish Requirements by Occupancy
Table 803.5 NYCBC

GROUP	SPRINKLERED		
	Vertical exits and exit passageways	Exit access corridors and other exit ways	Rooms and enclosed spaces
A-1, A-2, A-3	B	B	C
B, E, M	B	B	B

This building has met the requirements of section 803 Wall and Ceiling Finishes.

INTERIOR FLOOR FINISH:

Building Code Section 804.2 interior floor finish and floor covering materials required by section 804.5.1 to be class 1 or 2 materials shall be classified in accordance with NFPA 253. Section 804.4 Application of combustible materials installed in or on floors of buildings of Type 1 or 2 shall conform to the requirements of Sections 804.4.1 through 804.4.4. Section 804.4.2 wood finish flooring is permitted to be attached directly to the embedded or fire blocked wood sleepers and shall be permitted where

cemented directly to the top surface of approved fire resistance rated construction or directly to a wood subfloor attached to sleepers as provided for in section 804.4.1. Section 804.4 Carpeting type floor coverings are permitted where cemented directly to the top surface of approved fire-resistance-rated construction or directly to a wood subfloor attached to sleepers as provided.

This building has met the requirements of section 804 Interior Floor Finish.

DECORATIONS AND TRIM:

Building Code Section 805 all decorations shall comply with the requirements of the New York City fire code. Section 805.3 material used as interior trim shall have a minimum Class C flame spread as required by section 803.1 and smoke developed index as required by section 803.1.1. Combustible trim, excluding handrails and guardrails, shall not exceed 10 percent of the aggregate wall or ceiling area in which it is located. Section 805.5 imitation leather or other material consisting of or coated with pyroxylin or similar hazardous base shall not be used in Group A occupancies.

This building has met the requirements of Section 805 Decorations and Trim.

The building has met the requirements of chapter eight interior finishes. All wall and floor materials have met the flame and smoke ratings. All decorations, ornamental details and embellishments have met or exceeded the requirements as set forth in chapter eight of the New York City Building Code.

FIRE PROTECTION

FIRE PROTECTION SYSTEMS:

Building Code Section 901.1.1 where this code makes reference to the notational recognized standards NFPA 13, 14, and 72 such standards shall be as modified for New York City in accordance with appendix Q. Section 901.2 fire protection systems shall be installed, repaired, operated and maintained in accordance with this code and the New York City fire code. Section 901.4 threads provided for the fire department connections to sprinkler systems, standpipes, yard hydrants or any other fire hose connections shall be compatible with the connections used by the fire department. Section 901.5 fire protection systems shall be tested in accordance with the requirements of this code and the New York City fire code. When required, the tests shall be conducted in the presence of the department or approved agency. Section 901.6 where required, fire protection systems shall be monitored by an approved supervising station in accordance with NFPA72. Section 901.6.1 automatic sprinkler systems shall be monitored by an approved supervising station. Section 901.6.2 fire alarm systems required by the provision of section 907.2 of this code and the New York City fire code shall be monitored by an approved supervising station in accordance with section 907.14.

AUTOMATIC SPRINKLER SYSTEMS:

Building Code Section 903.2.1 an automatic sprinkler system shall be provided throughout buildings and portions thereof used as Group A occupancies as provided in this section. The automatic

sprinkler system shall be provided throughout the floor area where the Group A occupancy is located, and in all floors between the Group A occupancy and the level of exit discharge. In all Group A occupancies providing live entertainment, dressing rooms and property rooms used in conjunction with such assembly occupancy shall be provided with an automatic sprinkler system. Section 903.2.1.2 an automatic sprinkler system shall be provided for Group A-2 occupancies where any of the following conditions exists 1 the fire area exceeds 5,000 square feet, 2 the fire area has an occupant load of 300 or more.

The multipurpose room on the Sixth floor requires the installation of a Sprinkler System. It has occupancy of more than 300 people. It also has an area of Six thousand Four Hundred and Ninety Two Square Feet requiring sprinklers.

Building Code Section 903.2.6 an automatic sprinkler system shall be provided throughout buildings containing Group M occupancies where any one of the following conditions exists, 1 where a group M fire area exceeds 12,000 square feet. 2, where the combined area of all group M fire areas on all floors including any mezzanines exceed 24,000 square feet.

Building Code Section 903.2.10 an automatic sprinkler system shall be installed in the locations set forth in sections 903.3.10.1 through 903.2.10.6. An automatic sprinkler system shall be installed throughout every above or below grade story of buildings where the floor area exceeds 1,500 square feet and where there is not at least one of the following. 1, openings located below grade level that lead directly to the ground level by an exterior stairway complying with section 1009. 2, in buildings over 55 feet in height that have an occupant load of greater than 30 or more above fire department access.

The Mercantile Occupancy of this building is requiring a sprinkler system because the basement is Twenty thousand square feet, the first floor is more than Twelve thousand square feet, and the second floor has over Seventeen thousand Square feet.

Building Code Section 903.3 automatic sprinkler systems shall be designed and installed in accordance with section 903.3.1 through 903.3.7. An automatic sprinklers shall not be required in the following rooms such rooms or areas where such rooms or areas are protected with an automatic fire detection system in accordance with section 907.2 that will respond to visible or invisible particles of combustion and an alternate extinguishing system in accordance with section 904. Generator and transformer rooms separated from the remainder of the building by walls and floor/ceiling or roof/ceiling assemblies having a fire resistance rating of not less than 2 hours. Section 903.3.5 water supplies for automatic sprinkler systems shall comply with this section and the standards referenced in section 903.3.1. The potable water supply shall be protected against back flow in accordance with the requirements of this section, the New York City plumbing code, and rules of the New York City department of environmental protection.

The transformer vault and the electrical room on the basement level do not have sprinklers but have smoke detection and a two hour rated wall. Please refer to Figure 13 drawing name FS-3 of the Fire Sprinkler drawings in Appendix C and Figure 26 drawing name FA-3 of the Fire Alarm drawings in Appendix d for the location of the smoke detectors. Building Code Section 903.4 all valves controlling the water supply for automatic sprinkler systems, pump, tanks, water levels and temperatures, critical air pressures and water flow switches on all sprinkler systems shall be electrically supervised by the fire alarm system. Alarm, supervisory and trouble signals shall be distinctly different and automatically transmitted to an approved central station, remote supervising station or proprietary supervising station as defined in NFPA 72. Approved audible devices shall be connected to every automatic sprinkler system. Such sprinkler water flow alarm devices shall be activated by water flow equivalent to the flow of a single sprinkler of the smallest orifice size in the system. Approved supervised indicating valves

shall be provided at the point of connection to the riser on each floor in high rise buildings.

Refer to Appendix C for tables and figures. I want to discuss the design of the sprinkler system and discuss how the fire pump has met the requirements of the sprinkler system. First of all, there are two parts in determining the most demanding area. The fire water demand and the location of this design area. For example, the distance or elevation of the design area in relation to the location of the incoming fire water service. I will start off with how was the most hydraulic demanding area determined? Per section 5.3.2 of NFPA 13 the retail space is classified as Mercantile which has a water density of 0.2 GPM/FT^2 over 1500 FT^2 area of sprinkler operation area as shown in figure 11.2.3.1.1. Density Area Cure. The Educational Occupancy has the same area of operation but a density of 0.1 GPM/FT^2. With the use of quick response sprinklers the area of operation can be reduced in accordance to section 11.2.3.2.3.1 and Figure 11.2.3.2.3.1. For the second floor mercantile ceiling height of Fifteen feet the design area can be reduced Thirty-Three percent.

The water demand for the second floor mercantile is the design area of 1005 FT^2 multiplied by the density of 0.2 GPM/FT^2 equals Two Hundred and one gallons. The ceiling height in the multipurpose room is over twenty feet precluding the use of design area reduction. The water demand for the top floor multipurpose room is the design area of 1500 FT^2 times the density of 0.1 GPM/FT^2 equaling water demand of One Hundred and Fifty gallons. This is less than the demand of the second floor retail by Fifty gallons.

The next item to consider is the location of the design areas. The multipurpose room is Four stories above the Second floor retail, a distance of approximately Fifty Feet since the ceiling of the multipurpose room is more than twenty feet.

Looking at Figure 12 the static pressure is 53 PSI and the residual at 500 GPM is 52. The graph is the representation of the worst case flow test letters figure and 16. From inspection we can deduce that the flow test is able to reach the second floor without a pump from the flowing information. The elevation of the second floor ceiling is approximately twenty five feet above the ground level. With one pound of pressure approximately equal to two feet of lift, thirteen pounds of pressures is needed to raise the water to the sprinkler. Seven pounds of pressure is needed for the activation of the sprinkler. To be conservative estimate a backflow pressure drop of ten pounds, piping friction loss of anther ten pounds. Summing these numbers the total pressure required for the operation of the second floor is Forty pounds, with a ten pound safety factor the required pressure is fifty pounds. Since the flow test residual is fifty Two pounds there is not enough pressure to reach the sixth floor and therefore a pump is needed.

I have summarized the points of the graph in the table 12 below.

Table 12 Explanation of points on water supply curve

Point	Identification	Value	Description
C1	Flow test static	55 psi	Water pressure when there is no flow
C2	Residual pressure at flow	54 psi	Water pressure when the flow is 500 GPM
D1	Pressure required for elevation	33 psi	The pressure required to raise the water to the elevation neglecting friction
D2	The pressure required for the sprinkler demand	97 psi	The pressure required to operate the sprinkles including piping, elevation, and other friction losses
D3	Hose allowance	97 psi	The sprinkler demand must include a hose allowance, 100 GPM for light hazard
A1	Pump inlet pressure	55 psi	Pressure at inlet allowing for elevation difference
A2	Water supply pressure available at 1000 GPM	50 psi	This pressure is extrapolating what the pressure is past a point on the flow test
A3	Water supply pressure available at 1500 GPM	45 psi	As listed above extrapolating at a flow 1500 GPM
A1 + P1	Total pressure at no flow	138 psi	This point is added to the flow test static plus the pump dead heading or churn
A2+ P2	Total pressure at 1000 GPM	120 psi	This point is added the flow test plus the pump at 1000 GPM
A2 +P3	Total pressure at 1500 GPM	90 psi	This point is added the flow test and the pump at 1500 GPM

STANDPIPE SYSTEMS:

Section 905 standpipe systems shall be provided in buildings according to this section. Fire hose threads used in connection with standpipe systems shall be approved by the fire commissioner. Installation of standpipe systems shall comply with the special inspection requirements of chapter 17. Section 905.2 standpipe systems shall be installed in accordance with this section and NFPA 14 as modified in Appendix Q.

Section 905.3.1 Cass 3 standpipes systems shall be installed throughout the following buildings; In buildings two or more stories in height with a floor area of 10,000 FT^2 or greater on any story, in buildings three stories or more in height with a floor area or 7,500 FT^2 or greater on any story. In buildings of any area with a floor level having an occupant load of 30 or more that is located 55 feet or more above the lowest level or Fire Department Vehicle access. Exception 1, class I standpipes are allowed in buildings equipped throughout with an automatic sprinkler system in accordance with section903.1.1 or 903.3.1.2 provided the following additional requirements are met. 1.1 A locked storage cabinet is provided on the main entrance floor in a location approved by the approved by the fire commissioner near the standpipe riser enclosure. The cabinet shall have at least the open nozzles and 375 feet of 1-½ inch hose.

The building is required to have a Standpipe since it is more than Fifty Five in height, and has floor levels

larger than Ten thousand Square feet. Since the building is fully sprinklered a Class 1 standpipe is in installed.

Building Code Section 905.4 the location of Class 1 standpipe hose connections shall be provided in all of the following locations. In every required stairway, a hose connection shall be provided for each floor level above or below grade. At the roof or the highest landing of stairways with stair access to the roof. An additional hose connection shall be provided at the top of the most hydraulically remote standpipe for testing purposes. In buildings where more than one standpipe is provided, the standpipes shall be interconnected in accordance with NFPA 14.
Building Code Section 905.7.1 Cabinets shall be identified in an approved manner by a permanently attached sign with white letters not less than 2 inches high and a red background color. Section 905.9 valves controlling water supplies shall be supervised in the open position so that a change in the normal position of the valve will generate a supervisory signal at the supervising station required by section 903.4. Where a fire alarm system is provided, a signal shall be transmitted to the control unit.
The location of the hose valves is at each floor level. Refer to Figure 29 drawing FS-11 for the stair tower having two outlets.
A modification of section Q allows NFPA 14 section 7.8.1.1 for the pressure of 65 PSI at the top most Hose outlet instead on of 100 psi.
This building has met the requirements of section 905 standpipes systems as modified by appendix Q.

PORTABLE FIRE EXTINGUISHERS:

Section 906 portable fire extinguishers shall be provided in occupancies and locations as required by the New York City fire code. The following sections are from the NYC Fire Code, Section 906.1 portable fire extinguishers shall be installed in the following locations. 1, in all groups A, B, E, occupancies. Section 906.2 portable fire extinguishers shall be selected installed and maintain in accordance with this section and NFPA 10. Section 906.3 for occupancies that involve primarily class A fire hazards, the size and distribution shall comply with table 13 NYCFC 906.3(1).

Table 13 Portable Fire Extinguishers for Class A Fires NYCFC Table 906.3.1

	Light Hazard Occupancy	Ordinary Hazard Occupancy	Extra Hazard Occupancy
Minimum Rated Single Extinguisher	2-A	2-A	4-A
Maximum Floor Area per Unit of A	3,000 FT^2	1,500 FT^2	1,000 FT^2
Maximum Travel Distance to Extinguisher	75 feet	75 feet	75 feet

The building has met the requirements of Section 906 Portable Fire Extinguishers.

FIRE ALARM AND DETECTION SYSTEMS:

Building Code Section 907.2 an approved manual, automatic or manual and automatic fire alarm system shall be provided in accordance with sections 907.2.1 through 907.2.21. Where automatic sprinkler protection, installed in accordance with sections 903.3.1.1 or 903.1.2 is provided and connected to the building fire alarm system, automatic heat detection required by this section shall not

be required. An approved automatic fire detection system shall be installed in accordance with this code, the New York City mechanical code, and NFPA 72. Devices, combination of devices, appliances and equipment shall comply with section 907.1.2. The automatic fire detectors shall be smoke detectors, except that an approved alternate type of detector shall be installed in spaces such as boiler rooms where, during normal operation, products of combustion are present in sufficient quantity to actuate a smoke detector.
In all occupancies where an automatic fire alarm system is required by this section, selective coverage smoke detectors shall be located as follows, unless partial or total coverage automatic detection is specified. In each mechanical, electrical, equipment or similar room, in elevator machine rooms, and in elevator lobbies.
Building Code Section 907.2.1 a manual and automatic fire alarm system shall be installed in accordance with NFPA 72 in group A occupancies having an occupant load of 300 or more. Portions of Group E occupancies occupied for assembly purposes shall be provided with a fire alarm system as required for the Group E occupancy. Exception 1, manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system and the notification appliances will activate upon sprinkler water flow. Manual pull stations have been installed in the school.
Activation of the fire alarm in Group A-1 occupancies with an occupant load of 300 or more, shall initiate a pre-signal system at a constantly attended location from which the Fire Department shall be notified and live voice evacuation instructions shall be initiated using an emergency voice communications system in accordance with NFPA 72. The multipurpose room has invoked this requirement.
Emergency voice and or alarm communications systems where required by section 907.2.1.1 shall be provided with an approved emergency power source and shall be designed and install accordance with NFPA 72 and the New York City Electrical Code.
Building Code Section 907.2.3 a manual and automatic fire alarm system shall be installed in Group E occupancies. When automatic sprinklers or smoke detectors are installed, such systems or detectors shall be connected to the building fire alarm system.
Building Code Section 907.2.7 a manual and automatic fire alarm system shall be installed in Group M occupancies where any of the following conditions exits, where a Group M fire area exceeds 12,000 square feet. Where all of the combined floor area for the Group M occupancies has a fire area exceeding 24,000 square feet. Where a Group M fire area in a below grade story exceeds 1,500 square feet. The mercantile areas on the basement, first and second floors evoke this requirement.
Building Code Section 907.3 manual fire alarm boxes shall be installed in accordance with sections 907.3.1 through 907.3.5. Manual fire alarm boxes shall be located not more than 5 feet from the entrance to each exit. Additional boxes shall be located so the travel distance to the nearest box does not exceed 200 feet. The mounting height shall be between 42 and 48 inches. The boxes shall be red in color. Protective covers shall be required at the direction of the Fire Department.
Building Code Section 907.4 the primary and secondary power supply for the fire alarm shall be provided in accordance with NFPA 72. Refer to tables 37 thru 44 in Appendix D for calculations.
Building code Section 907.5 wiring shall comply with the requirements of the New York City Electric Code and NFPA 72. Refer to Figure 31 drawing FA-2 section 16721 Fire Alarm System for compliance to electrical requirements.
Building Code Section 907.7 pre-signal system and 24 hour personnel supervision station shall be approved by the fire department system. The transmission of the alarm signal to the supervising station shall activate upon the initial alarm signal.
Building Code Section 907.9.1 visible alarm notification appliances shall be provided in accordance with sections 907.9.1.1 through 907.9.1.3. In public and common areas, employee work areas.
Section 907.9.2 audible alarm notification appliances shall be provided and shall sound a distinctive sound that is not to be used for any purpose other than that of a fire alarm. The audible alarm

notification appliances shall provide sound pressure level of 15 decibels above the average ambient sound level or 5 DBA above the maximum sound level having duration of at least 60 seconds, whichever is greater, in every occupied space within the building. The minimum sound pressure levels shall be 90 DBA in mechanical equipment rooms and 60 dba in other occupancies. The maximum sound pressure level for audible alarm notification appliances shall be 120 dba at the minimum hearing distance from the audible appliance. Where the average noise is greater than 105 dba, visible alarm notification appliances shall be provide in accordance with NFPA 72.
Building Code Section 907.11 where a fire alarm system is provided, duct smoke detectors shall be connected to the building's fire alarm control panel. Upon activation of the Fire Alarm System duct detectors the HVAC unit in which the duct detector is located shall shut down the HVAC unit. Dampers shall close in accordance with section 716 of the building code. Smoke dampers will activate to prevent the passage of smoke at air supply openings that serve public corridors that serve as fire barriers or at penetrations of shaft enclosures.
Building Code Section 907.14 where required by this chapter or the New York City Fire Code, an approved supervising station in accordance with NFPA 72 shall be provided.
Building Code Section 907.16 upon completion of the installation of the fire alarm system, alarm notification appliances and circuits, alarm initiating devices and circuits, supervisory-signal initiating devices and circuits, signaling line circuits, and primary and secondary power supplies shall be tested in accordance with NFPA 72.
Building Code Section 907.17 a record of completion in accordance with NFPA 72 verifying the system has been installed in accordance with the approved construction documents and specifications shall be provided.
Building Code Section 907.18 Operating, testing and maintenance instructions and record as builts and equipment specifications shall be provided at an approved location.
Building Code Section 907.19 the maintenance and testing schedules and procedures for fire alarm and detection systems shall be in accordance with the New York City Fire Code.

The building has met the requirements of Section 907 Fire Alarm and Detection Systems by providing appropriate notification, limited detection in the form of duct detectors, and the installation of smoke and fire dampers to limit the spread of smoke and fire. The next section to cover is means of egress which will include the occupancy classifications to determine quantity of people, egress paths and the components of egress to verify compliance with the code.

MEANS OF EGRESS

Building Code Section 1003.1 the general requirements specified in sections 1003 through 1012 shall apply to all three elements of the means of egress system, in addition to those specific requirements for the exit access, the exit and the exit discharge detailed elsewhere in this chapter.
Building Code Section 1003.2 the means of egress shall have a ceiling height of not less than 6 feet, 6 inches. Exceptions, allowable projections in accordance with section 1003.3, stair headroom in accordance with section 1009.2, door height in accordance with section 1008.1.1.3.
Building Code Section 1003.3 protruding objects are permitted to extend below the minimum ceiling height required by section 1003.2 provided minimum headroom of 84 inches shall be provided for any walking surface, including walks, corridors, aisles and passageways. Not more than 50 percent of the ceiling area of a means of egress shall be reduced in height by protruding objects. Exception, door

closers and stops shall not reduce headroom to less than 78 inches.
Horizontal projections, structural elements, fixtures or furnishings shall not project horizontally from either side more than 4 inches over and walking surface between the heights of 27 inches and 80 inches above the walking surface. Exceptions, handrails serving ramps and stairs are permitted to protrude 4.5 inches.
Building Code Section 1003.5 where changes in elevation of less than 12 inches exist in the means of egress, sloped surfaces shall be used. Where the slope is greater than one unit vertical in 20 units horizontal, ramps complying with section 1010 shall be used. Where the difference in elevation is 6 inches or less and the ramp is not equipped with handrails, the floor finish materials shall contrast with adjacent floor finish materials.
Building Code Section 1003.6 the path of egress travel along a means of egress shall not be interrupted by any building element other than a means of egress component as specified in this chapter. Obstructions shall not be placed in the required width of a means of egress except projections permitted by this chapter. The required capacity of a means of egress system shall not be diminished along the path of egress travel.
This building has met the requirements.

OCCUPANT LOAD:

Building Code Section 1004.1 in determining means of egress requirements, the number of occupants for whom means of egress facilities shall be provide shall be established by the largest number computed in accordance with sections 1004.1.1 through 1044.1.3. Section 1004.1.2 the number of occupants computed at the rate of one occupant per unit of area as prescribed in section 1004.1.2., Table 14.

Table 14 Maximum Floor Area Allowance per Occupant NYCBC Table 1004.1.2

Use of Space	Floor Area in FT^2 Per Occupant
Assembly without fixed seats Concentrated (chairs only-not fixed) Unconcentrated (tables and chairs)	 7 net 15 net
Business areas	100 gross
Educational Classroom area Shops and other vocational areas	 20 net 50 net
Gymnasiums	15 net
Locker rooms	50 gross
Mercantile Areas on other floors Basement and grade floor areas Storage, stock, shipping areas	 60 gross 30 gross 300 gross
Stages and platforms	15 net for performing area and 50 net remaining area

Refer to figures in Appendix F for Occupancy Classification and Occupant Loads

Table 15 summarizes the occupant load by floor. The occupant load for the six floor is limited. The Egress capacity cannot handle the occupant load of the education and assembly simultaneously.

Table 15 Occupant Load Factor by Floor

Floor	Quantity of people for Business	Quantity of people for Storage	Quantity of people for Mechanical	Quantity of people for Education	Quantity of people for Assembly	Quantity of people for Mercantile	Total Occupant Load
Basement		4	4			694	702
First	2	1				718	721
Second			290				290
Third	151			491	98		605
Fourth	12		1	551	63		627
Fifth	8			653			661
Sixth		2		364	922		924
Roof			4		290		294

Building Code Section 1004.1.3 where occupants from accessory spaces egress through a primary area, the calculated occupant load for the primary space shall include the total occupant load of the primary space plus the number of occupants egressing through it from the accessory space.
Building Code Section 1004.3 every room or space that is assembly occupancy shall have the occupant load of the room or space posted in a conspicuous place, near the main exit or exit access doorway from the room or space. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner. Signs shall comply with section 1024.1.2.
Building Code Section 1004.4 where exits serve more than one floor, only the occupant load of each floor considered individually shall be used in computing the required capacity of the exits at that floor.
Building Code Section 1004.7 for areas having fixed seats and isles, the occupant load shall be determined by the number of fixed seats installed therein. For areas having fixed seating without dividing arms, as in our case with the bleaches on the top floor in the gymnasium, the occupant load shall not be less than the number of seats based on one person for each 18 inches of seating length.
Building Code Section 1004.8 yards, patios, courts and similar outdoor areas, the playground located on the roof at this building, shall be provided with a means of egress as required by this chapter.
Building Code Section 1004.9 where a building contains two or more occupancies, the means of egress requirements shall apply to each portion of the building based on the occupancy of that space. Where two or more occupancies utilize portions of the same means of egress system, those egress components shall meet the more stringent requirements of all occupancies that are served.

EGRESS WIDTH:

Building Code Section 1005.1 the total width of means of egress in inches shall not be less the total occupant load served by the means of egress multiplied by the factors in Table 16. Multiple means of egress shall be sized such that the loss of any one means of egress shall not reduce the available capacity to less than 50 percent of the required capacity. The maximum capacity required from any story of a building shall be maintained to the termination of the means of egress.

Table 16 Egress Width per Occupant Served NYCBC Table 1005.1

Occupancy	Stairways (inches per occupant)	Other Components (inches per occupant)
A, B, E, M	0.3	0.2

Building Code Section 1005.2 doors opening into the path of egress travel shall not reduce the required width to less than one-half during the course of the swing. When fully open, the door shall not project more than 7 inches into the required width.

Table 17 below determines the limiting factor, door or stair for egress capacity.
Refer to Appendix G egress drawing calculations.

Table 17 Egress Capacity Summary table

FLOOR	OCCUPANCY	OCCUPANT LOAD	EGRESS CAPACITY*		TOTAL EGRESS CAPACITY
			STAIR	DOOR	
Basement	Mercantile A Mechanical	702	746	-	746
First Floor	Education	-	-	-	-
	Mercantile C	146	-	900	900
	Mercantile B	422	-	720	720
	Mercantile D-L	By inspection egress code compliant			
Second Floor	Mercantile B	231	-	540	540
Third Floor	Education Business	605	180	586	766
Fourth Floor	Education Business	551	180	586	766
Fifth Floor	Education Business	553	180	586	766
Sixth Floor	Assembly	786	786	-	786
Roof	Assembly Mechanical	204	586	-	586

*Limiting capacity of door or stair based on width

MEANS OF EGRESS ILLUMINATION:

Building Code Section 1006 exit discharges and public corridors shall be illuminated at all times. Exit access components shall be illuminated at all times during occupancy. The means of egress illumination level shall not be less than 2 foot candles at the floor level in exits, at exit discharges, and in public corridors shall not be less than 1 foot candles. The power supply for means of egress illumination shall normally be provided by the premise's electrical supply. In the event of power failure an emergency electrical system shall automatically illuminate the following areas, Exit access corridors, passage ways, exit passage ways, exit stairways, exit discharge. The emergency power system shall provide power for duration of not less than 90 minutes and shall consist of storage batteries, unit equipment or an onsite generator. The installation of emergency power system shall be in accordance with section 2702.

Building Code Section 2702.1 emergency systems shall be installed in accordance with the New York City Electrical Code, NFPA 110 and NFPA 111, and shall have an on premise fuel supply sufficient for not less than 6 hour full demand operation of the system.
The building is provided with a generator, fuel storage tank and day tank meeting the requirement of 6 hour run time.
Emergency lighting facilities shall be arranged to provide initial illumination that is at least an average of 2 foot candle and a minimum at any point of .2 foot candle measured along the path of egress at floor level. Emergency lights are installed at adequate spacing to provide the required light levels.

The building has met the requirements of section 1006 Means of Egress Illumination.

ACCESSIBLE MEANS OF EGRESS:

Building Code Section 1007 accessible spaces shall be provided with not less than one accessible means of egress. Where more than one means of egress is required by section 1014.1 or 1018.1 from any accessible space, at least two accessible means of egress shall be provided to each accessible portion of the space. Each required accessible means of egress shall be continuous to a public way and shall consist of one or more of the following components, area of rescue assistance complying with section 1007.6, Stairways within vertical exit enclosures complying with sections 1007.3 and 1019.1. An accessible exit stair means of egress must have a minimum clear width of 48 inches between handrails and shall incorporate an area of rescue (an of refuge) assistance with an enlarged floor level landing or shall be accessed from either an area of rescue assistance complying with section 1007.6. Exception to the clear width of 48 inches between handrails and the area of rescue assistance is not required at exit stairways in buildings equipped throughout with an automatic sprinkler system in accordance with section 903. Every required area of rescue assistance shall be accessible from the space it serves by one or more accessible means of egress components as listed in Section 1007.2. The maximum travel distance from any accessible space to an area of rescue assistance shall not exceed the travel distance permitted for the occupancy in accordance with Section 1015.1. Every required area of rescue assistance shall have direct access to an enclosed stairway complying with Sections 1007.3 and 1019.1.
Each area of rescue assistance shall be sized to accommodate one wheelchair space of 30 inches by 48 inches for each 200 occupants or portion thereof, based on the occupant load of the area of rescue assistance and areas served by the area of rescue assistance. Such wheelchair spaces shall not reduce the required means of egress width. Access to any of the required wheelchair spaces in an area of rescue assistance shall not be obstructed by more than one adjoining wheelchair space. Section 1007.6 areas of rescue assistance shall be provided with a two-way communication system between the areas of rescue assistance and a central control point. If the central control point is not constantly access to a public telephone system. Location of the central control point shall be approved by the Fire Department. In areas of rescue assistance that have a two-way emergency communications system, instructions on the use of the area under emergency conditions shall be posted adjoining the communications system. The instructions shall include all of the following, directions to find other means of egress, information on planned availability of assistance in the use of stairs and how to summon such assistance, directions for use of the emergency communications systems. Each door providing access to an area of rescue assistance from an adjacent floor area shall be identified by a sign complying with ICC A117.

DOORS:

Section 1008 the minimum width of each door opening shall be sufficient for the occupant load thereof and shall provide a clear width of not less than 32 inches. Clear openings of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees. Where this section requires a minimum clear width of 32 inches and a door opening includes two door leaves without a mullion, one leaf shall provide a clear opening width of 32 inches. The maximum width of a swinging door leaf shall be 48 inches nominal. Exception, door openings to storage closets less than 10 square feet shall not be limited by the minimum width. Projections are not allowed into the required clear width lower than 34 inches. Projections into the clear opening width between 34 inches and 80 inches above the floor or ground shall not exceed 4 inches. Doors shall swing in the direction of egress travel where serving, rooms or spaces with an occupant load of 50 or more, rooms or spaces requiring more than one exit. The opening force for interior side-swinging doors without closers shall not exceed a 5-pound force. Section 1008.1.4 there shall be a floor or landing on each side of a door. The floor or landing shall be at the same elevation on each side of the door. Landings shall be level except for exterior landings, which are permitted to have a slope not to exceed (2-percent slope). Landings at doors shall have a width not less than the width of the stairway or the door, whichever is the greater. Doors in the fully open position shall not reduce a required dimension by more than 7 inches. When a landing serves an occupant load of 50 or more, doors in any position shall not reduce the landing to less than 75 percent of its required width. Landings shall have a length measured in the direction of travel of not less than 44 inches. Thresholds at doorways shall not exceed 0.5 inch. Raised thresholds and floor level changes greater than 0.25 inch at doorways shall be beveled with a slope not greater than 50-percent slope. Egress doors shall be readily openable from the egress side without the use of a key or special knowledge or effort. Door handles, pulls, latches, locks and other operating devices shall be installed 34 inches minimum and 48 inches maximum above the finished floor. Interior stairway means of egress doors shall be openable from both sides without the use of a key or special knowledge or effort. Exception, stairway discharge doors shall be openable from the egress side and shall only be locked from the opposite side. Each door in a means of egress from an occupancy of Group A or E having an occupant load of more than 75, shall be provided with panic hardware. The actuating portion of the releasing device shall extend at least one half of the door leaf width. The maximum unlatching force shall not exceed 15 pounds.

STAIRWAYS AND HANDRAILS:

Building Code Section 1009 the width of stairways shall be determined as specified in section 1005.1, but the width shall not be less than 44 inches. Exception if stairway serves an occupant load of less than 50 people. Stairways shall have a minimum headroom clearance of 84 inches measured vertically from the edge of stair. The headroom shall be continuous to the landing below. Stair riser heights shall be 7 inches and 4 inches minimum. Stair tread depths shall be I I inches minimum. The riser height shall be measured vertically between the leading edges of adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than 0.375 inch. The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than 0.375 inch.

There shall be a floor or landing at the top and bottom of each stairway. The width of landings shall not be less than the width of stairways they serve. Every landing shall have a minimum dimension measured in the direction of travel equal to the width of the stairway.

A flight of stairs shall not have a vertical rise greater than 12 feet between floor levels or landing, except

that the vertical rise shall not be greater than 8 feet in Group A occupancies.
Stairways shall have handrails on each side. Handrails shall be adequate in strength and attachment in accordance with section 1607.7. Handrail height measured above stair tread nosing, shall be uniform, not less than 34 and not more than 38 inches. Handrails with a circular cross section shall have an outside diameter of at least 1.25 inches and not greater than 2 inches or shall provide equivalent graspability. Projections into the required width at each handrail shall not exceed 4.5 inches
In buildings four or more stories or more than 40 feet in height above grade, one stairway shall extend to the roof surface through a stairway bulkhead complying with Section 1509.2.

Exit Signs:

Building Code Section 1011 Exits and exit access doors shall be marked by an approved exit sign readily visible from any direction of egress travel. Access to exits shall be marked by readily visible exit signs in cases where the exit or the path of egress travel is not immediately visible to the occupants. Exit sign placement shall be such that no point in an exit access corridor is more than 100 feet or the listed viewing distance for the sign, whichever is less, from the nearest visible exit sign. Exit signs are not required in rooms or areas which require only one exit or exit access. Exit signs shall be internally or externally illuminated. A tactile sign stating EXIT and complying with ICC A 117.1 shall be provided adjacent to each door to an egress stairway, an exit passageway and the exit discharge. Internally illuminated exit signs shall be listed and labeled and shall be installed in accordance with the manufacturer's instructions and Section 2702. Exit signs shall be illuminated at all times. The letters of exit signs shall be red. Section 1011.4.2 The height of letters shall be not less than 6 inches (152 mm), except that in Group A occupancies letters shall be not less than 8 inches.

Guards:

Building Code Section 1012 Guards shall be located along mezzanines, industrial equipment platforms, stairways and landings which are located more than 30 inches above the floor. Guards shall be adequate in strength and attachment in accordance with section 1607.7. Exception, guards are not required on the loading side of loading docks or piers. Guards shall form a protective barrier not less than 42 inches high, measured vertically above the leading edge of the tread. Open guards shall have balusters or ornamental patterns such that a 4-inch-diameter sphere cannot pass through any opening up to a height of 34 inches. From a height of 34 inches to 42 inches above the adjacent walking surfaces, a sphere 8 inches in diameter shall not pass.

Exit Access:

Building code Section 1013 exit access arrangement shall comply with Sections 1013 through 1016 and the applicable provisions of Sections 1003 through 1012. Egress from a room or space shall not pass through adjoining or intervening rooms or areas, except where such adjoining rooms or areas are accessory to the area served; are not high-hazard occupancy and provide a discernible path of egress travel to an exit. Egress shall not pass through kitchens, storage rooms, closets or spaces used for similar purposes. An exit access shall not pass through a room that can be locked to prevent egress.

Exit and Exit Access Doorways:

Building Code Section 1014 two exits or exit access doorways from any space are required where any of the following conditions exists, the occupant load exceeds the values in Table 18, the common path of travel exceeds Seventy-Five feet. If the Occupancy is B and sprinklered throughout in accordance to section 903.1.1, One hundred feet is allowed.

Table 18 Spaces with One Means of Egress NYCBC Table 1014.1

Occupancy	Minimum Occupant Load
A, B, E, M	74
S	30

Access to three or more exits shall be provided from a floor where required by section 1018.1. Required exits shall be located in a manner that makes their availability obvious. Exits shall be unobstructed at all times. Exit and exit access doorways shall be arranged in accordance with Sections 1014.2.1 and 1014.2.2. Where two exits or exit access doorways are required from any portion of the exit access, the exit doors or exit access doorways shall be placed by exception 2, a distance apart equal to one third of the length of the maximum overall diagonal dimension. Where access to three or more exits is required, at least two exit doors or exit access doorways shall be placed by the exception 1, a distance apart equal to one third of the length of the maximum overall diagonal dimension.

Exit Access Travel Distance:

Building Code Section 1015 Exits shall be so located on each story such that the maximum length of exit access travel, measured from the most remote point within a story to the entrance to an exit along the natural and unobstructed path of egress travel, shall not exceed the distances given in Table 19.

Table 19 Exit Access Travel Distance NYCBC Table 1015

Occupancy	Travel Distance (Ft.)
A	See table for Primary & Secondary Distance 1024
B	300
E, M, S-1	200
S-2	250

Corridors:

Building Code Section 1016 corridors shall be constructed in accordance with this section. Interior corridor wall required to be fire resistance rated shall comply with section 708 for fire partitions. Public corridor walls shall comply with section 706 for fire barriers. The required rating of the interior corridors not subjected to section 706 and 708 is zero due to being fully sprinklered. The minimum corridor width shall be as determined in section 1005.1, but not less than 44 inches except for access to equipment where 24 inches is allowed. 66 inch corridor width in E occupancy. Where more than one exit component is required, dead ends are limited to 20 FT. Group B is permitted to have 50 feet dead ends.

Exits:

Building Code Section 1017 exits shall comply with sections 1017 through 1022 and the applicable sections of 1003 through 1012. Once a given level of exit protection is achieved, such level of protection shall not be reduced until arrival at the exit discharge.

Number of Exits and Continuity:

Building Code Section 1018 all rooms and spaces within each story shall be provided with and have access to the minimum required number of exits as required by Table 20. For the purpose of this chapter, occupied roofs shall be provided with exits as required for stories. The required number of exits from any story, basement or individual space shall be maintained until arrival at grade or the public way. Unless required by other sections of this code, the minimum number of exits from the ground floor discharging at grade directly to the exterior shall in accordance with

Table 20 Minimum Number of Exits for Occupant Load NYCBC table 1018.1

Occupant Load	Number of Exits
1-500	2
501-1,000	3

Exits shall be continuous from the point of entry into the exit to the exit discharge. Exit door arrangement shall meet the requirements of sections 1014.2 through 1014.2.2.
Refer to appendix H Egress calculations drawings. The critical points of egress have been met, travel distance, corridor rating, exit protection, quantity and continuity, to be code compliant to chapter ten of the New York City building code.

Vertical Exit Enclosures:

Building Code Section 1019 Interior exit stairways shall be enclosed with fire barriers. Exit enclosures shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more. The number of stories connected by the shaft enclosure shall include any basements but not any mezzanines. An exit enclosure shall not be used for any purpose other than means of egress. Enclosures shall be constructed as fire barriers in accordance with Section 706.
Exit enclosure opening protectives shall be in accordance with the requirements of section 715. Penetrations into and openings through an exit enclosure are prohibited except for required exit doors, equipment and ductwork necessary for independent pressurization, sprinkler piping, standpipes, electrical raceway for Fire Department communication and electrical raceway serving the exit enclosure and terminating at a steel box not exceeding 16 square inches. Such penetrations shall be protected in accordance with Section 712. There shall be no penetrations or communication openings, whether protected or not, between adjacent exit enclosures.
Exterior walls of a vertical exit enclosure shall comply with the requirements of Section 704 for exterior walls. Where nonrated walls or unprotected openings enclose the exterior of the stairway and the walls or openings are exposed to other parts of the building at an angle of less than 180 degrees, the building exterior walls within 10 feet horizontally of a nonrated wall or unprotected opening shall be constructed as required for a minimum 1-hour fire-resistance rating with 45 minute opening protectives. This construction shall extend vertically from the ground to the roof line.

A sign shall be provided at each floor landing in interior vertical exit enclosures designating the floor level, the terminus of the top and bottom of the stair enclosure and the identification of the stair. The signage shall also state the story of, and the direction to the exit discharge and the availability of roof access from the stairway for the Fire Department. Each stair shall be identified by an alphabetic letter. Stairway identification signs shall be provided on both sides of each stair door. The signs shall be located 5 feet above the floor landing in a position which is readily visible when the doors are in the open and closed positions.

Exit Discharge:

Building Code Section 1023 Exits shall discharge directly to the exterior of the building. The exit discharge shall be at grade or shall provide direct access to grade. The exit discharge shall not reenter a building.

Assembly:

Building Code Section 1024 signs shall be posted in all assembly spaces, indicating the number of persons who may legally occupy the space. When a space is occupied for multiple purposes involving different occupant loads the sign shall reflect the different occupant loads. Signs shall be at least 12 inches wide and 16 inches high. The lettering shall be red on a white background. The letters shall be at least 1 inch high and the numerals at least 1-1/ 4 inches high. Signs shall be framed under a transparent protective cover, and permanently mounted in a location that is conspicuously visible to a person entering the space. Signs shall be lighted by artificial illumination at all times during occupancy to maintain at least 5 foot-candles on the surface of the sign
Copies of approved plans and approved alternate plans shall be kept on the premises. The plans shall be readily available for inspection, and shall provide the required information.
Buildings or spaces occupied by Group A that have an occupant load of greater than 300 shall be provided with a main exit. Such main exit shall be of sufficient width to accommodate not less than one-half of the occupant load, but such width shall not be less than the total required width of all means of egress leading to the exit. Where the main use or dominant occupancy of the building is classified as Group A, the main exit shall front on at least one street or an unoccupied space of not less than 10 feet in width that adjoins a street or public way. Other additional exits shall provide an egress capacity for at least one-half of the total occupant load served by that level and comply with Section 1014.2. Section 1024.2.1 where the net floor area of an assembly space, exclusive of stage area, is less than 12 square feet per person, such spaces shall also comply with Section 1024.17.
Exits and aisles shall be so located such that the travel distance to an exit door shall be provided in accordance with Table 1024.7. At least one exit opening shall be available from every standee space in an assembly space, or from the most remote point in the space when movable seats are provided, within the primary travel distance limitation listed in Table 21. In addition, an alternate exit opening shall be available from every standee space or from the most remote point when attached seats are not provided within the secondary travel distance limitation listed in Table 20. Such alternate exit openings may serve to satisfy the requirements for primary travel distance for other seats or locations. Where aisles are provided for seating, the distance shall be measured along the aisles and aisle access way without travel over or on the seats.

Table 21 Travel Distance NYCBC Table 1024.7

Occupancy	Primary	Secondary
A-1 thru A-4	150	250

The common path of travel shall not exceed 30 feet from any seat to a point where a person has a choice of two paths of egress travel to two exits.
Every occupied portion of any occupancy in Group A that contains seats, tables, shall be provided with aisles leading to exits or exit access doorways in accordance with this section. Aisle access ways for tables and seating shall comply with Section 1013.4.2. Section 1024.9.1 the minimum clear width of aisles shall be 36 inches for aisle not seating more than 50 seats.
Where seating rows have 14 or fewer seats, the minimum clear aisle access way width shall not be less than 12 inches measured as the clear horizontal distance from the back of the row ahead and the nearest projection of the row behind. Section 1024.10.1 for rows of seating served by aisles or doorways at both ends, there shall not be more than 100 seats per row. The minimum clear width of 12 inches between rows shall be increased by 0.3 inch for every additional seat beyond 14 seats, but the minimum clear width is not required to exceed 22 inches.
Standee areas may be permitted within assembly spaces provide each standee has a minimum width of 22 inches and a minimum depth of 21 inches. Standee areas shall not encroach on the required exit facilities and shall be separated from the space to be left clear for passage by tape, ribbon or other easily broken material, supported by lightweight posts fixed in stationary sockets.
Places of assembly in which the net floor area is less than 12 square feet per person shall have special egress provisions in accordance with this section. Class 1-Exit openings that are used for normal entry to the assembly space, and that open directly to a safe area or to an open exterior space. Class 2-Exit openings that are not used for normal entry to the assembly space, and that open directly to a safe area or to an open exterior space. Class 3-Exit openings are open from the assembly space into corridors, exit passageways or vertical exits.
The required exit capacity from assembly spaces in which the net floor area, exclusive of the stage area, is less than 12 square feet per person, shall be distributed so that exit openings of each class are provided to comply with the following requirements. Class 1-not less than 60 percent. Class 3-not more than 40 percent.
The capacity of exits from safe areas shall be provided for all occupants of the safe area. Safe areas shall comply with the following requirements, when provided to serve Class 1 or 2 exit openings, safe areas shall be separated from assembly spaces by noncombustible construction having a 2 hour fire-resistance rating, and shall serve as transition areas in the line and direction of exit travel. They shall serve for normal entry to the assembly space and may be used as corridors, or lobbies. The clear unobstructed floor area of each safe area shall be sufficient to accommodate the total occupant load of the safe area on the basis of 3 square feet per person, not including space occupied by furniture or equipment. The minimum dimension of such unobstructed space shall be 8 feet. The width of the unobstructed space shall be measured at right angles to the direction of travel to an exit and shall not be less than required for the occupant load. In addition to requirements of Section 1006, safe areas shall be artificially lighted by electrical means at all times during occupancy of a place of assembly so as to provide illumination of at least 5 foot-candles at the level of the floor within the safe area.

The building has met the requirements for stair tower rating, exit discharge location to exterior, exit capacity ratio for primary and alternate exits and, common path travel to an exit for assembly occupancy to be code compliant for these requirements.

SIGNAGE:

Building code Section 1026 Exits signs shall be provided in accordance with Section 1011. Stairway floor number and stairway identification signs shall be provided in accordance with Section 1019.1.7. Elevator identification and emergency signs shall be provided in accordance with Section

3002.3. Section 3002.3 an approved pictorial sign of a standardized design shall be posted adjacent to each elevator call station on all floors instructing occupants to use the exit stairways and not to use the elevators in case of fire. The sign shall read: IN FIRE EMERGENCY, DO NOT USE ELEVATOR. USE EXIT STAIRS.
For the following buildings, signs shall be posted and maintained on exit stair doors in accordance with this section, Buildings or portions thereof occupied by Group B or arranged to be occupied by more than 100 persons above or below the street level or more than 500 persons in the entire building. On the stair side, signs shall be posted and maintained at all stair doors at every floor. Such signs shall be either, Reentry. Where reentry is provided, a sign shall read, "REENTRY ON THIS FLOOR." The lettering and numerals of the signs shall be at least 1/ 2 inch high of bold type. The lettering and background shall be contrasting colors and the signs shall be securely attached approximately 5 feet above the floor. The signs may be either independent or combined with floor and stairway identification signs.
Accessible means of egress shall be provided with signs in accordance with Sections 1007.6.5 and 1007.7.
Occupant load signs shall be provided in accordance with Section 1004.3. Signs required by this section shall be of metal or other durable material.
Prescriptive egress conclusion:
The building has an issue with the mechanical room located on the roof. The maximum travel distance for one exit has been exceeded.

The building has met the requirements of chapter ten means of egress with one exception. On the roof the travel distance exceeds one hundred feet for one exit. A second means of egress is provided and is one hundred and five feet failing to meet the required common path of travel distance of seventy five feet. New York City does not follow the NFPA 101 Life safety code but, I would be remiss in my egress evaluation if I did not discuss some of the shortcomings of the building pertaining to this code. The life safety code has the following requirements for the kindergarten, first and second grades.
14.2.1.2 Rooms normally occupied by preschool, kindergarten, or first grade students shall be located on al level of exit discharge, unless otherwise permitted by 14.2.1.4.

14.2.1.3 Rooms normally occupied by second grade students shall not be more than one story above a level of exit discharge, unless otherwise permitted by 14.2.1.4

14.2.1.4 Rooms or areas located on floor levels other than as specified in 14.2.1.2 and 14.2.1.3 shall be permitted to be used where provided with independent means of egress dedicated for use by the preschool, kindergarten, first or second grade students.

Emergency Planning and Preparedness

Fire Code Section 401:

Fire Drill Procedure

Since the building is a school and a mercantile structure it is required to follow the New York City fire code. The school has an additional requirement of following the New York State Department of Education. The requirements of the Fire Code are fist.

Fire Code Section 401 the owner shall designate competent persons to act as FSP staff, train the FSP staff and conduct fire drills. Such persons shall possess such qualifications and or hold such certificate of fitness as are required by this chapter or the rules. The owner shall ensure that adequate FSP staff is present on the premises during regular business hours, and at other times when the building is occupied, to perform the duties and responsibilities set forth in the fire safety and evacuation plan.

Fire Safety and Evacuation plans:

Fire Code Section 404, a fire safety and evacuation plan is required for the following occupancies and buildings. Group M occupancies occupied or designed to be occupied by more than 500 persons on one or more floors, including street level, or by more than 100 persons on one or more floors other than street level, or in which more than 25 persons are employed. Group E occupancy schools, educational facilities and day care facilities.

A fire safety and evacuation plan shall include the following information and such other information and documentation as required by the commissioner.

1. The procedures for notifying building occupants of a fire and reporting a fire to the department, including the preferred and any alternative means of notifying and reporting.
2. Whether the response to a fire emergency will require the occupants of the building to be completely evacuated, partial evacuation or relocated within the building and the procedures for each such response.
3. Site plans indicating the following:
    a. Surrounding buildings and streets, including cross streets, and fire apparatus access roads.
    b. The location of building occupant assembly areas.
4. Floor plans, with corresponding legend, identifying the locations of the following:
    a. Exits
    b. Evacuation routes
    c. Fire Barriers
    d. Areas of refuge
    e. Stairs with letter designation
    f. Access and convince stairways.
    g. Elevator bank letters and car number designations.
    h. Fire command station.
    i. Fire warden phones
    j. Manual fire alarm boxes
    k. Standpipe hose outlets
    l. Sprinkler and standpipe system control valves.
    m. Emergency power generator and fuel supply
5. Identification of fire safety director or other building employees responsible for implementing the fire safety and evacuation plan (FSP), training FSP staff, or other duties related to the fire safety and evacuation plan
6. Identification and assignment of personnel responsible for operation of building fire protection, fire extinguishing and life safety systems, or other critical equipment.
7. Procedures for employees who must operate critical equipment.
8. Procedures for accounting for building employees and building occupants after such employees or occupants have been relocated or evacuated to a safe area.
9. Identification and assignment of personnel responsible for implementing the plan.

10. Identification of personnel available to provide emergency medical care.
11. A description of the emergency voice/alarm communication system alert tone and preprogrammed voice messages.
12. Procedures for identifying in advance building occupants who require assistance to participate in the plan because of an infirmity or disability or other special need, and approved procedures for providing such assistance.

Fire safety and evacuation plans and emergency action plans shall be reviewed and updated as necessitated by changes in staff assignments, use or occupancy, or the design and arrangement of the premises, but at the least annually. An entry shall be made in the log book required by section 405 documenting such review, and indicating the general nature of any amendments to be made to such plan.

A copy of the fire safety and evacuation plan and the emergency action plan shall be readily available of the premises during regular business hours.

Fire Drills and Emergency Action Plan (EAP) Drills:

Fire code section 405 requires fire drills be conducted in the building as set forth in Table 22. All building occupants, including the FSP staff, shall participate in fire drills.

Table 22 Fire Drill Frequency NYCFC Table 405.2

OCCUPANCY OR BUILDING TYPE	FREQUENCY
Group E schools and educational facilities	In accordance with New York State Education
Group M	No requirements listed in table

EAP drills shall be conducted or a regular basis, during business hours, in accordance with the following.

1. At least to EAP drills shall be conducted within one year of the date of department acceptance of the building's initial emergency action plan, the first of which shall be conducted within six months of such date of acceptance.
2. Beginning one year from the date of department acceptance of the building's initial emergency action plan, an EAP drill shall be conducted on each floor of the building at least once a year.

All building occupants present on the affected floors at the time the EAP drill is conducted, including visitors, shall participate.
EAP drills shall be conducted separately from fire drills required for the building, and shall highlight the differences between the building's fire safety and evacuation plan and emergency action plan, and the appropriate actions to be taken by building occupants upon implementation of each plan.
A written record of fire drills and EAP drills shall be maintained in a bound log book with consecutive numbered pages, or other form of approved electronic recordkeeping, and maintained on the premises for a period of 3 years for fire drills, and 5 years for EAP drills, and made available upon request of any department representative. An entry shall be made in such log book for each fire drill and EAP drill that is conducted in the building that includes the following information.

1. The name and if applicable, certificate of fitness number of the person conducting the drill.
2. Date and time of the drill
3. Name and title of the FSP staff and EAP staff assisting in the conduct of the drill.
4. Number of occupants participating in the drill.
5. Evaluation of effectiveness of the drill, including any delays and deficiencies.

6. If evacuation was conducted, time required to accomplish evacuation.

The fire alarm system shall be activated each time a fire drill is conducted to initiate the drill and familiarize building occupants with the alarm tones.

Fire Safety and Evacuation plan and Emergency Action Plan Staff Training:

Fire Code section 406 requires FSP and EAP staff receive initial training in the contents of the fire safety and evacuation plan and emergency action plan upon commencement of their authority and duties in the building. Such staff shall participate in training sessions designed to familiarize them with their duties pursuant to the plan in accordance with the frequency set forth in Tables 23 and 24. A written record of such staff training shall be maintained in a bound log book with consecutive numbered pages, or other form of approve recordkeeping, and maintained on the premises for a period of 3 years. An entry shall be made in such log book for each training session conducted.

Table 23 FSP Staff Training Drills NYCFC 406.2(1)

OCCUPANCY OR BUILDING TYPE	REFRESHER TRAINING DURATION AND FREQUENCY
Mercantile	1 Hour Annually

Table 24 EAP Staff Training Drills NYCFC 406.2(2)

EAP STAFF MEMBER	INITIAL TRAINING DURATION	REFESHER TRAINING DURATION AND FREQUENCY
Deputy Fire Safety/EAP Directors	3 Hours	1 Hour Semi-Annually
Fire Safety/EAP building Evacuation Supervisor	3 Hours	1 Hour Semi-Annually
Fire Safety/EAP Warden	2 Hours	1 Hour Annually
Fire Safety/EAP Brigade	2 Hours	1 Hour Annually
Deputy Fire Safety/Warden	2 Hours	1 Hour Annually

New York State Education:

New York State Education Law requires that schools are fully evacuated in the event of a fire alarm. Fire drills conducted to meet the requirements of the law require the full evacuation of the building. Fire and emergency drill conductors should at a minimum, follow the steps below when conducting a drill in which there is a total evacuation of building occupants in the event of a fire.

1. The CE shall call Central Station Company and take the fire alarm system OFF-LINE (if applicable) to avoid an unnecessary alarm.
2. The S-95 Certificate of Fitness Holder (usually the Custodian Engineer) shall, upon confirmation from the Central Station Company, document that the fire alarm system is off-line in the fire safety logbook maintained by the CE.
3. Initiate the Fire Drill
4. Building occupants should leave the building and gather at the designated assembly areas noted for their rooms/spaces, where they should remain until a recall or dismissal signal is given.
5. Ensure that staff determines that all occupants have been successfully evacuated and accounted for at the assembly points.
6. The S-95 C of F holder restores the fire alarm system to normal operation condition if altered for drill purposes.

7. An entry is required to be made in OORS by the C of F holder to record the details of the fire drill. In multi-campus locations, gathering the information required and entering the information into OORS is the responsibility of a specifically designated principal.
8. The S-95 C of F holder must call Central Station Company and request that they put the Fire Alarm System back "on-line." The S-95 holder shall, upon confirmation, document that the fire alarm system is on-line.

The fire alarm system should be activated each time a fire drill is conducted to initiate the drill and familiarize building occupants with the alarm tones. It is the responsibility of the S-95 Holder, the CE or BM, to notify the Central Station Company that a drill is being conducted and that on behalf of the building owner, they would like to request to take the fire alarm system off line.

All building occupants shall participate in fire and non-fire emergency drills. The FEDC should evaluate the performance of building occupants and BRT staff during the drills and provide feedback to them post-drill, and enter these comments in OORS. The FEDC shall provide written materials to all BRT staff members at this time, summarizing the important lessons of the drill.

Throughout the drill, the FEDC, Custodian Engineer and staff, and BRT staff shall pay particular attention to the following:

1. Difficulties experienced in determining that all building occupants are accounted for.
2. Difficulties experienced by people with disabilities or other special needs
3. Unnecessary delays or unsafe actions in implementing the school safety plan, such as building occupants stopping to collect personal items or attempting to use the elevators
4. Identifying any problems with the fire alarm system
5. Discuss how to evacuate via the nearest unaffected exit (if necessary). Explain the importance of checking the door for heat with the back of the hand in an actual fire emergency. Inform occupants of alternate exits to use if their exit door is hot.
6. Discuss that smoke from a fire will rise and that in some circumstances (such as a heavy smoke condition) building occupants may be required to remain low to the floor and crawl along the wall in order to safely reach an exit.
7. Monitoring whether the evacuation or other procedures in the school safety plan for the building are performed as required
8. Determining the amount of time it takes to implement the evacuation of the building (when evacuation is a necessary part of the drill)
9. Visually inspecting the building for any exit, stairway or hallway obstructions
10. Ensuring that self-closing doors close on their own and are not propped open
11. Ensuring that there are no locks, bolts or chains installed on exits while the building is occupied.

FEDCs should ensure that all those required to participate in a drill do so. If a building occupant refuses to participate in a drill, the FEDC should inform the appropriate entity that the person did not participate and initiate disciplinary action. After discussing the drill with the staff and building occupants, the FEDC should thank everyone for participating and answer any drill related questions.

NYS Education law requires a minimum of 12 drills each school year for every school within the state. Eight of those drills are required to be held between September first and December first of each such year.

FEDCs in schools may also find the following best practices helpful:

1. Assign limited mobility occupants to an adult so that they have someone to assist them during

drills and during a fire or non-fire emergency

2. Determine alternate accommodations for limited mobility occupants with special needs when necessary
3. During a drill, FEDCs should instruct faculty that they should be the last to leave their classroom to ensure that no student is left behind, and that they need to remove the Evacuation folder from the holder near the door. The contents of the Evacuation folder includes all of the following:
    a. Accurate student rosters
    b. GRP Assembly Card
    c. Building Response Team names
4. FEDCs should instruct faculty to shut their classroom doors and any hallway doors as they evacuate to prevent the spread of smoke or fire
5. FEDCs should instruct faculty to account for each student once they arrive at their designated meeting place o Faculty or other staff should use the folder at the door of the room for this purpose
6. Fire Drill and GRP signs are to be kept up to date and prominently posted in the classrooms
7. Ensure that hard and soft lockdowns are drilled so that building occupants are familiar with both
8. Ensure that students are aware of all of the exits from each room and that they are also aware of the location of each door and window
9. Instruct faculty to keep all doors and windows unobstructed so that they are available for exit
10. Instruct faculty to keep hallways and walkways in rooms clear to avoid tripping hazards or blocking a means of egress
11. Be familiar with the school's fire protection system, including the location of fire alarm pull stations and sprinklers
12. In addition to the FEDC, all staff should be familiar with the location of and how to operate a portable fire extinguisher

New York City Public Schools under the jurisdiction of the Department of Education shall maintain Fire Drill records in OORS. Other K-12 Schools shall maintain fire drill records in a bound log book or electronic method approved by the Commissioner of the Fire Department.
Entries shall be made in OORS or the log book to document drills, education, staff training, plan review and amendment, plan implementation and/or such other information as the commissioner may require. Entries shall include the following content:

1. Name and C of F number of the person who conducted the drill.
2. Date and time of the drill.
3. Name and title of staff assisting with the drill.
4. Number of occupants participating in the drill
5. Evaluation of effectiveness of the drill, including any delays and deficiencies.
6. The time required to conduct an evacuation.

Limited mobility staff, students, visitors or people who have special needs during a drill or an emergency shall be accommodated. Fire and emergency drill conductors must follow the procedures in the school safety plan for identifying in advance building occupants who require assistance to participate in the plan because of an infirmity or disability or other special need, and the approved procedures for providing such assistance. All procedures should be in compliance with the Americans with Disabilities Act. The dedicated intercoms that are located in spaces where limited mobility students and staff are directed to wait for rescue should be tested during drills.
It is important that anyone in the building who may have a special need during the drill or during an

actual emergency informs their employer at the start of their employment or residency within a building so that they can be included in the list of people requiring assistance.

Emergency Procedures for anyone who becomes aware of a fire or explosion or any other emergency should immediately report the emergency to 911. No owner or other person shall issue any directive or take any action to prevent or delay the reporting of a fire or other emergency to the department. A durable, legible sign setting forth the following information for reporting a fire or other emergency (including the text to be inserted based on the building's location) shall be posted in a conspicuous location in the lobby of the main front entrance of the school. Fire alarm box at _____ (name of street) and _____ (name of street)

To report a fire by telephone dial "911" or, depending upon the borough in which the property is located, Brooklyn properties 718-999-4444.

All employees must be trained in how to manually activate the fire alarm pull boxes. Generally, these pull boxes are installed at several locations on the premises and are usually located near the exits of a building. Activating the pull station is the most effective way to notify the building occupants in case of an emergency. The FEDC and members of the BRT staff must know how to manually operate each alarm station on the premises. Once activated, the fire alarm system must be re-set at the fire alarm control Panel (FACP).

The requirements of the New York City Fire code have been met. For the requirements of the New York State Department of Education I can confirm the following requirements. Site plans indicating the surrounding buildings and streets, including cross streets, fire apparatus access roads, and the location of the building occupants' assembly areas. Floor plans, with corresponding legend, identifying the locations of the following, Exits, Evacuation routes, Fire Barriers, Areas of refuge, Stairs with letter designation, Access and convince stairways, Elevator bank letters and car number designations, Fire command station, Fire warden phones, Manual fire alarm boxes, Standpipe hose outlets, Sprinkler and standpipe system control valves, Emergency power generator and fuel supply.

The evacuation drills for safety reasons the general public does not have access to nor was I able to observe since the actions are executed after the building is turned over to the owner. Since the school building has been occupied since 2009 under direction of the school board it is safe to assume that the state education requirements have been adhered to.

This concludes the prescriptive part of the report. I will now focus on the performance based design part of the report.

PERFORMANCED BASED ANALYSIS

The requirements for a Performance Based Analysis are listed in chapter five of NFPA 101 Life Safety Code. Section 5.2.1 states that a design shall meet the objectives specified in Section 4.2 if, for each design fire scenario, assumption, and design specification, the performance criterion in section 5.2.2 is met. The requirements of section 4.2 are as follows. 4.2.1 Occupant protection. A structure shall be designed, constructed, and maintained to protect occupants who are not intimate with the initial fire development for the time needed to evacuate, relocate, or defend in place. 4.2.2 Structural integrity shall be maintained for the time needed to evacuate, relocate, or defend in place occupants who are not intimate with the initial fire development. 4.2.3 System effectiveness. Systems utilized to achieve the goals of Section 4.1 shall be reliable, shall be maintained to the level which they were designed to operate, and shall remain operational. The Performance requirement of 5.2.2 of any occupant who is not intimate with ignition shall not be exposed to instantaneous or cumulative untenable conditions.

FIRE DESCRIPTION:

The fire design scenario is a Christmas tree fire in the multipurpose room located on the sixth floor of the building during lunch where mobile bench cafeteria table benches are lined up end to end. The location of the tree is on the front corner of the stage. The fire material property Douglas fir information was retrieved from the University of Maryland burning item data base. The heat release rate was taken from the SFPE handbook of fire Protection engineering 3rd edition V. Babrauskas. The ramp of the fire was modeled as ultrafast t-squared fire with a maximum heat release of 3 MW. The size of the fire is 1 square meter. The fire was modeled as a fuel limited fire since the 3 MW fire was small considered to the room size, leakage of the room and doors being open during evacuation. The burn time of the tree was Three hundred and ninety Five seconds. The incipient stage of the fire was Twenty Five seconds, the growth phase of the fire was from twenty five seconds to forty seconds, steady state was from forty to forty five seconds, and the decay phase was forty five to three hundred and twenty seconds. After three hundred and twenty seconds the fire reaches five percent of its steady state burn phase and continues till burn out at four hundred seconds.

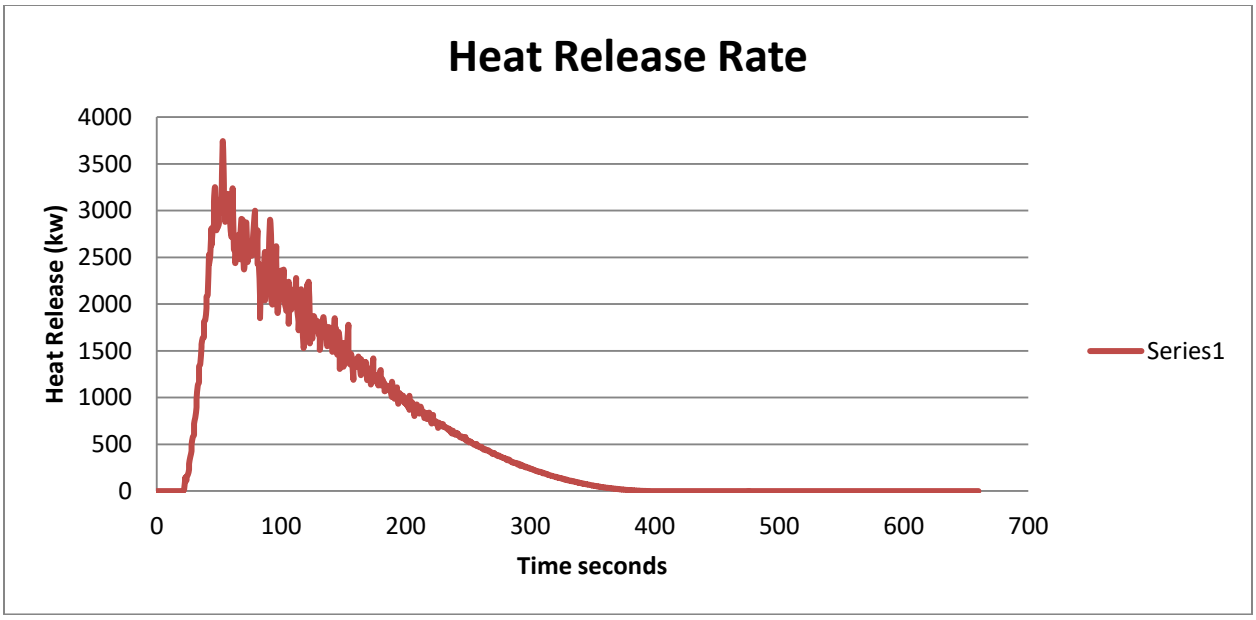


Figure 2 Plot of Heat Release Rate

MODEL RESOLUTION:

The resolution of the model, grid sized was guided by the D star equation. The D^*/dx equation gives a suggested mesh resolution. It is suggested that a ratio of between 4 and 16 be used. The characteristic fire diameter D* equation is below.

$$D^* = \left(\frac{\dot{Q}}{\rho_\infty c_p T_\infty \sqrt{g}} \right)^{\frac{2}{5}}$$

The characteristic fire diameter is 1.488. When D*/dx = 16 a suggested fine cell size was 9.3 centimeters. A grid size of 10 centimeters was used in the calculations. That falls just under a fine mesh number.

REQUIRED AND AVAILABLE SAFE EGRESS TIME (REST) (ASET):

There are two key factors in determining a valid performance analysis. The required safe egress time (RSET) and the available egress time (ASET) for the occupants to exit the building. The available safe egress time is when the conditions in the building or area in question reach an untenable environment. The three criteria that define the untenable condition. First of all visibility, how far an individual can see so they can navigate the area to find an exit. Secondly, Fractional effective dose is how much toxins an individual either inhales or absorbs until they become incapacitated and unable to move to the exit. By either becoming unconscious or lose the ability to make decisions to reach an exit. Finally the environment reaches a temperature that hurts the individual by either skin burns or damages the respiratory system.

I have set the Visibility perimeter at Thirty Feet which is a little more than the width of the Fifty Six Foot room. I assume the individual will still be able to find their way to an exit if they can see to the other side of the room to see an exit sign.
I have set the Fractional Effective Dose FED to 0.1 assuming this number to be low enough that no occupant is affected. All occupants are capable of self-rescue.
I have set the air Temperature of One Hundred and Forty degrees to set the environmental temperature limit. I used this air temperature for a conservative number based on the occupants being children.

I will compare safe egress time into two sections. The first section is manual calculation, the second section a computer simulation in Path Finder. The first section is in two parts. The first part is the time it takes the occupants to use the stairs and exit thru the stair at the bottom of the stair. It needs to be determined if the stair width or the door width is the limiting factor of the stair tower. The second part of the calculation is the time to exit the room. As part of the egress time, the time it takes for the occupants to acknowledge the fire and or alarm and begin to move needs to be determined it is called the pre-movement time.

PRE-MOVEMENT TIME:

It is assumed that 95% of the persons can move on their own. Table 23 below shows the main categories of each group in the Building, its occupant alertness, and occupant familiarity.

Table 23: Estimated Delay Time to Start Evacuation Table 3-13.1 SFPE Handbook Third Edition

Occupancy Type	Occupant Alertness	Occupant Familiarity	Delay Time (Minutes)
Offices, Schools, B, E	Awake	Familiar	<1
Assembly A-1	Awake	Familiar	<1
Gym, Lunch Room A-2	Awake	Familiar	<1
Multipurpose Room, Play Ground A-3	Awake	Familiar	<1
Mercantile Group M	Awake	Unfamiliar	>6
Storage Group S-2	Awake	Familiar	3

From the table above, the pre-movement for a school which includes the incidental use of offices is less than one minute. I will be using a pre-movement time of one minute.

EGRESS TIME:

I will next calculate two egress times. One time will be for the entire building to exit the building, the second egress time will be for the occupants to exit the multipurpose room.
I will calculate the egress time for the top floor to use the stairs and exit thru the doors on the discharge level. I will be using the first order approximation that a backup or queuing will occur when Fs = Fsm which means the specific flow will be the maximum specific flow.
Calculation for Stair A and B are the same since they generally have the same width and approximately the same landing length between floors refer to Table 24 and 25. Stair C will be done separately due to its unique layout refer to Table 26.

Table 24 Egress capacity calculation for stair A and B

Stair A & B
DOOR
72 “Door minus 12 “ for boundary layer, 6” for each side leaving 5’ for Effective Width
Maximum specific flow per table 3-14.5 24 (person/min)/Ft
24 (person/min)/Ft x 5Ft = **120 person / min**
STAIR
88” Stair minus 12” for boundary layer, 6” for each side leaving 6.3’ for Effective Width
Maximum specific flow for 11” tread and 7” riser per table 3-14.5 **18.5** 18.5 (person/min)/Ft 6.3 Ft = **116 person / min**
Speed of People down the stair
Equation **S=k-akD** Equation 3 pg 3-370 3rd SFPE Handbook for density between 0.05 and 0.35 person / Ft^2
S= speed along the line of travel
K=212 Ft / min table 3-14.2 3rd edition SFPE Handbook
a=2.86Ft/min table 3-14.2 3rd edition SFPE Handbook
D=.1215
S=138 Ft/min
Estimated floor to floor distance **32.65 Ft**
32.65 Ft / 138 Ft/min = .24 min / floor

Table 25 Egress capacity calculation for stair C

Stair C
DOOR
36” Door minus 12” for boundary layer, 6” for each side leaving 2 ‘ for Effective width
Maximum specific flow per table 3-14.5 24 (person/min)/Ft
24 (person/min)/Ft x 2Ft = **48 person / min**
STAIR
63” Stair minus 12” for boundary layer, 6” each side 5.3’ Effective width
Maximum specific flow for 11” tread and 7” riser per table 3-14.5 **18.5**
18.5 (person/min/Ft) x 5.3 Ft = **98 person / min**
Speed of People down the stair
Equation **S=k-akD** Equation 3 pg 3-370 3rd SFPE Handbook for density between 0.05 and 0.35 person / Ft^2
S= speed along the line of travel
K=212 Ft / min table 3-14.2 3rd edition SFPE Handbook
a=2.86Ft/min table 3-14.2 3rd edition SFPE Handbook
D=.1215
S=138 Ft/min
Estimated floor to floor distance **32.65 Ft**
32.65 Ft / 138 Ft/min = .24 min / floor

To summarize, the combined capacity of stair A and B is 232 people per minute, the capacity of stair C is 48 people per minute. The total capacity is 280 people.

Total Building Evacuation Time for the Required Safe Egress Time (RSET) refer to Table 26.

Table 26 Calculation of total egress time for the building

Total number of occupants for the second floor thru the roof 2706
Combined Egress capacity of all stairs 280 people per minute
Time for occupants to pass thru exit 2706 people / 280 people per minute = 9.7 minutes to pass thru exit
Additional time for people to reach first floor 32.65 / 280 = .12 minutes
Time to evacuate the building 9.8 minutes
Premovement time 1 minute
Total time to evacuate building 9.8 evacuation time plus premovment time of 1 minute. 10.8 minutes rounding to 11 minutes.

The Exit time of 11 minutes for the people to vacate the building is extremely conservative. Another determination of the safe egress time would be, once the people leave the room and either enter the corridor or the stair. The occupants have reached a safe area due to the smoke barrier provided by the corridor or the rating of the stair tower.

Next I will calculate the evacuation time for the occupants to exit the Gym and either enter into the stairways or the corridor, I will need to determine if the controlling factor is the doors for the people going into the corridor or the treads of the stair tower controlling people going thru the door refer to Table 27.

Table 27 Criteria for calculating calculated flow

Calculated Flow, *Fc*
The calculated flow, *Fc,* is the predicted flow rate of persons passing a particular point in an exit route.
The equation for actual flow is Equation (6) page 3-371 3rd Edition SFPE
Fc =Fs*We
Where
Fc = calculated flow
Fs = specific flow
We = effective width
Table 24 Table 3-14.1 pg 3-369 3rd Edition SFPE Handbook provides the boundary layer width of 6”

I first calculate the egress time for the doors. Effective width of a 3 FT. door is 2 FT. There are 3 6 FT. doors and 2 4FT. doors on either side of the stage leading out of the gym. I am assuming the corridor by the looker rooms is large enough to accommodate the people leaving by the door at the bottom of the page refer to Table 28.

Table 28 Calculation of egress time thru door of multipurpose room

The 6 FT doors. Effective width for all 3 doors is 15 FT.
The 4 FT doors. Effective width for all 2 doors is 6 FT.
Total is for all the doors is 21FT.

Calculation for the doors.
Door Limiting factor
24 person/minute Ft *21 Ft = 504 person/minute
Maximum possible worst case scenario at seven FT squared per person is 786 occupants.
786 occupants /504 person/minute = 1 minute 34 seconds.

With a pre movement time of 1 minute the total evacuation time to get out of the gym and into stair or corridor is 2 minutes 34 seconds. I will next calculate the egress time of the stairs refer to Table 29.

Table 29 Calculation of egress time by stairs serving multipurpose room

There are 3 stairs, stair A and B are 6 FT, = 8ft
Stair C is 63 inches = 53inch = 4ft 5in=4.42ft
Total width for all the stairs 8Ft + 4.42Ft = 12.42Ft
pg. 3-371 3rd Edition SFPE Handbook table 3-14.5 Fsm = 18.5 person/min.ft of effective width for stair with a 7 inch rise with a 11 inch tread
18.5 x 12.42=230 person/minute
786 people / 230 people/minute = 3.4 minutes or 3minutes 24 seconds

With a pre movement time of 1 minute the total evacuation time is 4.4 minutes. This time is longer than the time to egress thru the doors of 1 minute and 34 seconds. Therefore the egress time is dictated by the stairs. The required safe egress time (RESET) is determined to be **4 minutes and 24 seconds**. This is the time it takes for the occupants to exit the room. It is assumed that the time is adequate for occupants to enter the stair on the lower right hand corner or the corridor.

PATHFINDER ANALYSIS

Three Pathfinder models were generated. The first being the 6th floor only, the second being egress into the hallway or stair located in the lower right corner, and finally egress to the exit discharge on the ground floor refer to figure 53 for a plot of the building.

The first model of only the Sixth floor gave an egress time of **Eighty One seconds**. The model calculated the time for the occupants to exit the multipurpose room into either the stair or the corridor. This model did not take into consideration the queuing off the people outside the stair and backing up into the multipurpose room refer to Figure 54. This required a model to take into consideration the effect of the stairs on egress time.

The second model calculated the egress time taking into consideration the effect of the stairs had on the occupants exiting the multipurpose room. Each stair has been color coded. The blue stair is four stories. The green and orange stairs run to the roof. The red stair is adjacent to the multipurpose room. **An egress time of one hundred a Forth seconds was generated for the second model**. It only added about Sixty seconds to the egress time. From figure 55 it can be seen the effect of the Northwest stair (green) on egress time.

The last model calculated the egress time to the exit discharge on the ground floor. An egress time **of Three hundred and Sixteen seconds was generated**. From the figure 56 it can been seen that the last person to exit from the North West stair (green). Comparing the egress time from the model to the hand calculations there is a difference of twenty Five percent. The Author finds the time difference between the two methods negligible acceptable due to the different method used.

The Pathfinder results well be used. The total egress time is calculated by combining egress time plus the pre-movement time. Per table 23 the Pre-movement time of 1 minute plus the egress time of One Hundred and Thirty Nine seconds gives a Required Safe Egress Time (RSET) of **Three minutes and Eighteen seconds.**

AVAILABLE SAFE EGRESS TIME:

The next step is to determine the available safe egress time. As mentioned previously the three components that make it up are, visibility, temperature and fractional effective does. These requirements will vary depending on the elevation and location in the room. The time chosen is when any one of these factors exceeds the criteria at an elevation of 2.1 meters above at any location in the room. From industry standards visibility is usually the first component of the Available Safe Egress Time that fails, so the other two factors temperature and visibility will be calculated at the failure time of visibility. If the temperature or visibility also fails at the visibility time the smallest time will be used for evaluation. The criteria is a visibility of 30 feet, a temperature of 140 degrees Fahrenheit and a fractional effective dose of 0.1.

VISIBILITY:

The visibility criteria is for an occupant to be able to see an illuminated Exit sign 30 feet away from where the person is standing. This value is approximately half of the width of the room. It is my intent for an occupant to see an exit sign on either of the two closest walls if standing in the middle of the room. This allows a disoriented occupant to recognize a path to the exit. This assumption has the smoke layer descending to an elevation of 2.1 meters. From slice file 60 the time at which **visibility drops below 30 feet or 9.14 meters at 60.1 seconds.** Sixty seconds is the available safe egress time**.** Referring back to figure 53 that would be the red colored stair. The area where the concentration of people waiting to enter Red stair **fails to meet the 30 Foot visibility requirement**.

OCCUPANT TEMPERATURE EXPOSURE:

From the slice file on Figure 62 the color indicates that the average temperature in the room does not exceed 25 °C which equals 77 °F. As in the visibility slice figure there is a small area that exceeds the average room temperature. Comparing to the color bar, the area in question is about 128 °F. The criterion for occupant temperature exposure to 140 °F. **The occupant temperature exposure limit has not been exceeded.** I will now look at the Fraction effective dose.

FRACTIONAL EFFECTIVE DOSE:

The Fractional effective dose is determined by the exposure to harmful gasses. The level of gases is measured in parts per million. The concentration of these gases and the length of time an individual is exposed to these gases determines the Fractional Effective Dose. I will determine the levels of carbon dioxide and carbon monoxide and sum the two. I will then multiply for sixty seconds which is the ASET determined by the visibility component. An FED of 0.1 was chosen due to the group consisting mostly of

grade School children. The concentration of the gases varies both radially and vertical in the room's location.

Equation 11 on page 2-111 from the 3rd Edition SFPE Handbook

$$F'_{lCO2} = \frac{1}{\exp(6.1623 - .5189 * \%CO_2)}$$

From the slice file for CO_2 figure 63 shows the concentration of CO_2 as, 56 E-7 mol/mol= 5.6 ppm. Used the average of the number for the green color, which is between 51 and 61.

$$F'_{lCO2} = \frac{1}{\exp(6.1623 - .5189 * .0000056(CO_2))}$$

$F'_{lCO2} = .0021$ Multiply for 1 minute exposure = .0021

From the slice file figure 64 for CO shows the concentration of CO as, 1.0 E-6mol/mol= .1.0 ppm.

Equation 11 on page 2-110 from the 3rd Edition SFPE Handbook

$$F'_{lCO} = \frac{8.2925 \times 10^{-4} \times ppmCO^{1.036}}{30}$$

$$F'_{lCO} = \frac{8.2925 \times 10^{-4} \times 1.0ppmCO^{1.036}}{30}$$

F'_{lCO}= 2.67E-5 multiply for 1 minute exposure = .000027

Adding the two numbers together and rounding up gives the total fractional dose for the occupants of the room. **The total is .0021. I set the fractional effective dose limit at 0.1. This criteria has been met.**

Analysis

Of the three criteria for the performance based design, visibility was the only part that failed to meet the requirement. The area that failed to meet the thirty foot visibility, was a small portion next to the exit stair.

The area that failed is closer to the wall than thirty feet. Since the area that failed is close enough not to lose site of the wall and, the ceiling jet did not extend to the floor. The occupant could reach an exit. To get a perspective of the limited size that is failing, the distance from the wall to the corner of one of the tables is Ten feet Ten inches. From inspection the maximum length perpendicular to the wall that failed is approximately two feet or half a meter. The occupants did not lose sight of the wall indicating egress direction. Even though the visibility criteria failed, I find this condition acceptable.

Examining the criteria at the RSET, the maximum temperature on figure 61 is Ninety-Five degrees Fahrenheit. The thirty foot visibility requirement still failed. Figure 62 shows the area of visibility moved to the North West corner by the fire. The distance dropped to three meters or approximately ten feet. The occupants were still able to still see the wall allowing the people to recognize the path to the exit.

The FED at the RSET is calculated below. Again as calculated at the ASET, first will be carbon dioxide and then carbon monoxide. Referring to figure 63 the maximum concentration is 9.0 parts per million. The maximum concentration is used instead of the average.

$$F'lCO2 = \frac{1}{\exp\left(6.1623 - .5189 * .0000090(CO_2)\right)}$$

Multiplied by Three point Three minutes equals 0.0044

$$F'lCO = (8.2925 \times 10^{-4}.025ppm(CO)\text{^}1.036)/30$$

Multiplied by Three point Three minutes equals 0.00002

Combining these two numbers the totals is 0.00442. The number is less than one, this meets the FED requirement of being less than 0.1. Next I will analyze factors affecting the simulation.

Four assumption that influenced the smoke layer descending time are, the lack of modeling theatrical curtains or a smoke vent, the location of the fire on the stage, and modeling assumption of smoke production.

Most schools having a theatrical stage are fitted with a curtain set. Refer to figure 59, typical setups consist of wings, back-curtain, backcloth and borders. Often the space between a pair of wing curtains and border hang a pair of curtains that can be drawn across the stage to reveal or conceal the stage traverse tabs. The main obstruction to the ceiling jet would be a fire between the proscenium border, and either the first or second border. It is quite possible that the curtains on stage could have a substantial impact.

The effects of the location of the fire are connected with the curtains but even without the incursion on the ceiling jet, the elevated location decreasing the entrainment length effecting the decent time of the ceiling jet.

Another consideration is the over prediction of smoke. Section 2.2.14 of the Validation Guide summarizes several studies indicating that FDS over-predicts the smoke concentrations from Two to Five times. The National Institute of science and technology (NIST) and the nuclear regulatory commission (NRC) publications refer to tests in large compartments where the visibility predictions are much better, and that this is dependent upon the ceiling height, and that the over-prediction is most common in compartments with low ceilings.

What contributes to the over prediction of smoke is whether the fire is fuel limited. The large area of the room, assuming the doors are open for the RSET of One Hundred and Ninety Eight seconds, classifies this fire as fuel limited.

A Smoke vent is a cheap way to improve the tenability during a fire and assist firefighting efforts. Activation by a fusible link make the operation simple. The ITM costs will be minimal do to the elementary operation. Refer to figure 65.

CONCLUSION

In conclusion ,the building has met the New York City Building Code except for one instatance. The roof has a mechanical room that did not met the travel ditance of One Hundred Feet for one exit. Therefore two exits are required, when appling the maximum distance for common path of 75 feet it failed. It is notable to mention when appling the Life Safety Code persriptive requrments for building egress it did not meet the requirements of chapter Fourteen for new educational occupancies. Rooms for preschool, kindergarden, or first grade staudents shall not be located on the level of discharge unless they are provided with an independent means of etress.

For the performance analysis, the three criteria evaluated for tenibility, Temperature ,Fractional Effective Dose, and Visibility the temperature and Fractional effective dose have met the requirements. The visibility porttion of the criterial did not meet the thirty foot criteria.

APPENDIX A

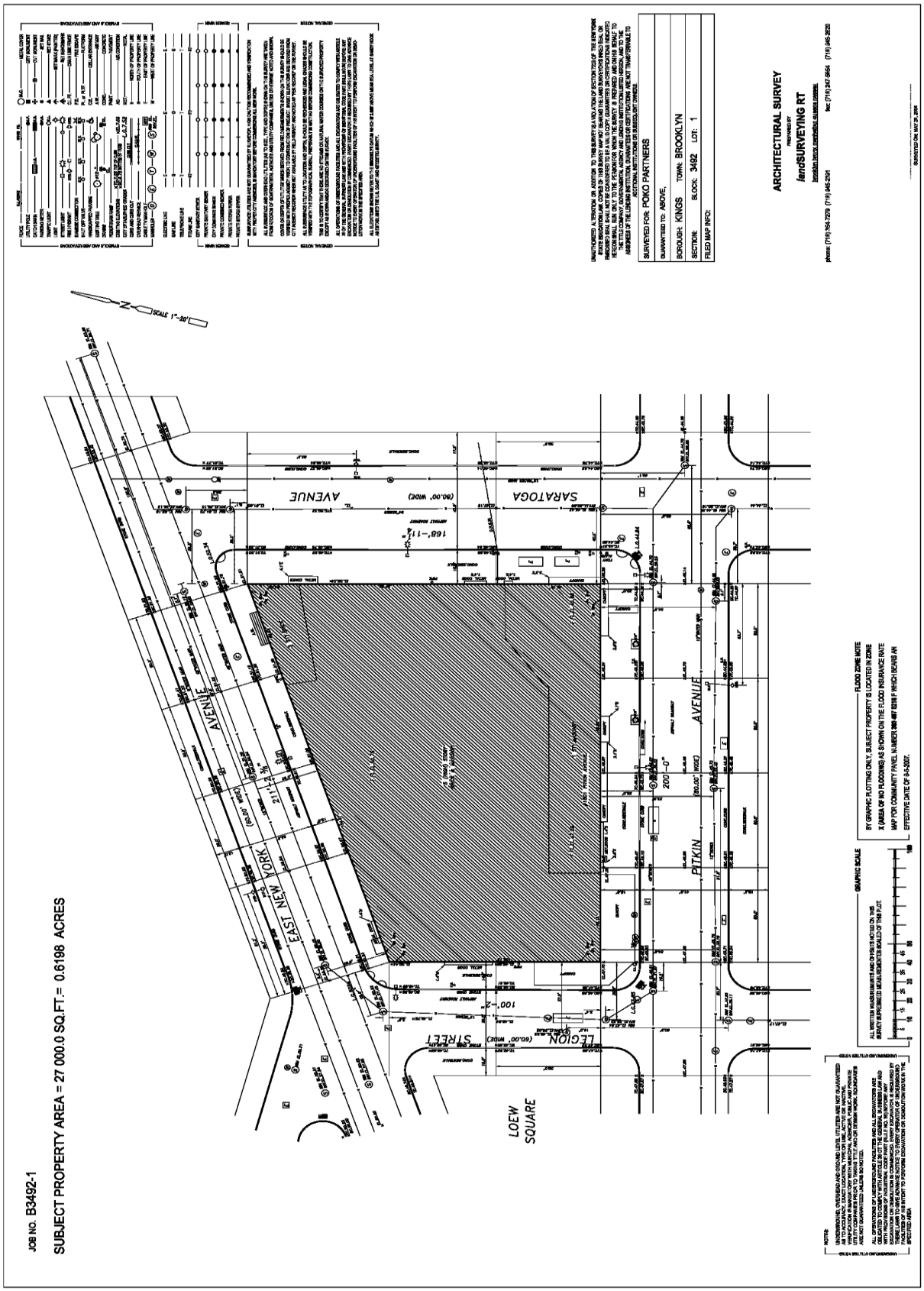


Figure 3 Site Plan

APPENDIX B

Excerpts from Fire Resistance Rating Submittal

UL Design X-772 – 2 hour rating, 1-1/8" thickness applied to wide flange columns.

UL Design D-925 – 2 hour rating (beams supporting metal deck). 5/16" applied to beams on 1st and 2nd floor.

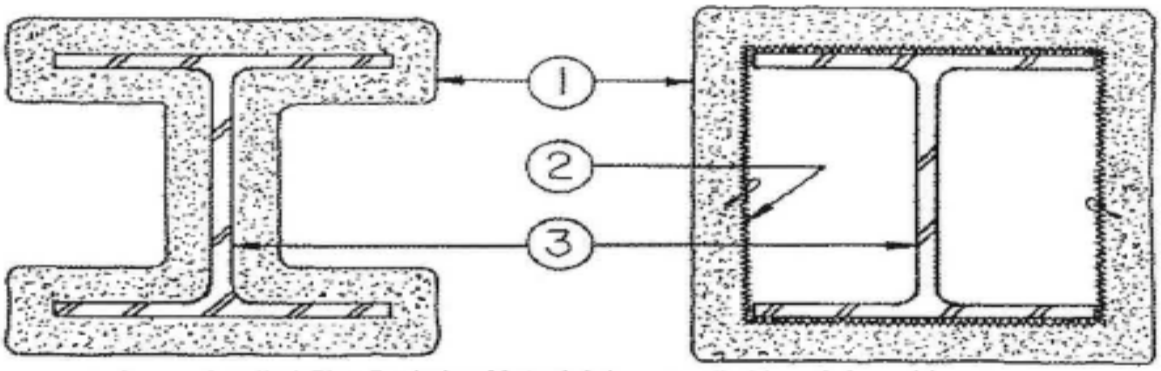
UL Design J-957 – 2 hour rating (beams supporting concrete planks). 7/16" thickness applied to beams on 3rd floor to roof.

Product data Monokote MK-6/HY, provided all steel surfaces are prepared per manufactures instructions and installations for spray Fire Proofing application

Fire Resistance Ratings - ANSI/UL 263

Design No. X772
October 22, 2008

Ratings — 1, 1-1/2, 2, 3 and 4 h.



1. Spray-Applied Fire Resistive Materials* — Applied by mixing with water and spraying in more than one coat to the thicknesses shown below, to steel surfaces which are clean and free of dirt, loose scale, and oil. Min avg and min ind density of 15/14 pcf respectively. Min avg and min ind density of 22/19 pcf respectively for Types Z-106, Z-106/G. Min avg and min ind density of 19/18 pcf respectively for Types 7GP and 7HD. Min avg and min ind density of 40/36 pcf respectively for Types Z-146, Z-146PC and Z-146T cementitious mixture. Min avg and min ind density of 50/45 pcf respectively for Types Z-156, Z-156T and Z-156PC. For method of density determination, see Design Information Section, Sprayed Material.

The thickness of Spray-Applied Fire Resistive Materials to be applied to all surfaces of the column (Item 1) required for rating periods of 1 h, 1-1/2 h, 2 h, 3 h, 4 h may be determined by the equation:

$$h = \frac{R}{1.05\,(W/D) + 0.61}$$

Figure 4 Fire Resistance Rating Submittal

APPENDIX B

Where
h = Spray Applied Fire Resistance Materials thickness in the range .25 - .3.875 inch.
R = Fire resistance rating in hours (1 -4 HR)
D = Heated perimeter of steel column in thickness
W = Weight of steel column in lbs. per foot
W/D = .33 to 6.62
As an alternate to the equation, the minimum thickness of Sprayed – Applied Fire Resistance Materials required for various fire resistance ratings of contour sprayed or boxed columns may be determined from the table below

Table 30 Minimum Spray Thickness for contour or boxed columns

Min Column size	W/D	MINIMUM THICKNESS INCH				
		1 HR	1-1/2 HR	2 HR	3 HR	4 HR
W6X9	.33	1-1/8	1-1/2	2	2-1/2	3-13/16
W6X16	.57	13/16	1-1/4	1-11/16	2-1/2	3-5/16
W8X28	.67	3/4	1-3/16	1-3/8	2	2-11/16
W10X49	.83	11/16	7/8	1-1/8	1-11/16	2-1/2
W14X228	2.49	5/16	½	9/16	7/8	1-1/4
W14X730	6.62	5/16	5/16	5/16	7/8	9/16

Fire Resistance Ratings - ANSI/UL 263

Design No. D925
October 05, 2010

Restrained Assembly Ratings — 3/4, 1, 1-1/2, 2 or 3 Hr (See Items 1, 6 and 10)

Unrestrained Assembly Rating — 0 Hr (See Items 3, 4, 4A and 10)

Unrestrained Beam Ratings — 1, 1-1/2, 2, 3 and 4 Hr (See Items 4, 4A and 10)

Restricted Load Condition — See Supports and Item 4C

Load Restricted for Canadian Applications — See Guide BXUV7

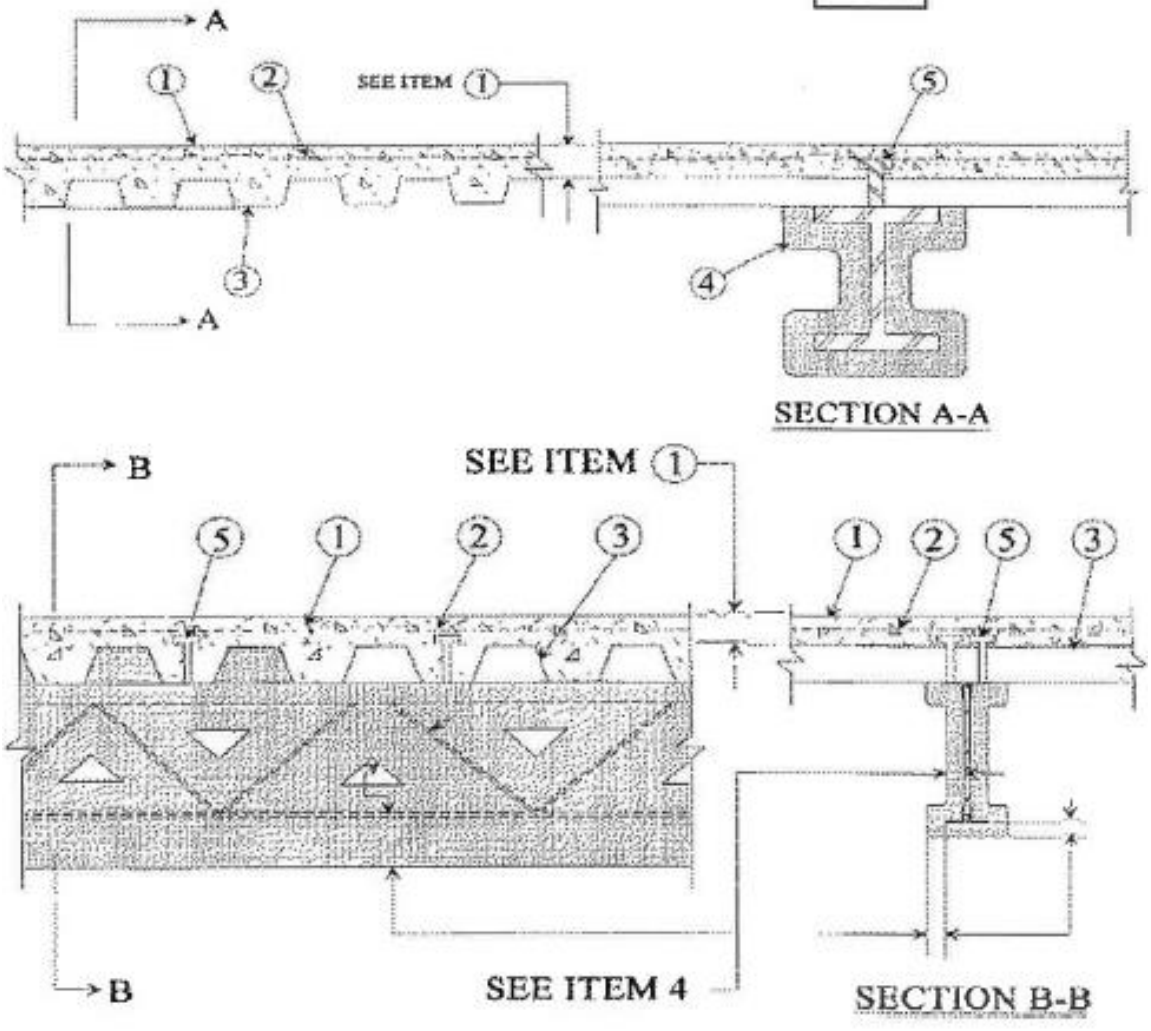


Figure 5 Fire Resistance Rating Submittal

APPENDIX B

Table 31 Minimum Spray Thickness for beams & floor assemblies

RESTRAINED ASSEMBLY RATING HR	UNRESTRAINED ASSEMBLY RATING HR	UNRESTRAINED BEAM RATING HR	W8X28 BEAM SUPPORTING	
			ALL FLUTED FLOOR UNITS W/ LIGHTWEIGHT CONCRETE	FLUTED FLOOR UNITS AND NORMAL WEIGHT CONCRETE ONLY
1	1	1	5/16, 11/16##	5/16
1-1/2	1-1/2	1-1/2	11/16, 1##	5/8
2	1	1	5/16, 11/16##	5/16
2	2	2	1, 1-3/16##	7/8
3	1-1/2	1-1/2	11/16	5/8
3	3	3	1-5/16	1-7/16
3	3	4	1-5/8	2

Fire Resistance Ratings - ANSI/UL 263

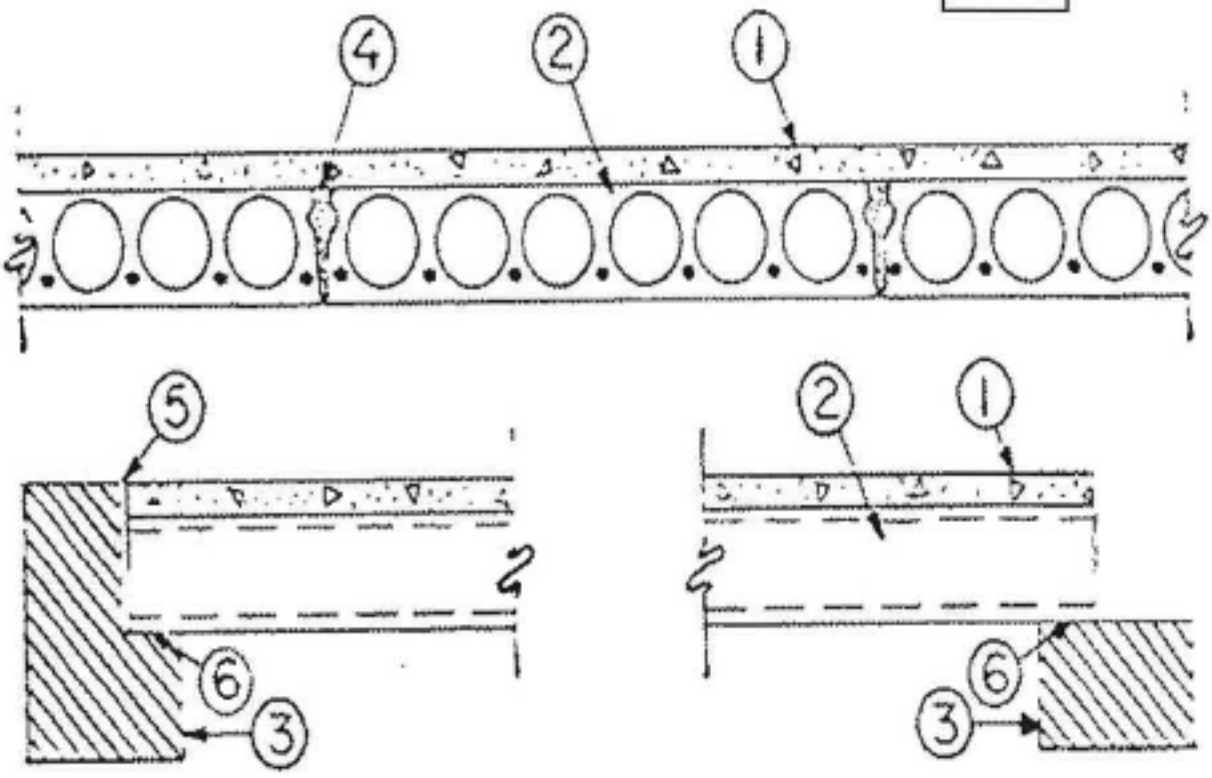
Design No. J957
April 05, 2011

Restrained Assembly Ratings — 2 and 3 Hr. (See Item 1)

Unrestrained Assembly Rating — 1 and 2 Hr.

Unrestrained Beam Rating — 1, 1-1/2, 2, 3 (See Items 8, 8A)

Load Restricted for Canadian Applications — See Guide BXUV7



Restrained End Detail

Unrestrained End Detail

1. Concrete Topping — 3000 psi compressive strength, 110 to 153 pcf unit weight. Normal weight aggregate.

Figure 6 Fire Resistance Rating Submittal

APPENDIX B

Spray Applied Fire Resistive Materials. Apply by mixing with water and spraying in one or more coats to the final thickness as shown in the table below, on the steel beam following the beam contour. Surfaces of the beam shall be clean and free of dirt, loose scale and oil. Minimum average and minimum individual density of 15/14 pounds per cubic foot respectively. Min average and minimum individual density of 22/19 pound as per cubic foot respectively for Types Z-106, Z-106/G, Z-106HY. Minimum average and minimum individual density of 19/18 pounds per cubic foot respectively for Type 7GP and 7HD.

Table 32 Spray applied thickness for Beam

Restrained Assembly Rating HR	Unrestrained Assembly Rating HR	Unrestrained Beam Rating HR	Thickness On Beam inch
2	1	1	7/16
2	1-1/2	1-1/2	3/4
2	2	2	1
3	1-1/2	1-1/2	3/4
3	2	2	1
3	2	3	1-5/16

APPENDIX C

. . . Fire Protection by Computer Design

DECKER DESIGNS
23 WESTEND AVE
MERCHANTVILLE, NJ 08109
856 662 6889

Job Name : PITKIN
Building :
Location :
System :
Contract :
Data File : FPE 523 .WXF

Computer Programs by Hydratec Inc. Route 111 Windham N.H. USA 03087

Figure 7 Cover sheet Hydraulic Calculations

DECKER DESIGNS
PITKIN

Page 1
Date 3/12/2012

Hydraulic Design Information Sheet

Name - PITKIN
Location -
Building -
Contractor -
Calculated By - DECKER DESIGN
Construction: ( ) Combustible (X) Non-Combustible
Occupancy - 13 LIGHT HAZARD

Date - 03/12/012
System No. -
Contract No. -
Drawing No. -
Ceiling Height - 20

SYSTEM
(X) NFPA 13 (X) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other
Specific Ruling Made By Date

DESIGN
Area of Sprinkler Operation - 1500
Density - .1
Area Per Sprinkler - 225
Elevation at Highest Outlet -
Hose Allowance - Inside -
Rack Sprinkler Allowance -
Hose Allowance - Outside - 100

System Type
(X) Wet
( ) Dry
( ) Deluge
( ) Preaction
( ) Other

Sprinkler/Nozzle
Make TYCO
Model TY-FRL
Size 1/2"
K-Factor 5.6
Temp.Rat.155

Note

Calculation Summary
Flow Required -
C-Factor Used:
Press Required -
Overhead
Underground

WATER SUPPLY
Water Flow Test:
Date of Test -
Time of Test -
Static Press -
Residual Press -
Flow -
Elevation -

Pump Data:
Rated Cap.-
@ Press -
Elev. -

Tank or Reservoir:
Cap. -
Elev.-

Well
Proof Flow

Location -

Source of Information -

COMMODITY CLASS
Commodity
Storage Ht.
Storage Method:

Class
Area

Location
Aisle W.

Solid Piled %
Palletised %
Rack

( ) Single Row ( ) Conven. Pallet ( ) Auto. Storage ( ) Encap.
( ) Double Row ( ) Slave Pallet ( ) Solid Shelf ( ) Non
( ) Mult. Row ( ) Open Shelf

STACKING ARRANGEMENT
Flue Spacing
Longitudinal
Transverse
Clearance:Storage to Ceiling
Horizontal Barriers Provided:

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Figure 8 Hydraulic Design Information Sheet

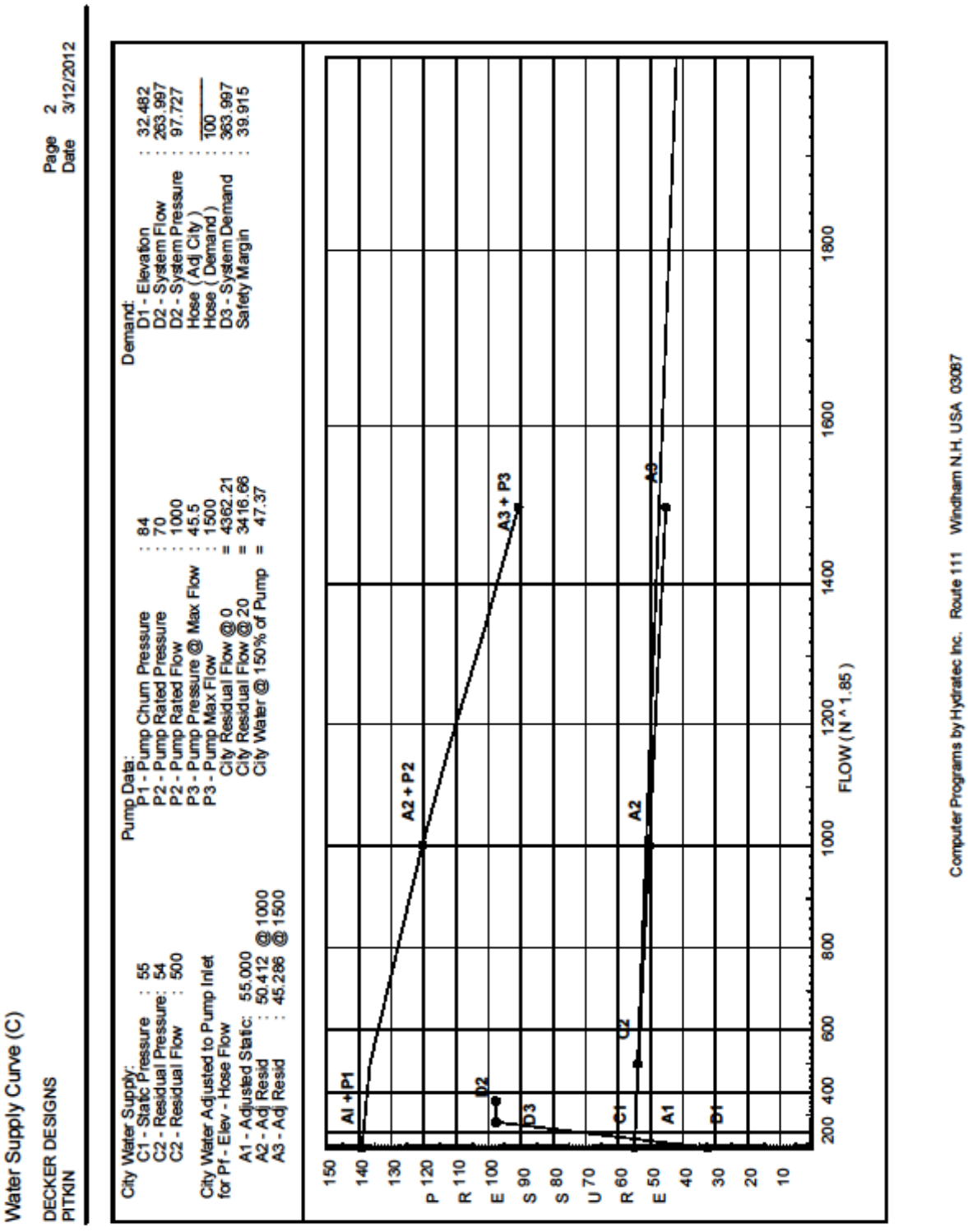

Figure 9 Water Supply Curve

Table 33 Fitting Friction Loss Table

Fittings Used Summary

DECKER DESIGNS
PITKIN

Page 3
Date 3/12/2012

Fitting Legend Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
A	Generic Alarm Valve	0	0	0	0	0	0	7.7	21.5	0	17	17	27	29	0	0	0	0	0	0	0
B	Generic Butterfly Valve	0	0	0	0	0	0	7	10	0	12	9	10	12	19	21	0	0	0	0	0
E	90' Standard Elbow	2	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
S	Generic Swing Check Valve	4	5	5	7	9	11	14	16	19	22	27	32	45	55	65	76	87	98	109	130

Table 34 Pressure Flow Summary

Pressure / Flow Summary - STANDARD

Page 4
Date 3/12/2012

DECKER DESIGNS
PITKIN

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
10	70.0	5.6	16.14	na	22.5	0.1	225	7.0
20	70.0	5.6	20.23	na	25.19	0.1	225	7.0
35	70.0	5.6	18.21	na	23.9	0.1	225	7.0
30	70.0	5.6	20.66	na	25.45	0.1	225	7.0
40	70.0	5.6	24.26	na	27.58	0.1	225	7.0
50	70.0	5.6	31.17	na	31.26	0.1	225	7.0
60	70.0		34.27	na				
70	70.0	5.6	16.56	na	22.79	0.1	225	7.0
80	70.0	5.6	18.97	na	24.39	0.1	225	7.0
90	70.0	5.6	28.2	na	29.74	0.1	225	7.0
95	70.0	5.6	31.03	na	31.2	0.1	225	7.0
100	70.0		44.68	na				
200	65.0		51.06	na				
300	63.0		57.05	na				
400	-2.0		94.95	na				
500	-2.0		95.5	na	100.0			
600	-5.0		97.54	na				
PO	-5.0		97.73	na				
PI	-5.0		54.29	na				
TEST	-5.0		54.44	na				

The maximum velocity is 19.64 and it occurs in the pipe between nodes 40 and 50

Computer Programs by Hydratec Inc. Route 111 Windham N.H. USA 03087

Table 35 Final Calculations

APPENDIX C

Final Calculations - Hazen-Williams

DECKER DESIGNS
PITKIN

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Date 3/12/2012

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*MAIN LINE 1								
*UPPER CEILING OF GYM ON 7TH FL								
*BRANCH 1								
10	22.50	1.049	1E	2.0	23.250	16.143		K Factor = 5.60
to		120		0.0	2.000	0.0		
20	22.5	0.1618		0.0	25.250	4.086		Vel = 8.35
20	25.19	1.38		0.0	2.500	20.229		K Factor = 5.60
to		120		0.0	0.0	0.0		
30	47.69	0.1708		0.0	2.500	0.427		Vel = 10.23
	0.0							
	47.69					20.656		K Factor = 10.49
35	23.90	1.049	2E	4.0	9.500	18.214		K Factor = 5.60
to		120		0.0	4.000	0.0		
30	23.9	0.1809		0.0	13.500	2.442		Vel = 8.87
30	73.14	1.61		0.0	12.000	20.656		K Factor = 5.60
to		120		0.0	0.0	0.0		
40	97.04	0.3001		0.0	12.000	3.601		Vel = 15.29
40	27.58	1.61		0.0	14.500	24.257		K Factor = 5.60
to		120		0.0	0.0	0.0		
50	124.62	0.4767		0.0	14.500	6.912		Vel = 19.64
50	31.26	2.067		0.0	14.500	31.169		K Factor = 5.60
to		120		0.0	0.0	0.0		
60	155.88	0.2136		0.0	14.500	3.097		Vel = 14.90
60	0.0	2.067		0.0	48.750	34.266		
to		120		0.0	0.0	0.0		
100	155.88	0.2136		0.0	48.750	10.414		Vel = 14.90
	0.0							
	155.88					44.680		K Factor = 23.32
*BRANCH 2								
70	22.79	1.049		0.0	14.500	16.565		K Factor = 5.60
to		120		0.0	0.0	0.0		
80	22.79	0.1657		0.0	14.500	2.403		Vel = 8.46
80	24.39	1.049		0.0	14.500	18.968		K Factor = 5.60
to		120		0.0	0.0	0.0		
90	47.18	0.6367		0.0	14.500	9.232		Vel = 17.51
90	29.74	1.61		0.0	14.500	28.200		K Factor = 5.60
to		120		0.0	0.0	0.0		
95	76.92	0.1952		0.0	14.500	2.831		Vel = 12.12
95	31.19	1.61		0.0	48.750	31.031		K Factor = 5.60
to		120		0.0	0.0	2.166		
200	108.11	0.3665		0.0	48.750	17.867		Vel = 17.04
	0.0							
	108.11					51.064		K Factor = 15.13
*CROSS MAIN								
100	155.88	2.067	1E	5.0	14.750	44.680		
to		120		0.0	5.000	2.166		
200	155.88	0.2136		0.0	19.750	4.218		Vel = 14.90

Computer Programs by Hydratec Inc. Route 111 Windham N.H. USA 03087

Table 36 Final Hydraulic Calculations

Final Calculations - Standard

DECKER DESIGNS
PITKIN

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Date 3/12/2012

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
200	108.12	2.635	2E	16.474	13.000	51.064		
to		120		0.0	16.474	0.866		
300	264.0	0.1735		0.0	29.474	5.115		Vel = 15.53
300	0.0	2.635	2E	16.474	9.000	57.045		
to		120	2A	21.142	47.226	28.152		
400	264.0	0.1735	1B	9.61	56.226	9.758		Vel = 15.53
	0.0							
	264.00					94.955		K Factor = 27.09
*DROP FROM TOP OF RISER TO BSMNT								
400	264.00	6.357	8E	140.822	90.000	94.955		
to		120		0.0	140.822	0.0		
500	264.0	0.0024		0.0	230.822	0.549		Vel = 2.67
500	0.0	4.26	2E	26.334	18.000	95.504		
to		120		0.0	26.334	1.299		
600	264.0	0.0167		0.0	44.334	0.742		Vel = 5.94
600	100.00	6.357	1S	40.235	2.000	97.545		Qa = 100
to		120		0.0	40.235	0.0		
PO	364.0	0.0043		0.0	42.235	0.182		Vel = 3.68
	0.0							
	364.00					97.727		K Factor = 36.82
System Demand Pressure						97.727		
Safety Margin						39.915		
Continuation Pressure						137.642		
Pressure @ Pump Outlet						137.642		
Pressure From Pump Curve						-83.350		
Pressure @ Pump Inlet						54.292		
*PUMP								
PI	0.0	6.16	1E	20.084	20.000	54.292		
to		140		0.0	20.084	0.0		
TEST	364.0	0.0038		0.0	40.084	0.152		Vel = 3.92
	0.0							
	364.00					54.444		K Factor = 49.33

Environmental Protection

Caswell F. Holloway
Commissioner

James J. Roberts, P.E.
Deputy Commissioner
Bureau of Water and Sewer Operations
jroberts@dep.nyc.gov

59-17 Junction Boulevard
Flushing, NY 11373

Tel (718) 595-5330
Fax (718) 595-5342

July 16th, 2010

AKF Engineers, LLP
330 West 42nd Street, 14th Floor
New York, NY 10036
Attn: David King

To Whom It May Concern:

The hydrant flow test you requested in the vicinity of ***Saratoga Avenue btw. Pitkin & East New York Avenues, Brooklyn*** was performed on ***71112010*** at ***10:45 AM*** with the following results:

The static pressure taken on the east side of Saratoga Avenue 1st hydrant north of Pitkin Avenue was 55 pounds per square inch. The residual pressure at this point was 54 pounds per square inch when 500 gallons of water per minute were flowing from the north side of Pitkin Avenue 1st hydrant east of Saratoga Avenue.

This Department cannot guarantee that this pressure will be maintained in the future because a change may be needed in conformity with good engineering practices.

The flow test was performed on a 12 inch water main, which is fed from two directions.

If you have any questions on the above, please contact me at (718) 595-7029, fax at (718) 595-7408.

Very truly yours,

Edward Ayvazyan, P.E.
Water Distribution Engineer
City Wide Hydraulic Testing Unit

File: FT2010-0780-N24-0011

All hydrant flow test requests are to be addressed to: NYCDEP-BWSO; 59-17 Junction Blvd, 12th Fl., Flushing; NY 11373-5108, Attn: Citywide Hydraulic Flow Test Unit
Enclose payment for $250 payable to NYC Water Board for each test. Indicate the test street, cross streets and borough for each test. All requests are to be made by US or overnight mail, no hand deliveries accepted.

Figure 10 Flow test Saratoga Avenue

NYC Environmental Protection

July 16th, 2010

AKF Engineers, LLP
330 West 42nd Street, 14th Floor
New York, NY 10036
Attn: David King

Caswell F. Holloway
Commissioner

James J. Roberts, P.E.
Deputy Commissioner
Bureau of Water and Sewer Operations
jroberts@dep.nyc.gov

59-17 Junction Boulevard
Flushing, NY 11373

Tel (718) 595-5330
Fax (718) 595-5342

To Whom It May Concern:

The hydrant flow test you requested in the vicinity of ***Pitkin Avenue btw. Legion Street & Saratoga Avenue, Brooklyn*** was performed on ***7/1/2010*** at ***11:00 AM*** with the following results:

The static pressure taken on the south side of Pitkin Avenue 1st hydrant west of Saratoga Avenue was 53 pounds per square inch. The residual pressure at this point was 52 pounds per square inch when 500 gallons of water per minute were flowing from the south side of Pitkin Avenue 1st hydrant west of Legion Street.

This Department cannot guarantee that this pressure will be maintained in the future because a change may be needed in conformity with good engineering practices.

The flow test was performed on a 12 inch water main, which is fed from two directions.

If you have any questions on the above, please contact me at (718) 595-7029, fax at (718) 595-7408.

Very truly yours,

Edward Ayvazyan, P.E.
Water Distribution Engineer
City Wide Hydraulic Testing Unit

File: FT2010-0781-N23-0541

All hydrant flow test requests are to be addressed to: NYCDEP-BWSO; 59-17 Junction Blvd, 1st Fl., Flushing; NY 11373-5108, Attn: Citywide Hydraulic Flow Test Unit
Enclose payment for $250 payable to NYC Water Board for each test. Indicate the test street, cross streets and borough for each test. All requests are to be made by US or overnight mail, no hand deliveries accepted.

Figure 11 Flow test from Legion Street

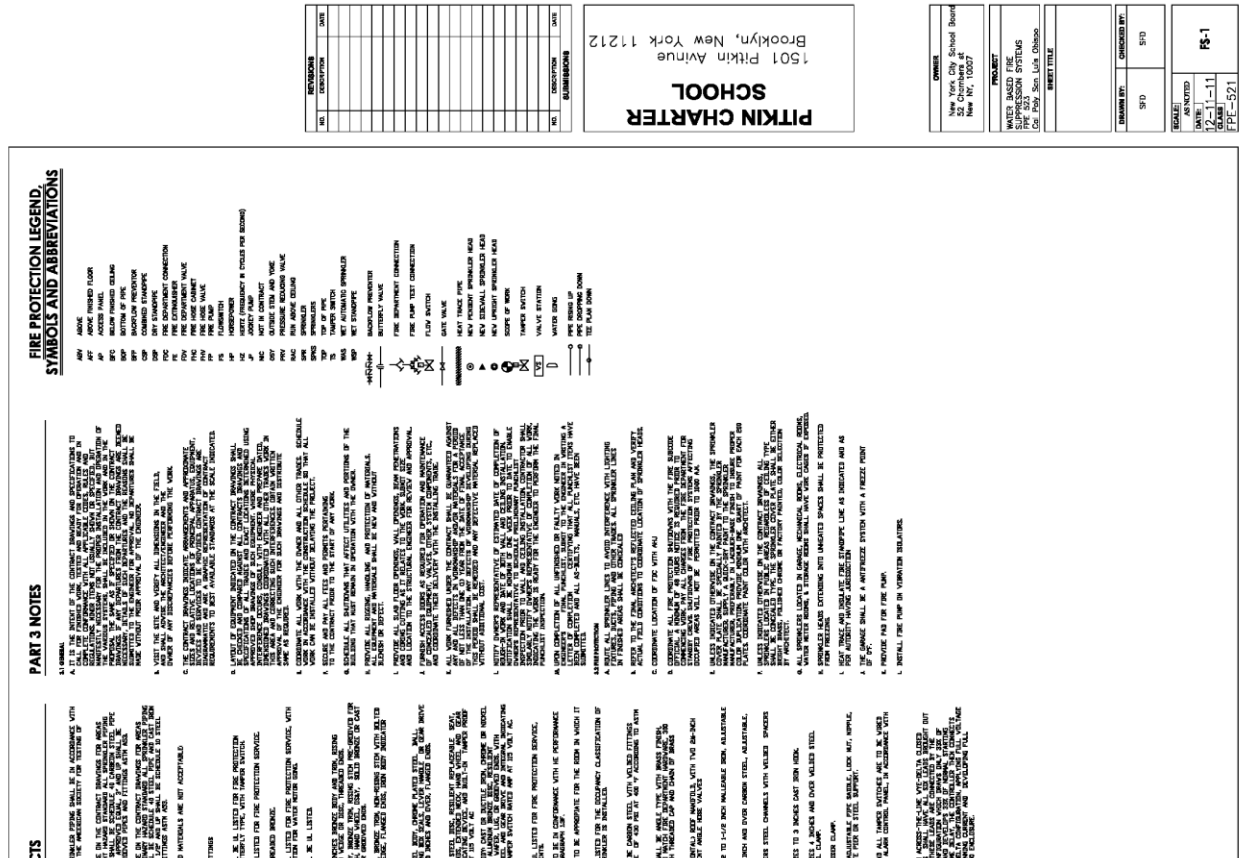

Figure 12 Fire Sprinkler notes, symbols, and abbreviations

APPENDIX C

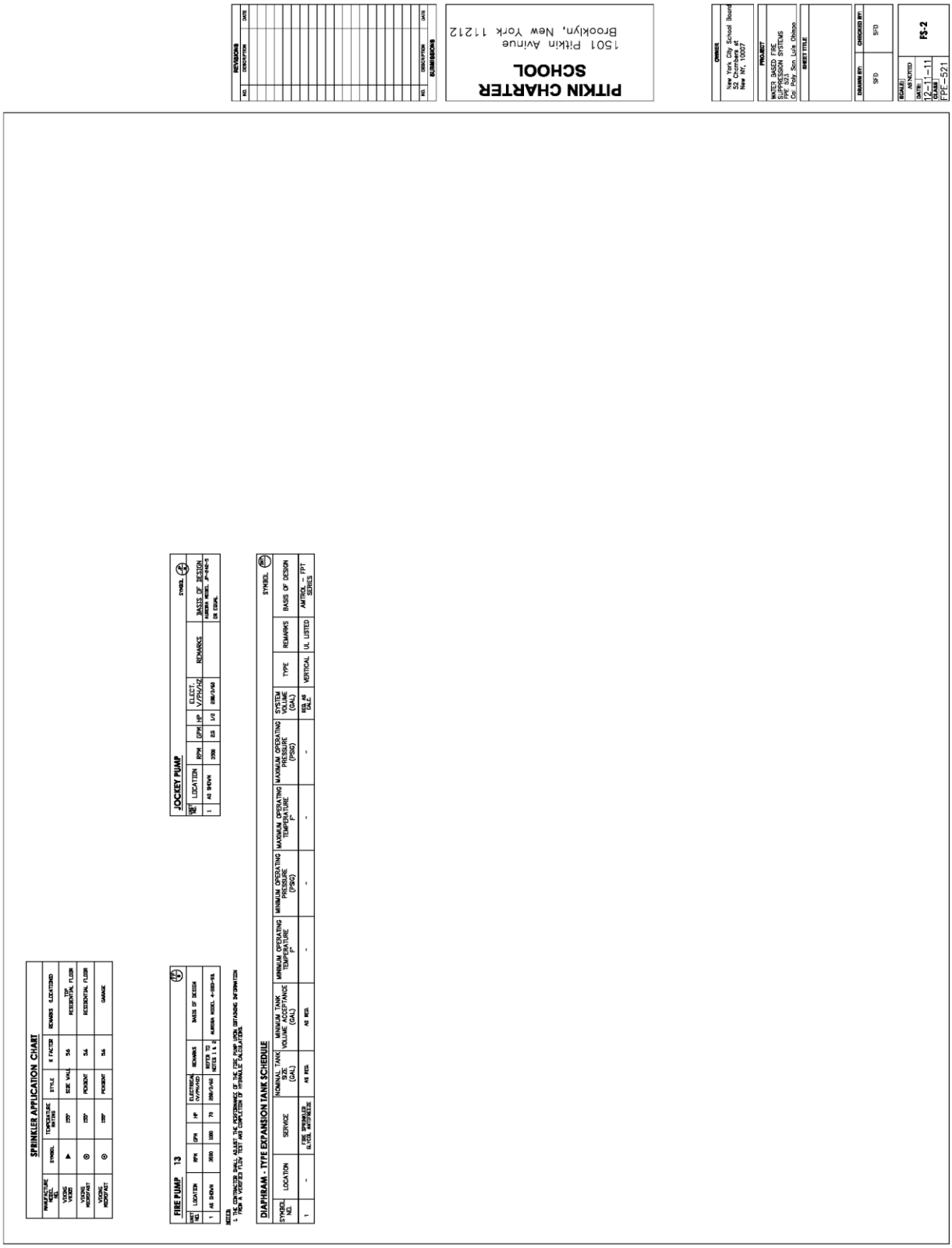

Figure 13 Fire sprinkler schedules

APPENDIX C

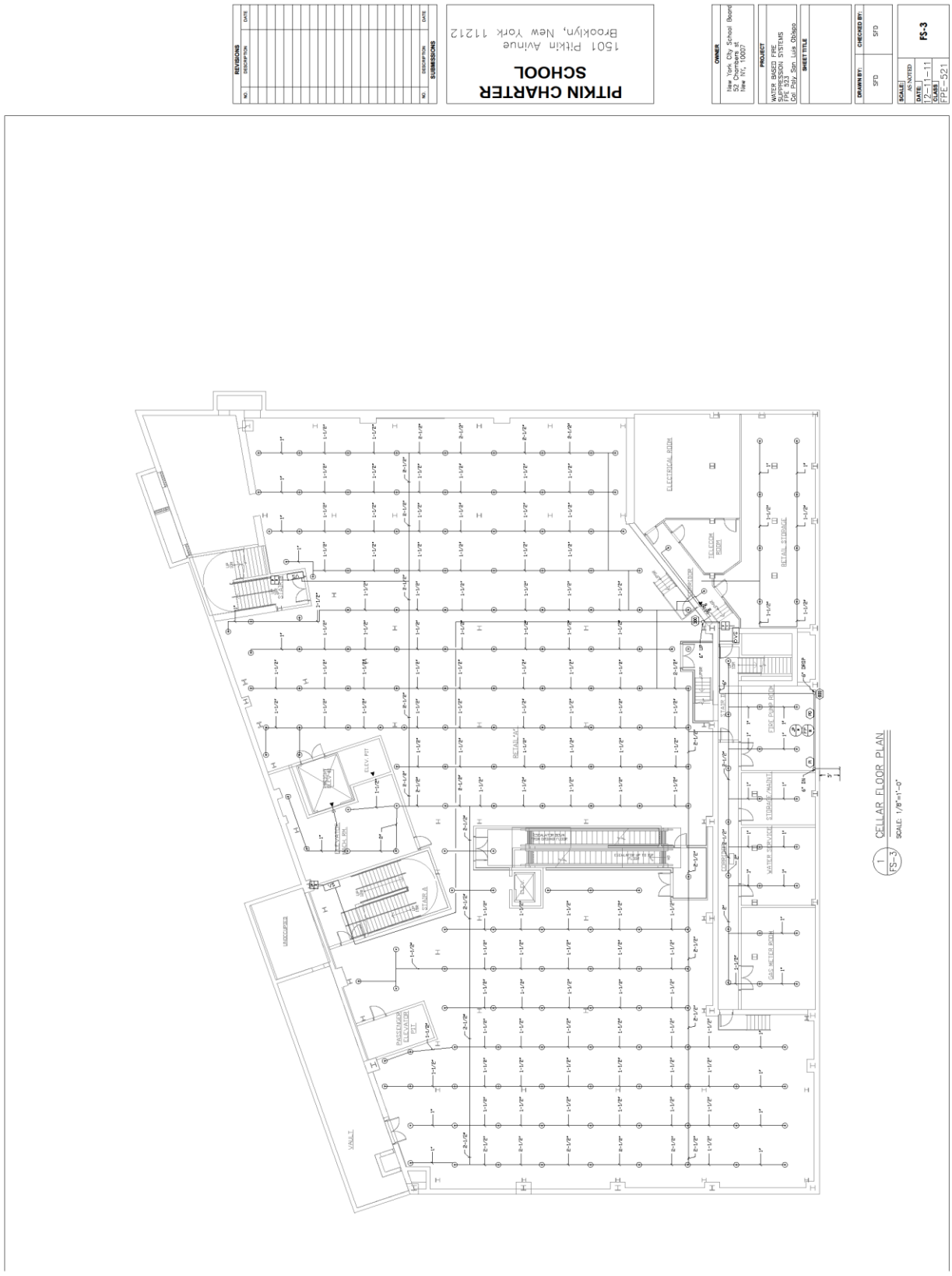

Figure 14 Fire sprinkler Cellar Floor Plan

APPENDIX C

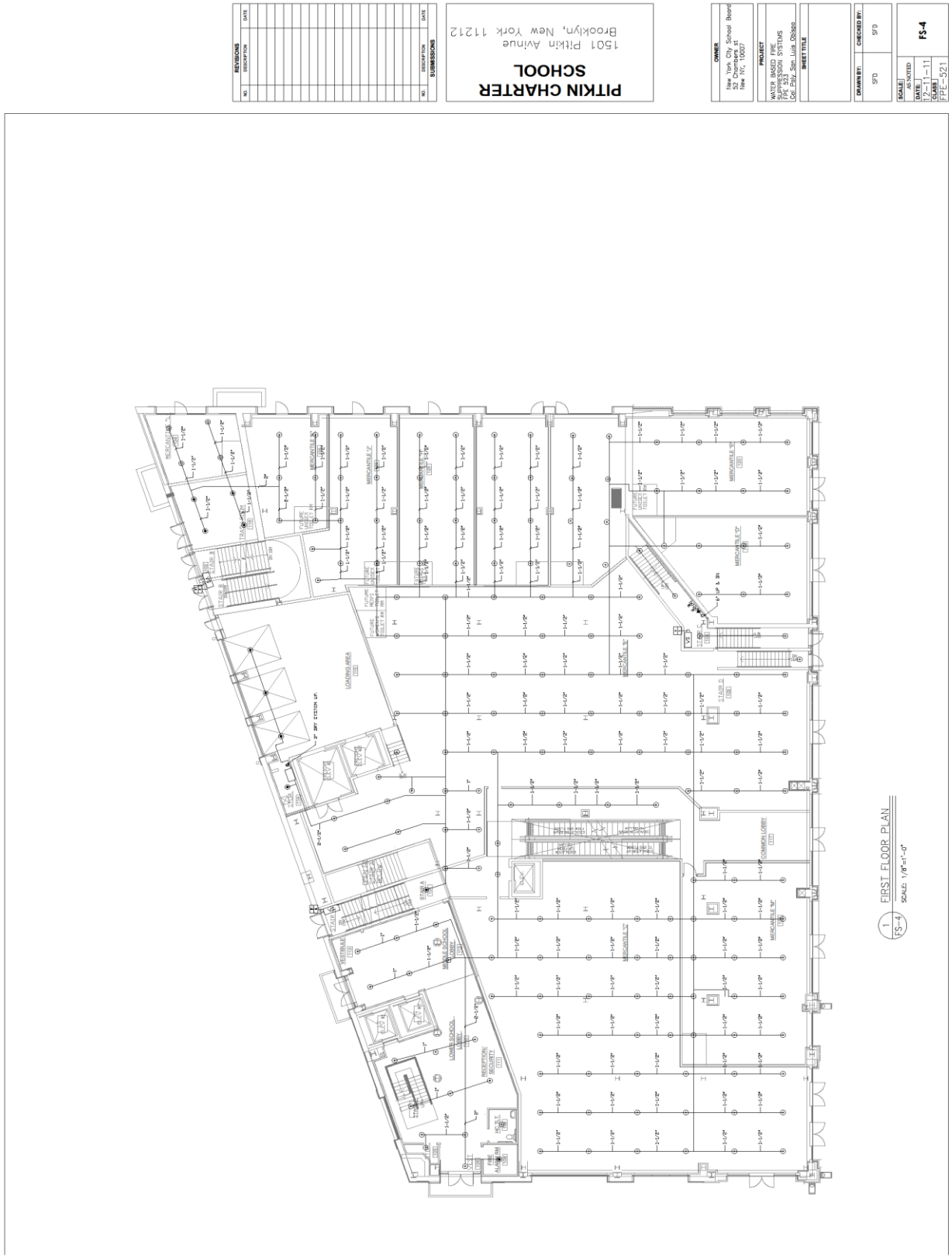

Figure 15 Fire Sprinkler First Floor Plan

APPENDIX C

Figure 16 Fire Sprinkler Second Floor Plan

APPENDIX C

Figure 17 Fire Sprinkler Third Floor Pan

APPENDIX C

Figure 18 Fire Sprinkler Fourth Floor Plan

APPENDIX C

Figure 19 Fire Sprinkler Fifth Floor Plan

APPENDIX C

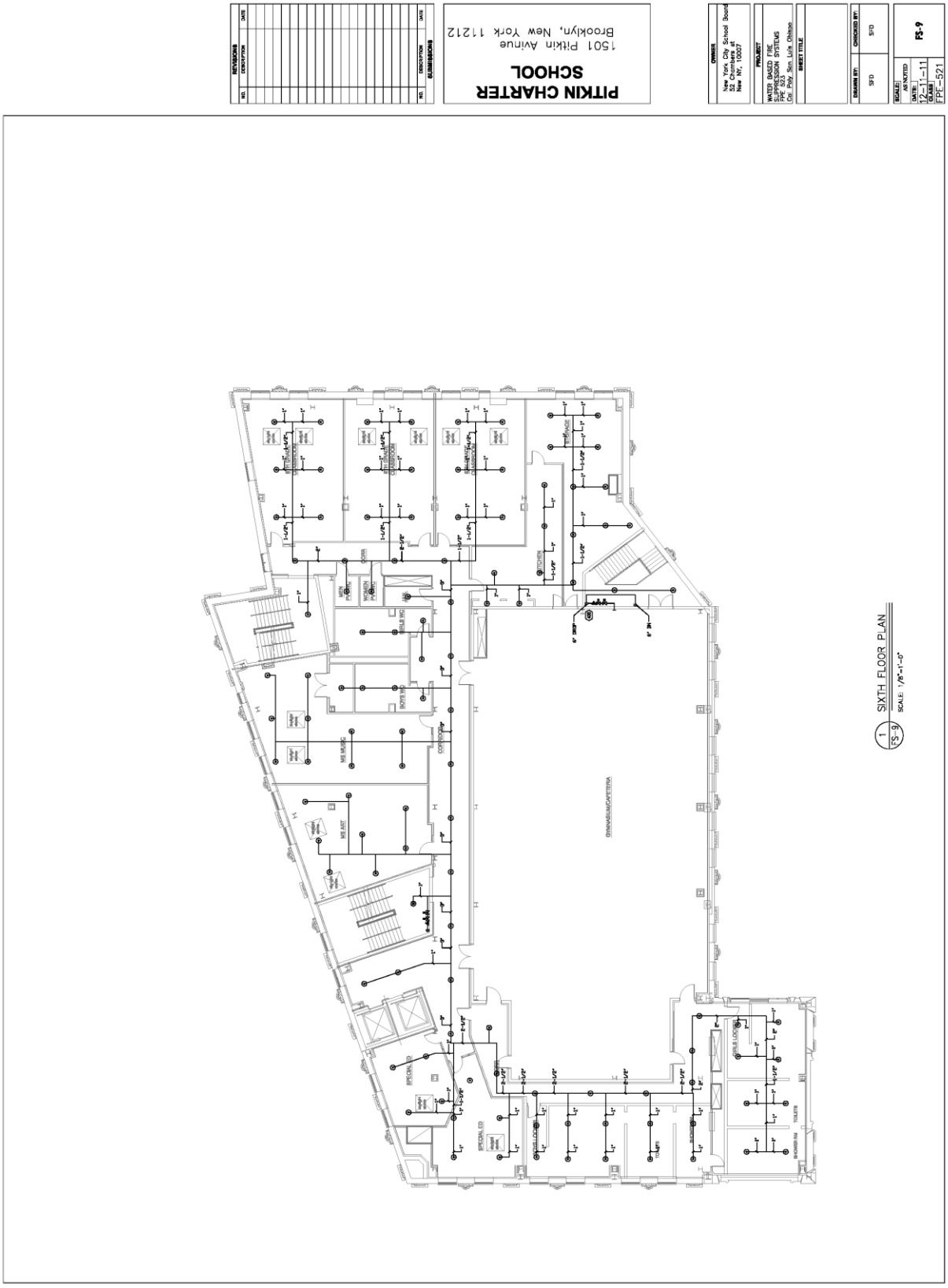

Figure 20 Fire Sprinkler Sixth Floor Plan

APPENDIX C

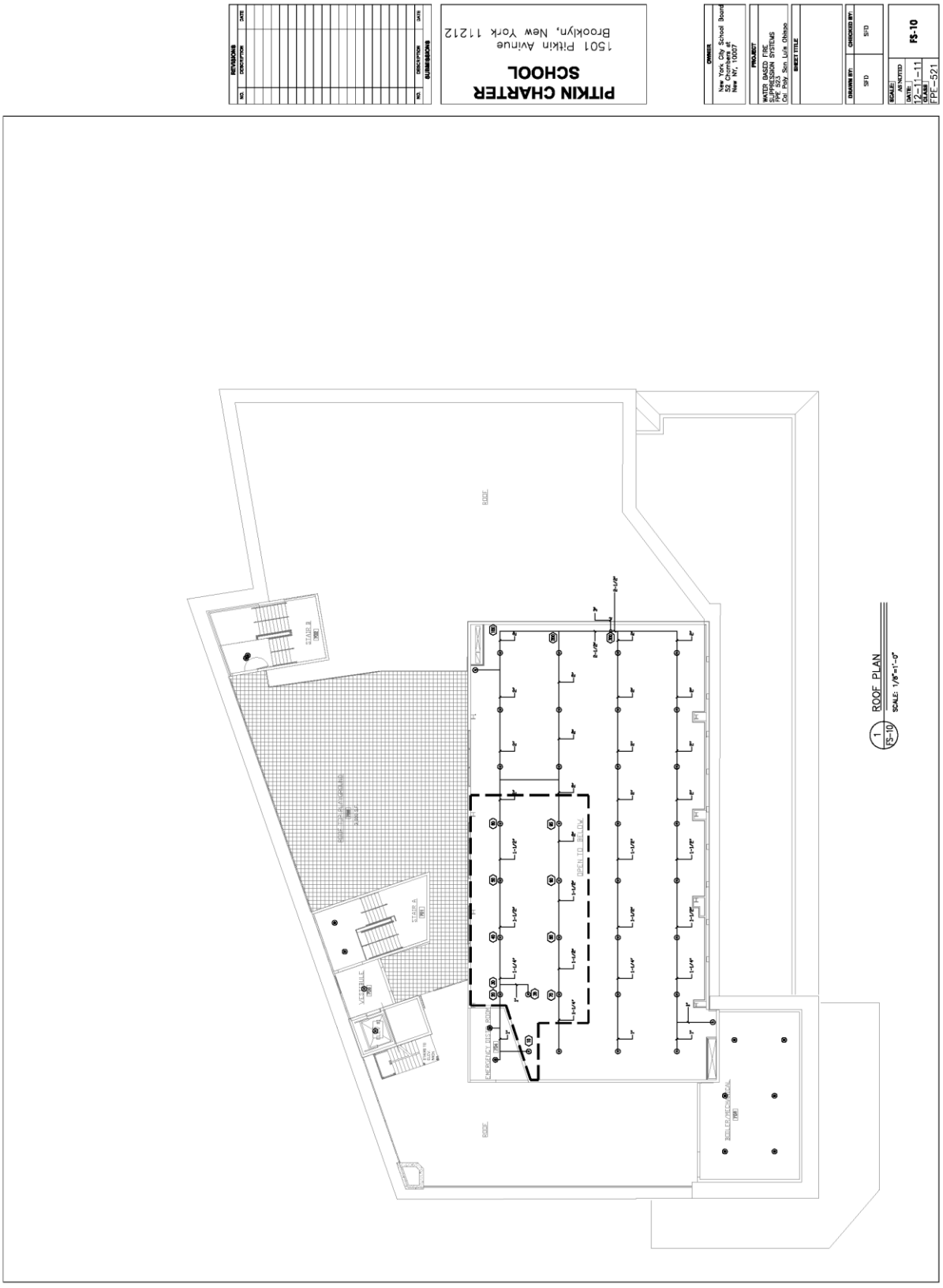

Figure 21 Fire Sprinkler Roof Plan

APPENDIX C

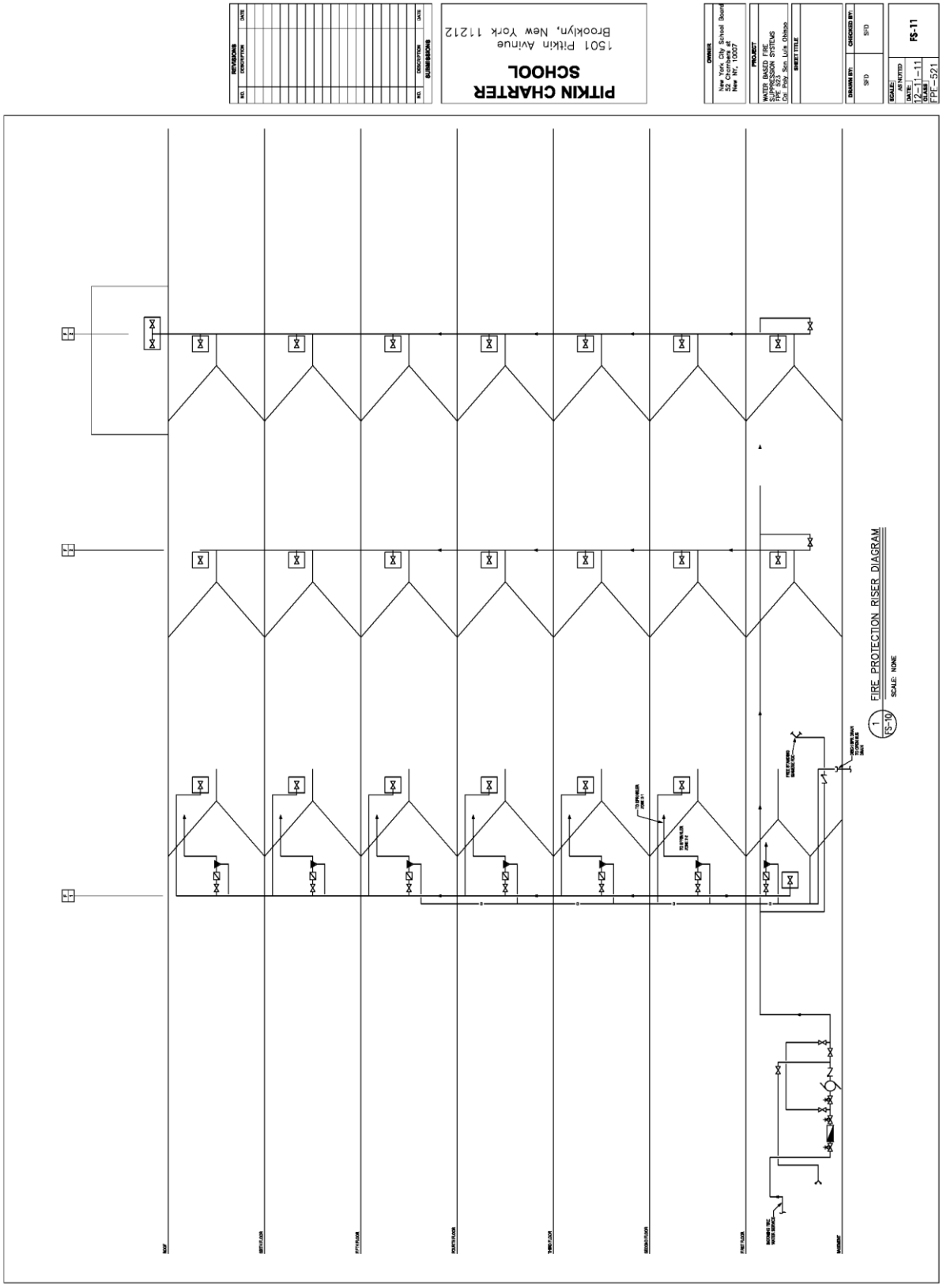

Figure 22 Fire Sprinkler Riser Diagram

APPENDIX C

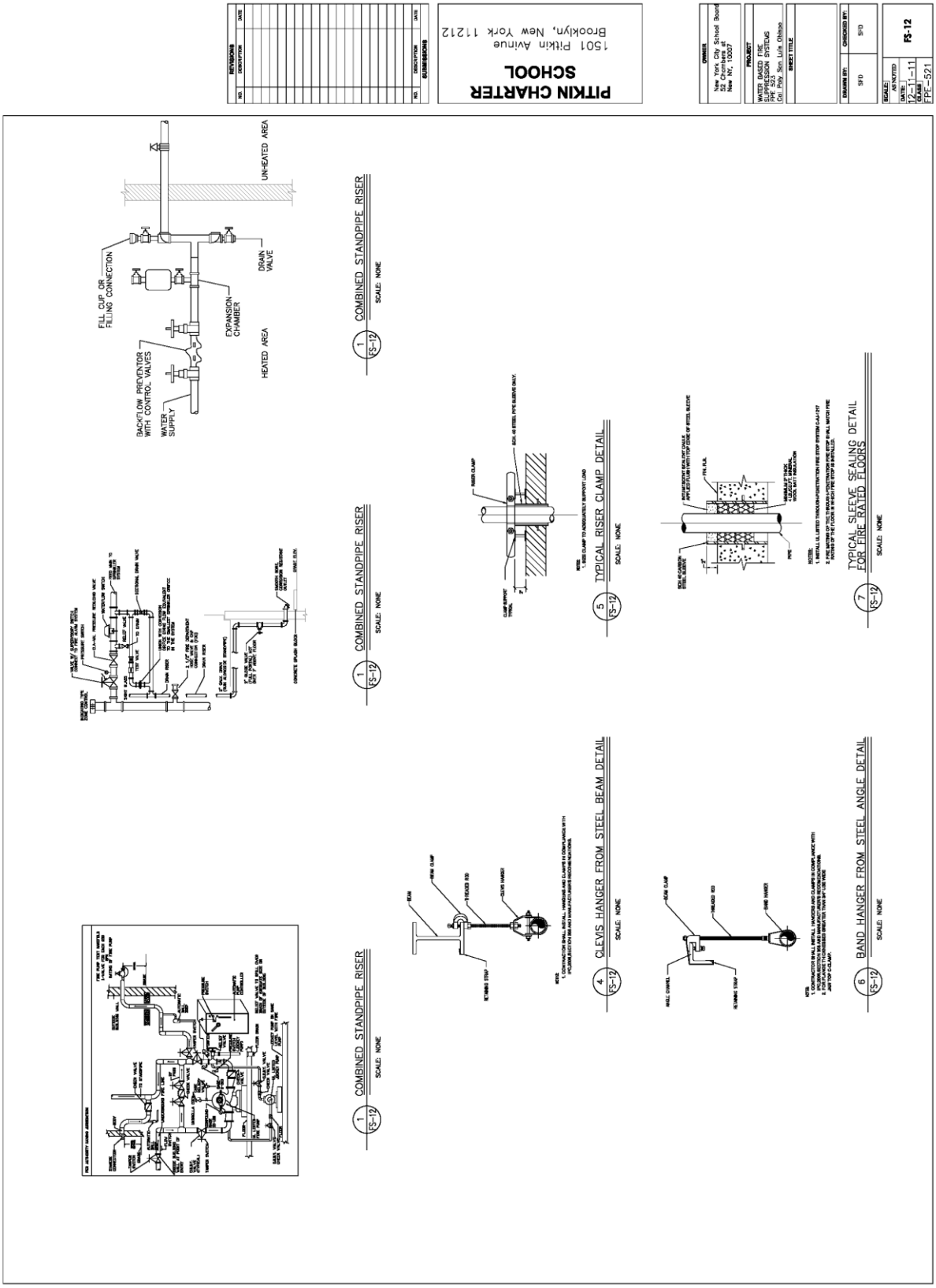

Figure 23 Fire Sprinkler Details

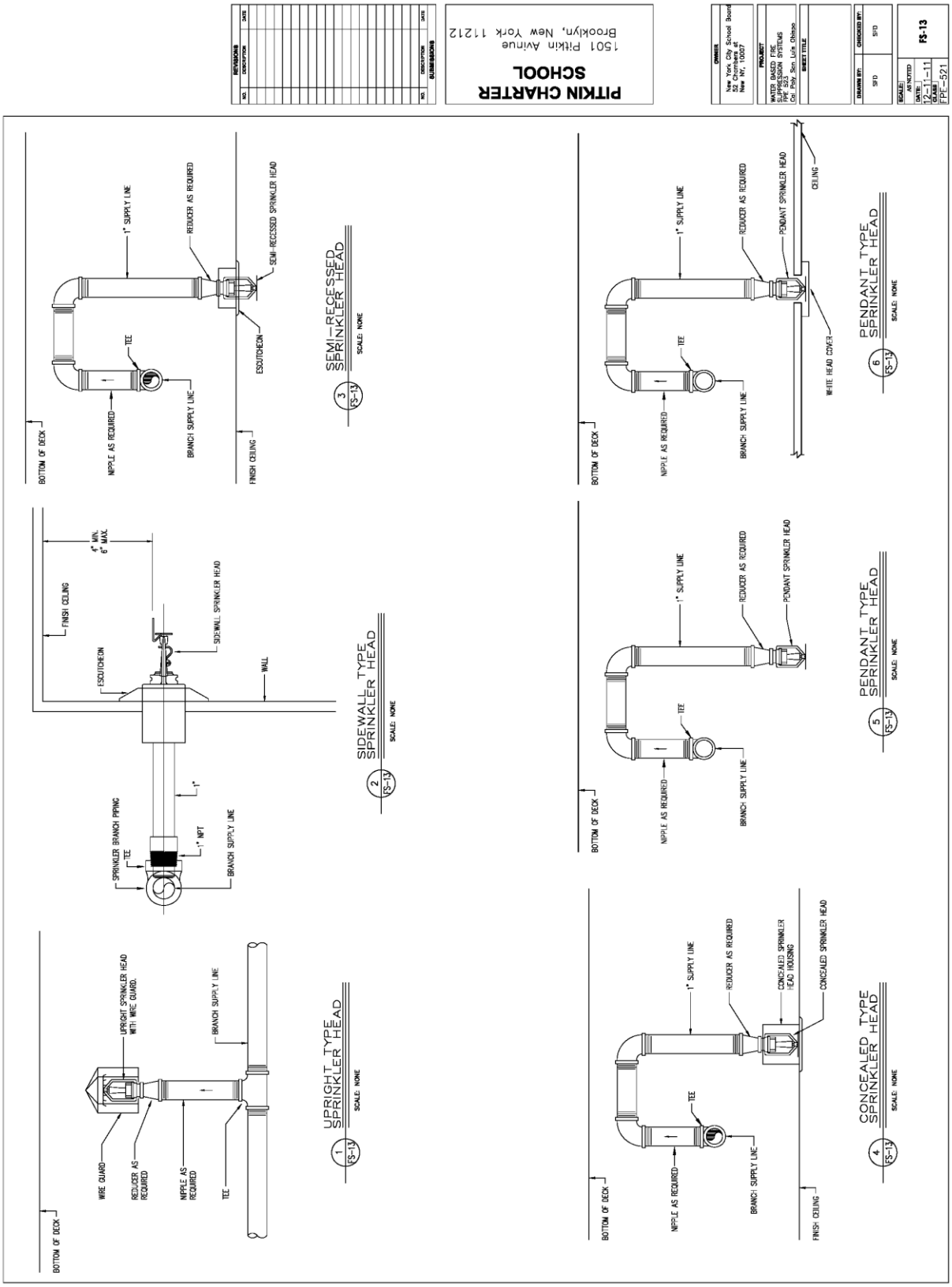

Figure 24 Fire Sprinkler Details

APPENDIX D

NFPA 25 Testing, Maintenance, Inspection Schedule

Inspection	**Frequency**
Gauge (dry, preaction, and deluge systems)	Weekly/monthly
Control valve	
Water flow alarm device	Quarterly
Valve supervisory alarm device	Quarterly
Supervisory signal devices (except valve supervisory switches)	Quarterly
Gauge (wet pipe systems)	Monthly
Hydraulic nameplate	Quarterly
Buildings	Annually (prior to freezing weather)
Hanger/seismic bracing	Annually
Pipe and fittings	Annually
Sprinklers	Annually
Spare sprinkler	Annually
Information sign	Annually
Fire department connections	
Valves (all types)	
Obstruction, internal inspection of piping	5 year
Hose connection	Annually
Fire Pump system	Weekly
Test	
Water flow alarm devices	Quarterly
Mechanical devices	Semiannually
Vane and pre sure witch type devices	
Valve, supervisory alarm device	
Supervisory signal devices (except valve supervisory switches)	
Main drain	Annually
Antifreeze solution	Annually
Gauges	5 years
Sprinkler - extra-high temperature	5 years
Sprinkler - fast-response	At 20 year and every 10 year thereafter
Sprinklers	At 50 years and every 10 years thereafter
Sprinklers	At 75 year and every 5 year thereafter
Sprinklers Dry	At 10 year and every 10 year thereafter
Flow Test	5 years
Fire Pump no flow	Monthly
Fire Pump Flow	Annually
Maintenance	
Valve (all types)	Weekly
Low-point drains (dry pipe system)	Annually
Hose Connections	Varies
Fire Pump controller	Annually
Fire pump Motor	

APPENDIX E

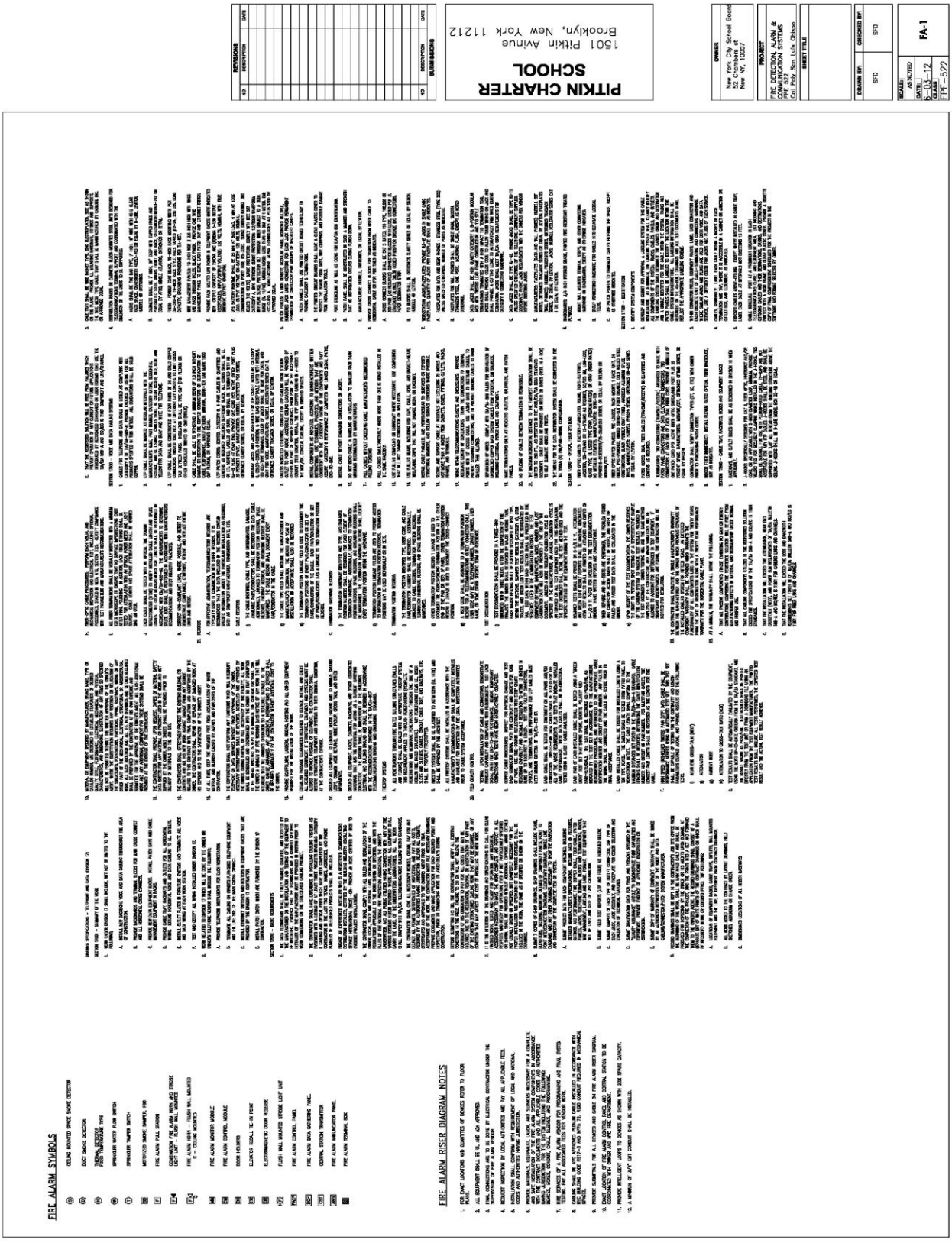

Figure 25 Fire Alarm Symbols & Notes

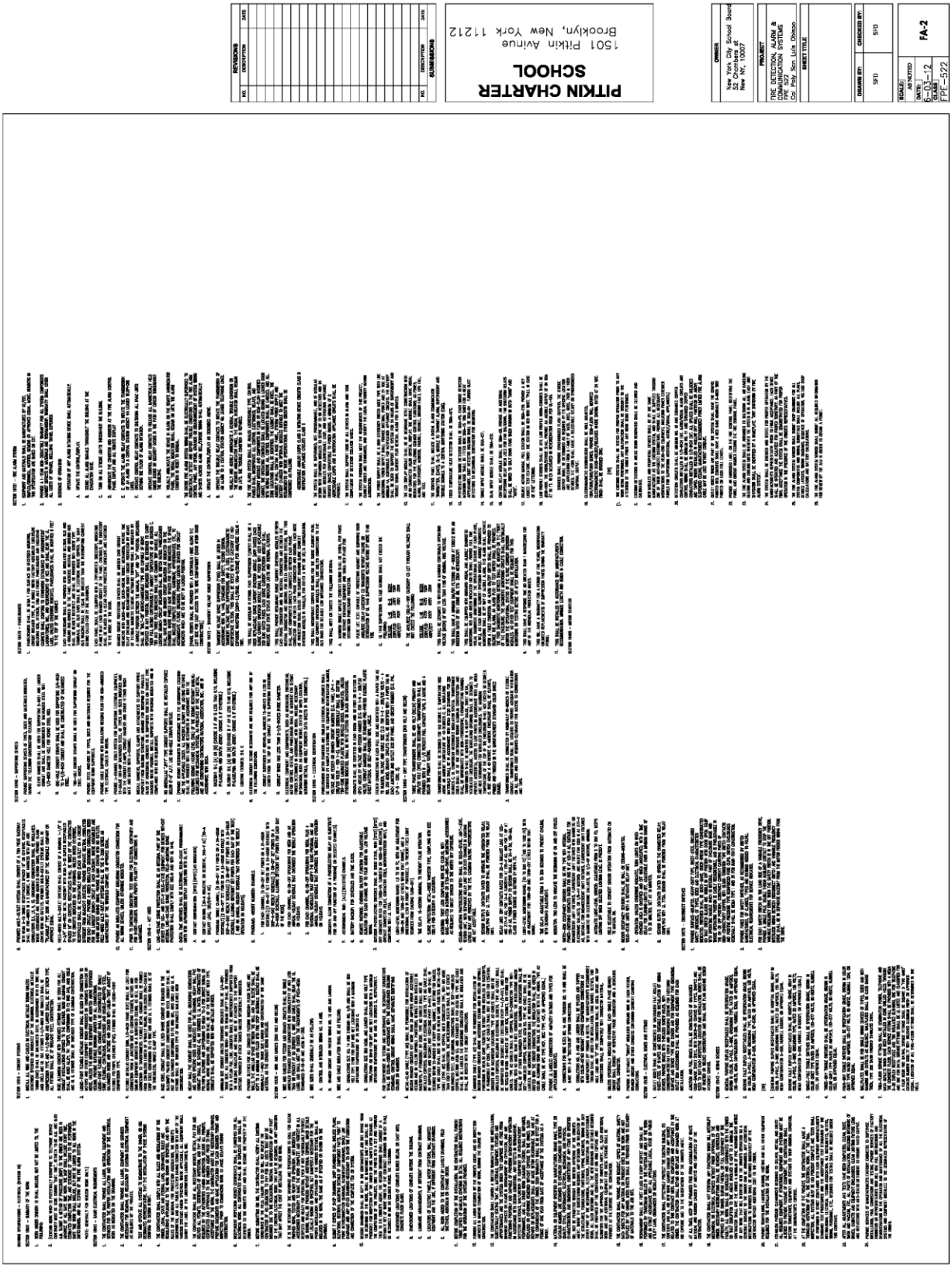

Figure 26 Fire Alarm Specifications

APPENDIX E

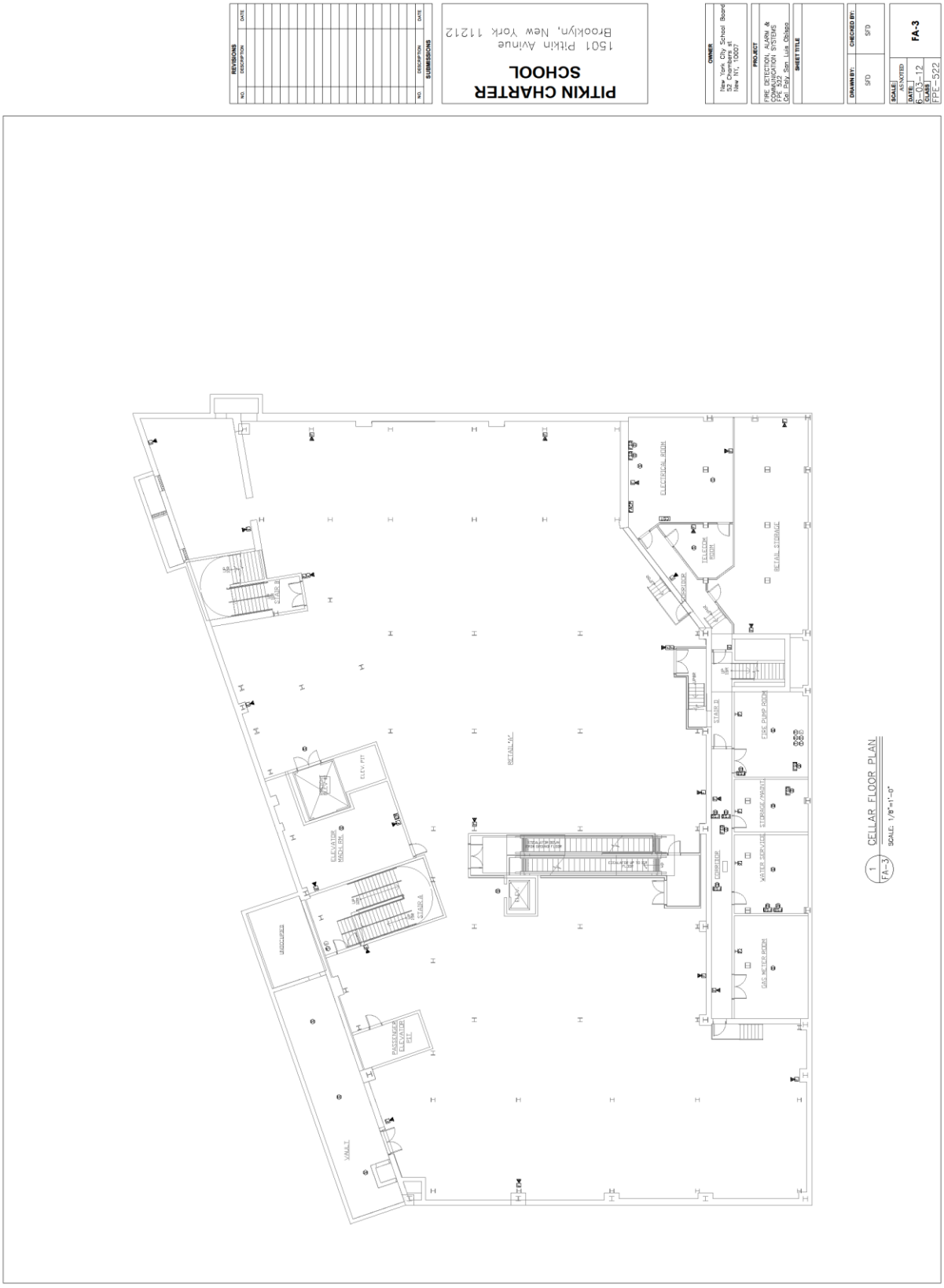

Figure 27 Fire Alarm Basement Floor Plan

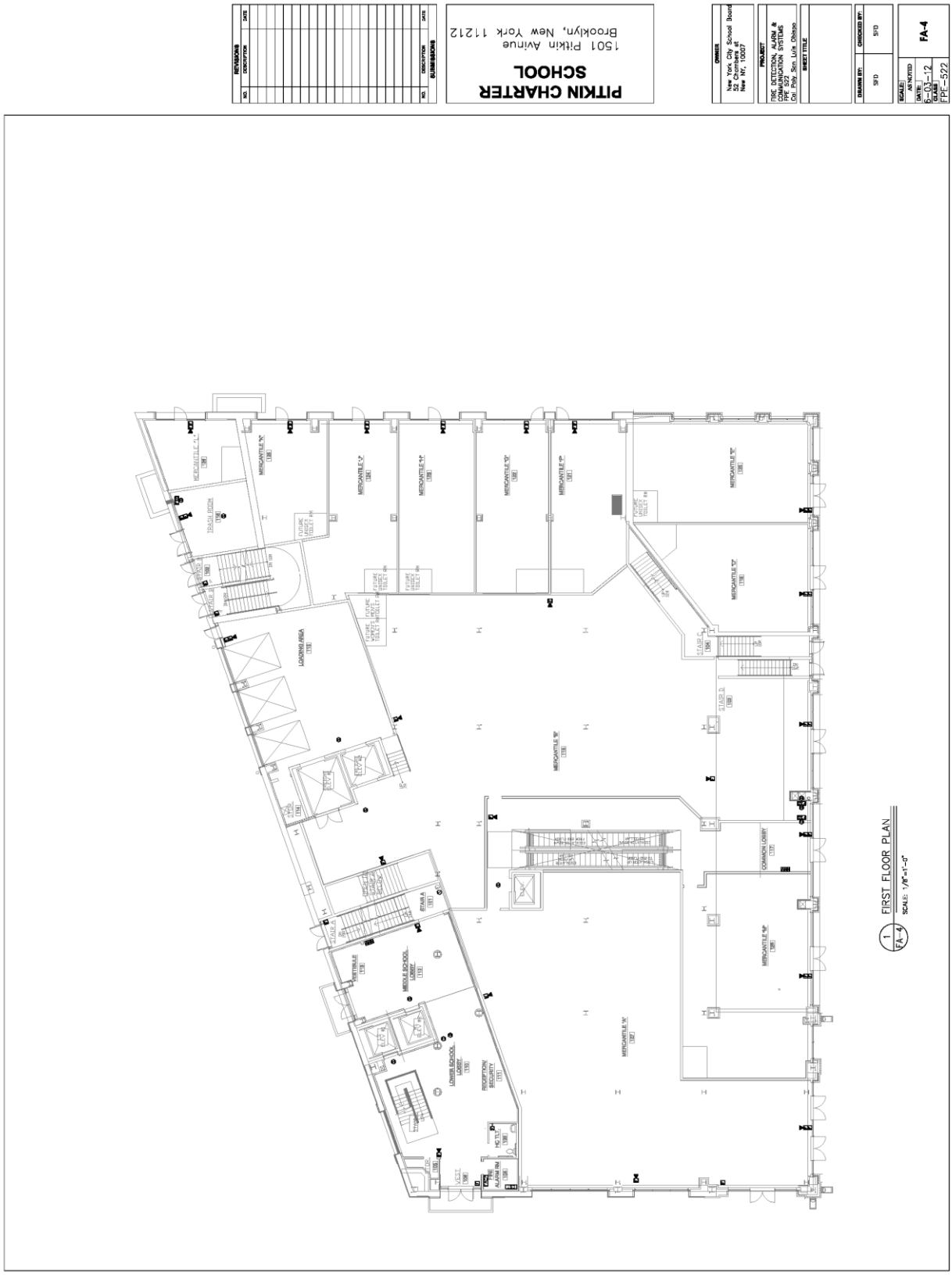

Figure 28 Fire Alarm First Floor Plan

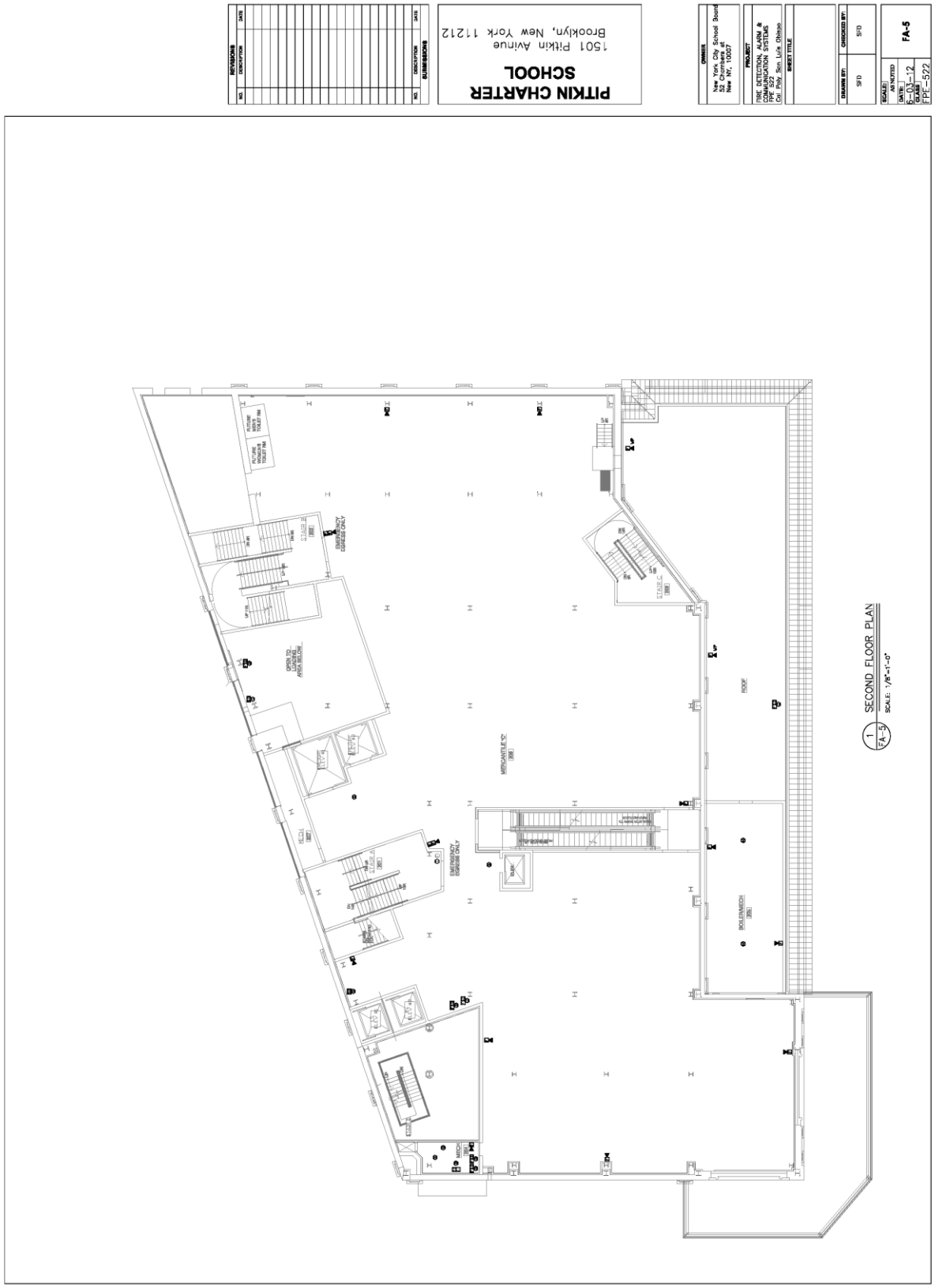

Figure 29 Fire Alarm Second Floor Plan

APPENDIX E

Figure 30 Fire Alarm Third Floor Plan

Figure 31 Fire Alarm Fourth Floor Plan

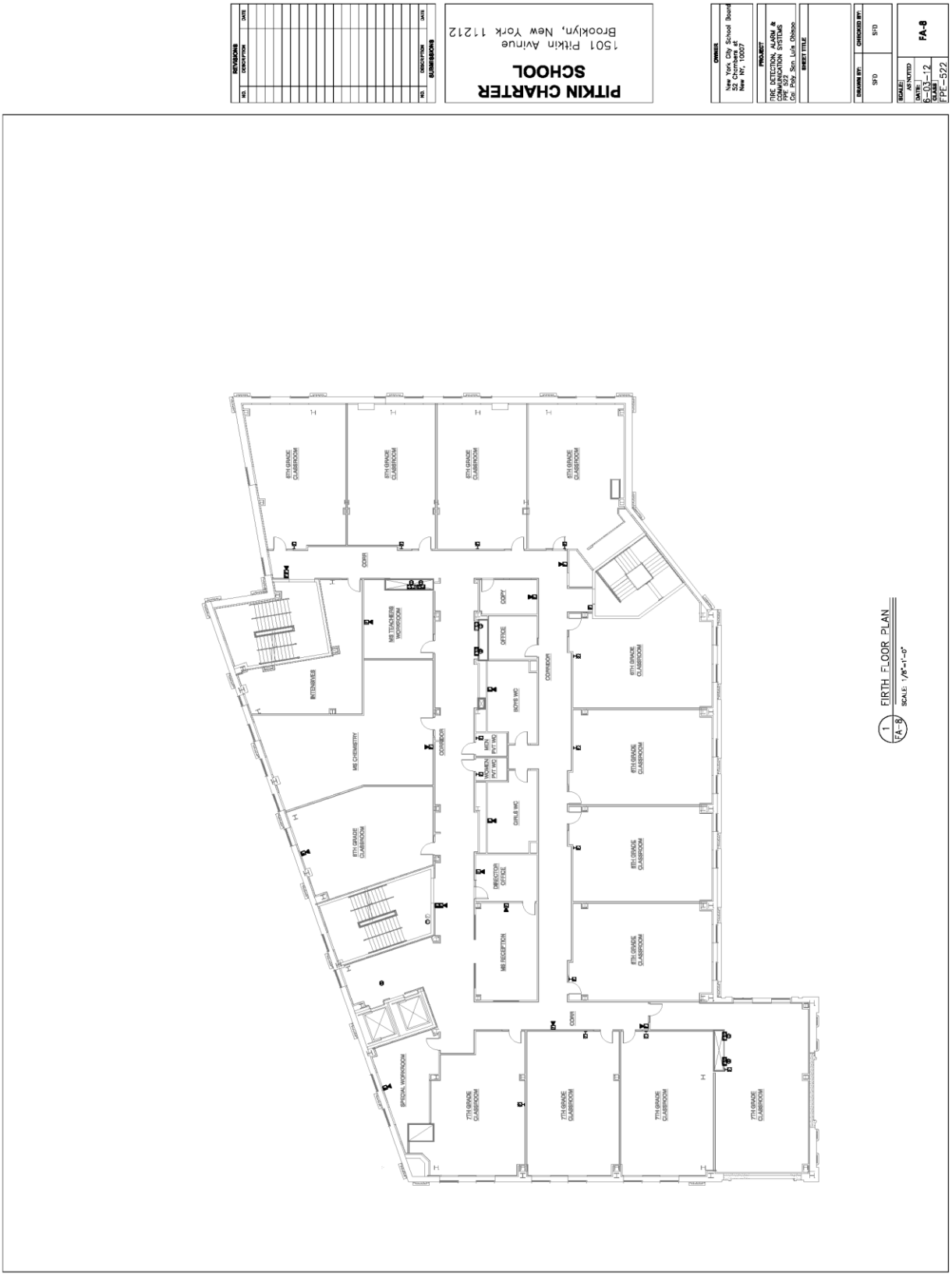

Figure 32 Fire Alarm Fifth Floor Plan

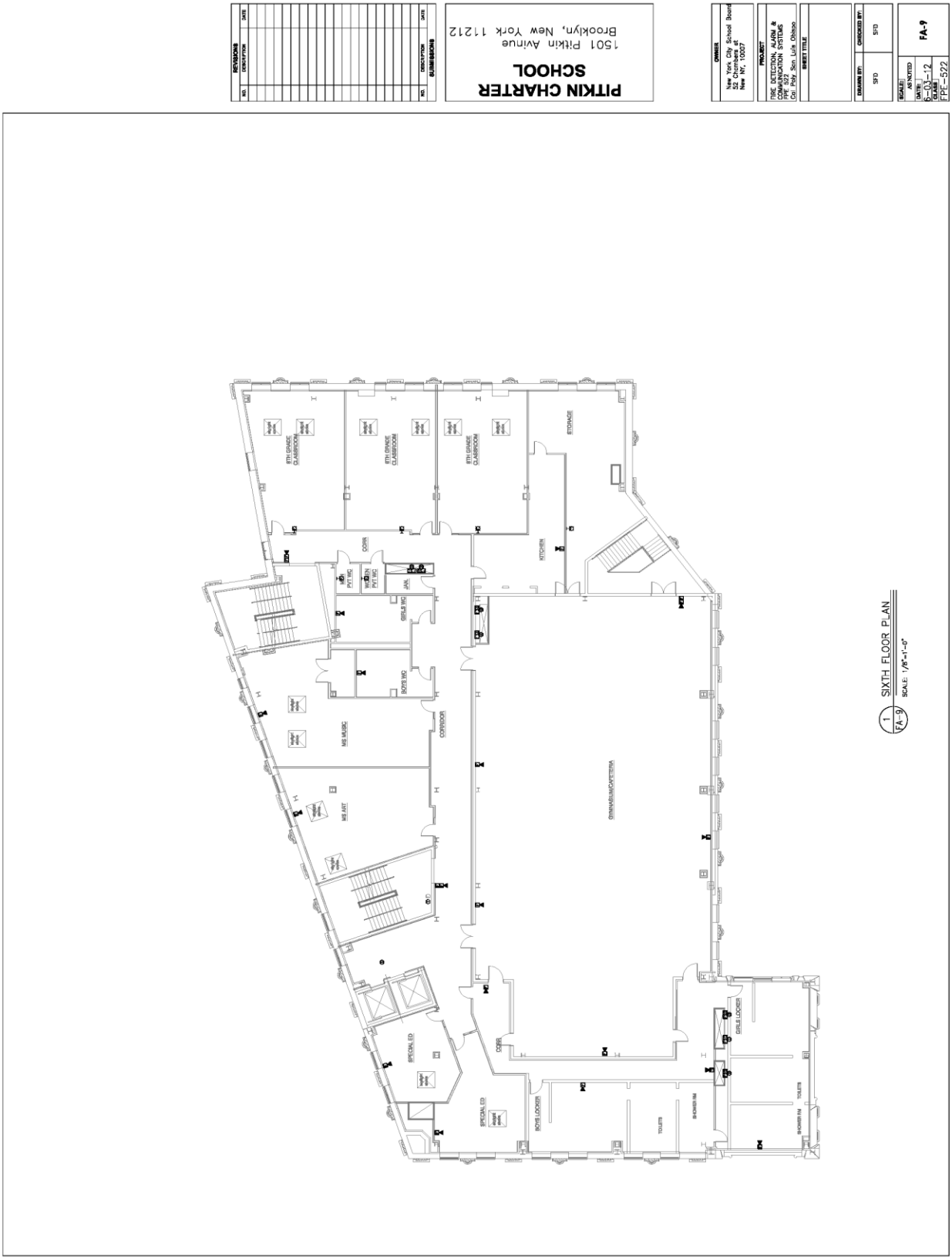

Figure 33 Fire Alarm Sixth Floor Plan

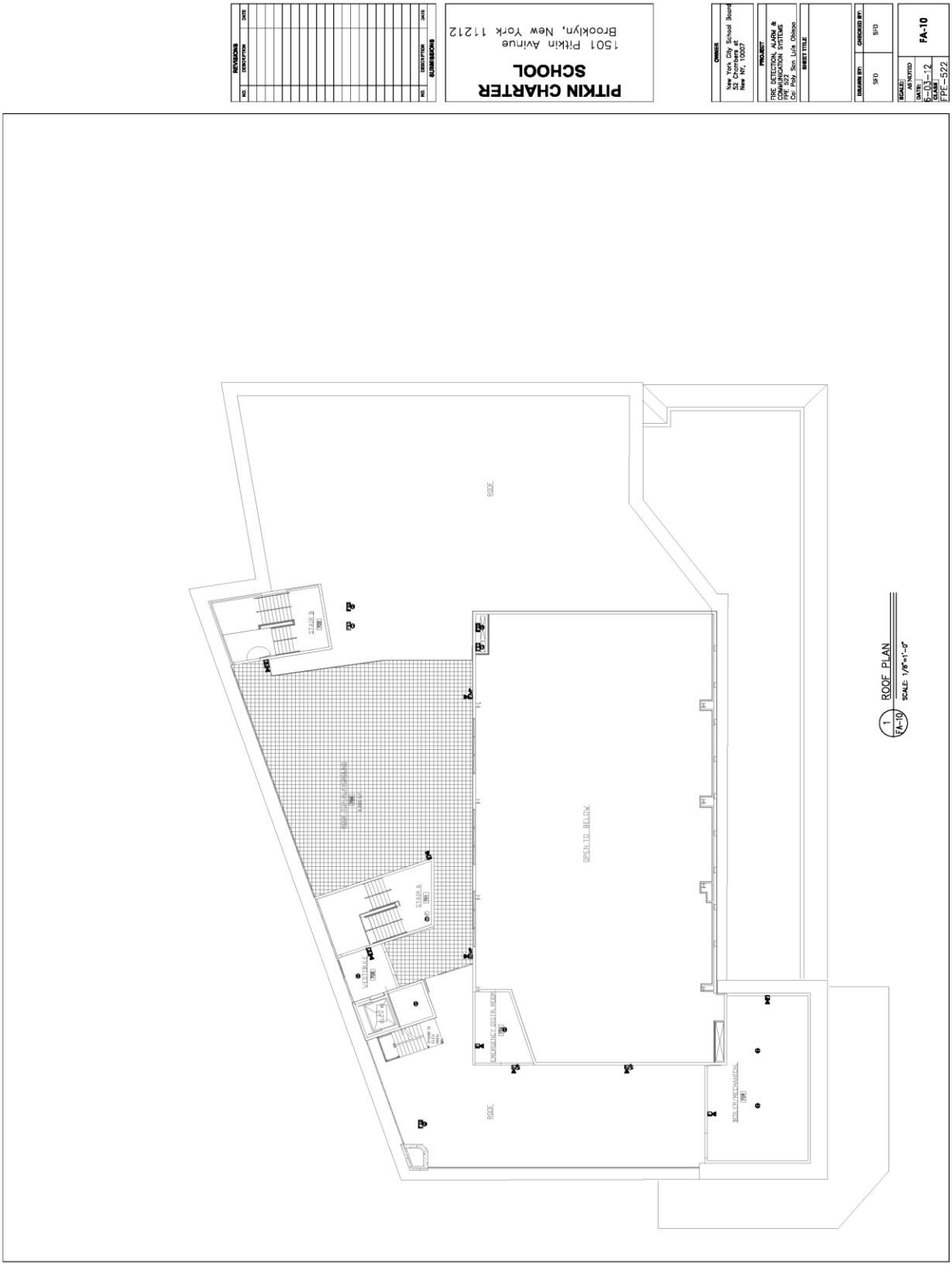

Figure 34 Fire Alarm Roof Floor Plan

APPENDIX E

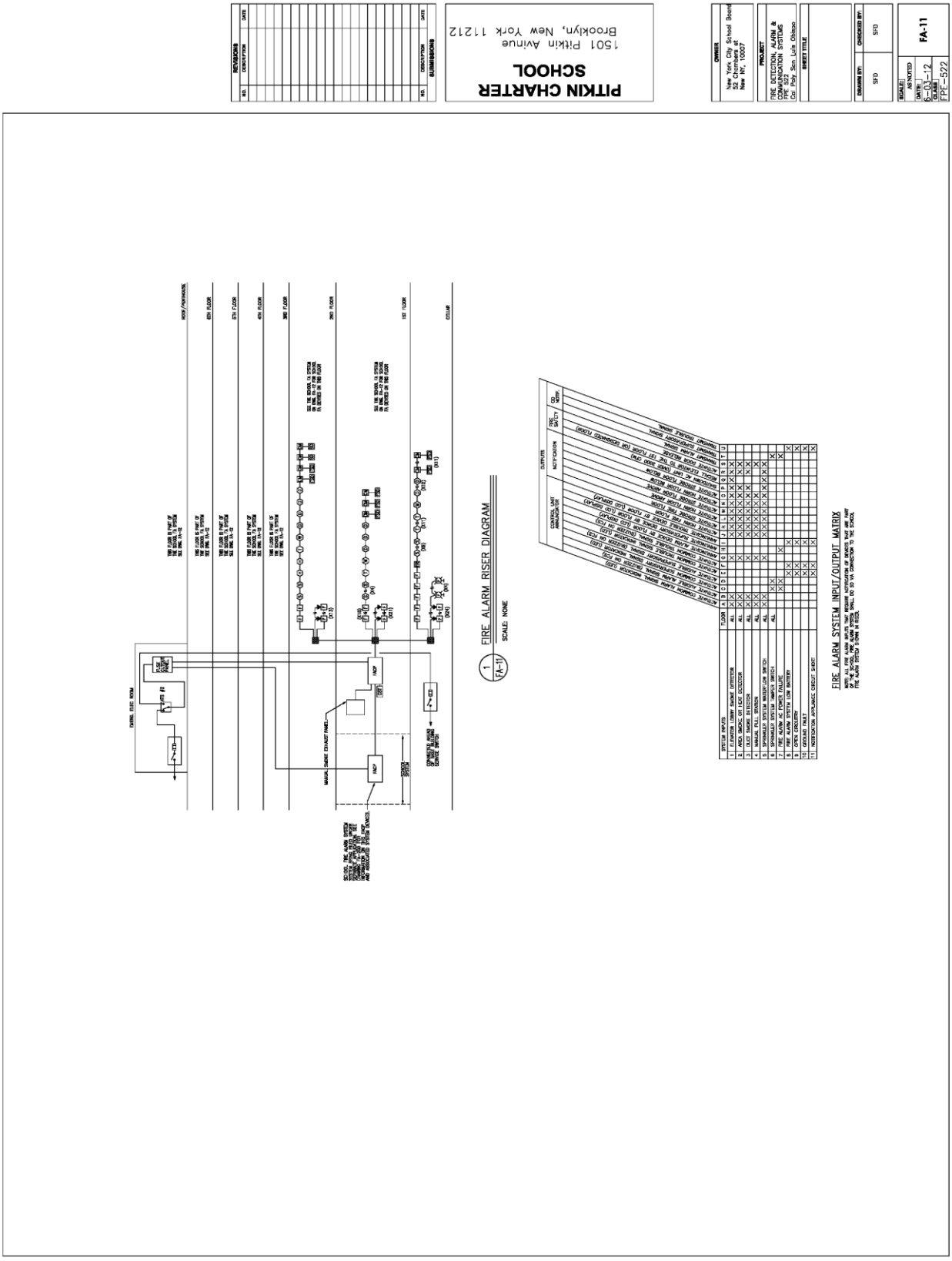

Figure 35 Fire Alarm Riser Diagram for the Non Educational Part of the Building

APPENDIX E

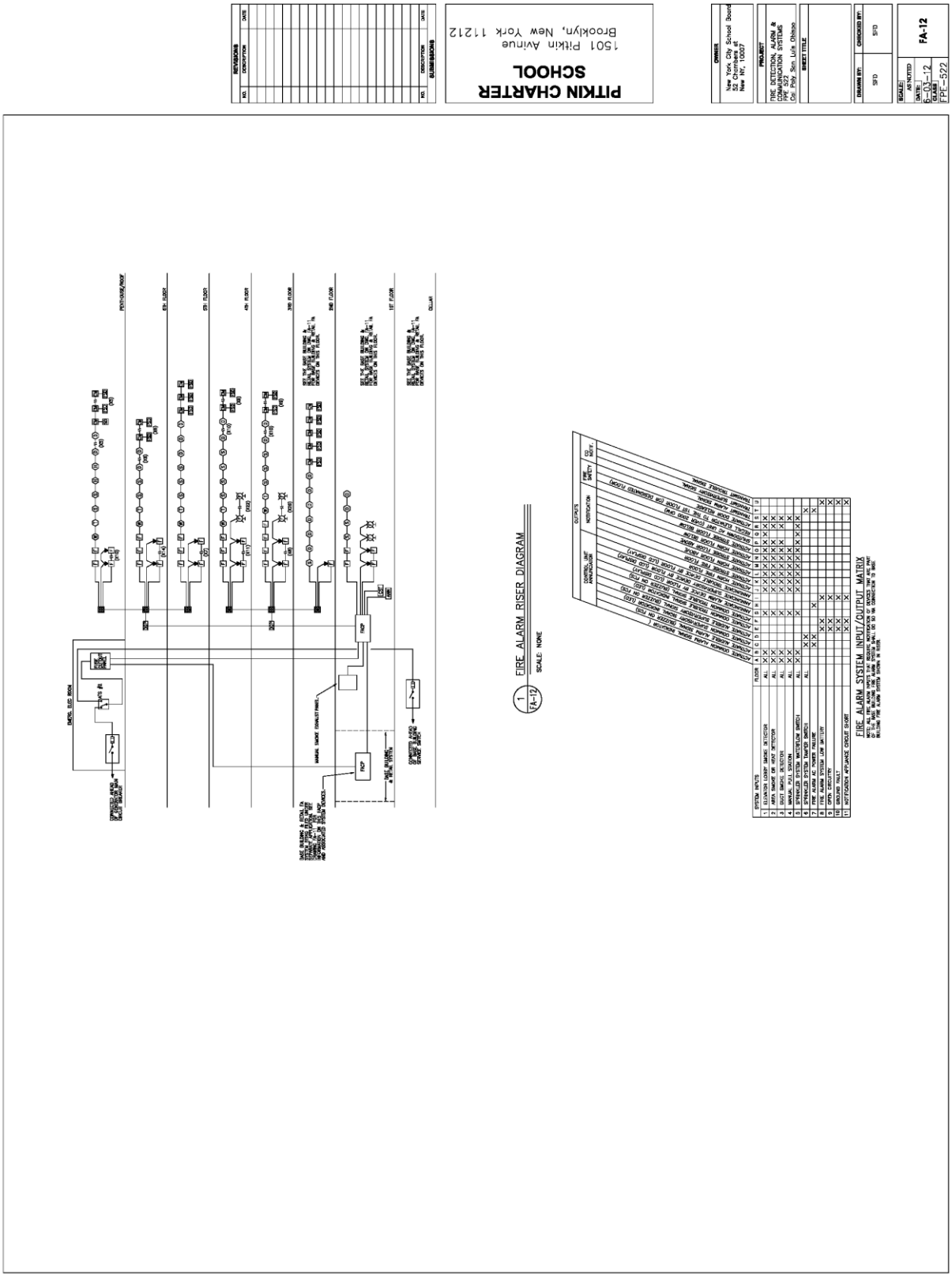

Figure 36 Fire Alarm Riser Diagram Educational part of the building

APPENDIX F

Table 37 Battery Calculation Cellar

BATTERY CALCULATION						
PITKIN BASEMENT						
	EQUIPMENT	QUANITY	SUPERVISING CURRENT (IN AMPS)		ALARM CURRENT (IN AMPS)	
			UNIT	TOTAL	UNIT	TOTAL
1	HORN STROBE	20	-	-	0.139	2.78
2	STROBE	0	-	-	0.129	0
3	GONG	0	-	-	0.17	0
4	ANUNCIATOR PANEL	2	0.02	0.04	0.025	0.05
5	PULL STATION	3	1	3	0.0003	0.0009
6	TAMPER SWITCH	6	2.5	15	0.057	0.342
7	FLOW SWICH	2	0.0003	0.0006	0.0003	0.0006
8	HEAT DETECTOR	5	1	5	1	5
9	SMOKE DETECTOR	2	0.006	0.012	0.06	0.12
10	FACP W/ LCD & CKONTROL MODULE	0	0.38	0	0.38	0
11	ACTUATOR FOR FIRE SMOKE DAMPER	2	-	-	0.18	0.36
12	DEVICE ATIVATION CURRENT	1	0.2	0.2	0.2	0.2
	SUB TOTAL			23.2526		8.8535
	TIME FACTOR			MULTIPLY BY 24 558.0624		MULTIPLY BY .083 0.735
	SAFETY FACTOR 20 PERCENT			669.67 AMP-HR		0.8818 AMP-HR
	TOTAL	670.56 AMP-HR				

NOTE:

APPENDIX F

Table 38 Battery Calculation First Floor

BATTERY CALCULATION						
PITKIN FIRST FLOOR						
	EQUIPMENT	QUANITY	SUPERVISING CURRENT (IN AMPS)		ALARM CURRENT (IN AMPS)	
			UNIT	TOTAL	UNIT	TOTAL
1	HORN STROBE	22	-	-	0.139	3.058
2	STROBE	0	-	-	0.129	0
3	GONG	1	-	-	0.17	0.17
4	ANUNCIATOR PANEL	2	0.02	0.04	0.025	0.05
5	PULL STATION	3	1	3	0.0003	0.0009
6	TAMPER SWITCH	1	2.5	2.5	0.057	0.057
7	FLOW SWICH	1	0.0003	0.0003	0.0003	0.0003
8	HEAT DETECTOR	5	1	5	1	5
9	SMOKE DETECTOR	2	0.006	0.012	0.06	0.12
10	FACP W/ LCD & CKONTROL MODULE	2	0.38	0.76	0.38	0.76
11	ACTUATOR FOR FIRE SMOKE DAMPER	2	-	-	0.18	0.36
12	DEVICE ATIVATION CURRENT	1	0.2	0.2	0.2	0.2
	SUB TOTAL			11.5123		9.7762
	TIME FACTOR			MULTIPLY BY 24		MULTIPLY BY .083
				276.2952		0.811
	SAFETY FACTOR 20 PERCENT			331.55 AMP-HR		0.9737 AMP-HR
	TOTAL	332.53 AMP-HR				

NOTE:

APPENDIX F

Table 39 Battery Calculation Second Floor

BATTERY CALCULATION						
PITKIN SECOND FLOOR						
	EQUIPMENT	QUANITY	SUPERVISING CURRENT (IN AMPS)		ALARM CURRENT (IN AMPS)	
			UNIT	TOTAL	UNIT	TOTAL
1	HORN STROBE	13	-	-	0.139	1.807
2	STROBE	0	-	-	0.129	0
3	GONG	0	-	-	0.17	0
4	ANUNCIATOR PANEL	0	0.02	0	0.025	0
5	PULL STATION	3	1	3	0.0003	0.0009
6	TAMPER SWITCH	1	2.5	2.5	0.057	0.057
7	FLOW SWICH	1	0.0003	0.0003	0.0003	0.0003
8	HEAT DETECTOR	2	1	2	1	2
9	SMOKE DETECTOR	6	0.006	0.036	0.06	0.36
10	FACP W/ LCD & CKONTROL MODULE	0	0.38	0	0.38	0
11	ACTUATOR FOR FIRE SMOKE DAMPER	6	-	-	0.18	1.08
12	DEVICE ATIVATION CURRENT	1	0.2	0.2	0.2	0.2
	SUB TOTAL			7.7363		5.5052
	TIME FACTOR			MULTIPLY BY 24 185.6712		MULTIPLY BY .083 0.457
	SAFETY FACTOR 20 PERCENT			222.81 AMP-HR		0.5483 AMP-HR
	TOTAL	223.35 AMP-HR				

NOTE:

APPENDIX F

Table 40 Battery Calculation Third Floor

BATTERY CALCULATION						
PITKIN THIRD FLOOR						
	EQUIPMENT	QUANITY	SUPERVISING CURRENT (IN AMPS)		ALARM CURRENT (IN AMPS)	
			UNIT	TOTAL	UNIT	TOTAL
1	HORN STROBE	11	-	-	0.139	1.529
2	STROBE	27	-	-	0.129	3.483
3	GONG	0	-	-	0.17	0
4	ANUNCIATOR PANEL	0	0.02	0	0.025	0
5	PULL STATION	3	1	3	0.0003	0.0009
6	TAMPER SWITCH	1	2.5	2.5	0.057	0.057
7	FLOW SWICH	1	0.0003	0.0003	0.0003	0.0003
8	HEAT DETECTOR	0	1	0	1	0
9	SMOKE DETECTOR	12	0.006	0.072	0.06	0.72
10	FACP W/ LCD & CKONTROL MODULE	0	0.38	0	0.38	0
11	ACTUATOR FOR FIRE SMOKE DAMPER	9	-	-	0.18	1.62
12	DEVICE ATIVATION CURRENT	1	0.2	0.2	0.2	0.2
	SUB TOTAL			5.7723		7.6102
	TIME FACTOR			MULTIPLY BY 24 138.5352		MULTIPLY BY .083 0.632
	SAFETY FACTOR 20 PERCENT			166.24 AMP-HR		0.7580 AMP-HR
	TOTAL	167.00 AMP-HR				

NOTE:

Table 41 Battery Calculation Forth Floor

BATTERY CALCULATION						
PITKIN FOURTH FLOOR						
	EQUIPMENT	QUANITY	SUPERVISING CURRENT (IN AMPS)		ALARM CURRENT (IN AMPS)	
			UNIT	TOTAL	UNIT	TOTAL
1	HORN STROBE	13	-	-	0.139	1.807
2	STROBE	14	-	-	0.129	1.806
3	GONG	0	-	-	0.17	0
4	ANUNCIATOR PANEL	0	0.02	0	0.025	0
5	PULL STATION	3	1	3	0.0003	0.0009
6	TAMPER SWITCH	1	2.5	2.5	0.057	0.057
7	FLOW SWICH	1	0.0003	0.0003	0.0003	0.0003
8	HEAT DETECTOR	0	1	0	1	0
9	SMOKE DETECTOR	10	0.006	0.06	0.06	0.6
10	FACP W/ LCD & CKONTROL MODULE	0	0.38	0	0.38	0
11	ACTUATOR FOR FIRE SMOKE DAMPER	9	-	-	0.18	1.62
12	DEVICE ATIVATION CURRENT	1	0.2	0.2	0.2	0.2
	SUB TOTAL			5.7603		6.0912
	TIME FACTOR			MULTIPLY BY 24 138.2472		MULTIPLY BY .083 0.506
	SAFETY FACTOR 20 PERCENT			165.90 AMP-HR		0.6067 AMP-HR
	TOTAL	166.50 AMP-HR				

NOTE:

APPENDIX F

Table 42 Battery Calculation Fifth Floor

BATTERY CALCULATION						
PITKIN FIFTH FLOOR						
	EQUIPMENT	QUANITY	SUPERVISING CURRENT (IN AMPS)		ALARM CURRENT (IN AMPS)	
			UNIT	TOTAL	UNIT	TOTAL
1	HORN STROBE	13	-	-	0.139	1.807
2	STROBE	18	-	-	0.129	2.322
3	GONG	0	-	-	0.17	0
4	ANUNCIATOR PANEL	0	0.02	0	0.025	0
5	PULL STATION	3	1	3	0.0003	0.0009
6	TAMPER SWITCH	1	2.5	2.5	0.057	0.057
7	FLOW SWICH	1	0.0003	0.0003	0.0003	0.0003
8	HEAT DETECTOR	0	1	0	1	0
9	SMOKE DETECTOR	8	0.006	0.048	0.06	0.48
10	FACP W/ LCD & CKONTROL MODULE	0	0.38	0	0.38	0
11	ACTUATOR FOR FIRE SMOKE DAMPER	7	-	-	0.18	1.26
12	DEVICE ATIVATION CURRENT	1	0.2	0.2	0.2	0.2
	SUB TOTAL			5.7483		6.1272
	TIME FACTOR			MULTIPLY BY 24		MULTIPLY BY .083
				137.9592		0.509
	SAFETY FACTOR 20 PERCENT			165.55 AMP-HR		0.6103 AMP-HR
	TOTAL	166.16 AMP-HR				

NOTE:

APPENDIX F

Table 43 Battery Calculation Sixth Floor

BATTERY CALCULATION						
PITKIN SIXTH FLOOR						
	EQUIPMENT	QUANITY	SUPERVISING CURRENT (IN AMPS)		ALARM CURRENT (IN AMPS)	
			UNIT	TOTAL	UNIT	TOTAL
1	HORN STROBE	18	-	-	0.139	2.502
2	STROBE	0	-	-	0.129	0
3	GONG	0	-	-	0.17	0
4	ANUNCIATOR PANEL	0	0.02	0	0.025	0
5	PULL STATION	3	1	3	0.0003	0.0009
6	TAMPER SWITCH	1	2.5	2.5	0.057	0.057
7	FLOW SWICH	1	0.0003	0.0003	0.0003	0.0003
8	HEAT DETECTOR	0	1	0	1	0
9	SMOKE DETECTOR	7	0.006	0.042	0.06	0.42
10	FACP W/ LCD & CKONTROL MODULE	0	0.38	0	0.38	0
11	ACTUATOR FOR FIRE SMOKE DAMPER	7	-	-	0.18	1.26
12	DEVICE ATIVATION CURRENT	1	0.2	0.2	0.2	0.2
	SUB TOTAL			5.7423		4.4402
	TIME FACTOR			MULTIPLY BY 24 137.8152		MULTIPLY BY .083 0.369
	SAFETY FACTOR 20 PERCENT			165.38 AMP-HR		0.4422 AMP-HR
	TOTAL	165.82 AMP-HR				

NOTE:

Table 44 Battery Calculation Roof

BATTERY CALCULATION						
PITKIN ROOF						
	EQUIPMENT	QUANITY	SUPERVISING CURRENT (IN AMPS)		ALARM CURRENT (IN AMPS)	
			UNIT	TOTAL	UNIT	TOTAL
1	HORN STROBE	9	-	-	0.139	1.251
2	STROBE	0	-	-	0.129	0
3	GONG	0	-	-	0.17	0
4	ANUNCIATOR PANEL	0	0.02	0	0.025	0
5	PULL STATION	2	1	2	0.0003	0.0006
6	TAMPER SWITCH	1	2.5	2.5	0.057	0.057
7	FLOW SWICH	1	0.0003	0.0003	0.0003	0.0003
8	HEAT DETECTOR	2	1	2	1	2
9	SMOKE DETECTOR	5	0.006	0.03	0.06	0.3
10	FACP W/ LCD & CKONTROL MODULE	0	0.38	0	0.38	0
11	ACTUATOR FOR FIRE SMOKE DAMPER	5	-	-	0.18	0.9
12	DEVICE ATIVATION CURRENT	1	0.2	0.2	0.2	0.2
	SUB TOTAL			6.7303		4.7089
	TIME FACTOR			MULTIPLY BY 24		MULTIPLY BY .083
				161.5272		0.391
	SAFETY FACTOR 20 PERCENT			193.83 AMP-HR		0.4690 AMP-HR
	TOTAL	194.30 AMP-HR				

NOTE:

APPENDIX G

NFPA 72 Testing, Maintenance, Inspection

TESTING	**Frequency**
Control Equipment - Building systems connected to supervising station	
a) Functions	Annually
b) Fuses	Annually
c) Interfaced equipment	Annually
d) Lamps and LEDs	Annually
e) Primary Power	Annually
f) Transponders	Annually
Engine-driven generator - Public fire alarm reporting systems	Weekly
Batteries - Fire alarm systems	
a) Sealed lead-acid type	
1. Charger test (replace battery within 5 years after manufacture or more frequently as needed	Annually
2. Discharge test (30 minutes	Annually
3. Load voltage test	Semiannually
Emergency Voice / Alarm Communications Equipment	Annually
Initiating Devices	
a) Duct detectors	Annually
b) Electromechanical releasing device	Annually
c) Heat detectors	Annually
d) Fire alarm boxes	Annually
e) System smoke detectors – functional	Annually
f) Supervisory signal devices (except valve tamper switches)	Annually
g) Water flow devices	Annually
h) Valve tamper switches	Annually
Alarm notification appliances	
a) Audible devices	Annually
b) Audible textual notification appliances	Annually
c) Visible devices	Annually

APPENDIX G

NFPA 72 Testing, Maintenance, Inspection

INSPECTION	**Frequency**
Control equipment: fire alarm systems monitored for alarm, supervisory, and trouble signals	
a) Fuses	Annually
b) Interfaced equipment	Annually
c) Lamps and LEDs	Annually
d) Primary (main) power supply	Annually
Batteries	
a) Sealed lead-acid	Semiannually
Initiating Devices	
a) Duct detectors	Semiannually
b) Electromechanical releasing devices	Semiannually
c) Fire alarm boxes	Semiannually
d) Heat detectors	Semiannually
e) Smoke detectors	Semiannually
f) Supervisory signal devices	Quarterly
g) Water flow devices	Quarterly
Alarm notification appliances	Semiannually

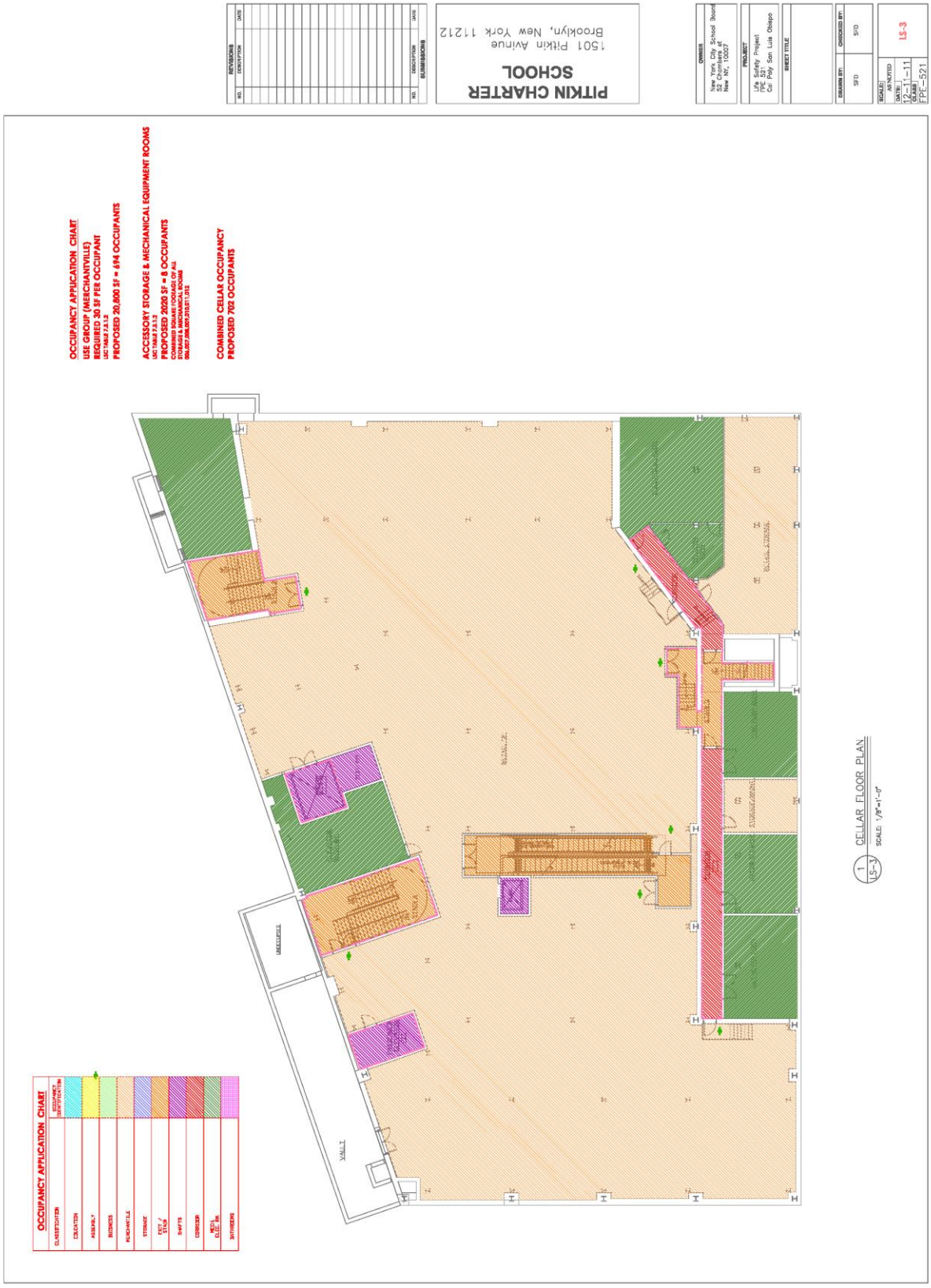

Figure 37 Occupancy Classification Basement level

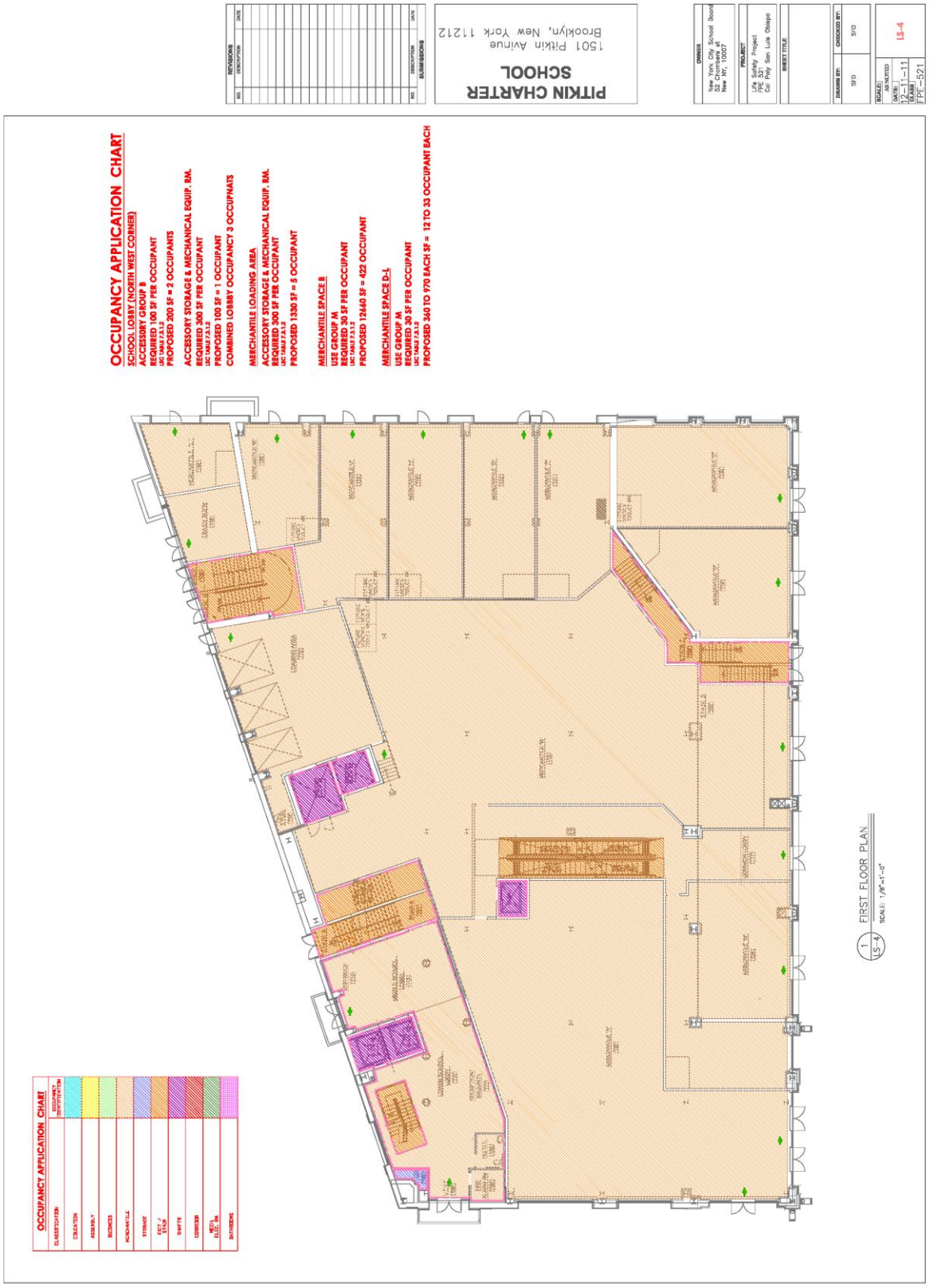

Figure 38 Occupancy Classification First Floor

APPENDIX H

Figure 39 Occupancy Classification Second Floor

Figure 40 Occupancy Classification Third Floor

APPENDIX H

Figure 41 Occupancy Classification Fourth Floor

APPENDIX H

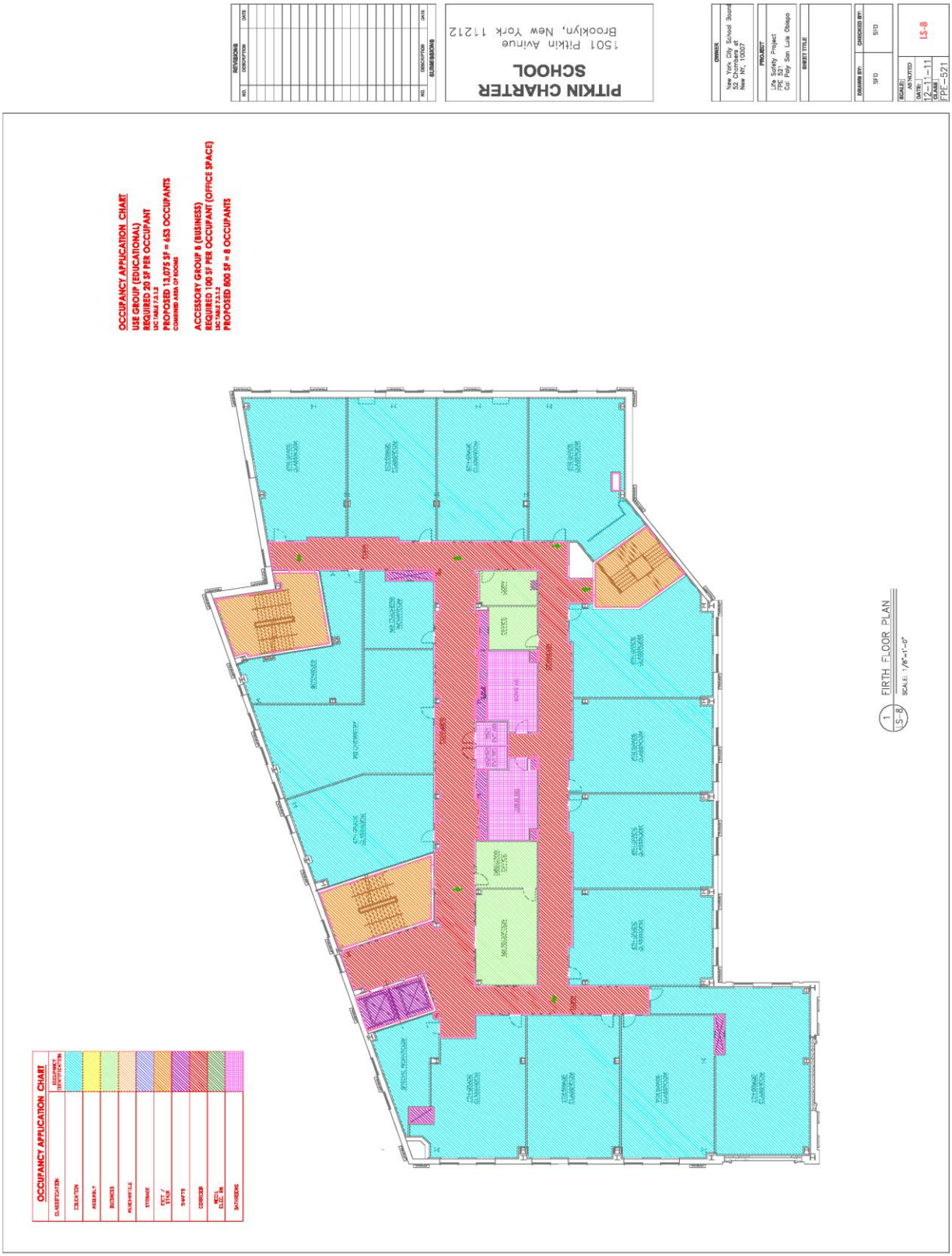

Figure 42 Occupancy Classification Chart

APPENDIX H

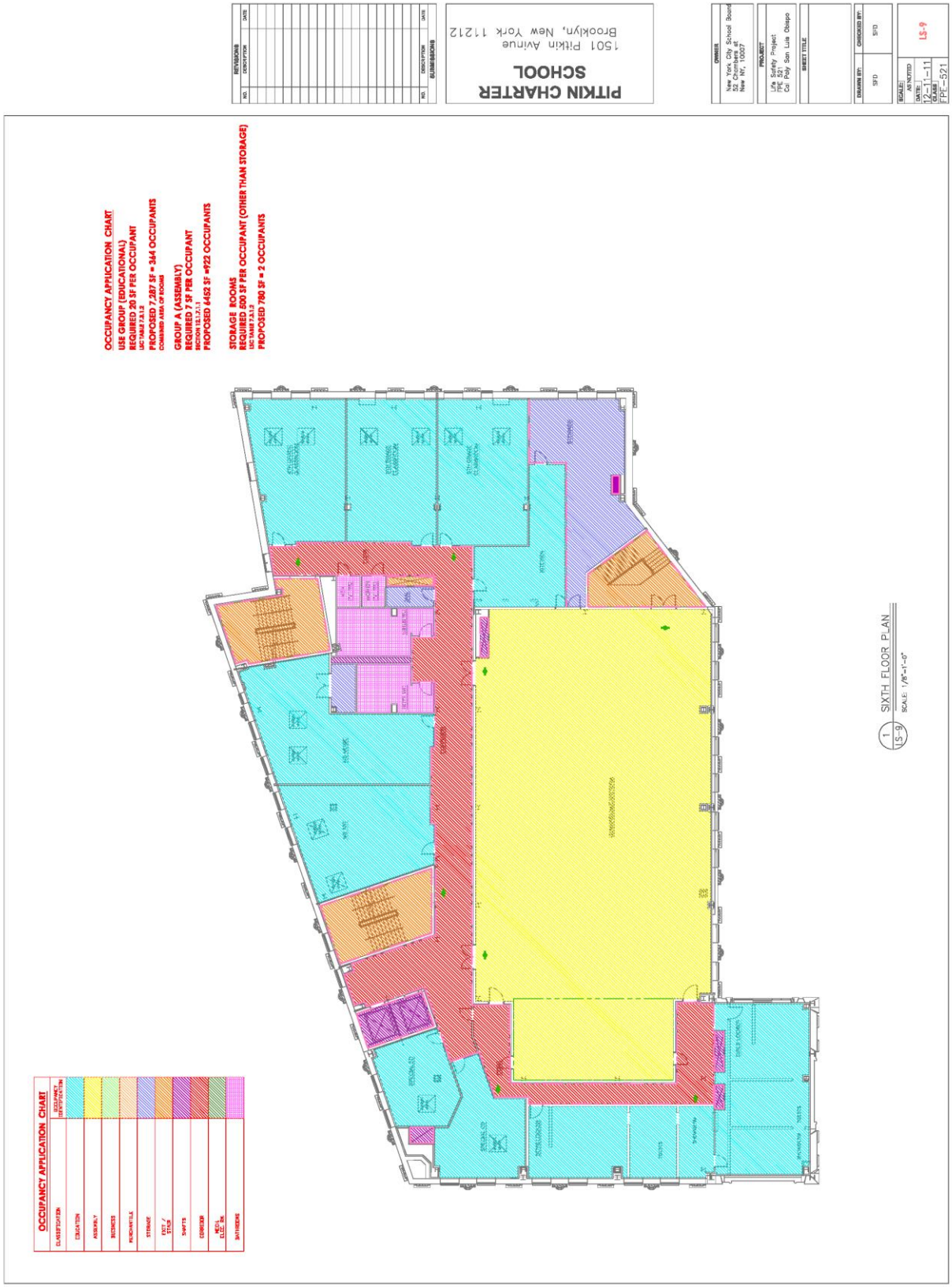

Figure 43 Occupancy Classification Sixth Floor

Figure 44 Occupancy Classification Roof plan

APPENDIX I

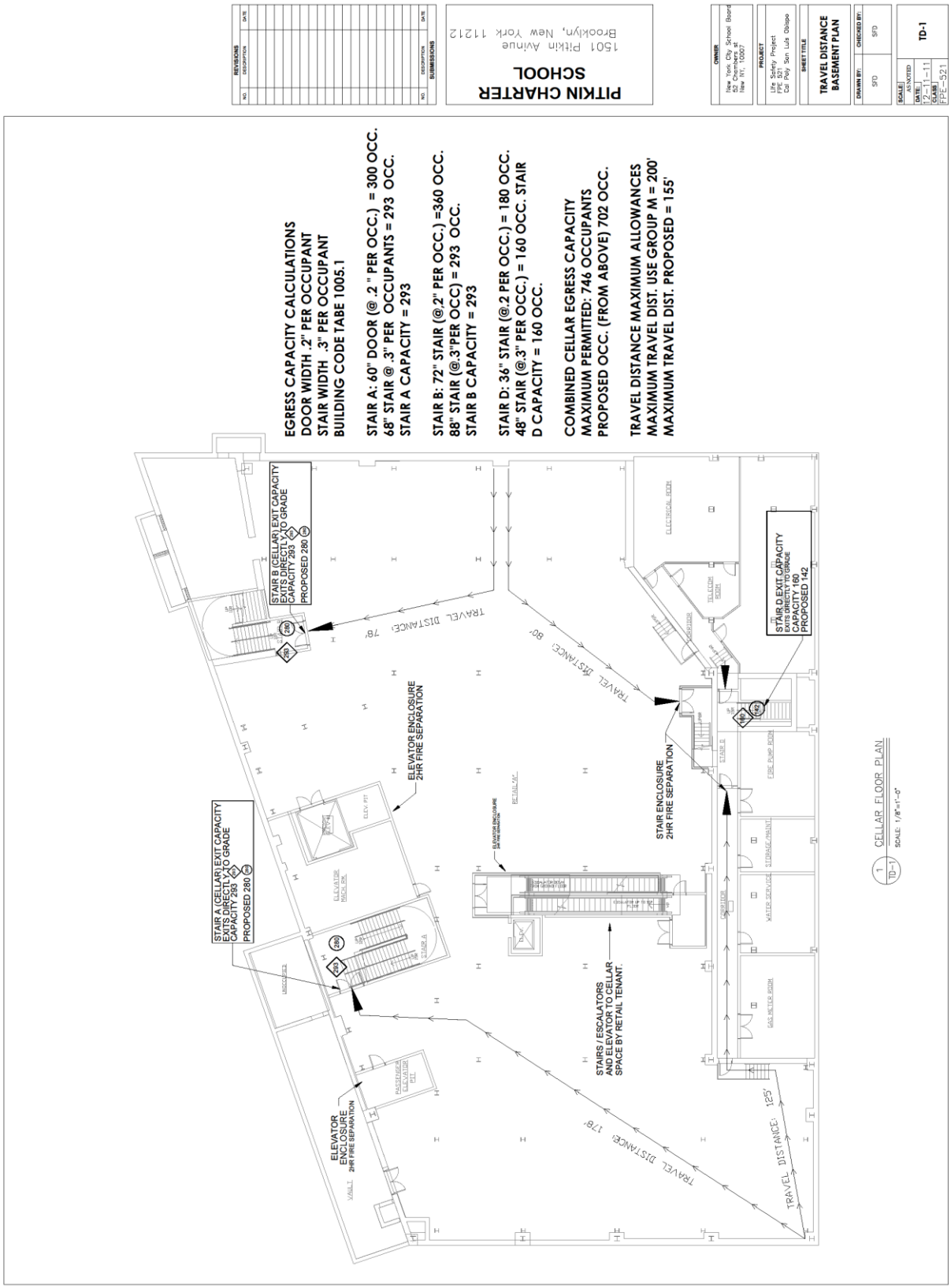

Figure 45 Egress calculation and paths cellar floor plan

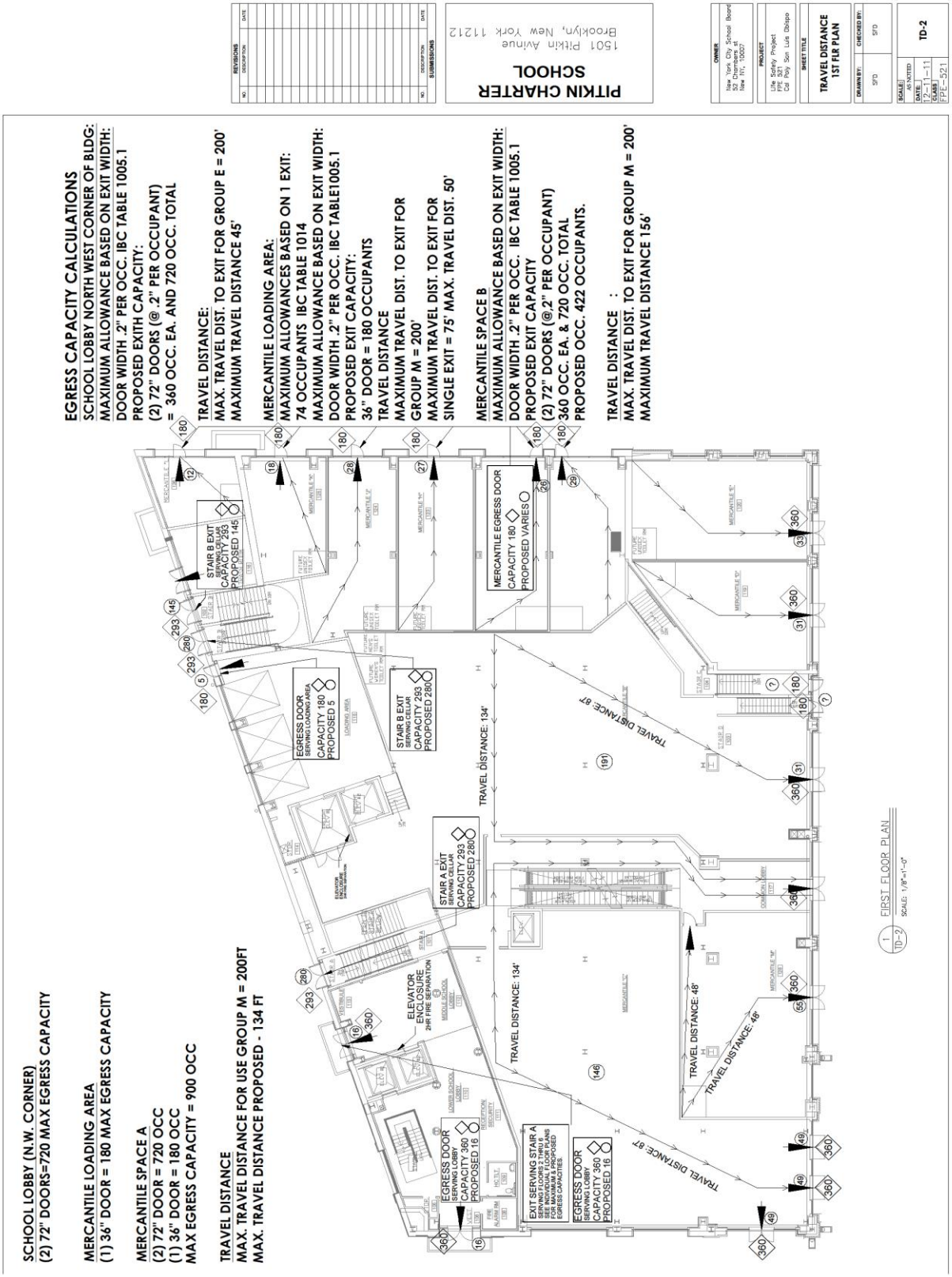

Figure 46 Egress calculation and egress paths First floor plan

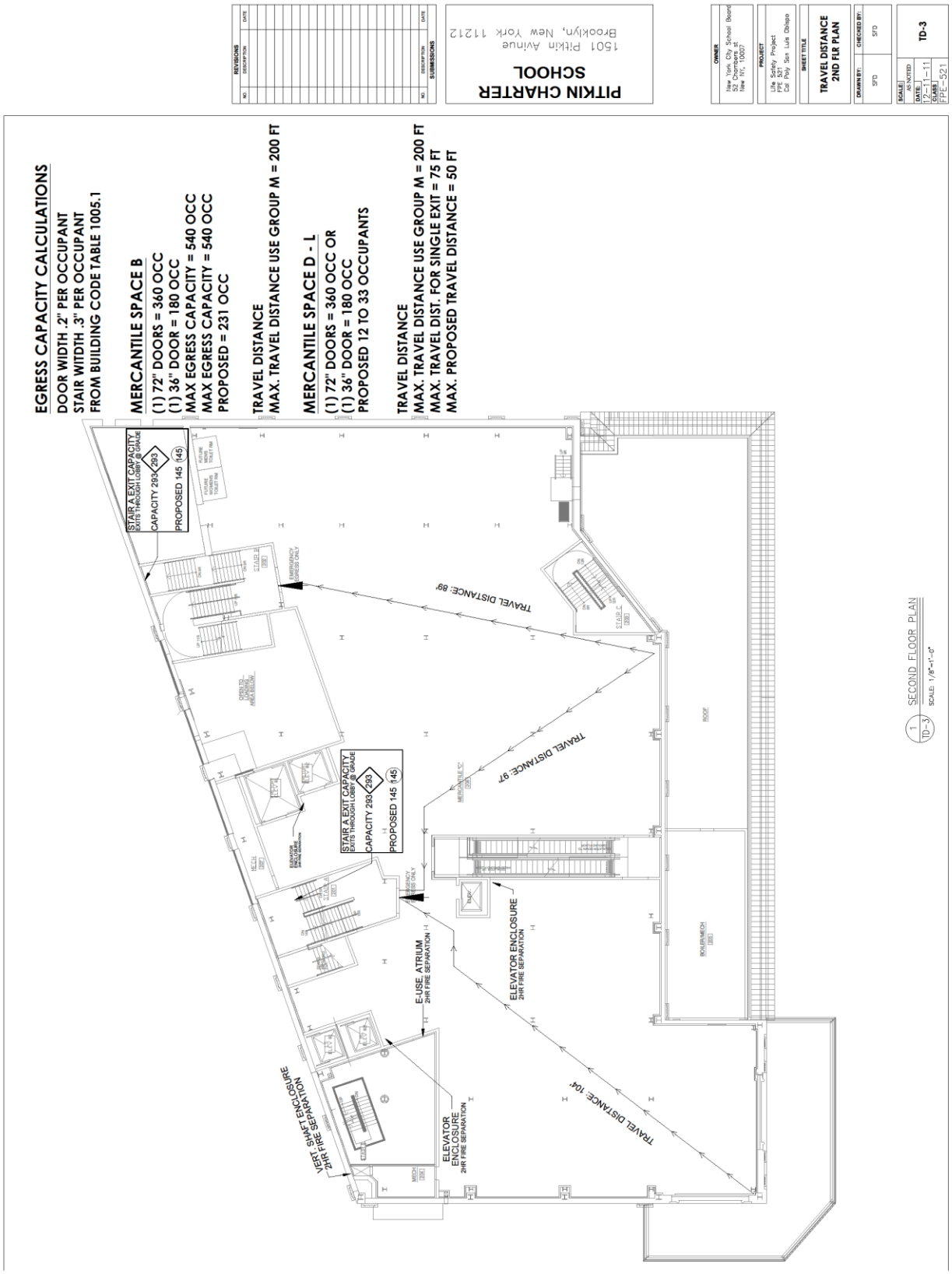

Figure 47 Egress Calculations and egress paths second floor plan

APPENDIX I

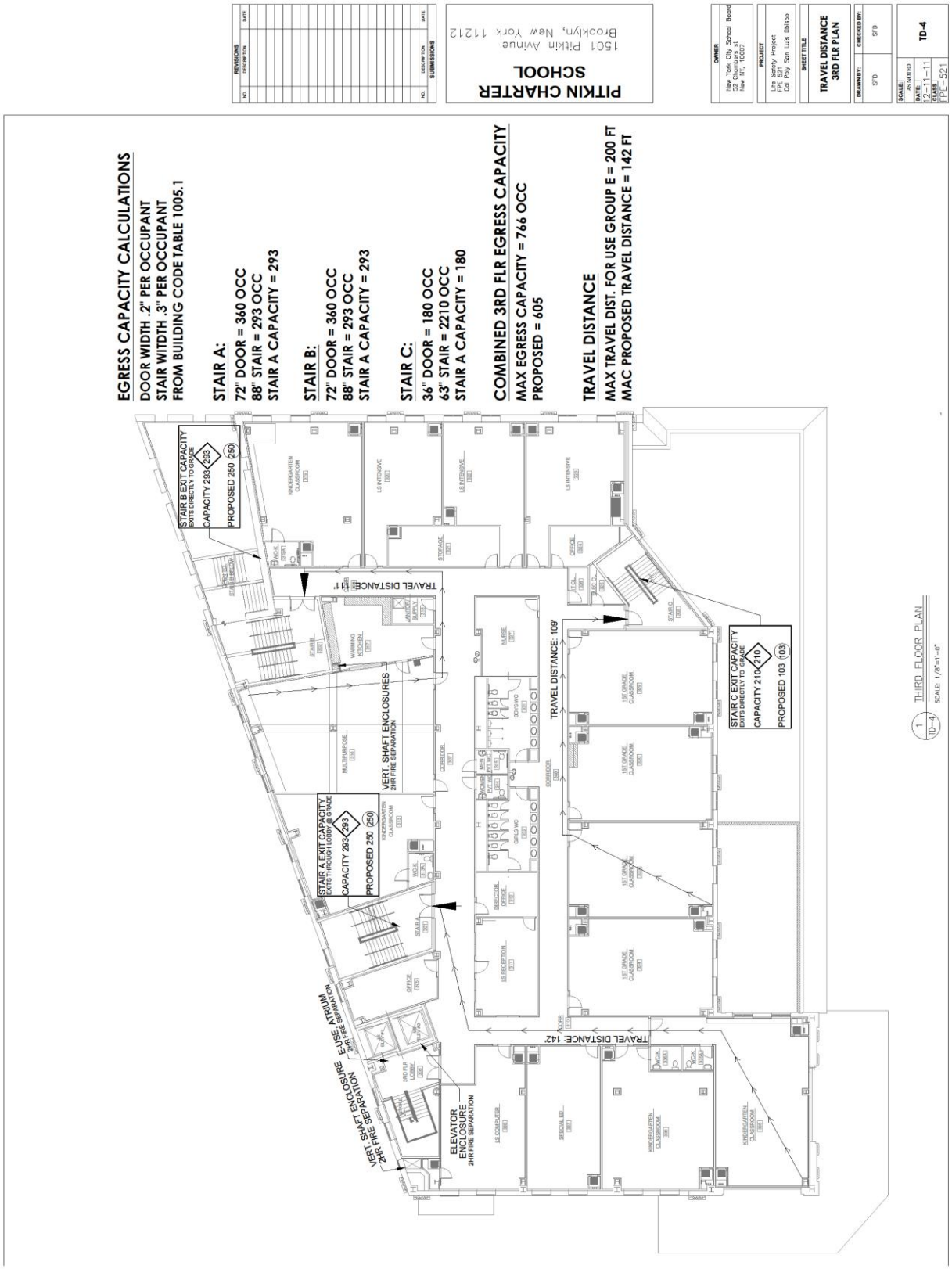

Figure 48 Egress Calculations and egress paths third floor plan

APPENDIX I

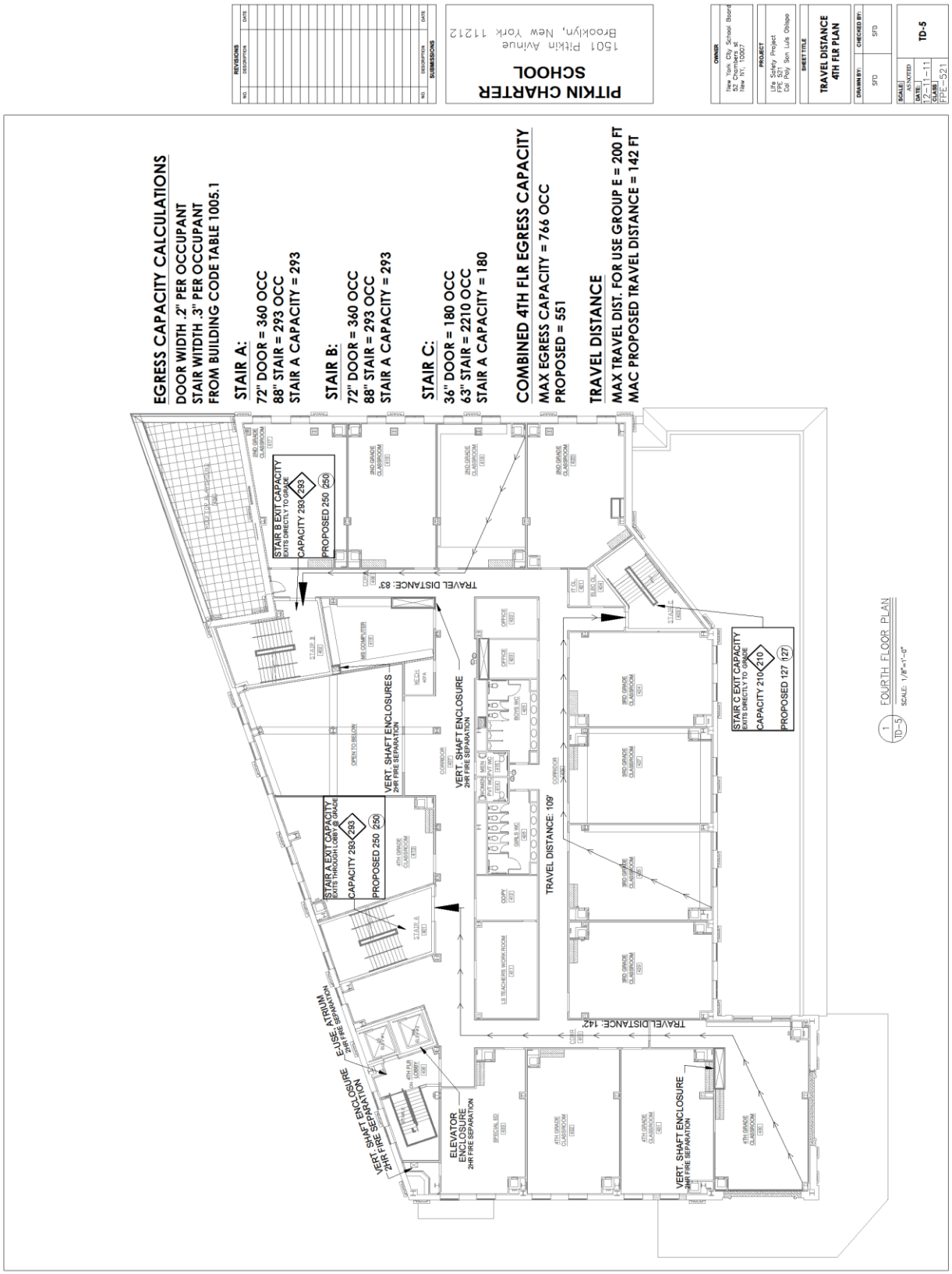

Figure 49 Egress calculation and egress paths fourth floor plan

APPENDIX I

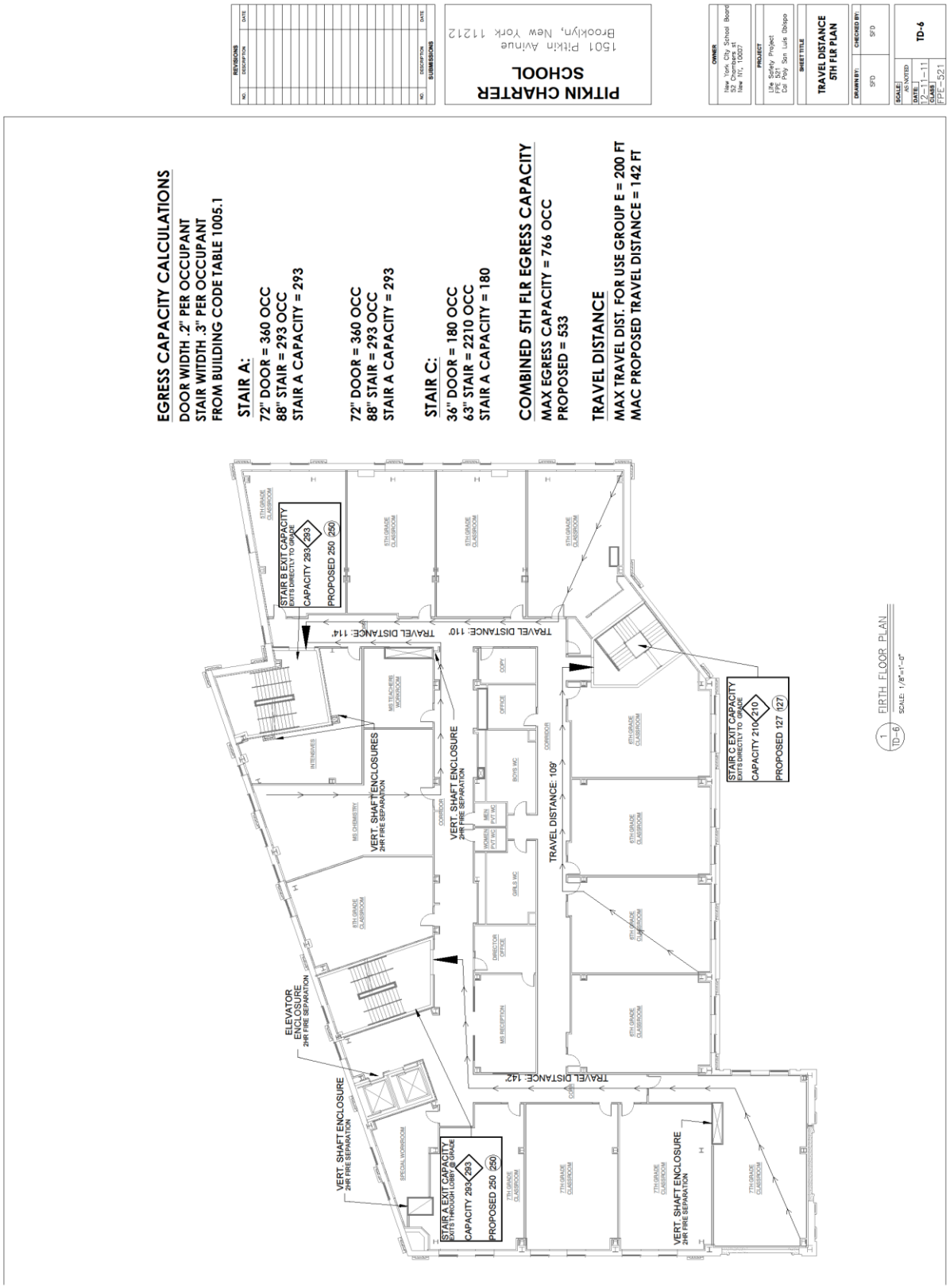

Figure 50 Egress Calculation and Egress paths Fifth floor plan

APPENDIX I

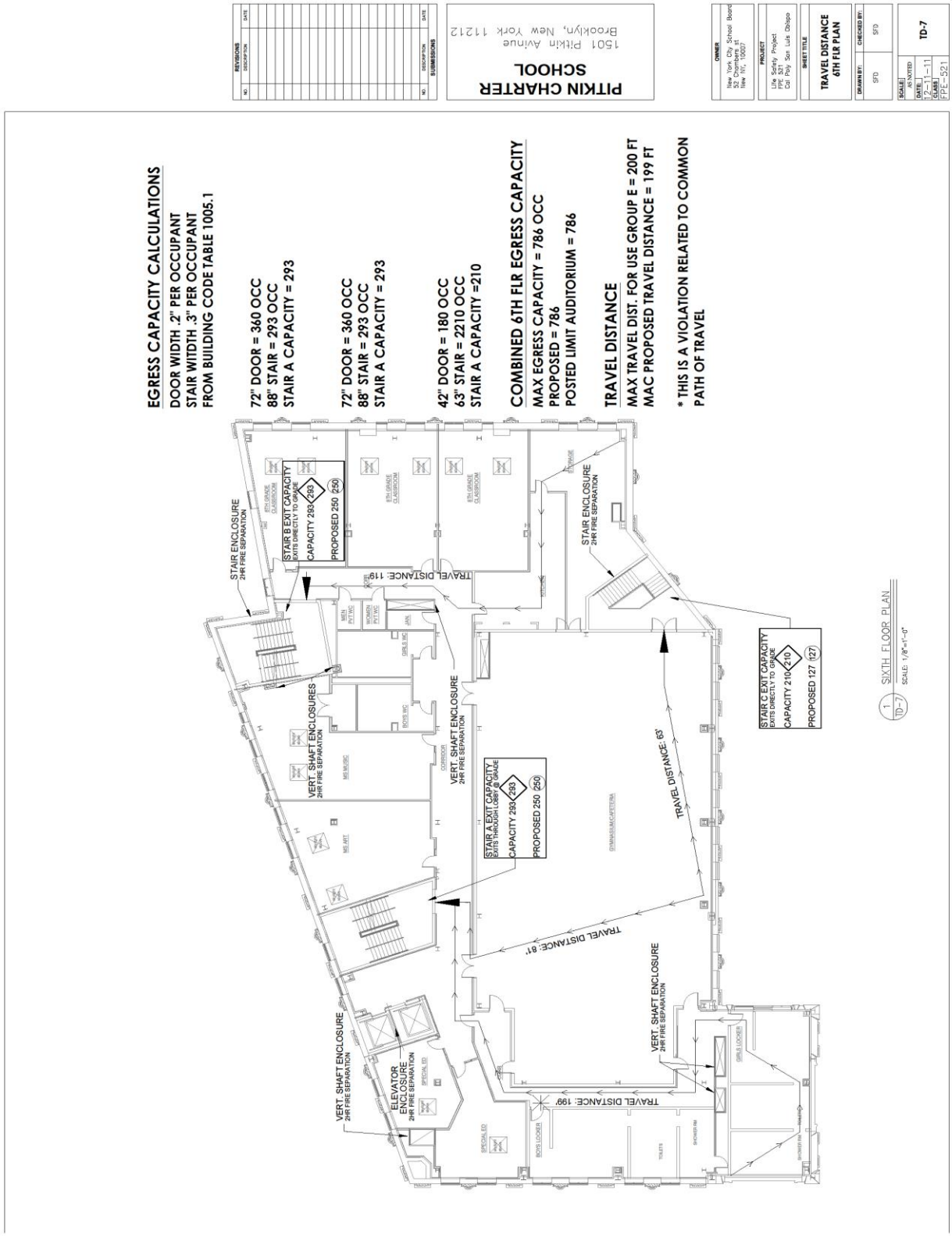

Figure 51 Egress Calculation and egress paths Sixth floor plan

APPENDIX I

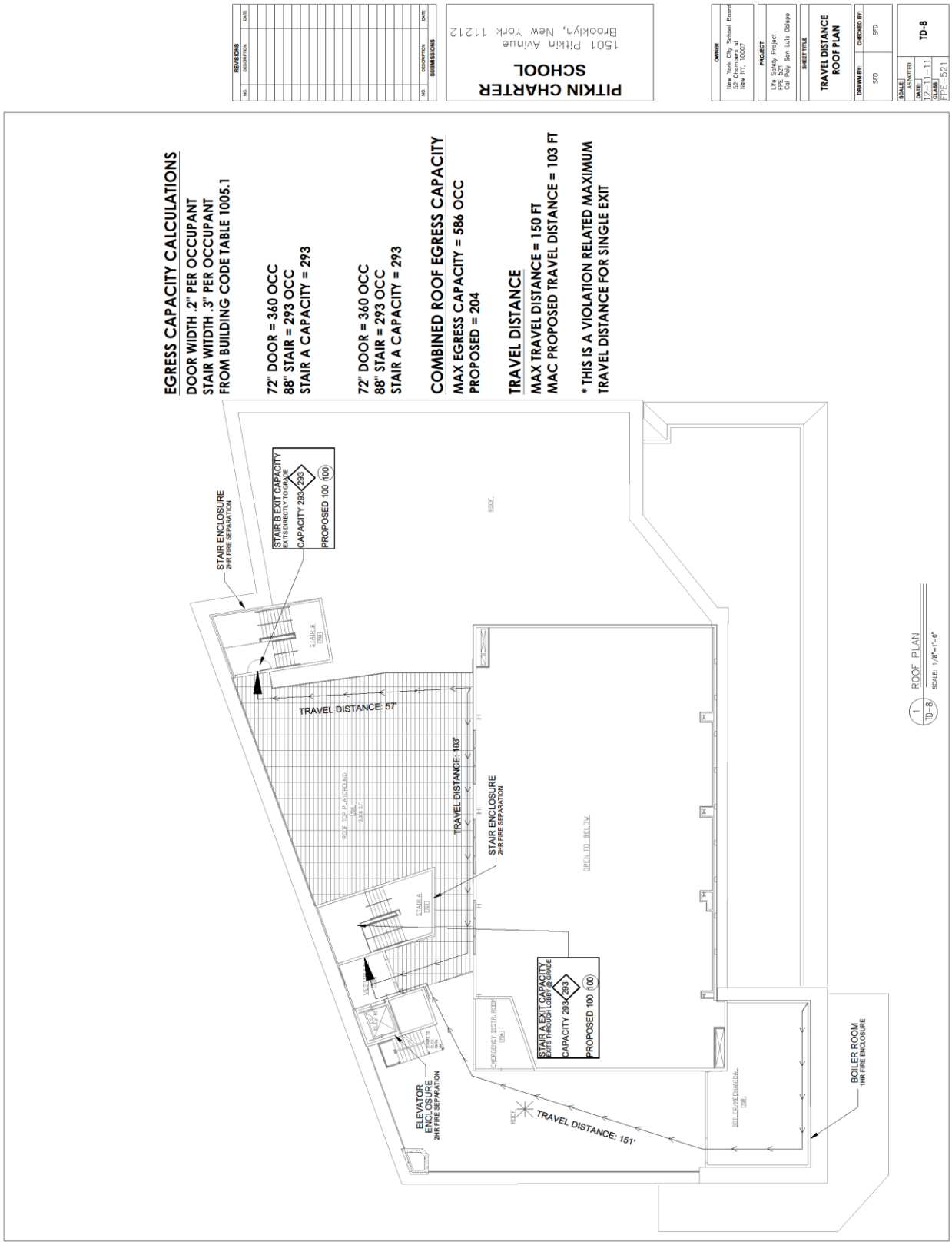

Figure 52 Egress Calculation and egress path roof plan

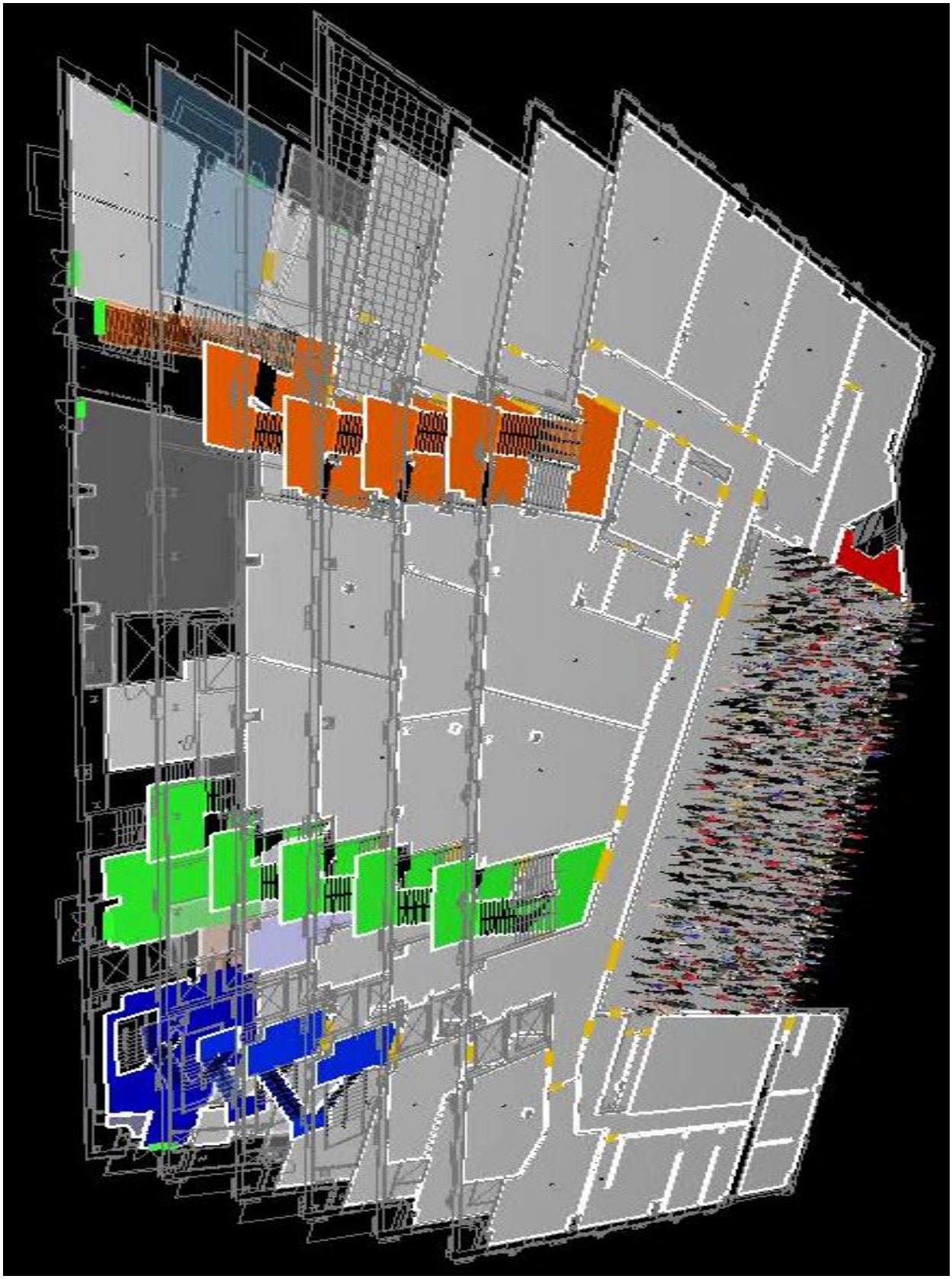

Figure 53 Plot of Pathfinder model First floor through sixth

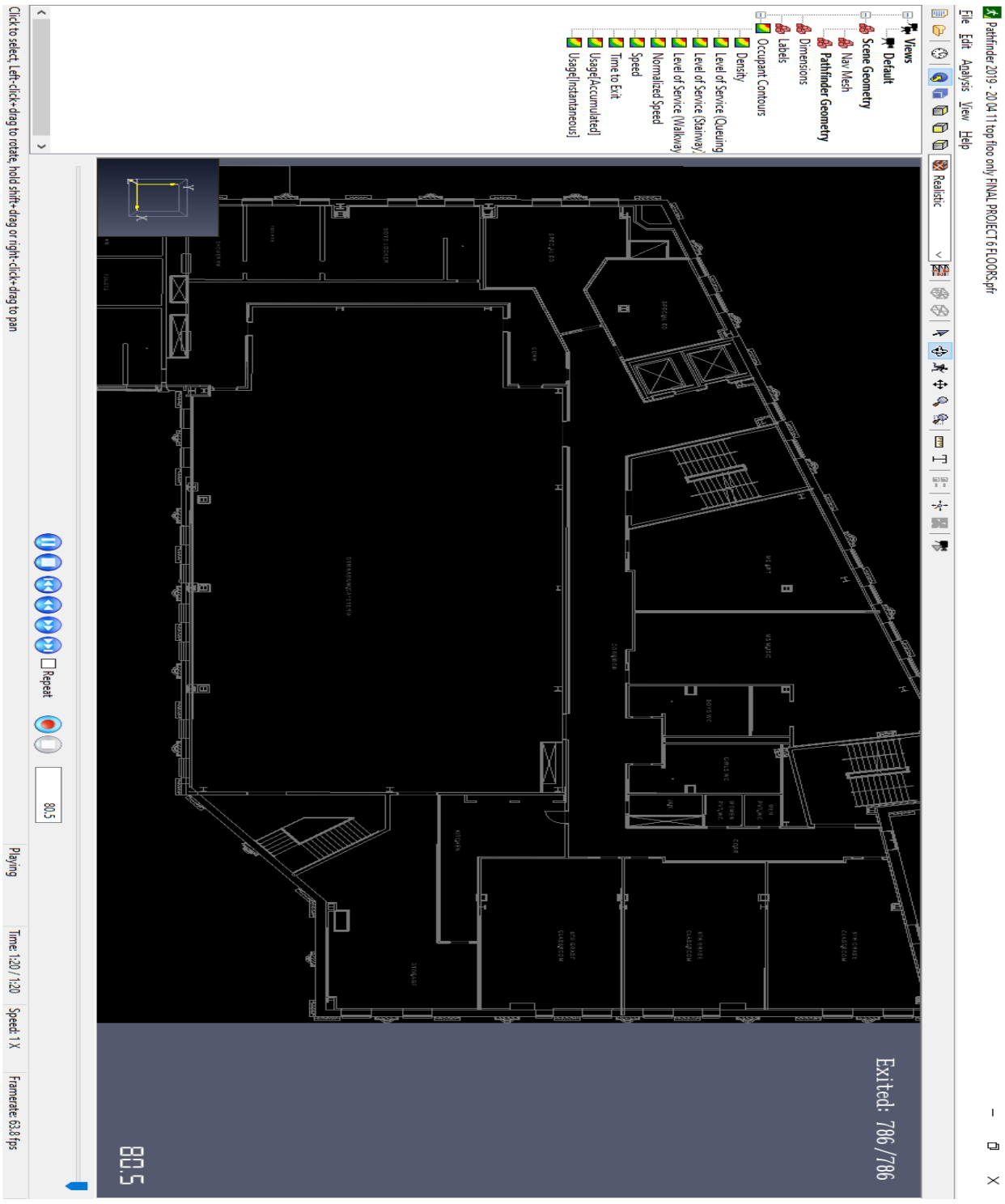

Figure 54 Plot of egress time for simulation of Sixth Floor only

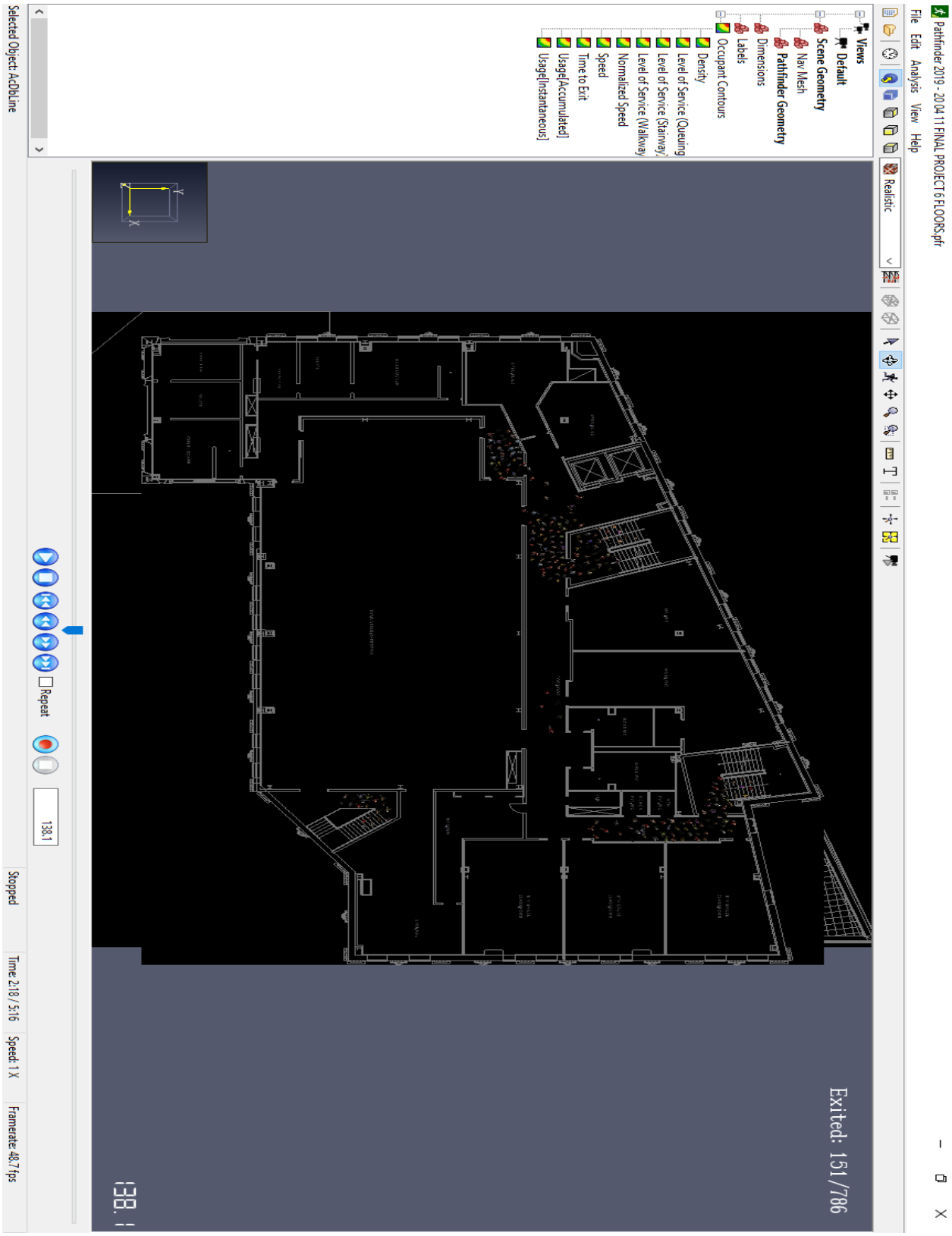

Figure 55 Plot of egress for simulation of first through Sixth Floor

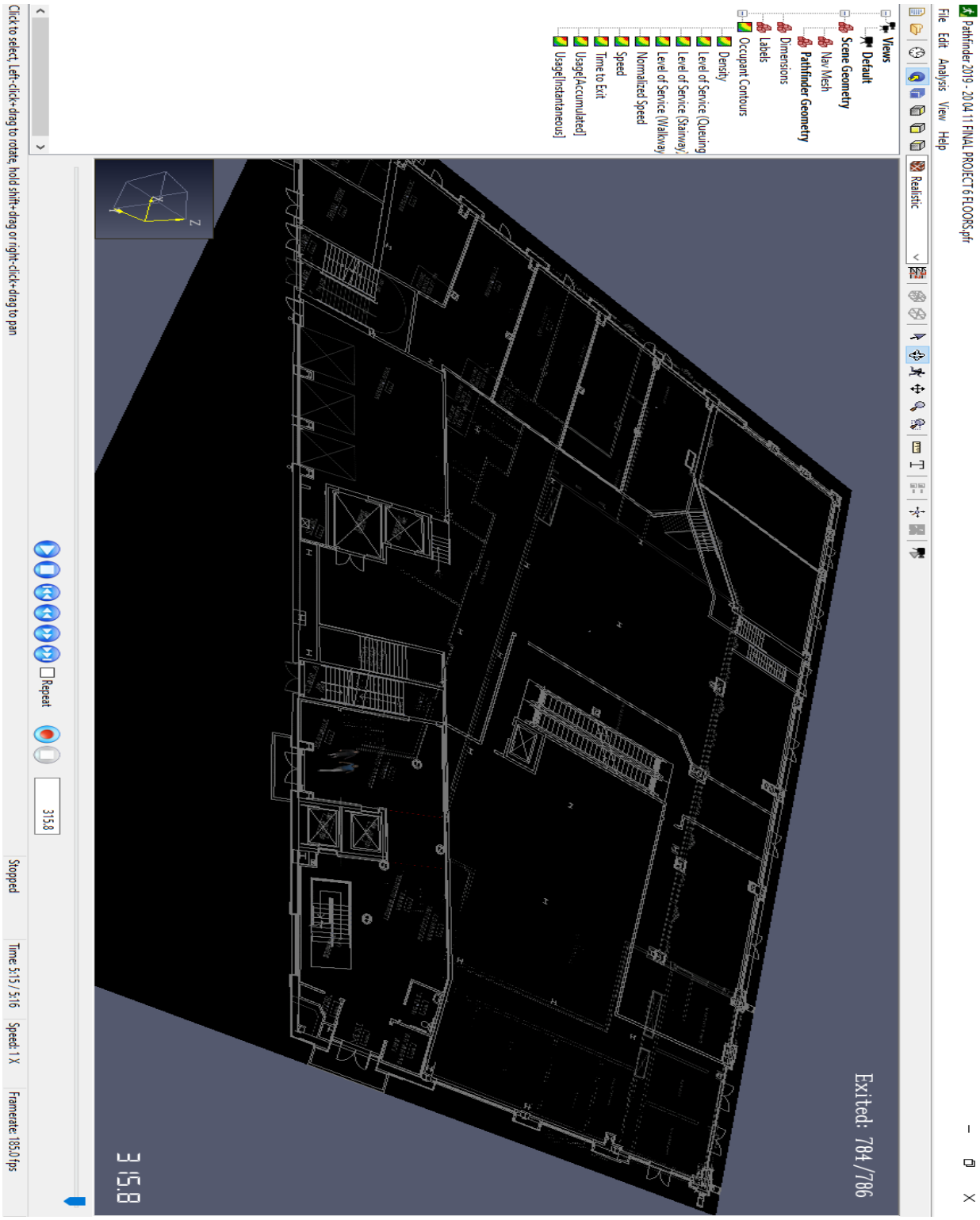

Figure 56 plot of egress time through exit discharge

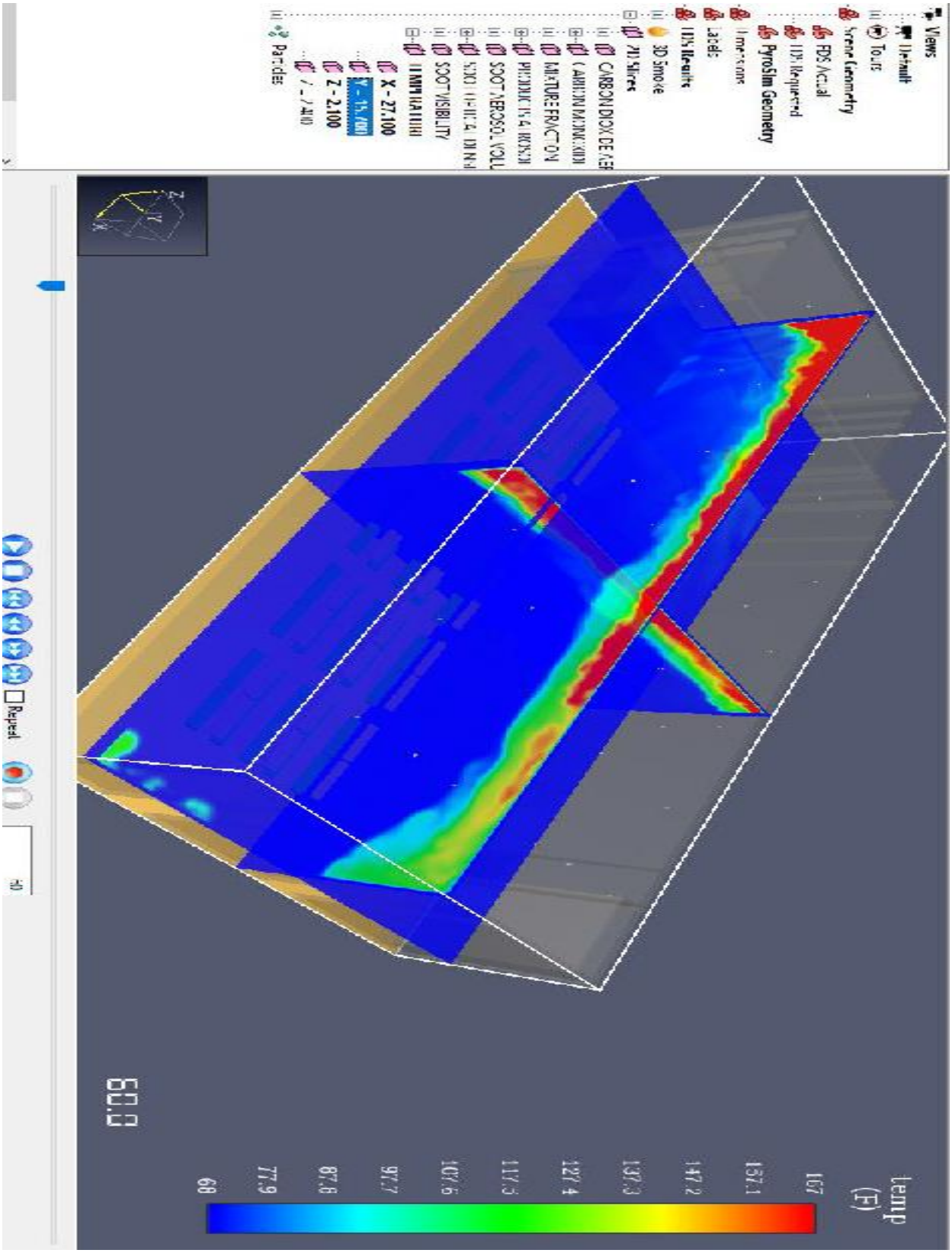

Figure 57 Slice File Temperature at ASET

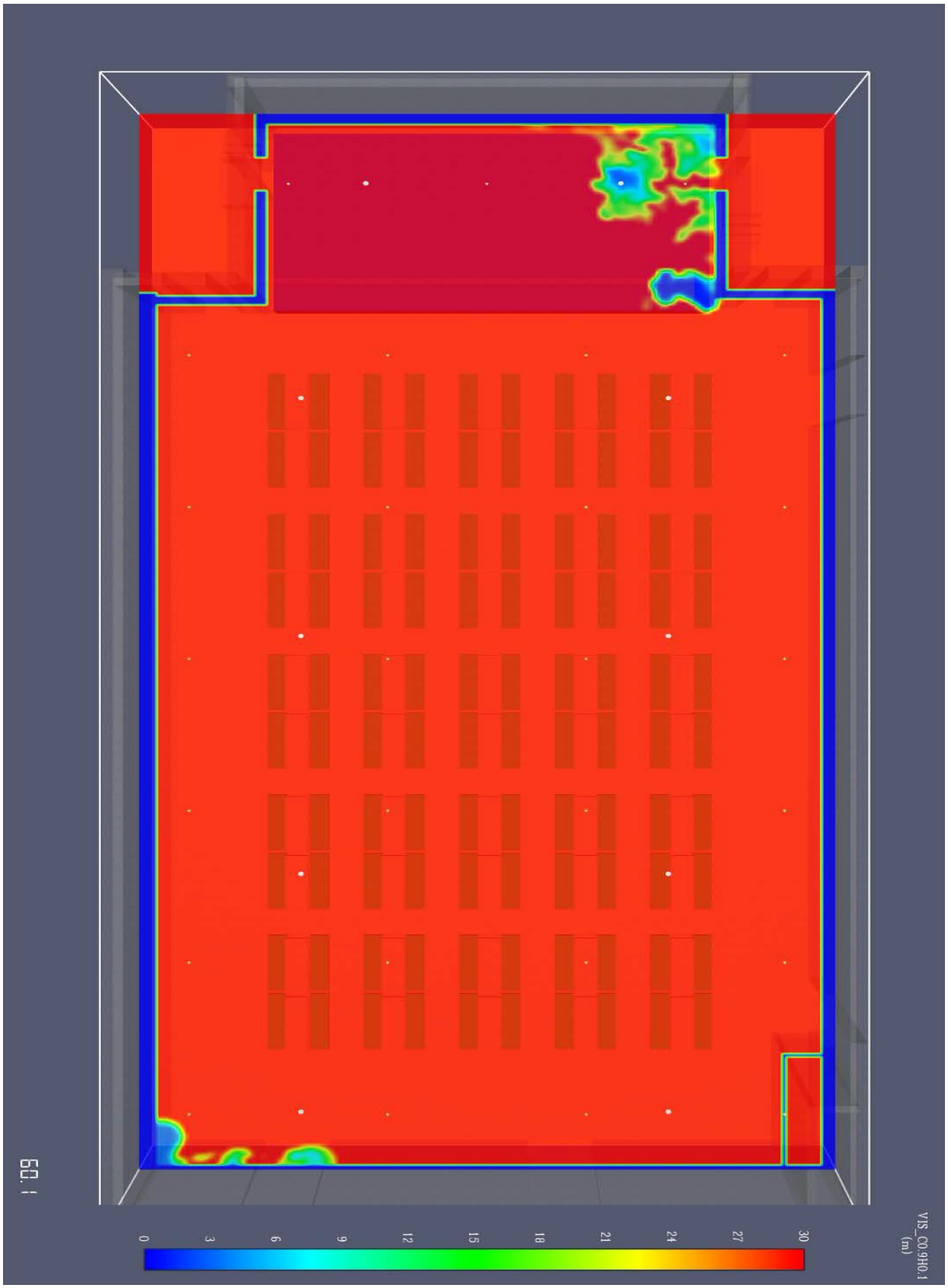

Figure 58 Slice File Visibility Distance at ASET

APPENDIX K

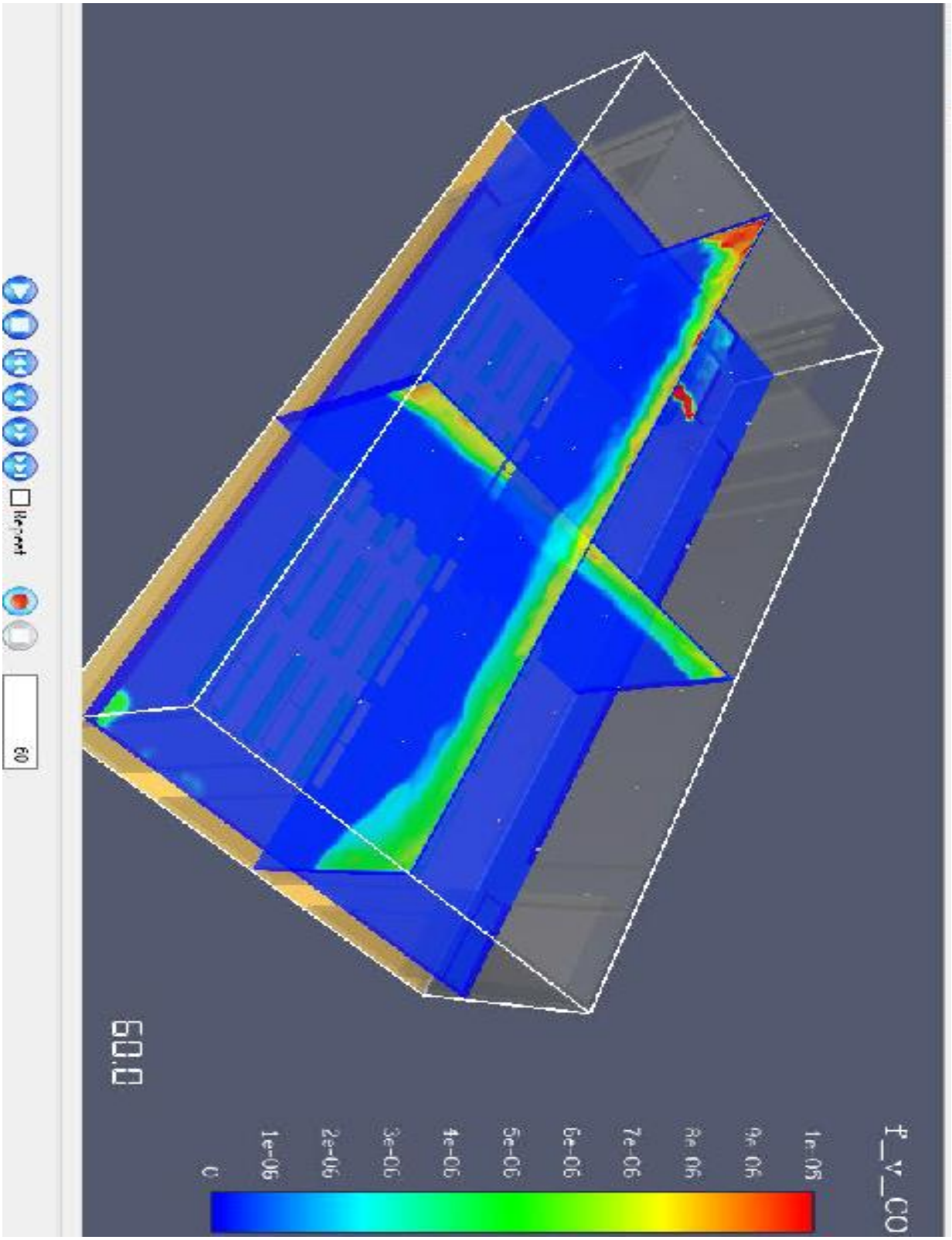

Figure 59 Carbon Dioxide FED at ASET

APPENDIX K

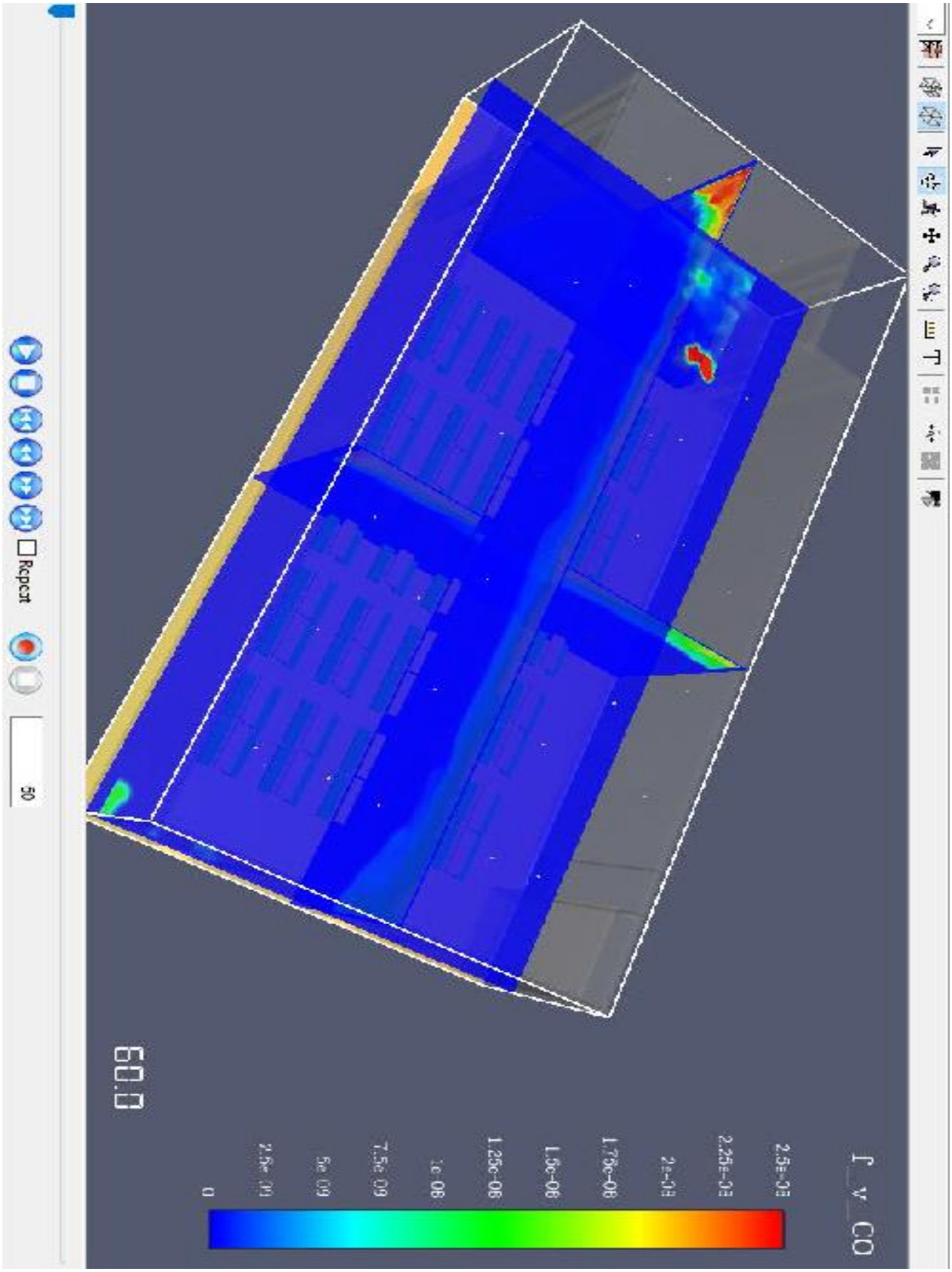

Figure 60 Carbon Monoxide FED at ASET

APPENDIX K

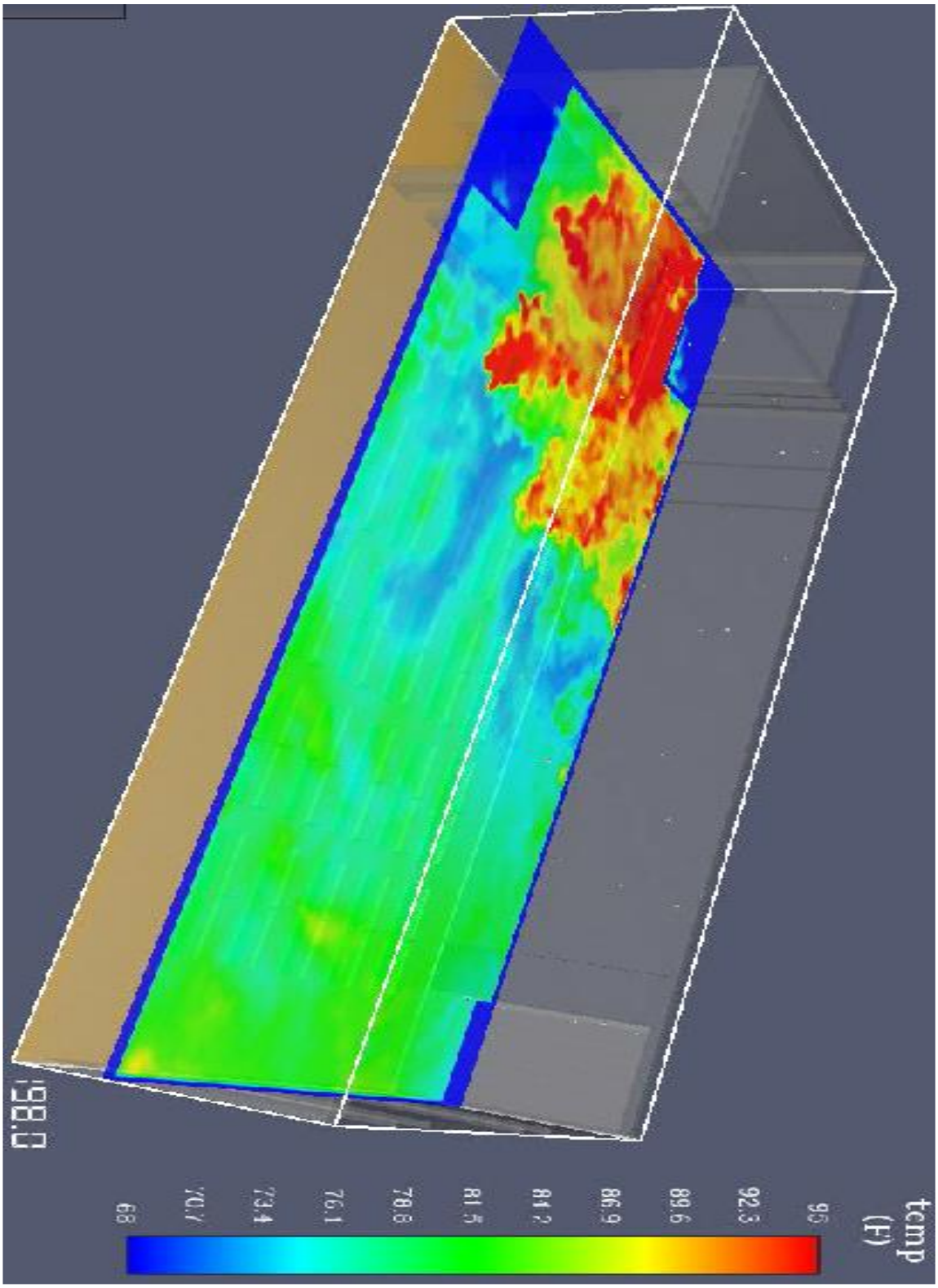

Figure 61 Temperature at RSET

APPENDIX K

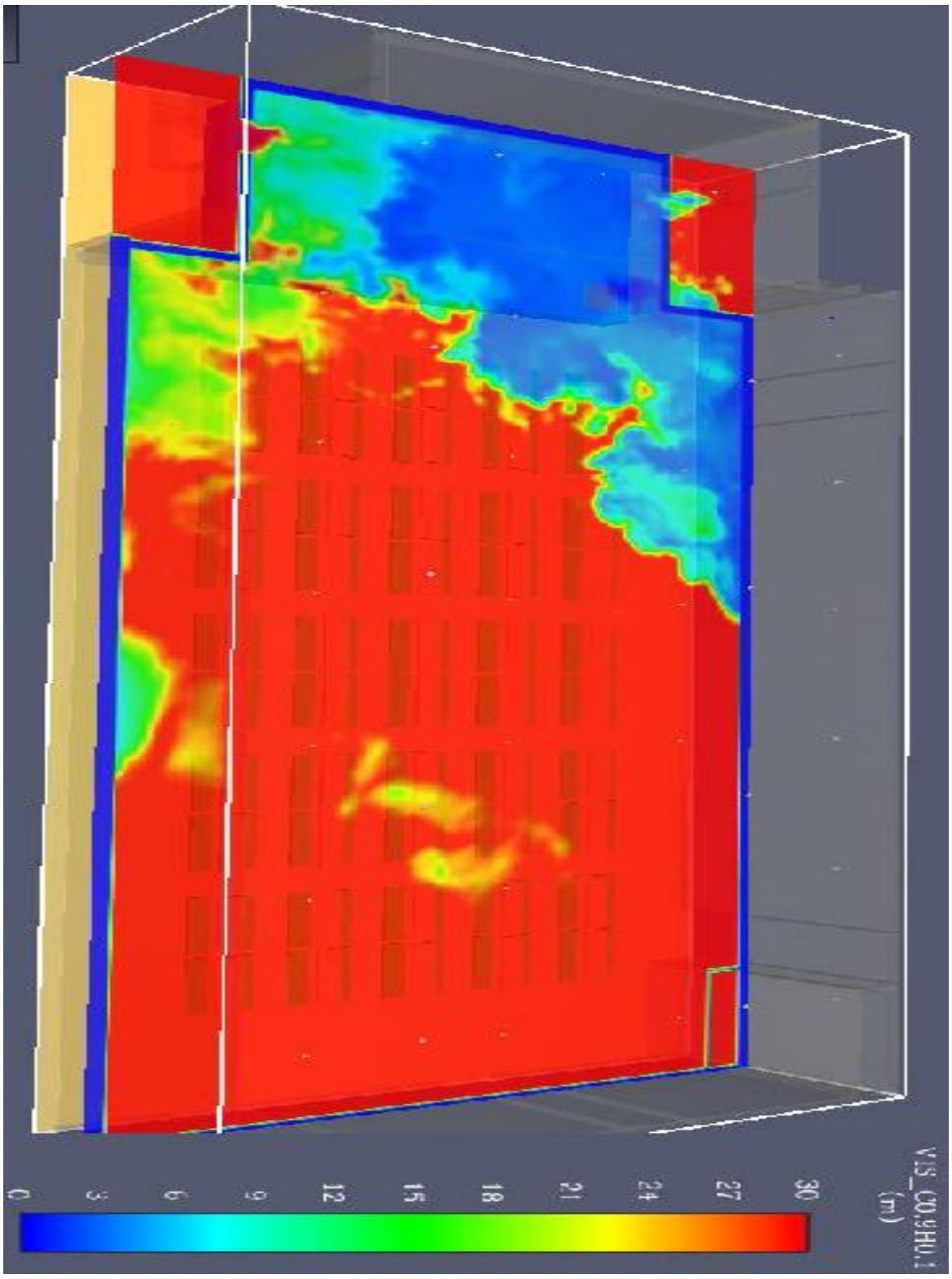

FIGURE 62 VISIBILITY AT RSET

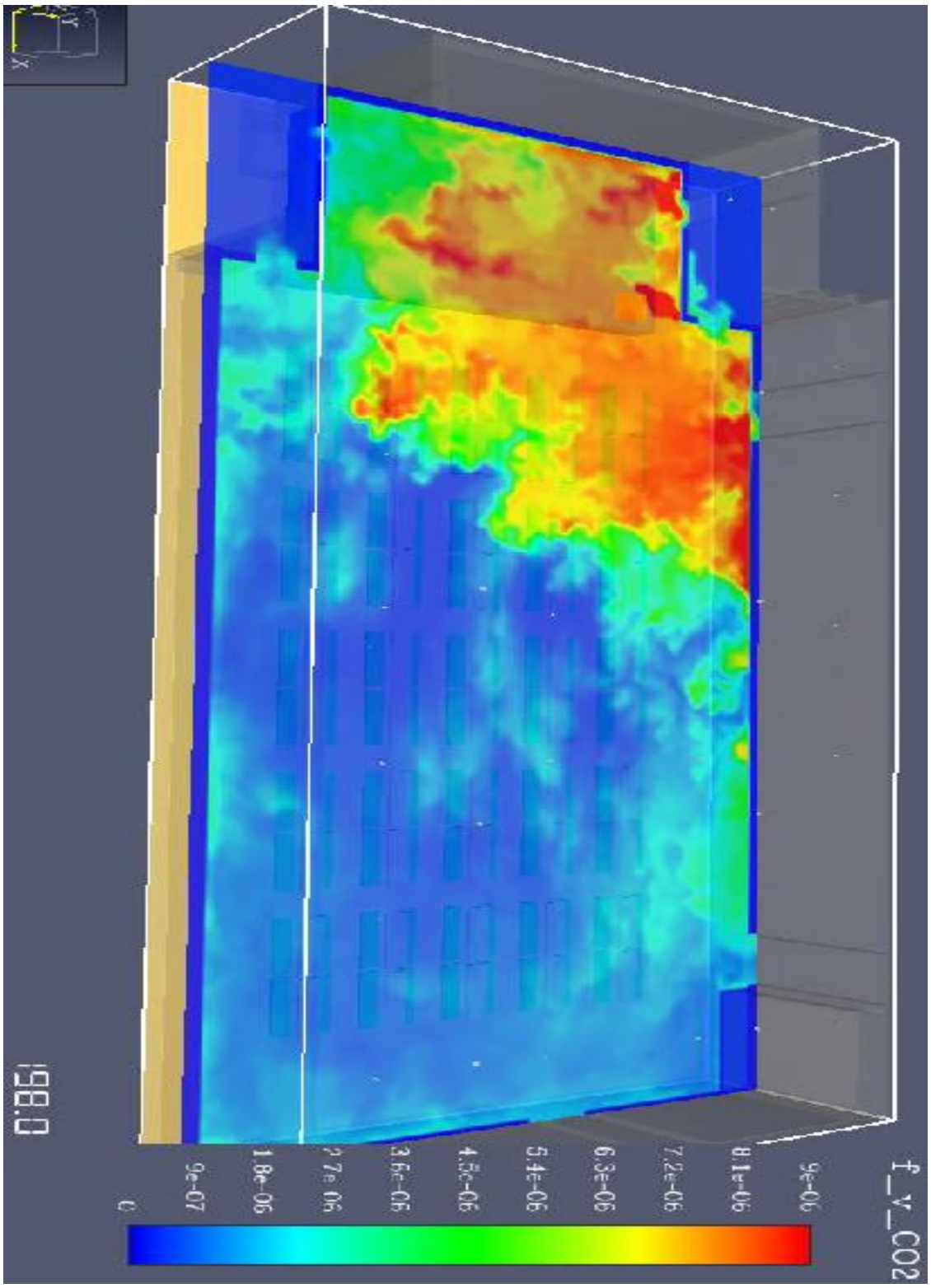

FIGURE 63 CARBON DIOXIDE AT RSET

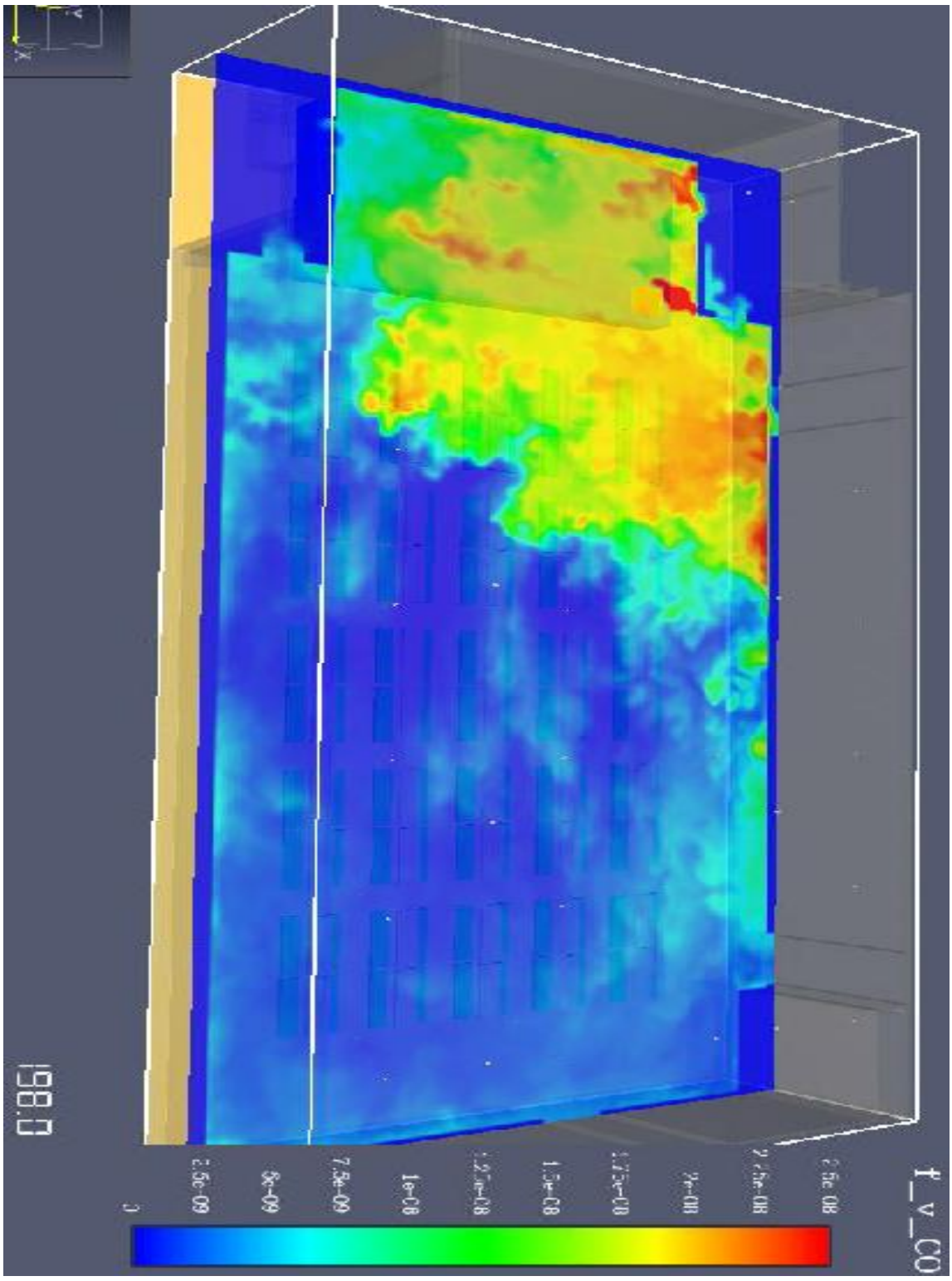

FIGURE 64 CARBON MONOXIDE AT RSET

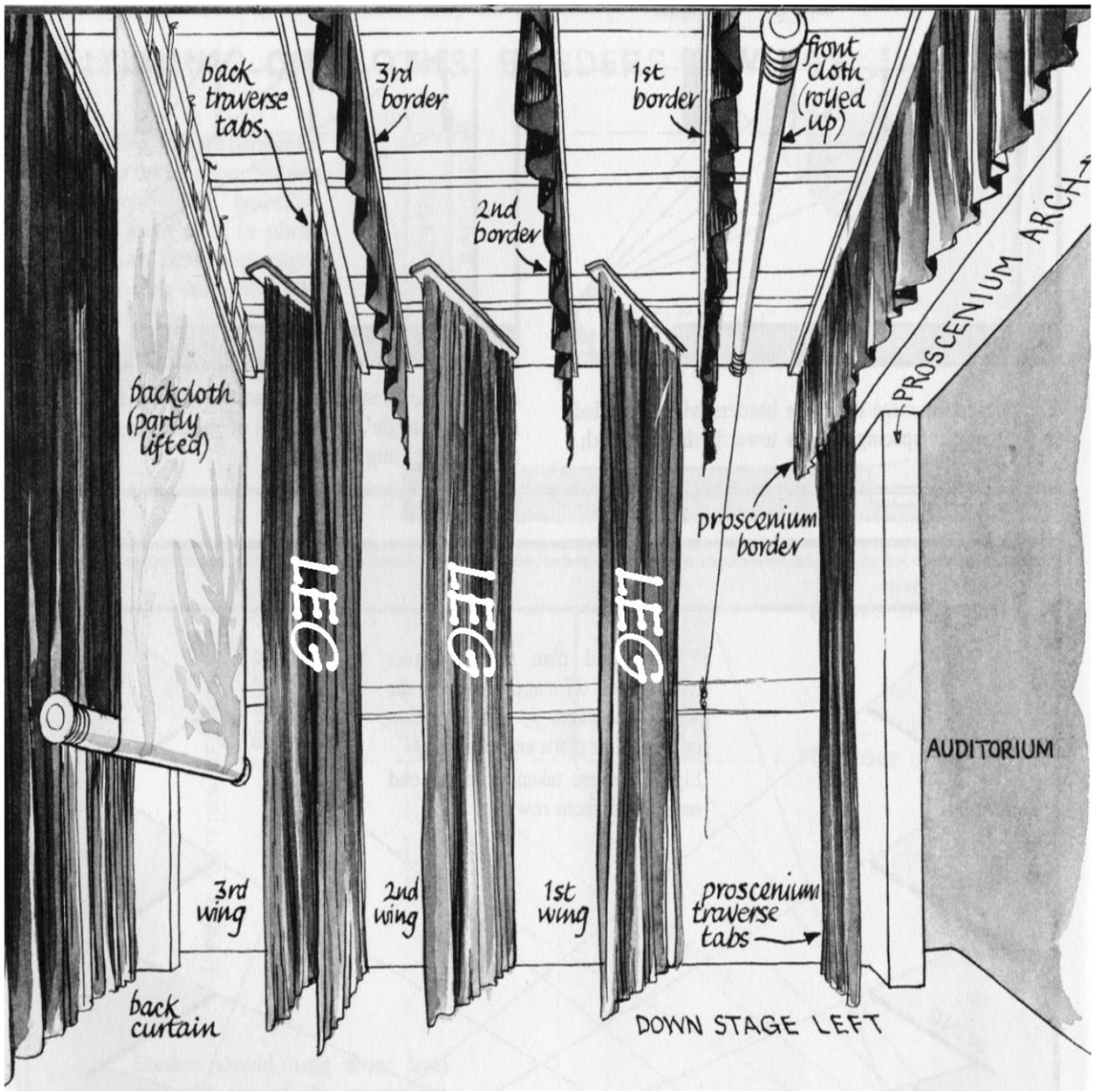

Figure 65Typical student theatrical setup

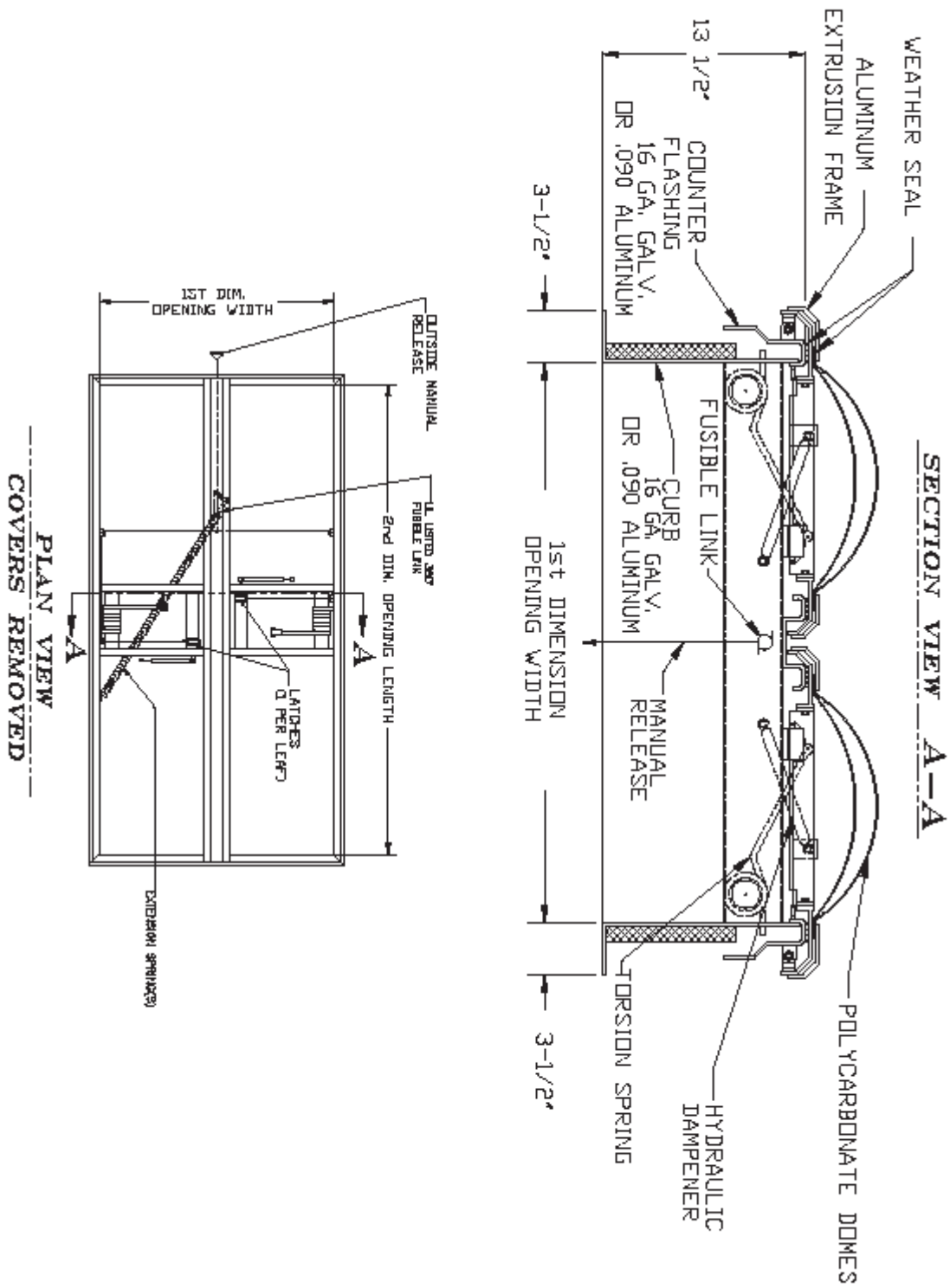

Figure 66 Typical Smoke V**ent**

APPENDIX N

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    SPECIFIC_HEAT=1.04,
    CONDUCTIVITY=1.8,
    DENSITY=2280.0/
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    TEXTURE_WIDTH=0.762,
    TEXTURE_HEIGHT=0.762,
    BACKING='VOID',
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    MATL_MASS_FRACTION(1,1)=1.0,
    THICKNESS(1)=0.2/
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    HRRPUA=3000.0,

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    BACKING='VOID',
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    THICKNESS(1)=0.01/

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SURF_ID='concrete surface'/
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SURF_ID='concrete surface'/
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SURF_ID='concrete surface'/
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SURF_ID='concrete surface'/
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SURF_ID='concrete surface'/
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SURF_ID='concrete surface'/
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SURF_ID='concrete surface'/
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SURF_ID='concrete surface'/
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SURF_ID='concrete surface'/
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SURF_ID='concrete surface'/
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APPENDIX N

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