FIRE AND LIFE SAFETY ANALYSIS OF THE Recreation Center

CALIFORNIA POLYTECHNIC STATE UNIVERSITY

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Keywords: Performance Based Design, Fire Dynamics Simulator (FDS) , RSET, Pathfinder,Egress,

Executive Summary

This report discusses the fire and life safety analysis of the existing fire protection features installed in the Recreation Center building on the California Polytechnic State University. The analysis is conducted using two different approaches, the prescriptive analysis of the building and the performance-based design analysis.

The prescriptive analysis approach will examine installed fire protection features and systems in accordance with the International Building Code, such as structural fire protection, water-based suppression system, alarm and detection system, egress system, smoke control, and fire safety management plan. The egress system failed when the old gym area was used as a fixed seating assembly area. Other features met the requirements.

The performance-based analysis of the Recreation Center was based on the performance based design method 1 and method 2 of the Life Safety Code, which compares the required safe egress time (RSET) and available safe egress time (ASET) for occupants to evacuate the building safely in the event of a fire. This comparison of REST and ASET will ensure that no occupant shall be incapacitated by the effects of fire before the safe evacuation is competed.

The performance-based analysis is done using Pathfinder and FDS to simulate a chosen design fire scenario to make sure the requirement of safe evacuation is met. In this simulation, the RSET is 410s and the ASET is 177s due to the visibility loss in the chosen fire scenario of the old gym. The RSET is greater than the ASET. That shows the building failed to provide safe evacuation to the occupants.

In order to make sure the occupants can be evacuated safely, no combustible material should be put under or near the bleachers when they are fully extended in the old gym area. A mechanical exhaust smoke control system is recommended to be installed in the old gym to provide enough visibility during a fire situation.

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Introduction:

The Recreation Center is located on the campus of California Polytechnic State University, CA 93407. The Recreation Center is a 2-story structure with primary steel frame, concrete slab and masonry exterior.

It was originally designed and built in 1991 and was expanded in 2009. The expanded Recreation Center was opened in January 2012. It is designed as a gymnasium. The building is fully sprinkled. Both stories of the building are used as a gym primarily, with a few office rooms and storage rooms. The whole building has a wet-pipe auto-sprinkler system. The building also has mounted heat detectors, pull stations and smoke detectors.

The expansion part of the building was designed in accordance with the prescriptive requirements in the 2007 California Building Code and the performance-based

requirements in NFPA 101 2009.

The location of the Recreation Center is shown on the campus map in Figure 1.

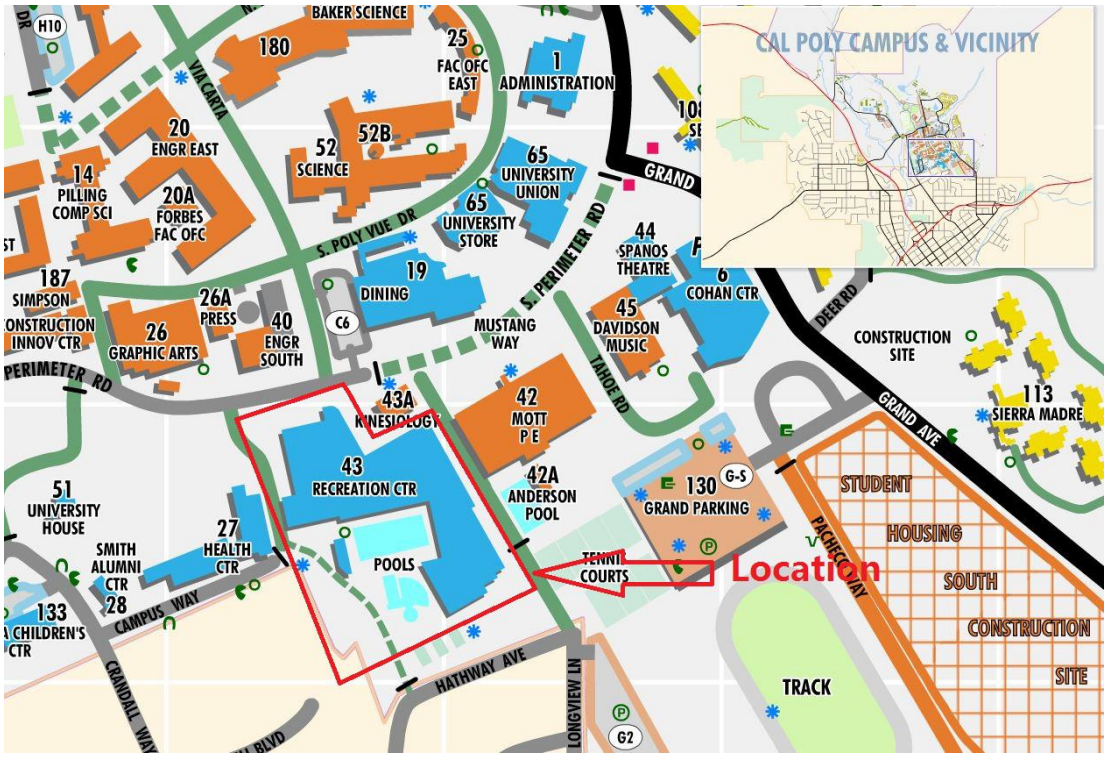


Figure 1. Location of business Building on Main Campus

The aerial view of the building is shown from Google Earth in Figure 2.

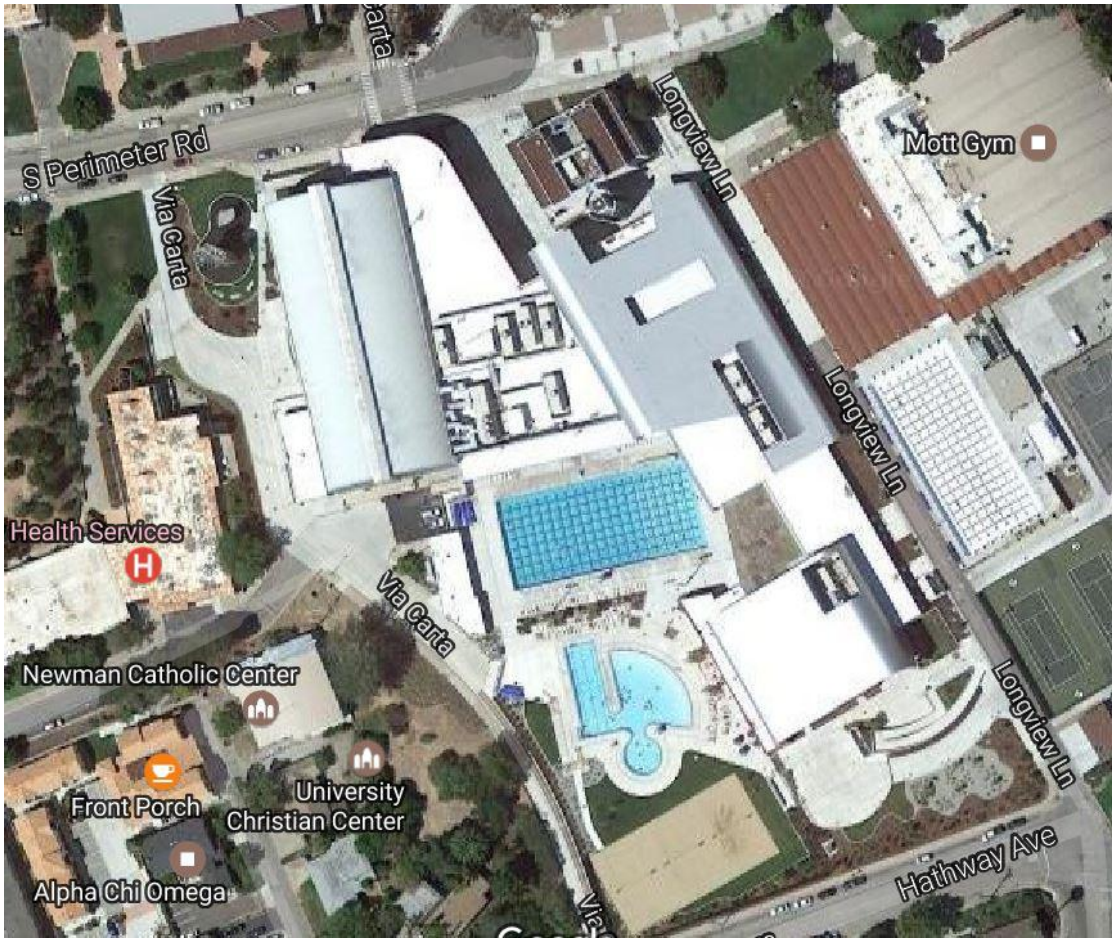


Figure 2. The aerial view of the Recreation Center

The Recreation Center has more than 165000 square feet for recreation space for the first floor.It contains three separate exercise areas with equipment,an indoor track at the second floor,three fitness studios,locker rooms with showers,and other exercise areas. The Figure 3 and 4 show the floor plan of the building, and the Figure 5-8 were taken inside of the building.

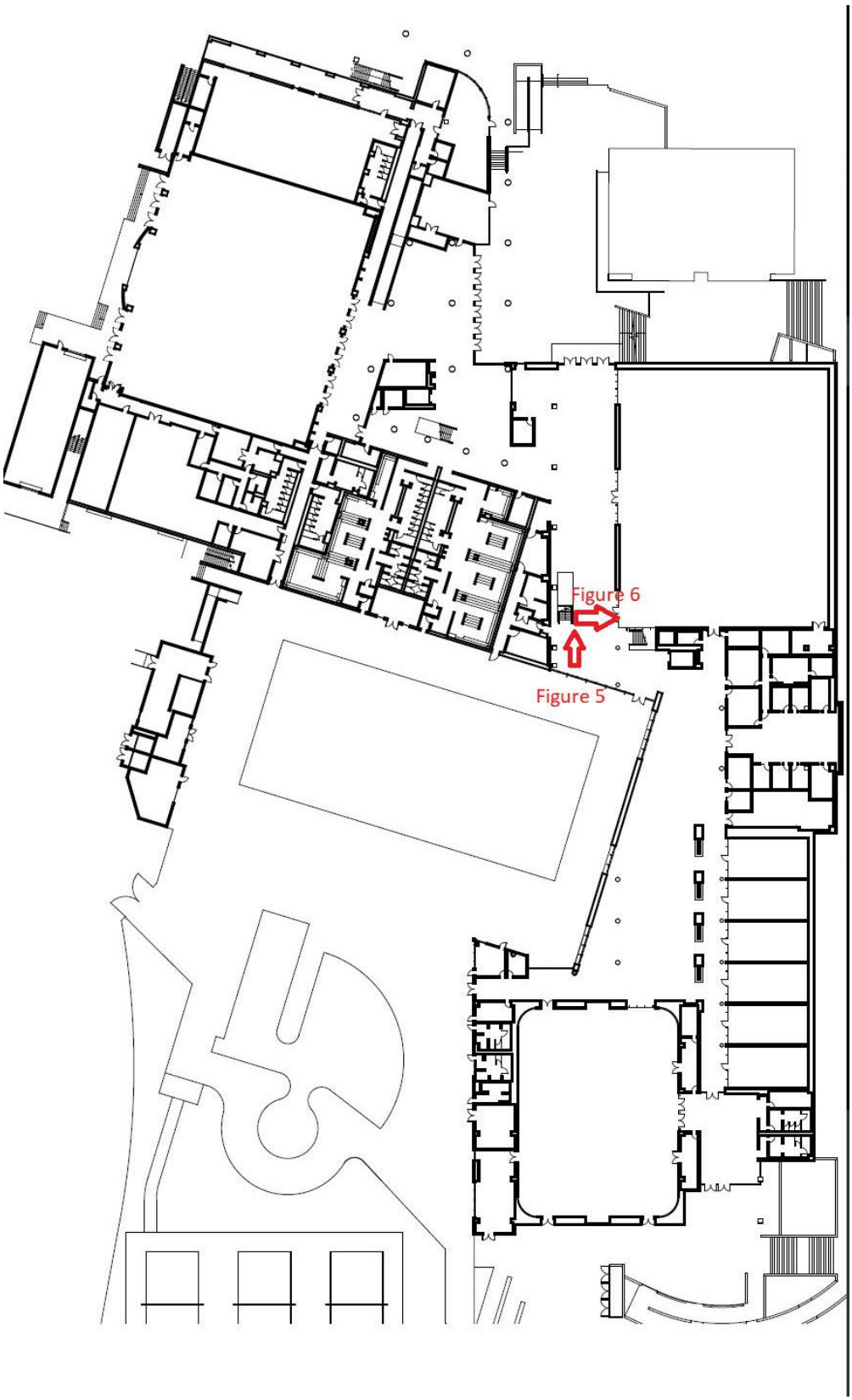


Figure 3. Floor Plan Of The 1st Floor

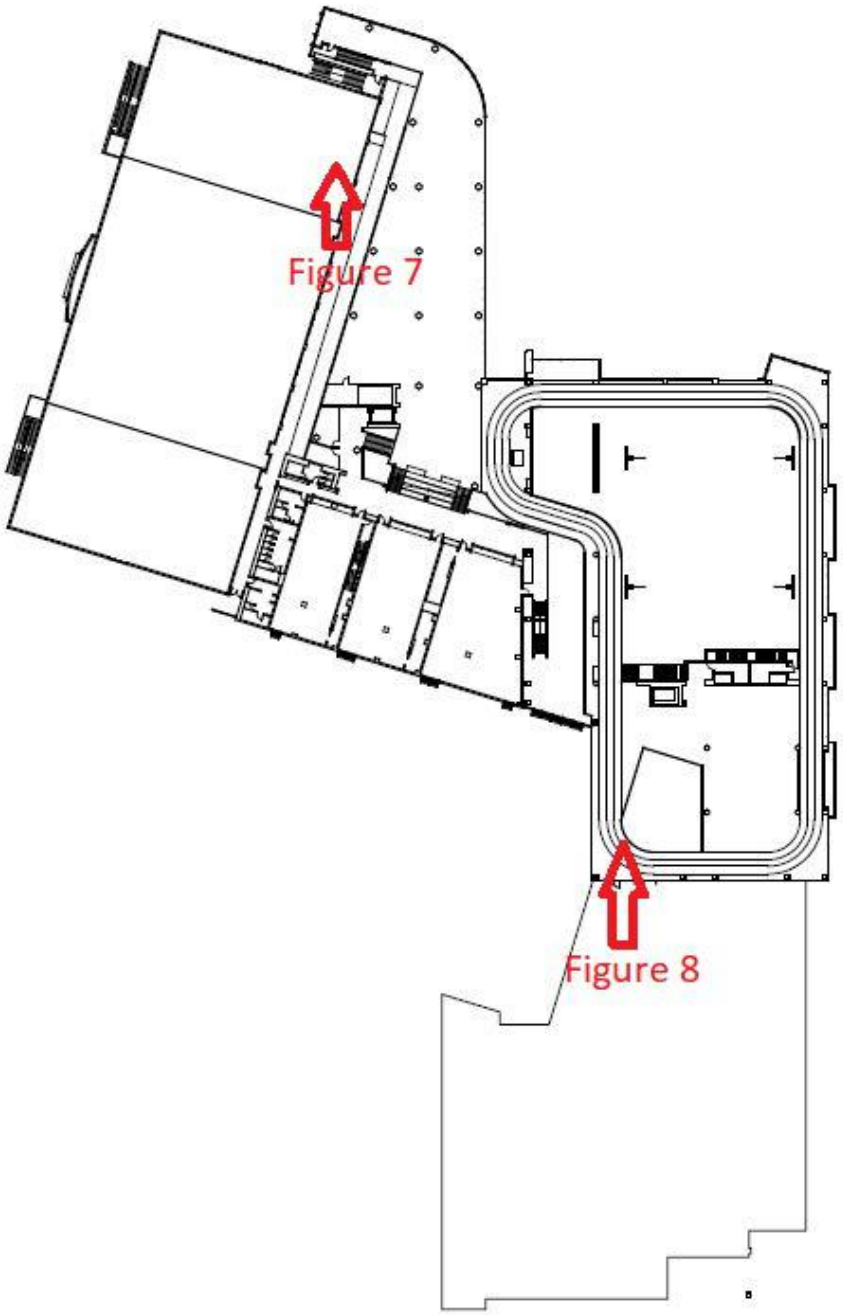


Figure 4. Floor Plan Of The 2nd Floor

Figure 5. The Stairways Inside of the Recreation Center.

Figure 6. The New Basketball Room

Figure 7. The Old Gym with Bleachers at 2nd Floor

Figure 8. The Indoor Track

This project will examine installed fire protection features and systems in the prescriptive analysis approach in accordance with the International Building Code, such as structural fire protection, water-based suppression system, alarm and detection system, egress system, smoke control, and fire safety management plan.

Also a performance based analysis of the Recreation Center was based on the performance based design method 1 and method 2 of the Life Safety Code. This method compares the required safe egress time (RSET) and available safe egress time (ASET) for occupants to evacuate the building safely in the event of a fire.One chosen fire scenario was analyzed using Pathfinder and FDS model. Two other fire scenarios were selected to discuss the other potential fire risks that effect the safe evacuation of the Recreation Center.

Applicable Codes and Standards

- International Building Code (2015)
- California Building Code (2013)
- NFPA 13: Automatic Sprinkler Systems (2013)
- NFPA 72: National Fire Alarm Code (2013)
- NFPA101: Life Safety Code
- SFPE Handbook of Fire protection engineering

This report begins with a prescriptive analysis. The structural fire protection is the first step in analyzing the building to ensure the building provides a safe protection from a fire .

Structural Fire Protection

Introduction:

The Recreation Center was built with structural components such as columns, beams, girders and joists, interior and exterior walls. During a fire, the structural components will play a significant role to keep the whole building from collapsing, and give the occupants enough time to safely evacuate from the building.

The Recreation Center is classified as **A3 - GYMNASIUM WITHOUT SPECTATOR SEATS** and **B - LOCKER ROOM/SHOWERS, EXERCISE AREAS AND ADMINISTRATION AREAS.** The primary occupancy of the building is A3,B and S.

The building is 2 stories, the average height of highest roof is 65ft. The highest occupied floor level is less than 75ft, therefore, the building is not a high-rise building according to the IBC.

Construction Type

According to Table 503 of IBC, we can determine the required construction type for this building. Tables 1-3 are extracted from IBC and are used to determine the construction type of the Recreation Center.

Table 1. Allowable Building Height. Extract from IBC

ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION									
	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
H-1, H-2, H-3, H-5	NS[c, d]	UL	160	65	55	65	55	65	50	40
	S									
H-4	NS[c, d]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60

Based on the examination of the building height Types IA IB, Types IIA IIB, Types IIIA IIIB , Type IV HT and Type VA are allowed.

Table 2. Allowable Number of Stories. Extract from IBC

ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A-1	NS	UL	5	3	2	3	2	3	2	1
	S	UL	6	4	3	4	3	4	3	2
A-2	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-3	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-4	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-5	NS	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	NS	UL	11	5	3	5	3	5	3	2
	S	UL	12	6	4	6	4	6	4	3

Table 3. Allowable Area Factor. Extract from IBC

ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, or SM, as applicable) IN SQUARE FEET

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	15,000	11,500	5,500
	S1	UL	UL	62,000	34,000	56,000	34,000	60,000	46,000	22,000
	SM	UL	UL	46,500	25,500	42,000	25,500	45,000	34,500	16,500
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-5	NS	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S1									
	SM									
B	NS	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	108,000	54,000	27,000
E	NS	UL	UL	26,500	14,500	23,500	14,500	25,500	18,500	9.500
	S1	UL	UL	106,000	58,000	94,000	58,000	102,000	74,000	38,000
	SM	UL	UL	79,500	43,500	70,500	43,500	76,500	55,500	28,500

Several area modifications increase the allowable area (already calculated in the table).

$$A_a = \lfloor A_t + (NS * I_f) \rfloor * S_a$$

where:
A_a = Allowable area (square feet).
A_t = Tabular allowable area factor (NS, S13R or SM value, as applicable) in accordance with Table 506.2.
NS = Tabular allowable area factor in accordance with Table 506.2 for a nonsprinklered building (regardless of whether the building is sprinklered).
I_f = Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3.
S_a = Actual number of building stories above grade plane, not to exceed three. For buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2, use the actual number of building stories above grade plane, not to exceed four.

The total area of the first floor is 165717 ft^2 is well above 46500 ft^2 of type IIA, based on group A-3 and B occupancy. According to the IBC, type II, type III, type IV and type V do not meet the requirement of the IBC. The first acceptable building type is IB.

The columns are made of concrete enhanced steel. The beams are steel. The floor assemblies, roof assembly, exterior walls and interior walls and partitions use steel as the frame.

The fire resistance ratings

As a Type I-B building, the Recreation Center building elements shall meet the following minimum fire-resistance ratings in accordance with IBC requirements as shown in Table 1.

Table 4. Fire Resistance Rating Requirement from IBC

Building Element	Fire Resistance Rating
Structural frame	2
Exterior bearing wall	2
Interior bearing wall	2
Exterior Nonbearing walls and partitions	0
Interior Nonbearing walls and partitions	0
Floor construction	2
Roof construction	1

The primary structural frame must have a fire-resistance rating of 2-hour. Both the interior and exterior walls should have a 2-hour FRR. The floor construction and secondary members must have 2-hour FRR and the roof construction and secondary members must have 1-hour FRR.

The Recreation Center is a Type IB building, and the building is fully sprinkled with a wet-pipe sprinkler system.

Columns, Beams,Girders and Joists

The primary structure consists of steel columns, beams, girders and joists. All of these structural elements are protected with spray applied fire resistive materials or are concrete enhanced steel, which provide 2-hour fire resistance rating. The different sizes of steel columns used in its construction, are W10x33, W10x39, W10x49, W10x60, W14x61, W14x74 and W14X82.
The minimum SFRM thickness for 2 hour rating of those steel columns are 1) W10x33, 1-11/16in; 2) W10x39, 1-3/8in; 3) others 1-1/8in.

Floor Assemblies

The floor assemblies are W10x19 to W30x90 steel with 2.5in lightweight concrete over 2in metal deck, and are protected with spray applied fire resistive materials, which provide 2-hour fire resistance rating.

Ceiling Assemblies

The ceiling assemblies are W10x19 to W33x169 steel with 2.5in lightweight concrete over 2in metal deck,and are protected with spray applied fire resistive materials, which provide 1-hour fire resistance rating.

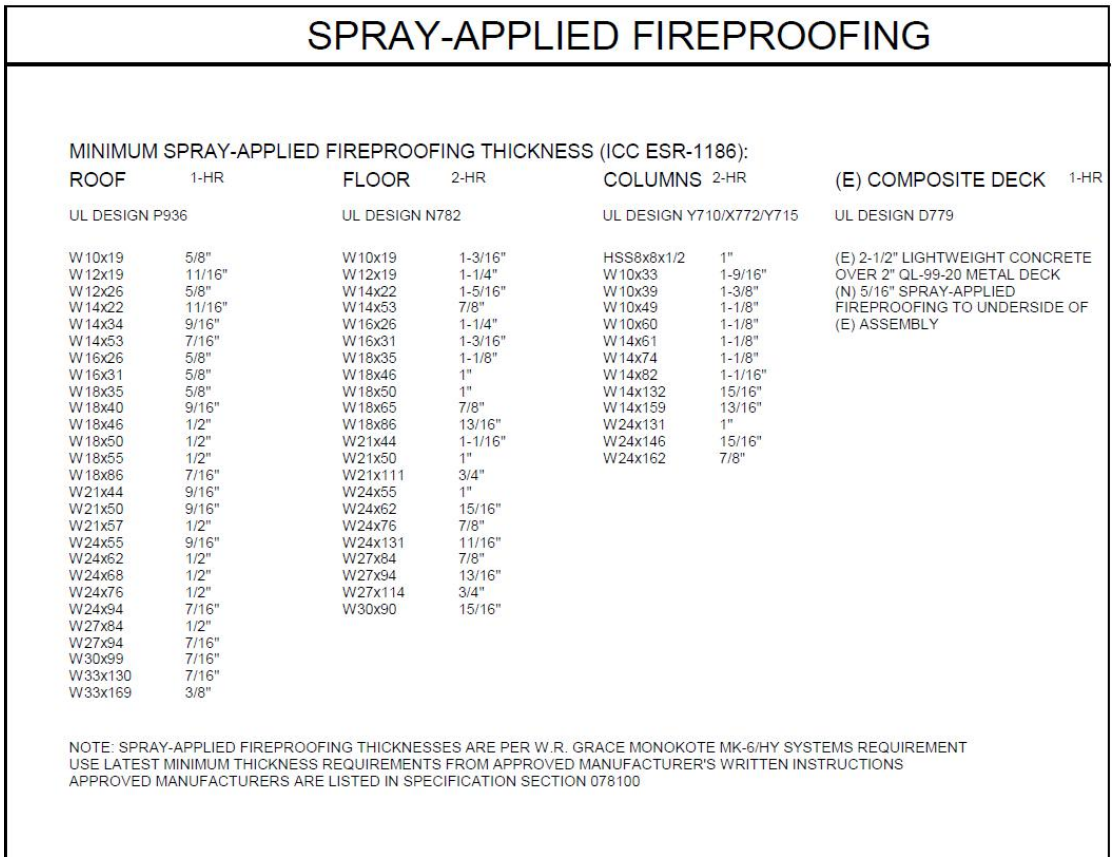
Exterior Walls

The exterior walls of the Recreation Center are corrugated metal wall and concrete wall. All of the exterior walls are covered with gypsum wall board of 1/2 in to 5/8 in to provide 2-hour fire resistance rating.

Interior Walls

The interior walls of the Recreation Center are corrugated metal wall and aluminum wall and concrete wall. All the interior walls are covered with gypsum wall board of 1/2 in to 5/8 in to provide 2-hour fire resistance rating.

Figure 9 shows details of minimum SFRM thickness requirement.



SPRAY-APPLIED FIREPROOFING

MINIMUM SPRAY-APPLIED FIREPROOFING THICKNESS (ICC ESR-1186):

ROOF 1-HR		FLOOR 2-HR		COLUMNS 2-HR		(E) COMPOSITE DECK 1-HR
UL DESIGN P936		UL DESIGN N782		UL DESIGN Y710/X772/Y715		UL DESIGN D779
W10x19	5/8"	W10x19	1-3/16"	HSS8x8x1/2	1"	(E) 2-1/2" LIGHTWEIGHT CONCRETE
W12x19	11/16"	W12x19	1-1/4"	W10x33	1-9/16"	OVER 2" QL-99-20 METAL DECK
W12x26	5/8"	W14x22	1-5/16"	W10x39	1-3/8"	(N) 5/16" SPRAY-APPLIED
W14x22	11/16"	W14x53	7/8"	W10x49	1-1/8"	FIREPROOFING TO UNDERSIDE OF
W14x34	9/16"	W16x26	1-1/4"	W10x60	1-1/8"	(E) ASSEMBLY
W14x53	7/16"	W16x31	1-3/16"	W14x61	1-1/8"	
W16x26	5/8"	W18x35	1-1/8"	W14x74	1-1/8"	
W16x31	5/8"	W18x46	1"	W14x82	1-1/16"	
W18x35	5/8"	W18x50	1"	W14x132	15/16"	
W18x40	9/16"	W18x65	7/8"	W14x159	13/16"	
W18x46	1/2"	W18x86	13/16"	W24x131	1"	
W18x50	1/2"	W21x44	1-1/16"	W24x146	15/16"	
W18x55	1/2"	W21x50	1"	W24x162	7/8"	
W18x86	7/16"	W21x111	3/4"			
W21x44	9/16"	W24x55	1"			
W21x50	9/16"	W24x62	15/16"			
W21x57	1/2"	W24x76	7/8"			
W24x55	9/16"	W24x131	11/16"			
W24x62	1/2"	W27x84	7/8"			
W24x68	1/2"	W27x94	13/16"			
W24x76	1/2"	W27x114	3/4"			
W24x94	7/16"	W30x90	15/16"			
W27x84	1/2"					
W27x94	7/16"					
W30x99	7/16"					
W33x130	7/16"					
W33x169	3/8"					

NOTE: SPRAY-APPLIED FIREPROOFING THICKNESSES ARE PER W.R. GRACE MONOKOTE MK-6/HY SYSTEMS REQUIREMENT
USE LATEST MINIMUM THICKNESS REQUIREMENTS FROM APPROVED MANUFACTURER'S WRITTEN INSTRUCTIONS
APPROVED MANUFACTURERS ARE LISTED IN SPECIFICATION SECTION 078100

Figure 9. Minimum SFRM Thickness Requirement.

Interior Finish Regulations

According to Section 7.1.4. of LSC 2015, the building is mixed use with occupants classification of A-3, and B, therefore, the interior finishes in exit enclosures and exit passageways, corridors, and rooms are supposed to meet the requirements in Table 5.

Table 5. Requirement for Interior Finish

Exit enclosures and exit passageways	Class C
Corridors	Class B
Rooms and other spaces	Class C

ASTM E 84 classified interior finished into three groups with corresponding flame spread and smoke development values

Class A: Flame spread 0-25; smoke-developed 0-450
Class B: Flame spread 26-75; smoke-developed 0-450
Class C: Flame spread 76-200; smoke-developed 0-450

According to Table 8.3.4.2 IBC, fire resistance ratings for corridors and stairways are

Corridors: wall 1hr, fire door 1/3hr
Stairways: wall 2hr, fire door 1.5hr

Figures 10 and 11 show the actual fire ratings of the walls present on each floor of the building.

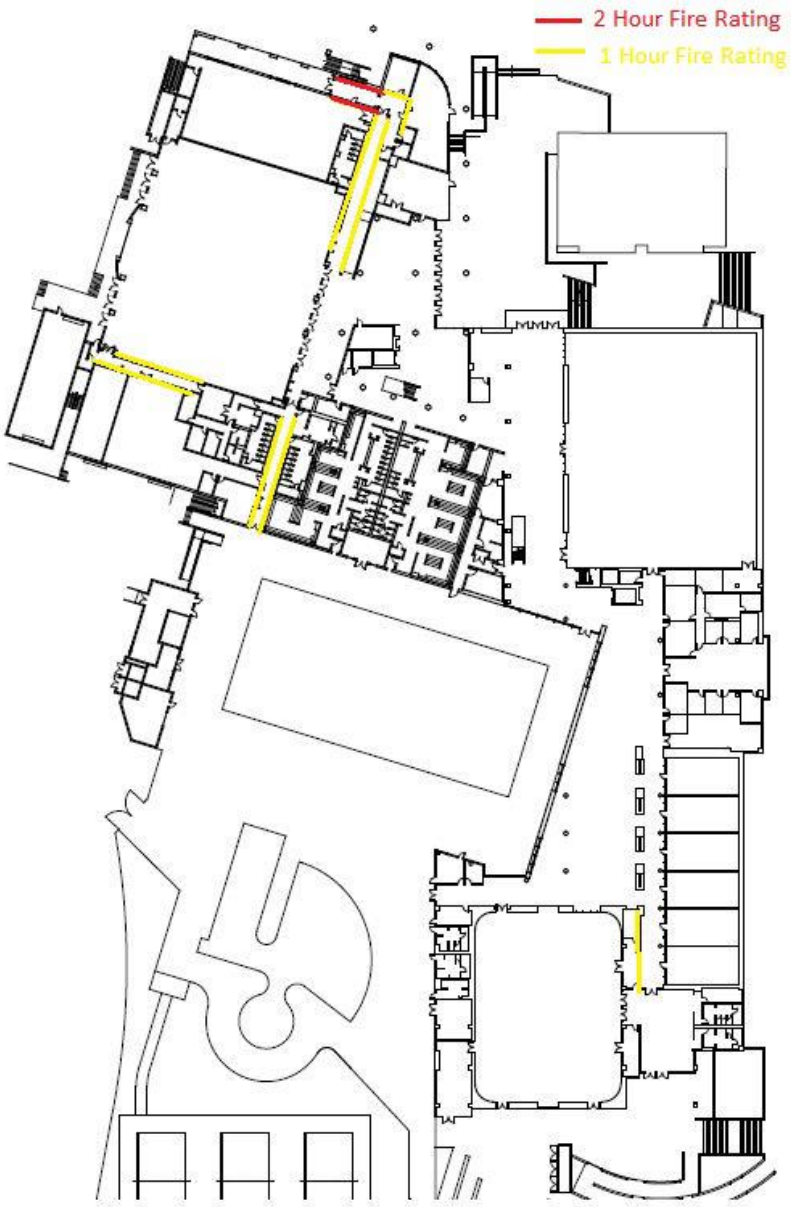


Figure 10. Fire Rating of Walls on 1st Floor

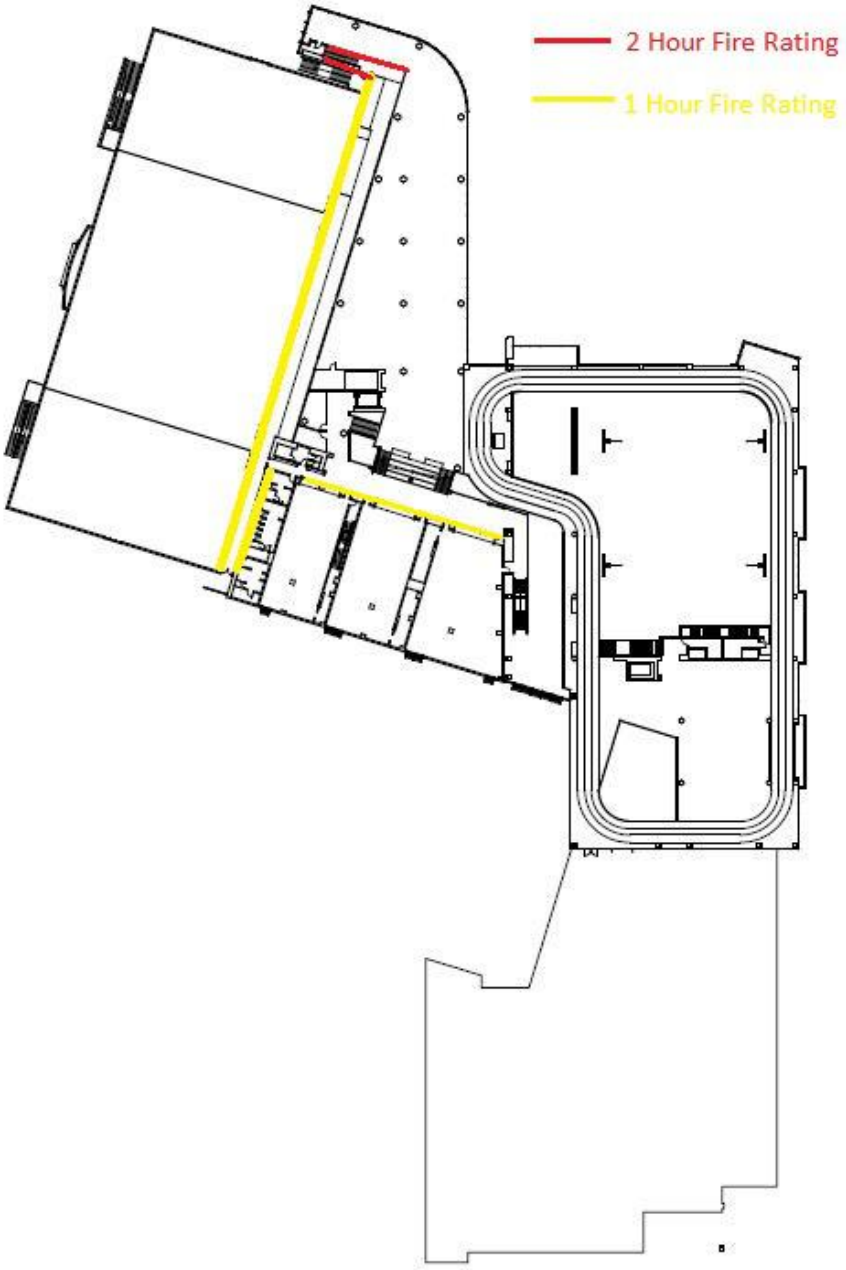


Figure 11. Fire Rating of Walls on 2nd Floor

Table 6 shows the actual fire rating of the penetration through the concrete of the Recreation Center. It clearly meets the requirements for the fire rating of the walls.

Table 6. Fire Rating of the Penetrations

Min Floor or Wall Thkns In.	Nom Pipe Tube or Conduit Diam In.	Max Annular Space In.	Min Caulk Thkns In.	F Rating Hr
2–1/2 (64)	1/2–12 (13–305)	1–3/8 (35)	1/2 (13)	2
2–1/2 (64)	1/2–12 (13–305)	3–1/4 (83)	1 (25)	2
4–1/2 (114)	1/2–6 (13–152)	1–3/8 (35)	1/4 (6) (a)	2
4–1/2 (114)	1/2–12 (13–305)	1–1/4 (32)	1/2 (13)	3
4–1/2 (114)	1/2–20 (13–508)	2 (51)	1 (25)	3
4–1/2 (114)	1/2–20 (13–508)	2 (51)	1 (25)	3
4–1/2 (114)	1/2–12 (13–305)	3–1/4 (83)	1 (25)	3
4–1/2 (114)	22–30 (558–762)	2 (51)	2 (51)	3
5–1/2 (140)	1/2–6 (13–152)	1–3/8 (35)	1 (25) (b)	4

The Fire Separation Distance

The fire-resistance requirement of the exterior walls can be found in Table 602, IBC. The fire separation distance is the distance measured from the building face, 1) to the closest interior lot line; 2) to the centerline of a street or public way; 3) to an imaginary line between two buildings on the property.

The fire separation distance of the Recreation Center is shown in Figure 12. The shortest distance is 12ft. According to IBC, the exterior wall should have at least 1 hour fire resistance rating. The Recreation Center is a Type IB building, and it meets the requirement.

Figure 12. Fire Separation Distance

The structural fire protection features provide a safe building elements that meet the requirement of the IBC. But to safely evacuate the building, the occupants should be notified about the fire as soon as possible, then they will know to begin the evacuation. The next section discusses the fire alarm and detection system.

Fires Alarm and Detection System

Introduction:

The fire detection and alarm system is the significant part of the fire protection analysis. The time of the first detection of the fire and the time of the alarm determine when the occupants realize a fire has occurred and begin to evacuate from the building. Lack of detection and alarm is one important reason for a fire leading to a life loss tragedy.

Sequence of Operation

The Sequence of Operation (Figure 13) shows the response of the alarm system to a trouble, supervisory or alarm signal.

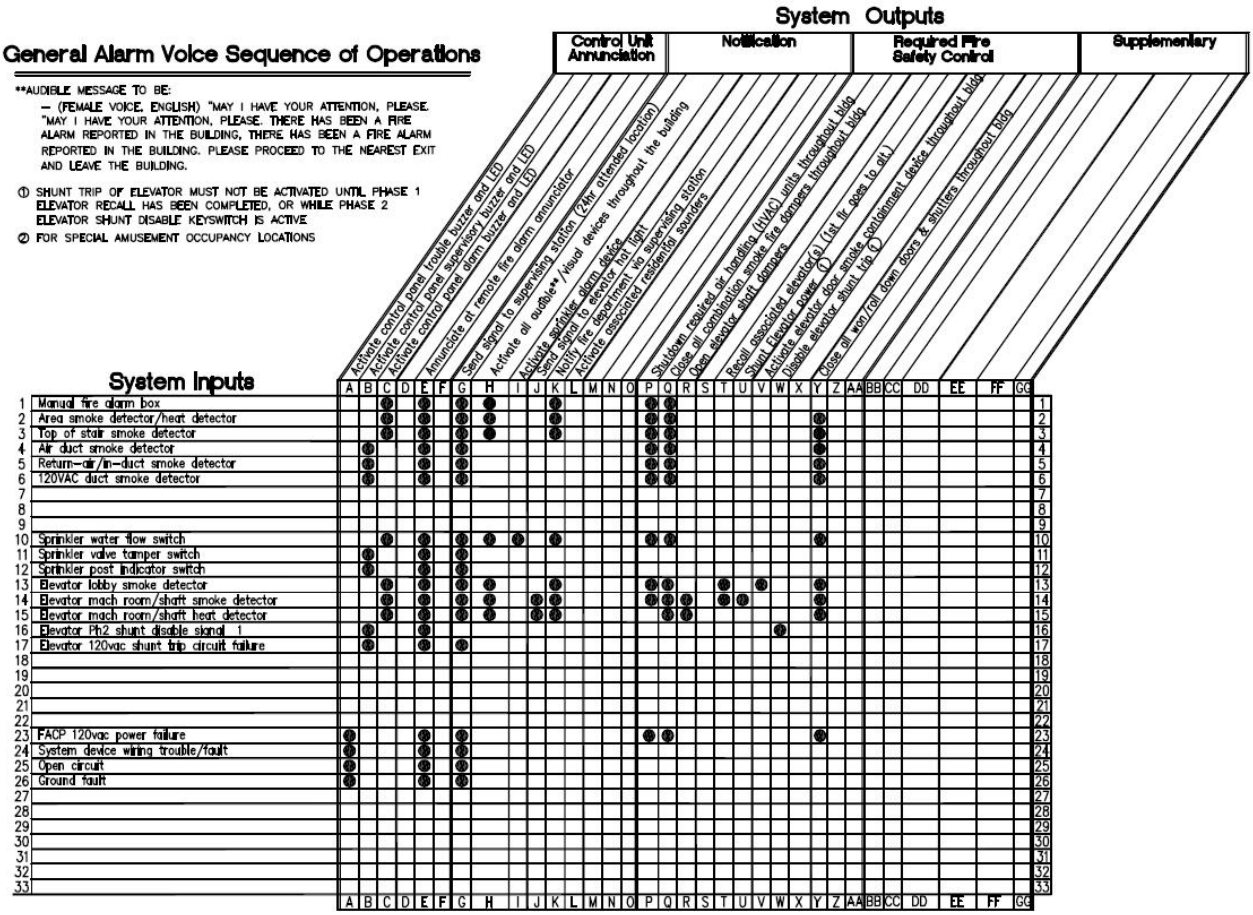


Figure 13. Sequence of Operation of the Recreation Center

Alarm signals indicate a fire or fire signature condition. An alarm signal is initiated by a fire alarm device such as automatic smoke/heat detector, manual fire pull station, or water-flow of sprinkler system.

Supervisory signals indicate a need for action in connection with the fire suppression system or other systems connected to the fire alarm system.

Trouble signals are initiated by a device or a system to indicate a fault in the monitored device or system.

The supervising station is located in the university police department building with operators at all time monitoring and handling all the fire alarm signals. It connects all fire alarm signals of all individual buildings on campus.

The Fire Alarm Control Panel(FACP)

The Recreation Center fire alarm system uses a NOTIFIER ONYX NFS2-640 fire alarm control panel (see Figure 14). It is located in the same room as the main electric power supply cabinets on the first floor of the building.

Figure 14. NOTIFIER ONYX NFS2-640 FACP

The location and details of the FACP is shown in Figures 15 and 16.

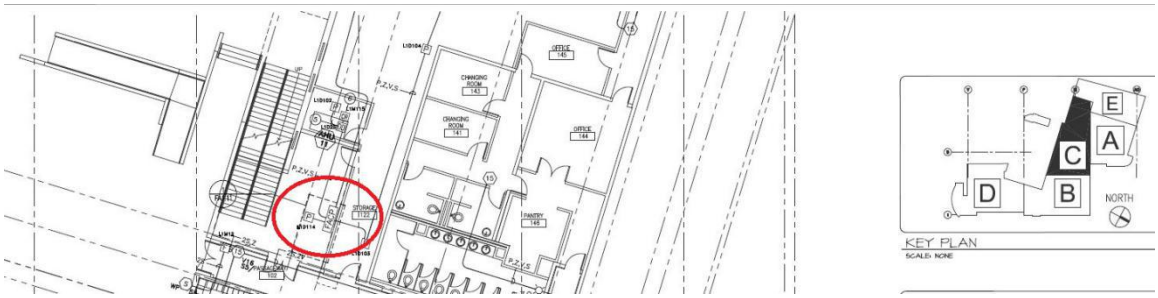


Figure 15. The Location of FACP

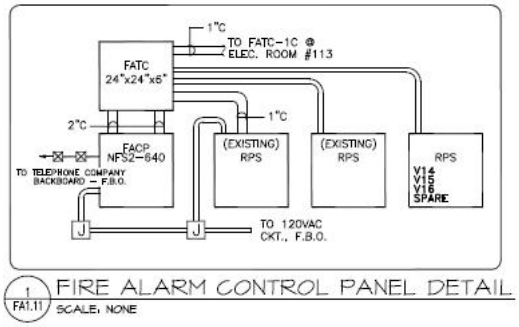


Figure 16. Details of Fire Alarm Control Panel

Initiating Devices

The Recreation Center has smoke detectors, heat detectors, duct detectors, and water flow detectors as part of the automatic fire alarm system. There are also manual pull stations as part of the fire alarm system.

Smoke detectors:

The Model of the smoke detectors is FSP-851 B710LP. Here are the details of the smoke detectors.

Figure 17. FSP-851 Smoke Detectors

FSP-851 B710LP is Low-Profile Intelligent Photoelectric Smoke Detector. There are 19 smoke detectors installed in mechanical and electrical spaces throughout the Recreation Center. The FSP-851 smoke detectors are shown in Figure 17.

Heat detectors:

The Model of the heat detectors is FSP-851. They have the same appearance as the smoke detectors FSP-851 B710LP. There are only a few heat detectors used in the Recreation Center. All of them are located in elevator machine room.

Also,the Recreation Center is equipped with a wet-pipe automatic sprinkler system. Each sprinkler head can be treated as an individual heat detector. The quick response sprinklers have an activation temperature of 155°F. When a sprinkler head is activated, the flow switch installed in the sprinkler riser will connect to the FACP and initiate an alarm signal.

Manual Pull Station

Figure 18. Notifier NBG-12LX Manual Pull Station

The Model of the Manual Pull Stations is Notifier NBG-12LX (See Figure 18). Every major exit has a manual pull station throughout the Recreation Center.the NBG-12LX has an addressable interface, therefore, the FACP can get the exact location of the activated manual station. That will help the operators make a quick decision about the fire location and take the appropriate actions to deal with the situation.

Duct-type smoke detectors:

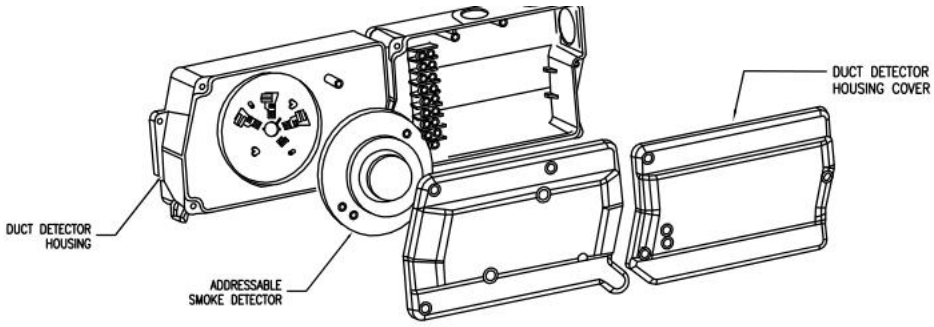


Figure 19. Duct-type Smoke Detectors Detail

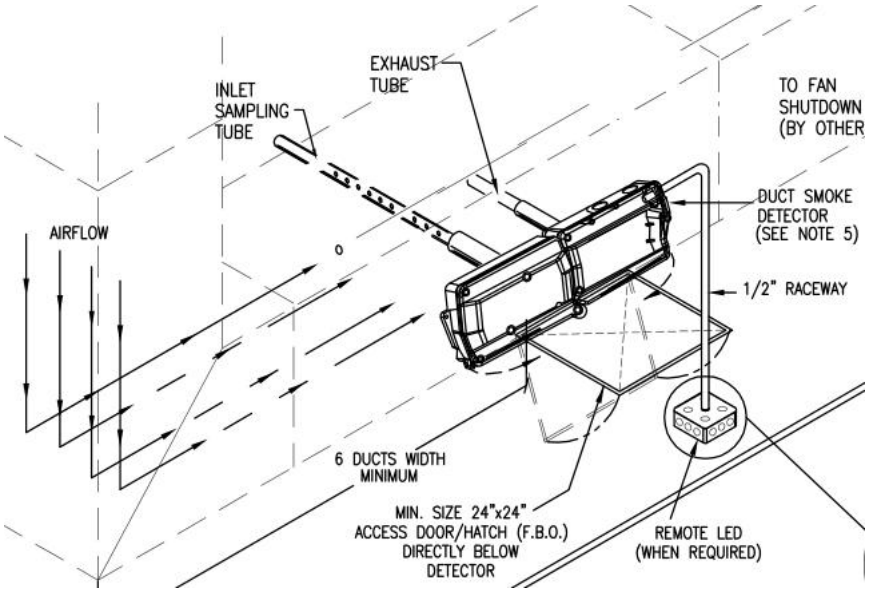


Figure 20. Duct-type Smoke Detectors Mounting Information

Figure 19 shows the details of the duct-type smoke detectors, and the mounting details are showed in Figure 20.

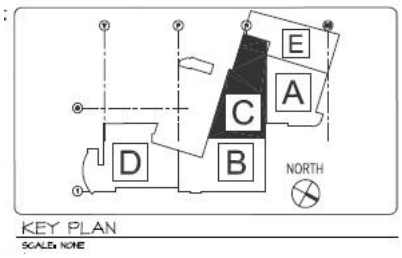


Figure 21. Key Plan of the First Floor

Type FSP-851 smoke detector is also used as the Duct-type smoke detectors. Duct-type smoke detectors used in sampling tube applications shall be UL listed for velocity range of 100-4000ft/min.

There are 2 Duct-type detectors in first floor, located in area C and area E (see Figure 21). 8 Duct-type detectors are located in the roof.

Location and Spacing of Fire Detection Devices

NFPA 72, chapter 17 shows the general requirements of detection devices installation.

The distance between detectors shall not exceed their listed spacing, and there shall be detectors within a distance of one-half the listed spacing.

The whole building is protected by over 800 sprinklers and 55 smoke detectors and 3 heat detectors. The smoke detectors are mounted in the corridors and in all the large spaces. The spacing between all the detectors comply with the requirements of the NFPA 72. Three heat detectors are located in the different elevator machine rooms. Table 7 shows the summary of the location of the fire detection devices in the Recreation Center.

Table 7. Fire Detection Devices Locations

Devices	1st floor	2nd floor	Roof
Smoke detectors	28	17	
Heat detectors	3	0	
Duct-type air smoke detectors	2	0	8
Manual pull station	18	4	

The details of fire initiating devices are summarized in Table 8. including the quantity, symbols, model, back box, mounting height, and other information.

Table 8. Quantity and details of Fire Initiating Devices

32	CR	FIRE ALARM RELAY MODULE	FRM–1	NOTIFIER	4S DEEP BOX W/ 4S EXTENSION	VERIFY IN FIELD
11	M	FIRE ALARM MONITOR MODULE	FMM–1	NOTIFIER	4S DEEP BOX W/ 4S EXTENSION	VERIFY IN FIELD
6	MD	FIRE ALARM DUAL MONITOR MODULE	FDM–1	NOTIFIER	4S DEEP BOX W/ 4S EXTENSION	VERIFY IN FIELD
7	R	24VDC RELAY	PR–1	SYSTEM SENSOR	5S DEEP BOX W/ 5S EXTENSION	VERIFY IN FIELD
4	F WP	WEATHERPROOF MANUAL PULL STATION	NBG–12LOB w/ FMM–101	NOTIFIER	SB–I/O PROVIDED	48" A.F.F. TO TOP OF BOX
19	P	AREA SMOKE DETECTOR (ADDRESSABLE – PHOTO)	FSP–851 B710LP	NOTIFIER	4S DEEP BOX W/ 3–0 RING	CEILING MOUNTED
3	P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)	FSP–851 B710LP	NOTIFIER	4S DEEP BOX W/ 3–0 RING	CEILING MOUNTED
24	ID	AREA SMOKE DETECTOR (INSIDE DUCT)	FSP–851 B501	NOTIFIER	4–0 PANCAKE BOX w/ 3–0 ADAPTER	INSIDE DUCT (AT TOP)
3	H	AREA HEAT DETECTOR (ADDRESSABLE)	FST–851 B710LP	NOTIFIER	4S DEEP BOX W/ 3–0 RING	CEILING MOUNTED
12	DD	DUCT DET. HOUSING w/ SMOKE DETECTOR HEAD	DNR w/ FSP–851	SYSTEM SENSOR NOTIFIER	DNR PROVIDED	VERIFY IN FIELD
18	F	MANUAL PULL STATION	NBG–12LX	NOTIFIER	4S DEEP BOX W/ SINGLE GANG RING	48" A.F.F. TO CENTER

Alarm Notification Devices

The building has in-building fire emergency voice/alarm communications system.There are many forms on notification appliances, e.g. audible, visible.The whole building has over 180 fire alarm speakers/strobes.

Speaker Strobes

For this building, the Speaker Strobes are type SPSW Speaker Strobes (See Figure 22). The current data of SPSW speaker strobe is shown in Table 9.

Print This Page

SPSW

Model: SPSW

Type: Speaker Strobes

The SpectrAlert Advance SPSW is a white speaker strobe for wall installation with selectable strobe settings of 15, 15/75, 30, 75, 95, 110 and 115 cd.

Figure 22. SPSW Speaker Strobes.

Table 9. Current data of SPSW Speaker Strobes.

UL Current Draw Data

UL Max. Strobe Current Draw (mA RMS)					
		8 to 17.5 Volts		16 to 33 Volts	
	Candela	DC	FWR	DC	FWR
Standard Candela Range	15	123	128	66	71
	15/75	142	148	77	81
	30	NA	NA	94	96
	75	NA	NA	158	153
	95	NA	NA	181	176
	110	NA	NA	202	195
	115	NA	NA	210	205
High Candela Range	135	NA	NA	228	207
	150	NA	NA	246	220
	177	NA	NA	281	251
	185	NA	NA	286	258
Sound Output					
UL Reverberant (dBA @ 10 ft.)		2W	1W	½ W	¼ W
Wall-Mount SP Series		86	83	80	77
Wall-Mount SPV Series		90	87	84	81
Wall-Mount SPS Series		85	82	79	76
Wall-Mount SPSV Series		89	86	83	80

According to the 6dB law, the separation of the audible appliances should be no further than 80ft. The visible appliances should be based on Table 18.5.4.3.1a, NFPA 72.

Horn / Strobes

For this building,the other horn/strobes are type SCW/SW/SCRK Strobes (see Figure 23-25).

Figure 23. Model SCW Strobe

Figure 24. Model SW Strobe

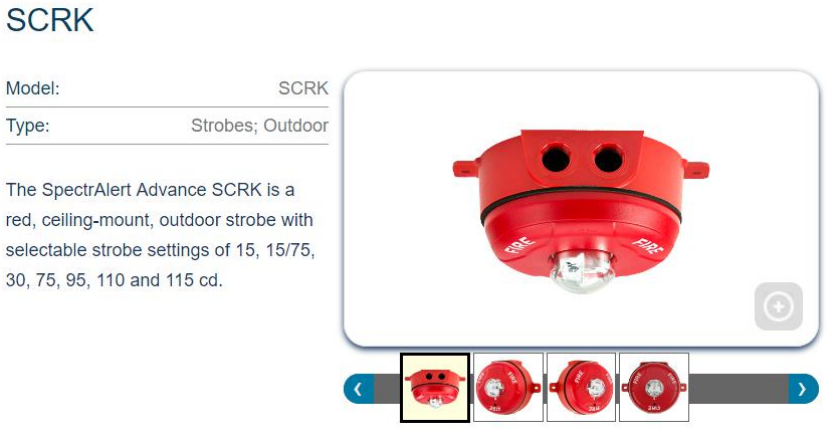


Figure 25. Model SCW Strobe

These strobes can be adjusted to 15, 30, 75, 95, or 115 cd. According to NFPA 72, average ambient sound level for assembly occupancy is 55 dBA. Audible appliances shall be at least 15 dBA above average ambient sound level. These audible appliances installed in the Recreation Center are set up to over 75 dBA, therefore, the audible appliances meet the requirements. The visible appliances requirement is discussed next.

Location and spacing of Alarm Notification Devices

Audible appliances are required to have a sound level at least 15 dB above the average ambient sound level or 5 dB above the maximum sound level. They also mostly have a duration of at least 60 seconds, whichever is greater, measured 5 feet above the floor. If ceiling heights allow, wall-mounted appliances shall have tops located not less than 90 inches and not less than 6 inches below finished ceiling 18.4.8.1, NFPA 72.

For Visible appliances, wall-mounted appliances shall be located such that the entire lens is between 80 – 96 inches according to 18.5.4, NFPA 72 (see Table 10).

Table 10. Room Spacing for Wall-Mounted Visible Appliances. Extract from 18.5.5.4.1(a) NFPA 72

Maximum Room Size		*Minimum Required Light Output [Effective Intensity (cd)]*		
ft	*m*	*One Light per Room*	*Two Lights per Room (Located on Opposite Walls)*	*Four Lights per Room (One Light per Wall)*
20 × 20	6.10 × 6.10	15	NA	NA
28 × 28	8.53 × 8.53	30	Unknown	NA
30 × 30	9.14 × 9.14	34	15	NA
40 × 40	12.2 × 12.2	60	30	15
45 × 45	13.7 × 13.7	75	Unknown	19
50 × 50	15.2 × 15.2	94	60	30
54 × 54	16.5 × 16.5	110	Unknown	30
55 × 55	16.8 × 16.8	115	Unknown	28
60 × 60	18.3 × 18.3	135	95	30
63 × 63	19.2 × 19.2	150	Unknown	37
68 × 68	20.7 × 20.7	177	Unknown	43
70 × 70	21.3 × 21.3	184	95	60
80 × 80	24.4 × 24.4	240	135	60
90 × 90	27.4 × 27.4	304	185	95
100 × 100	30.5 × 30.5	375	240	95
110 × 110	33.5 × 33.5	455	240	135
120 × 120	36.6 × 36.6	540	305	135
130 × 130	39.6 × 39.6	635	375	185

The multi-activity center (MAC) on the first floor is used as the example in this analysis to illustrate compliance of notification appliance spacing and placement. The MAC is equipped with 4 wall mounted 110-dBA audible-strobes. As shown in Figure 26 below, the MAC room is adequately covered. Each colored square represents a coverage of 110 cd audible-strobe.

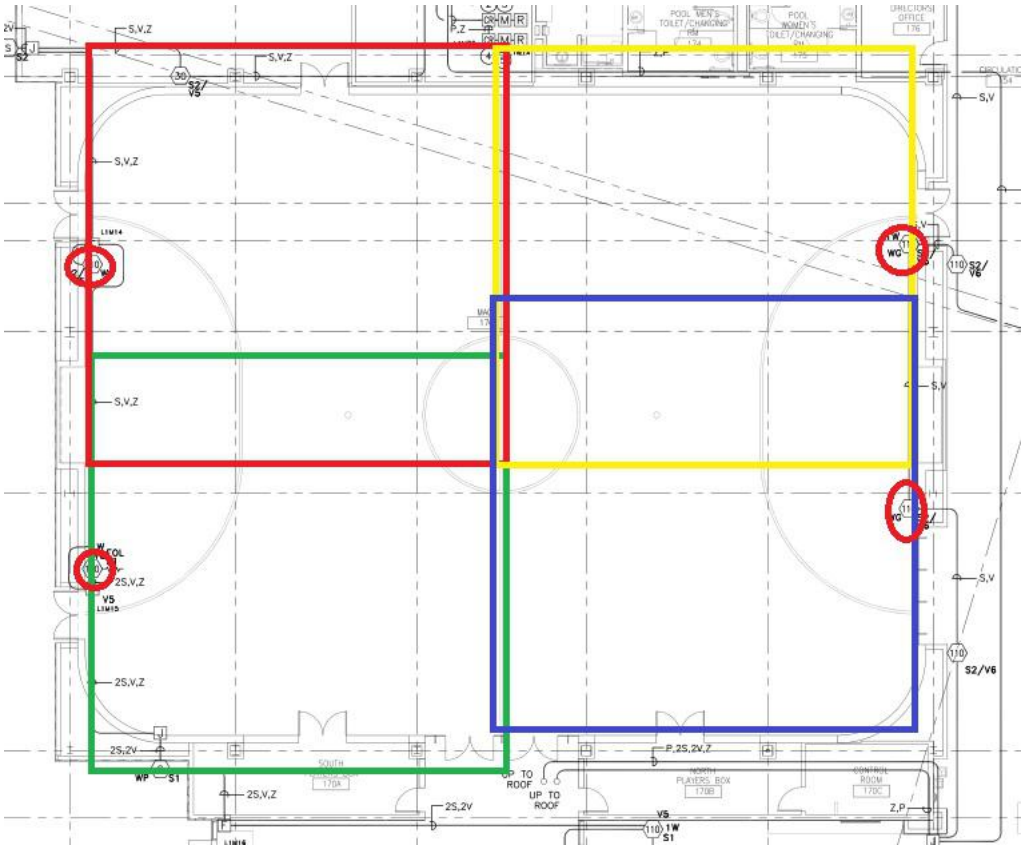


Figure 26. MAC Audible/Visible Appliances Coverage

Figure 27 shows the details of device mounting in the Recreation Center, including the smoke detectors, manual stations, visual and audible appliances, which shows that NFPA 72 audible and visible requirements were met.

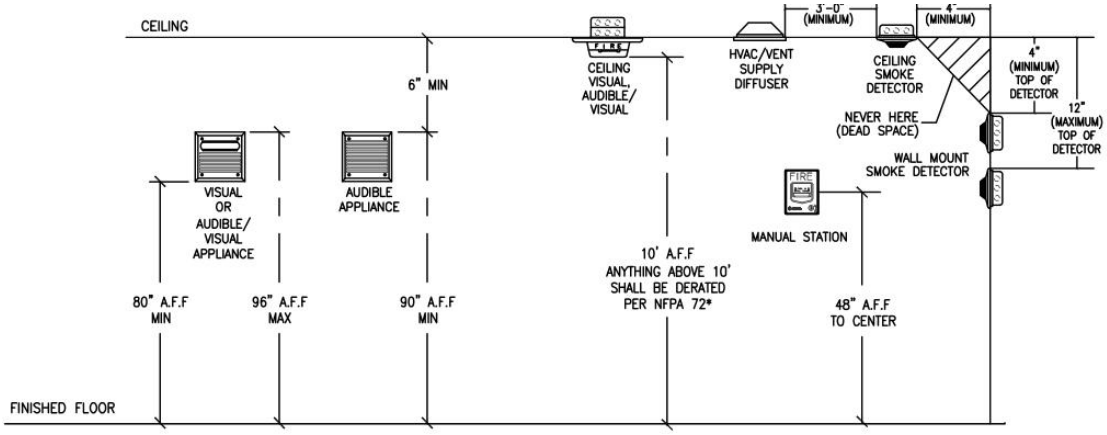


Figure 27. Device Mounting Details to meet the performance-based requirement in the Recreation Center

Power requirements for fire alarm and communication systems

At least two independent and reliable power supplies shall be provided, one primary and one secondary, according to 10.5.3, NFPA72.

The secondary power supply shall have sufficient capacity to operate the system under quiescent load (system operating in a non-alarm condition) for a minimum of 24 hours. At the end of that period, the power supply shall be capable of operating all alarm notification appliances used for evacuation or to direct aid to the location of an emergency for 5 minutes. Battery calculations shall include a 20 percent safety margin added to the calculated amp-hour rating. According to NFPA 72 10.6.7.2

The secondary power supply shall be capable of providing power including the normal standby for 24 hours as well as the load during 15 minutes period of alarm. Table 10 is an example of manual battery calculation. The rest of the calculation can be found in page 2, Appendix B, and was done by Pyro-Comm Systems, Inc.

Table 11. Manual Battery Calculation of Main Fire Alarm Control Panel

Quantity	Device Type	Model	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	NFS2-640	CPU2—640 w/CPS—24	0.325	0.325	0.285	1
1	NFS2-640	KDM—R2	0.1	0.1	0.1	0.1
1	Voice	DVC&DVC—KD	0.5	0.5	0.5	0.5
32	Control Relay	FRM—1	0.00026	0.00832	0.0065	0.208
11	Duct Det	DNR w/ FSP—851	0.00036	0.00396	0.00686	0.07546
2	Heat Det	FST—851	0.0003	0.0006	0.0065	0.013
3	Monitor	DIMM	0.0006	0.0018	0.03	0.09
4	Monitor	FDM—1	0.00075	0.003	0.0064	0.0256
9	Monitor	FMM—1	0.00035	0.00315	0.005	0.045
4	Pull Station	FMM-101	0.00038	0.00152	0.00038	0.00152

19	Pull Station	NBG—12LX	0.00038	0.00722	0.00688	0.13072
46	Smoke Det	FSP—851	0.0003	0.0138	0.0068	0.3128
4	Pull Station	NBG12LOB	0	0	0	0
37	Speaker 25V	Speaker — 1/2 Watt Tap	0	0	0.02	0.74
1	Dialer	UDACT	0.04	0.04	0.1	0.1
7	Relay	PR—1	0	0	0.015	0.105
23	Remote LED	RA100Z	0	0	0.01	0.23
			Standby Load	1.008	Alarm Load	2.962

Standby Load	1.008Amps	Alarm Load:	2.962Amps
Standby Time	24 Hours	Alarm Time:	15minutes
Total Standby Load	24.19Amp-Hours	Total Alarm Load:	0.74Amp-Hours

Batteries provided:	(2) BAT-12380	Available Battery	30.4 A.H.
Battery Size:	38 A.H.	Load (ALM+STBY)	24.93 A.H.
De-Rated Size(80%)	30.4 A.H.	Spare Capacity	5.47 A.H.

All the secondary power supplies are over the minimum requirement of NFPA 72. Noticed that the first FACP has a second power supply that is greater than this requirement. All of the batteries match the requirement very well, and have a spare capacity between 1.11A.H. to 5.47A.H.

Inspection Testing and Maintenance

The reason for inspection and testing of the fire alarm system is to ensure the installation is in accordance with the approved design documents. Unless otherwise permitted by 14.3.2 NFPA 72, visual inspections shall be performed in accordance with the schedules in Table 14.3.1 NFPA 72 or more often if required by the authority having jurisdiction.

The frequency of maintenance shall depend on the type of equipment and the local conditions,also accordance with the manufacturer's instructions.After each test and alarm,all apparatus items that require resetting shall be reset as soon as possible.All ITM records shall be retained at least one year until the next test time.

Cal Poly Electrical Service Department is responsible for ITM of the fire alarm and communication system installed in the Recreation Center. Cal Poly Electrical Service Department maintains initiating devices, and notification appliances of the Recreation Center fire alarm system according to instructions of the manufacturer.

The smoke detection devices and alarm devices meet the requirements of the IBC and provide adequate coverage to notify occupants of a potential fire scenario. The Recreation Center also has a smoke control system to prevent smoke spread throughout the building, and provides additional time for occupants to evacuate from other areas of the building. The smoke control system is discussed in the next section.

Smoke control

Introduction:

The most common cause of death during a fire is from smoke not the heat of the fire. The smoke not only restricts the visibility, but, it also has irritants that cause asphyxia or other physical disabilities. A smoke control system can provide additional evacuation time for the occupants.

Smoke Control Features:

The Recreation Center is equipped with fusible link smoke dampers. The building also have the heating, ventilation and air conditioning (HVAC) system.

When the smoke/heat detectors, or the sprinkler activates, the fans in the ducts will shut down, and the fusible link smoke dampers will close to prevent smoke moving through the ducts. Also, the HVAC system will shutdown the air handling system.

The Recreation Center has one Roll-Up door on the first floor in the old gym area. The Roll-Up door will be closed to prevent the smoke spread through the building if there is a fire alarm or FACP power failure. The location of the Roll-Up door is shown on Figure 28.

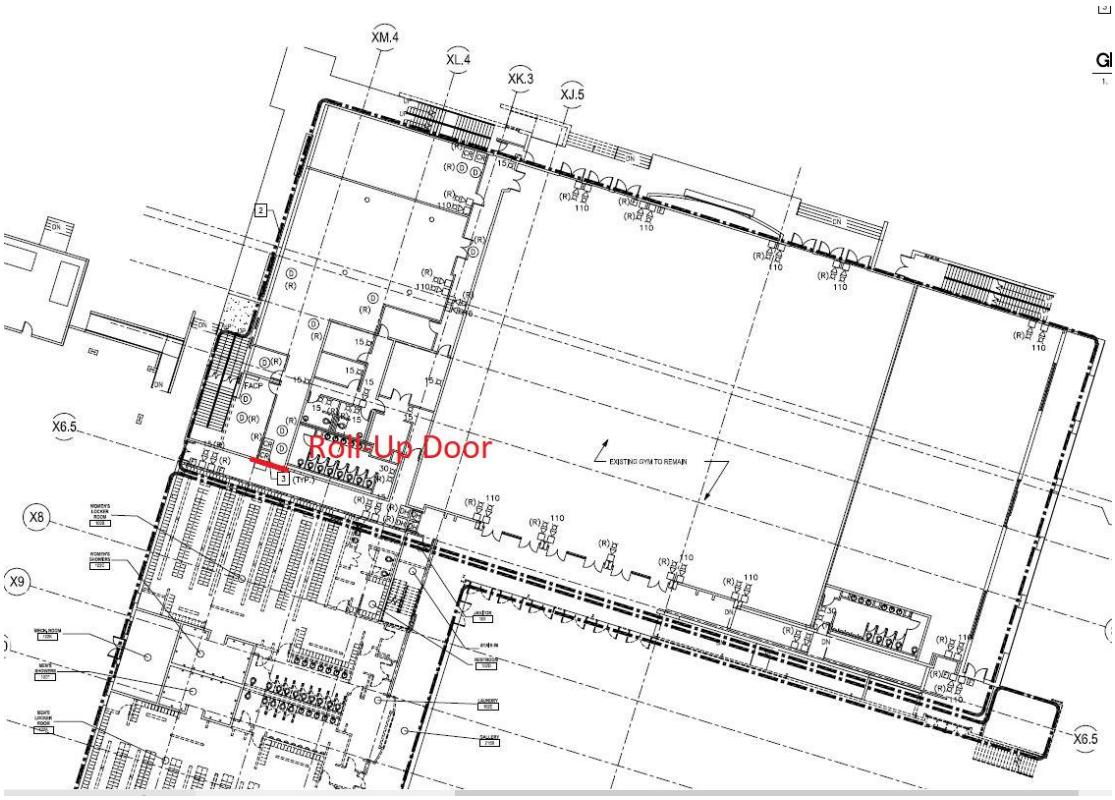


Figure 28. Location of Roll-Up Door

Also there are six vents on the roof of the old gym, each has a size of 4ft x 4ft, and has small fans with them. But those vents were built in 1990s, and the purpose of those vents is to provide ventilation to the gym.

The smoke control system installed in the Recreation Center will restrict the smoke movement inside of the building. Another important area of fire safety is providing early suppression on the fire. The objective of early fire suppression is to control the fire before the fire department arrives. The next section discusses the water-based fire suppression system that is installed in the Recreation Center.

Water-Based Fire Suppression System

Introduction:

The water-based sprinkler system is the most widely used system for active suppression of a fire by releasing the water on the fire area. Also, the sprinkler head can be used as a heat detector at the ceiling.

The Recreation Center is completely sprinklered with a wet-pipe sprinkler system. There are three kinds of sprinklers used in the Fire Suppression System. All of the building is protected with quick response sprinklers.

Figure 29 shows the information on the 3 different quick response sprinklers used in the building.

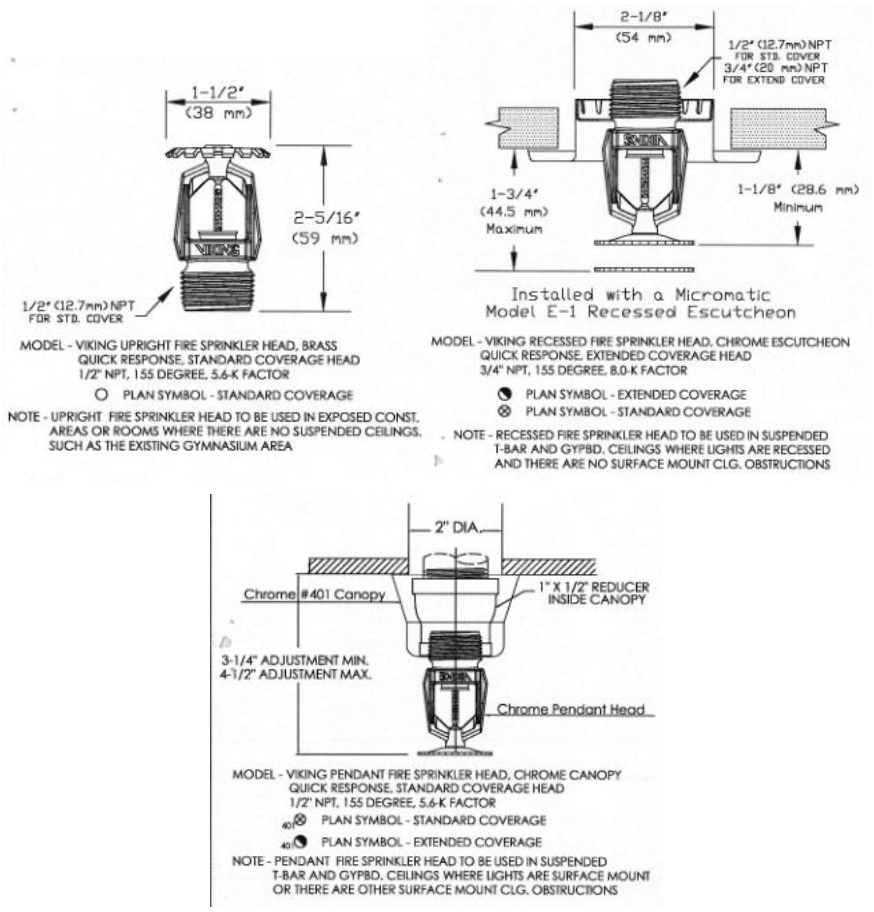


Figure 29. Three Different Types of Sprinklers Installed in the Recreation Center

The occupancy hazard classification for the sprinkler system installed in the

Recreation Center.

The Recreation Center has two different classifications: 1) Light Hazard, which includes administration offices and classrooms; 2) Ordinary Hazard, which includes storage rooms, electrical rooms, and mechanical rooms.

Figure 30 is extracted from Figure 11.2.3.1.1,NFPA13. The water demand design criteria, using the CMDA method approach, will be determined according to Figue 29 and Table 12.

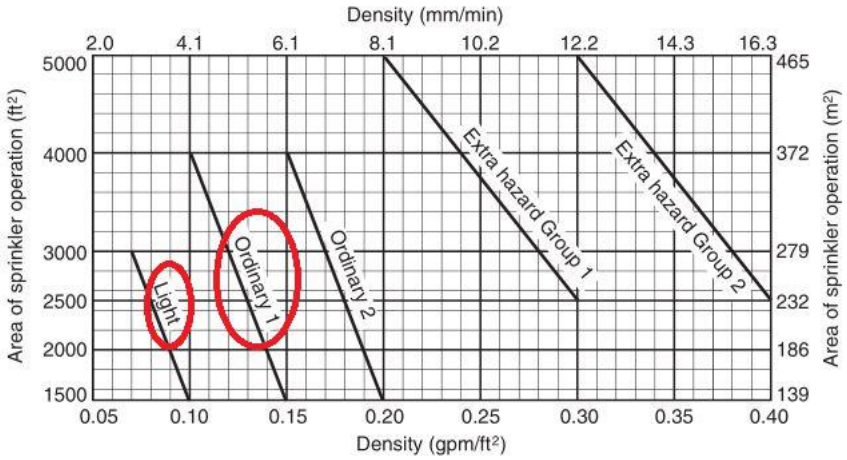


Figure 30. Different Hazards Density/Area Curves

Table 12. Hose Stream Allowance and Water Supply Duration Requirements

Occupancy	Inside Hose		Total Combined Inside and Outside Hose		Duration (minutes)
	gpm	L/min	gpm	L/min	
Light hazard	0, 50, or 100	0, 189, or 379	100	379	30
Ordinary hazard	0, 50, or 100	0, 189, or 379	250	946	60–90
Extra hazard	0, 50, or 100	0, 189, or 379	500	1893	90–120

Water supply

A flow test was preformed on 3/8/2010 using two hydrants and was used as the basis

for the water supply for the suppression system. One of the hydrants is adjacent to Campus Way; the other one is near the swimming pool. (See Appendix F)

Static pressure = 140psi
Residual pressure = 132psi
Flow = 1186gpm

Piping and Riser

The city provides a 12” loop piping at the connection of the project building. Water flows into the building sprinkler system through a 6” pipe at the riser on the 1st floor. (the new riser is shown as the black square on Part B of the floor at Appendix C).

Figure 31 shows the two risers location on the first floor, and more details are shown in Figure 32.

Figure 31. The Location of the Risers

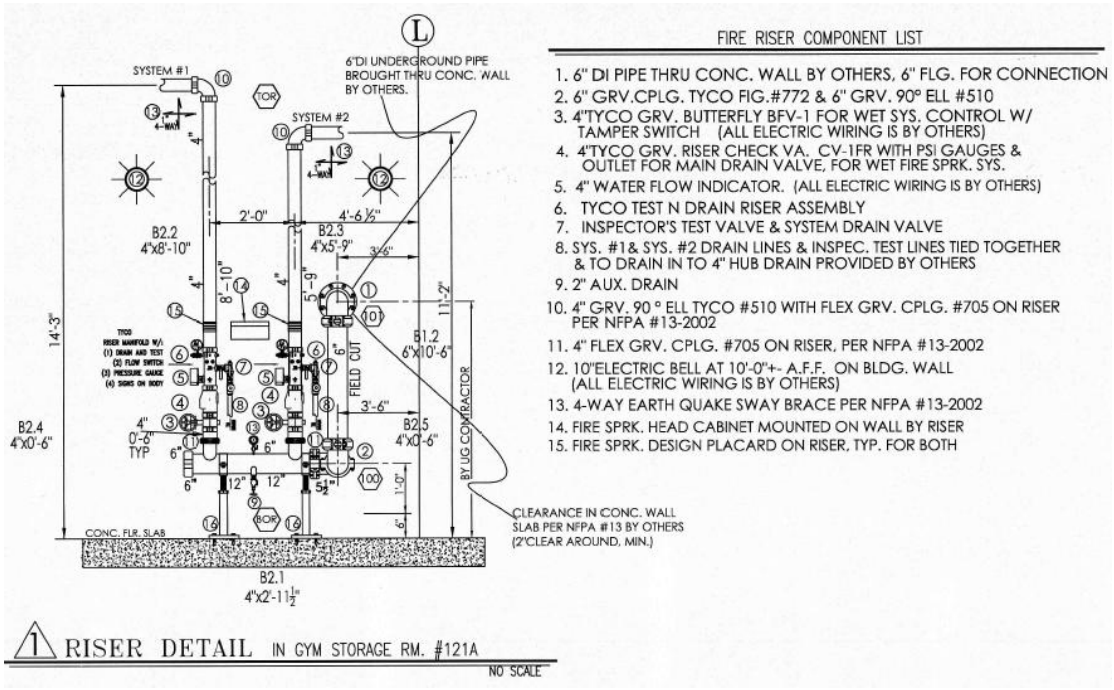


Figure 32. Riser Detail

Associated Sprinkler System Design Criteria

Example design criteria on 1st Floor.

The design area is based on the remote area of the sprinkler system (shown as the blue part in Appendix C). Other calculations are shown at Appendix C.
The location of the design example is shown as the blue area in Figure 33.

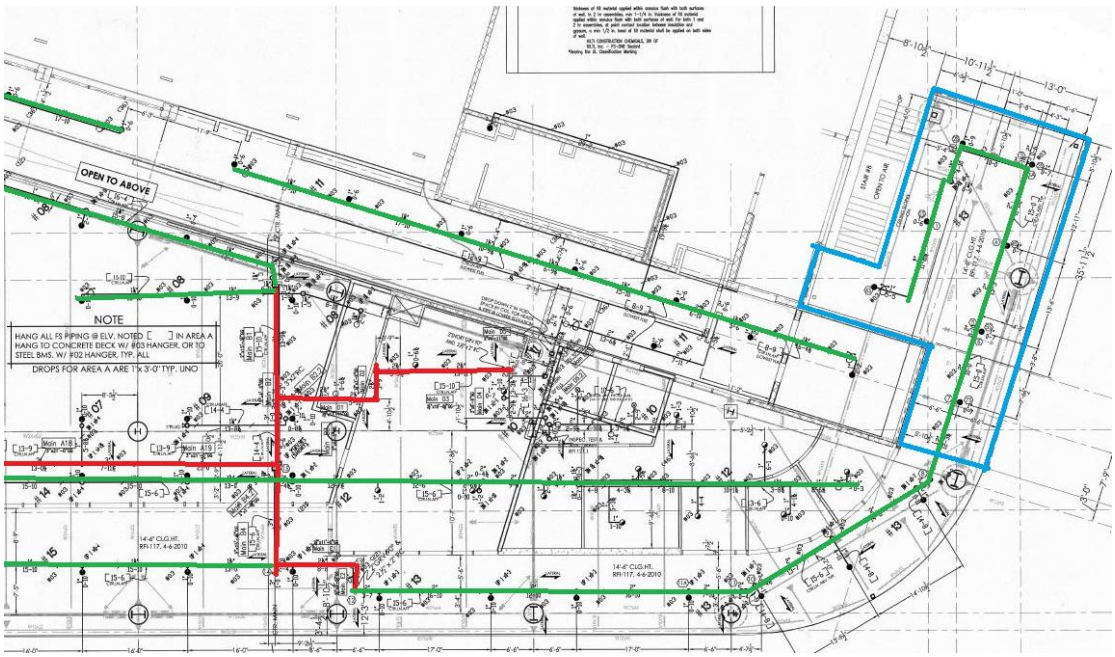


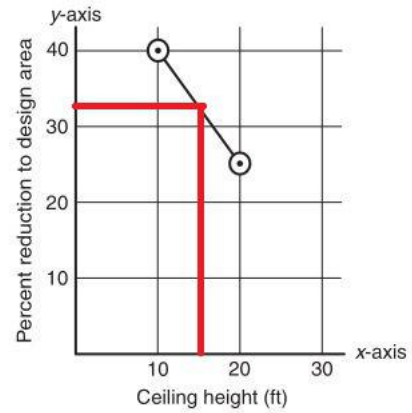
Figure 33. The Location of the Example Design Criteria

Part A

Occupancy Hazard Classification = Light Hazard

Sprinkler System Design Criteria Density = 0.10 GPM/ft^2
Area of Operation = 1013ft^2(with 32.5% area reduction utilizing quick response sprinklers with 15'ceilings)

The Figure 34 shows the result of reduction factor from NFPA 13.



Note: $y = \frac{-3x}{2} + 55$

For ceiling height ≥10 ft and ≤20 ft, $y = \frac{-3x}{2} + 55$
For ceiling height <10 ft, $y = 40$
For ceiling height >20, $y = 0$
For SI units, 1 ft = 0.31 m.

Figure 34. Design Area Reduction for Quick-Response Sprinklers.

7 sprinklers are used with a maximum area per sprinkler of 144.8 ft^2. The K factor of the sprinklers is 8.0

The hose stream allowance is 100 GPM for light hazard occupancies according to Table 11.2.3.1.2, NFPA 72.
The demand at the base of the riser for the sprinklers (including a 100GPM hose stream) is 269.89 GPM and 102.9 PSI

Hydraulic Calculations Example and Hydraulic Graph Paper

The manual hydraulic calculation was done for the example in Part-A on the 1st floor. The results are shown at Table 13 as follows.

Table 13. Manual Hydraulic Calculations

Project name:			FPE 523 example												Date:			
Step No.	Nozzle Ident and Location		Flow in gpm		Pipe size(in)	Pipe Fittings and Devices	Equivalent Pipe Length			Friction loss (psi/ft)		Pressure Summary		Normal Pressure		Notes	
1	sp	1	q		1.049		L	10.1	C=	120	Pt	3.3	Pt		k=	
						elb	F	2			Pe		Pv			q = k * (Pt)^1/2
			Q	14.5			T	12.1	pf	0.100	Pf	1.2	Pn		Pt=	
		2	q	17.0	1.049		L	7	C=		Pt	4.5	Pt		k=	
							F				Pe		Pv			
			Q	31.5			T	7	pf	0.302	Pf	2.1	Pn			
			q		1.38		L	4.8	C=		Pt	6.6	Pt		k=	
							F				Pe	0.1	Pv			
			Q	31.5			T	4.8	pf	0.302	Pf	1.5	Pn			
		3	q	22.9	1.38		L	10	C=		Pt	8.2	Pt		k=	
							F				Pe		Pv			
			Q	54.4			T	10	pf	0.220	Pf	2.2	Pn			
		4	q	25.8	2.067		L	11.8	C=		Pt	10.4	Pt		k=	
							F				Pe		Pv			
			Q	80.2			T	11.8	pf	0.060	Pf	0.7	Pn			
		5	q	26.7	2.067		L	13.2	C=		Pt	11.1	Pt		k=	
							F				Pe		Pv			
			Q	106.9			T	13.2	pf	0.106	Pf	1.4	Pn			
		6	q	28.3	2.067		L	10	C=		Pt	12.5	Pt			
							F				Pe		Pv			
			Q	135.2			T	10	pf	0.164	Pf	1.6	Pn			
	sp	7	q	34.7	2.067		L	183	C=		Pt	14.1	Pt			
	to	CM					F				Pe		Pv			
			Q	169.9			T	183	pf	0.250	Pf	45.8	Pn			
		CM1	q		3.068		L	94	C=		Pt	59.9	Pt			
	to	M1					F				Pe		Pv			
			Q	169.9			T	94	pf	0.037	Pf	3.5	Pn			
		M1	q	169.9	4.026		L	323	C=		Pt	63.5	Pt			
	to	RS					F				.	7.1	Pv			
			Q	169.9			T	323	pf	0.010	Pf	32.3	Pn			
			q				L		C=		Pt	102.9	Pt			

Figure 35 shows the supply and demand of the sprinkler system with the city water supply. There is no need for a fire pump because the water supply is much greater than the demand.

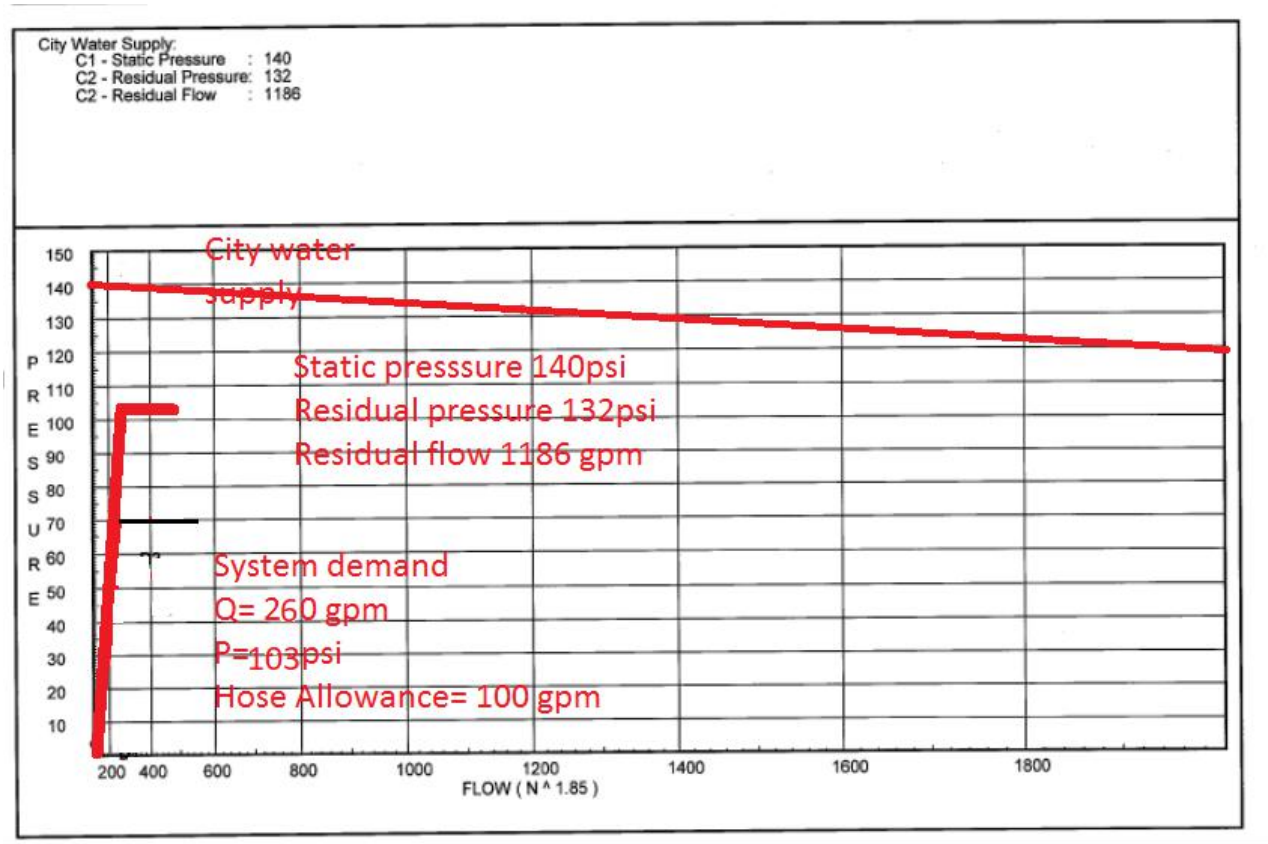


Figure 35. Water Supply Hydraulic Curve

Analysis of fire detector response(DETACT Model)

As described,the building is mainly used as a gym,along with some office area inside of the building. The equipment of the gym usually are made of metal and plastic. Some of the equipment have computers and screens. But in the office room, some computers do no shut down at anytime, a computer short circuit is the most likely reason to cause the fire.

Two different DETACT models for both the sprinkler system and the smoke detection system will be presented. Both model an office area.

Sprinkler Model

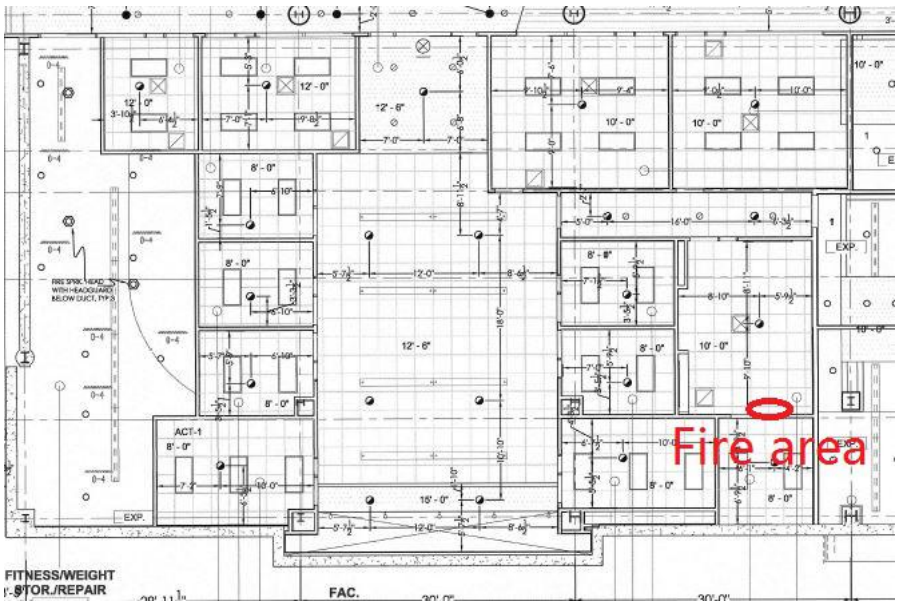


Figure 36. The Location of Fire Area of the DETACT Sprinkler Model

In this fire scenario, a fire starts in an office room (Figure 36), and grows as a slow t-squared fire with a fire growth coefficient of $\alpha = 0.012$ kW/s^2.

Table 14. Input Parameters of the DETACT Model

INPUT PARAMETERS			CALC. PARAMETERS	
Ceiling height (H)	3	m	R/H	1.077
Radial distance (R)	3.2	m	dT(cj)/dT(pl)	0.285
Ambient temperature (To)	20	C	u(cj)/u(pl)	0.188
Actuation temperature (Td)	68	C	Rep. t2 coeff.	k
Response time index (RTI)	50	(m-s)1/2	Slow	0.003
Fire growth power (n)	2	-	Medium	0.012
Fire growth coefficient (k)	0.012	kW/s^n	Fast	0.047
Time step (dt)	2	s	Ultrafast	0.400

Table 14 shows the input parameters used in the DETACT model. The ceiling height input parameter represents the height above the fire. For this fire scenario, the ceilings are at 10 feet to the computers. The radial distance represents the horizontal distance from the fire to the sprinkler. Assume the sprinkler's radial distance is 3.2 m. Assume an ambient temperature of 20°C and a sprinkler actuation temperature of 68°C. The sprinkler RTI was not provided, therefore, assume a RTI of 50 (m-s)$^{1/2}$. The time step is 2 seconds.

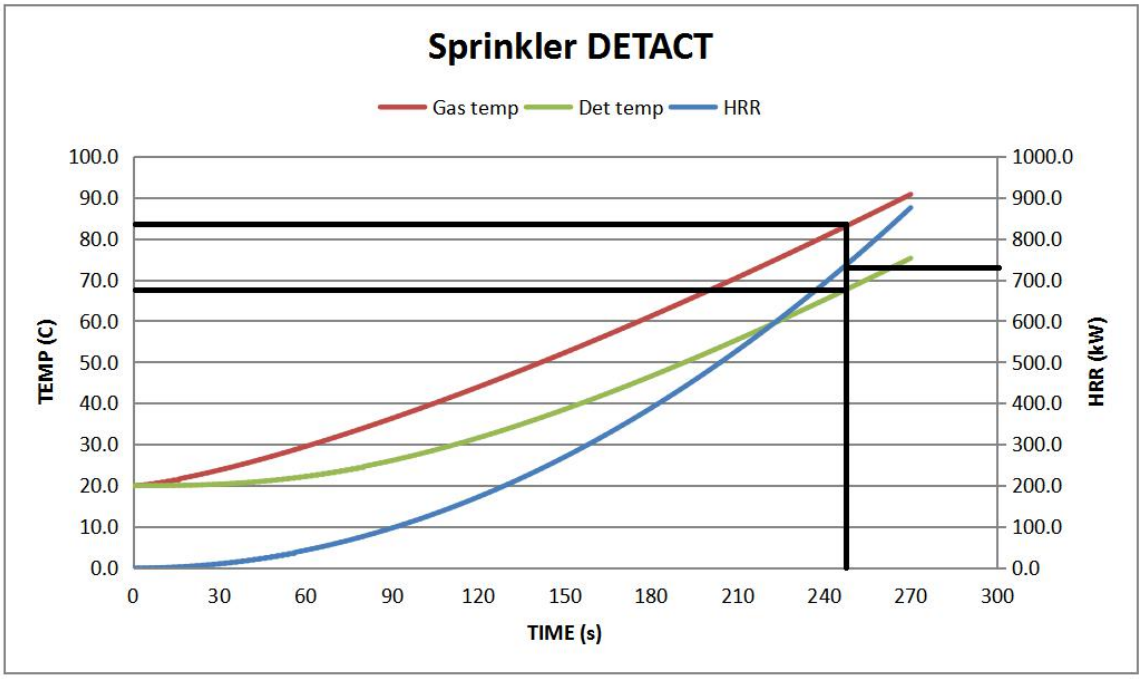


Figure 37. DETACT Curves for Gas Temperature, Detector Temperature, and Heat Release Rate of Fire

Table 15. Activation Time of First Sprinkler

Calculation time (s)	HRR	Gas temp	Gas velocity	Det temp	dT/dt
246	726.2	82.5	1.17	67.06	0.3332
248	738.0	83.1	1.18	67.73	0.3344
250	750.0	83.8	1.18	68.40	0.3355
252	762.0	84.5	1.19	69.07	0.3366
254	774.2	85.2	1.20	69.74	0.3377

Figure 37 shows the DETACT curves for gas temperature, detector temperature and the heat release rate of the fire. The sprinklers will operate in 250 seconds (4.2 minutes) with an approximate HRR of 750 kW, according to Table 15. It would be very late to be aware of the fire after 4 minutes. My recommendation is to have other fire detection device inside of the room.

Smoke Detector Model

For smoke detector, there is an in duct smoke detector in the room of the fire scenario.

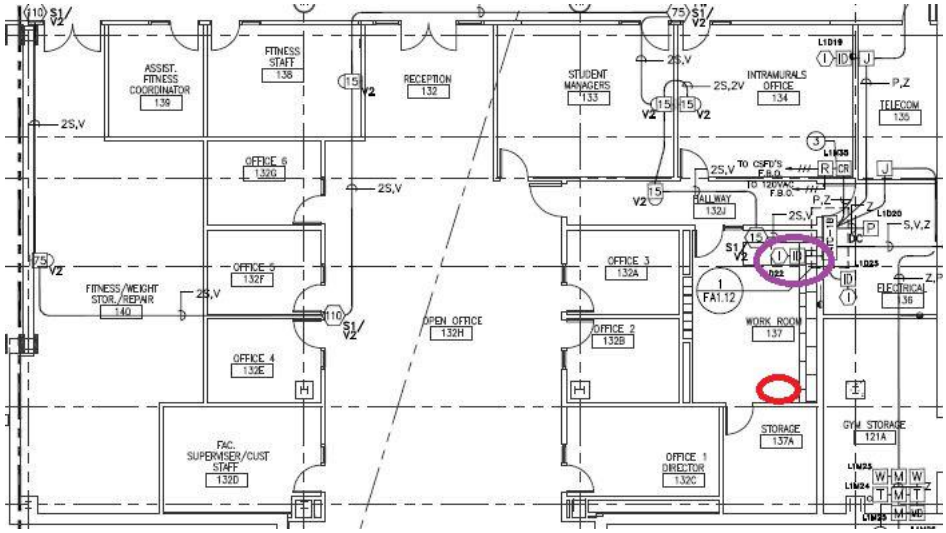


Figure 38. The Location of Fire Area(red)and Smoke Detector(purple) of the DETACT Model

Figure 38 shows the location of the second fire. The smoke detector is not located near the location of the sprinkler; therefore, the radial distance for the duct smoke detector is 3.4m.

Assuming an actuation temperature 27°C, according to Table B.4.5.3, NFPA 72, light scattering detector with PVC fuel should respond at temperature rise of 7°C. The Table 16 shows the detail of input parameters.

Table 16. Input Parameters of the DETACT Model

INPUT PARAMETERS			CALC. PARAMETERS	
Ceiling height (H)	3	m	R/H	1.133
Radial distance (R)	3.4	m	dT(cj)/dT(pl)	0.276
Ambient temperature (To)	20	C	u(cj)/u(pl)	0.180
Actuation temperature (Td)	27	C	Rep. t2 coeff.	k
Response time index (RTI)	2	(m-s)1/2	Slow	0.003
Fire growth power (n)	2	-	Medium	0.012
Fire growth coefficient (k)	0.012	kW/s^n	Fast	0.047
Time step (dt)	2	s	Ultrafast	0.400

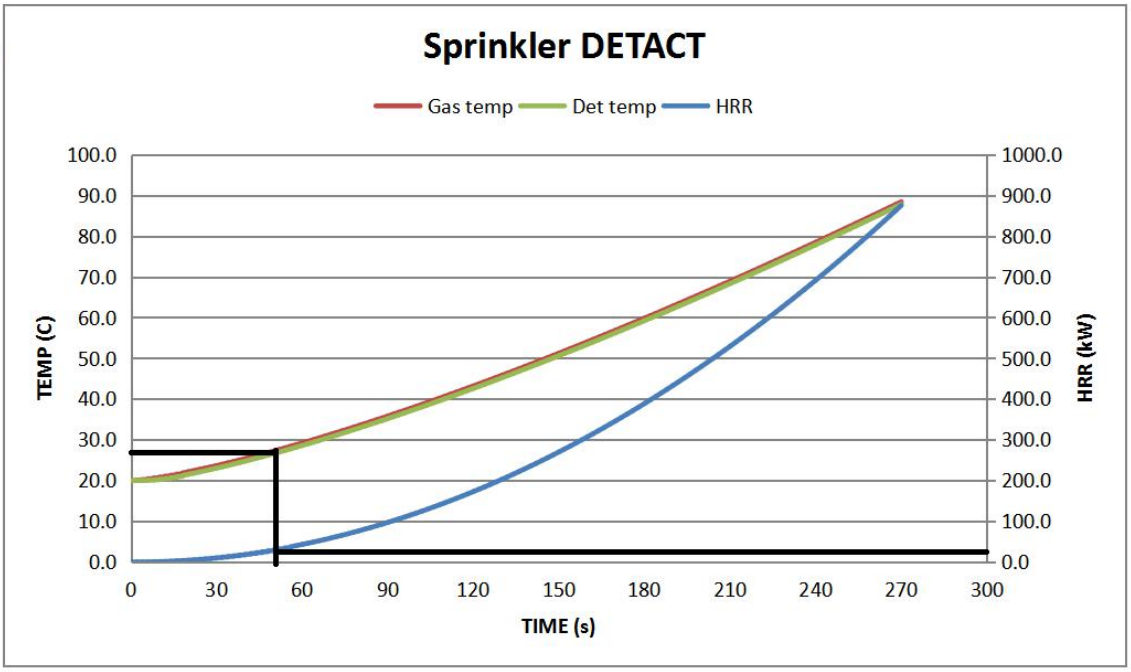


Figure 39. DETACT Curves for Gas Temperature, Detector Temperature, and Heat Release Rate of Fire

Table 17. Activation Time of First Sprinkler

Calculation time (s)	HRR	Gas temp	Gas velocity	Det temp	dT/dt
48	27.6	26.8	0.38	26.21	0.1912
50	30.0	27.2	0.39	26.59	0.1938
52	32.4	27.6	0.40	26.98	0.1963
54	35.0	28.0	0.41	27.37	0.1987
56	37.6	28.4	0.42	27.77	0.2011
58	40.4	28.8	0.43	28.17	0.2034

Figure 39 shows the DETACT curves for gas temperature, detector temperature and the heat release rate of the fire. The smoke detector will operate in 52 seconds with an approximate HRR of 32.4 kW, according to Table 17. The smoke detectors are more sensitive resulting in a faster response time compared to fire sprinklers.

INSPECTION, TESTING, AND MAINTENANCE

The inspection, testing, and maintenance requirements for sprinkler system are summarized in Table 18. Additional Requirements and Frequency data should follow NFPA 25 Table 5.1.1.2, Table 6.1.1.2 and Table 13.1.1.2 as attached.

Table 18. Inspection,Testing,and Maintenance Requirement

Sprinklers	1. Sprinklers installed for 50 years must be tested, and tests must be repeated every 10 years thereafter. 2. Sprinklers manufactured prior to 1920 must be replaced. 3. Should comprise 1% of the total number of sprinklers installed in the facility 4. Never be less than four sprinklers 5. } Replacement of any sprinkler that shows signs of: contamination ;Corrosion;paint (other than the paint applied by the manufacturer)
Check valves	1. Needed to prevent backflow into the public systems 2. property owner is usually responsible 3. Tightness should be determined periodically by proper tests 4. arranged and located in accordance with the appropriate NFPA standards 5. should be readily accessible and unobstructed 6. Must be able to be operated promptly and examine}7. Pits for gate valves and check valves should be dry and clean}8. Manhole covers should be kept clear of snow and ice. 9. Each control valve should be numbered, identified, cataloged by location, portion of the system, etc. 10. Locations should be posted at a central point known to plant and public fire officials.
Pressure Gauges	air pressure on each dry-pipe system should be checked at least once a week. Water and air pressure gauges should be tested for accuracy whenever the system valve is repaired or reset. Not less frequently of every 5 years.
Pipe	Piping should be thoroughly drained before freezing weather and kept clear of water during the winter. Make sure that all low-point drains of the system are kept free of water and that the automatic drip or drain is clear and free to operate
Quick Opening Devices	1. tested either with or without operating the dry-pipe valve 2. Refer to manufacturer' s instructions for testing and resetting the valve
Waterflow Alarm Devic	1. Vane-type water waterflow alarm devices should be tested semi-annually 2. pressure switches tested quarterly.
Fire Department Connections	1. make sure caps are in place, threads are in good condition 2. ball drip or drain is in order 3. check valve is not leaking. 4. Hydrostatic test should be conducted periodically on older FDC piping to ensure that it will withstand the required pressure.
Fire Pumps	Fire pumps should be inspected and tested on a weekly basis. Test is accomplished without flowing water.
Water Storage Tanks	1. should be inspected monthly to verify the correct water level and condition of the water. 2. When installed in areas subject to freezing, tanks should be equipped with a heating system to maintain a minimum water temperature of 42° F 3. Steel tanks should be inspected for corrosion, including 4. painting systems and cathodic protection where provided. 5. Interior inspections should be done every 5 years by either a certified diver or by draining the tank completely and following confined space entry procedures.

The water-based fire suppression system installed in the Recreation Center meet the prescriptive analysis requirement of IBC. The sprinklers inside of the building will provide early fire suppression before the fire department arrives. In order to ensure the occupants can safely exit from the building, the egress analysis is discussed in next section.

Egress Analysis

Introduction:

Egress is the path that occupants will take to safely get out of the building during a emergency situation. An egress analysis is conducted to determine whether the building provides enough exit capacity for occupants to evacuate from the building.

Occupancy classifications

The Recreation Center building is a multiple use building and has different types of occupants.Most of the gym area is categorized as Type A-3 or Type A-4(fixed seating) occupancy. Other area like the office space is categorized as Type B occupancy, and the storage rooms/mechanical rooms are categorized as Type S occupancy. Table 19 shows the occupants and occupancy loads for the Recreation Center.

Table 19. Occupancy Type and Load Factor

Space classification	Occupancy	Occupancy Load(ft^2/person)
Gymnasium with equipment	A-3	50
Offices	B	100
Storage rooms,mechanical rooms	S	300
Assembly fixed seating	A-4	1 per 18 inch
Standing non concentrated space	A-3	15

The different occupancy classifications as shown in Figure 40 are color-coded. The color-coding of space designations areas are shown in Figures 41 and 42.

Space designations	Example color codes
Exercise	
Business	
Storage	
Corridors	
Changing rooms,Restrooms	

Figure 40. Color-code for Different Occupancy

Figure 41. Color-Coding Of Space Designations: 1st floor

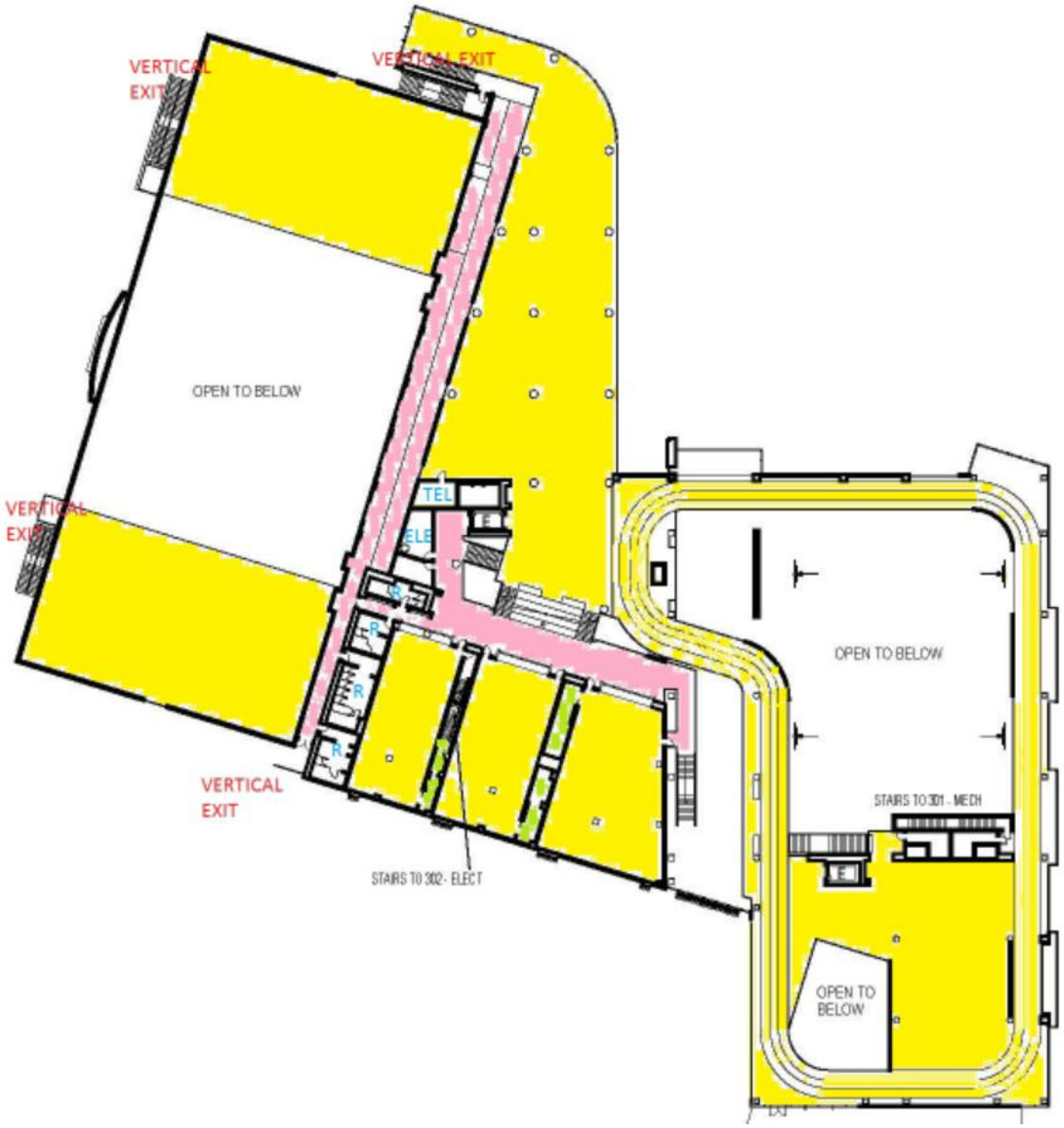


Figure 42. Color-Coding Of Space Designations: 2nd floor

Occupant load

Using Table 7.3.1.2 in the LSC Handbook, the occupant load can be calculated based on the occupancy classification of each room. Table 20 shows the summary of the occupant load of the Recreation Center.More details can be found in Appendix E.

Table 20. Occupant Load Summary

Floor	Occupant load
1st	1322
2nd	829(2373)
Total	2151(3695)

The reason for the different occupant loads on the 2nd floor is because of different uses of the two gym areas. The A-3 occupancy without fixed seating, the total 2nd floor occupant load is 829; but the 2 basketball rooms can be used as a fixed seating room, type A-4 occupancy. In this situation, the total occupant load of 2nd floor will exceed 2373.

Exit Capacity

Using Table 7.3.3.1 in the LSC Handbook,exit capacities can be calculated. Table 21 shows the summary of Exit Capacity of the Recreation Center.

Table 21. Exit Capacity Summary

Floor	Exit Capacity
1st	N/A
2nd	1462

The exit capacity is based on the stairway exit door clear width or the stairway width, and the first floor has over 30 exit doors, so the exit capacity of the first floor is not applicable. The second floor has 2 stairways with door width of 34” and 68” , 2 emergency exit stairway with door width of 92”, and a emergency exit stairway with door width of 77”.

Stairway capacity (width less than 44”) = width / (0.3 in/person)
Stairway capacity (width more than 44”) =146 + (width-44”) / (0.2 in/person)

The exit capacity of it is 113*1+266*1+386*2+311*1=1462

The stairway capacity calculation is based on LSC Table 7.3.3.1 as shown at Table 22.

Table 22. Capacity factors and calculation.

Table 7.3.3.1 Capacity Factors

Area	Stairways (width/person)		Level Components and Ramps (width/person)	
	in.	mm	in.	mm
Board and care	0.4	10	0.2	5
Health care, sprinklered	0.3	7.6	0.2	5
Health care, nonsprinklered	0.6	15	0.5	13
High hazard contents	0.7	18	0.4	10
All others	0.3	7.6	0.2	5

7.3.3.2* For stairways wider than 44 in. (1120 mm) and subject to the 0.3 in. (7.6 mm) width per person capacity factor, the capacity shall be permitted to be increased using the following equation:

$$C = 146.7 + \left(\frac{Wn - 44}{0.218} \right) \qquad [7.3.3.2]$$

where:

C = capacity, in persons, rounded to the nearest integer

Wn = nominal width of the stair as permitted by 7.3.2.2 (in.)

Remoteness

Since the Rec Center is protected throughout by approved automatic sprinkler system, the remoteness requirement for the building must satisfy 7.5.1.3.3 of the LSC Handbook which states that the exits should not be less than one-third the length of the maximum overall diagonal dimension of the building or area to be served.

Figure 43 shows the example remoteness calculation in the MAC area on the 1st floor.

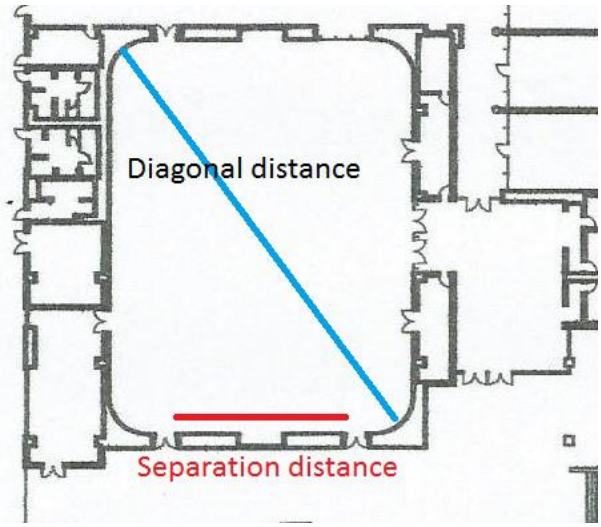


Figure 43. Remoteness Assessment at MAC of 1st floor.

The diagonal distance is about 200 ft. One third of the diagonal distance is about 67 ft. Therefore,the separation distance is about 70 ft. The separation distance is greater than 1/3 the diagonal distance.

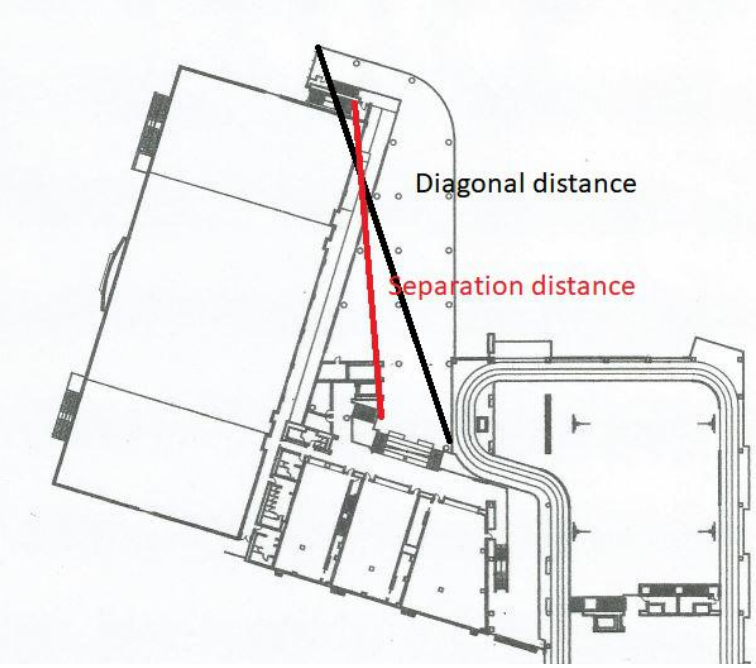


Figure 44. Remoteness Assessment on 2nd floor.

Figure 44 shows the remoteness on the 2nd floor. The separation distance is clearly greater than 1/3 the diagonal distance.

Number of exits

Table 23. Number of Exits Requirement

Occupant load served	Number of exits required
< 50 (typical but varies)	1
< 500	2
501-1000	3
> 1000	4

Table 23 shows the summary of the number of exits requirement. In the Recreation Center,all rooms under 50 occupant load have at least 1 door and the other rooms which are under 500 occupant load have 2 doors or 4 doors. The fixed seating area on the 1st floor of old gym which has more than 1000 occupants, has 8 exits. The exit capacity of all rooms is adequate.

Common Path, Dead-End and Travel distance

The required maximum travel distance from an exit can be found in Table A.7.6, LSC. The requirement is 250 ft for assembly spaces and 300 ft for business occupancy.

Table 24. Common Path, Dead-End and Travel Distance Limits.

	Common Path Limit				Dead-End Limit				Travel Distance Limit			
	Unsprinklered		Sprinklered		Unsprinklered		Sprinklered		Unsprinklered		Sprinklered	
Type of Occupancy	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
Assembly												
New	20/75	6.1/23[a]	20/75	6.1/23[a]	20	6.1[b]	20	6.1[b]	200	61[c]	250	76[c]
Existing	20/75	6.1/23[a]	20/75	6.1/23[a]	20	6.1[b]	20	6.1[b]	200	61[c]	250	76[c]
Business												
New	75	23[l]	100	30[l]	20	6.1	50	15	200	61	300	91
Existing	75	23[l]	100	30[l]	50	15	50	15	200	61	300	91

Figure 45 shows the location of the longest travel distance of the entire building. It is in the south part of the 1st floor.

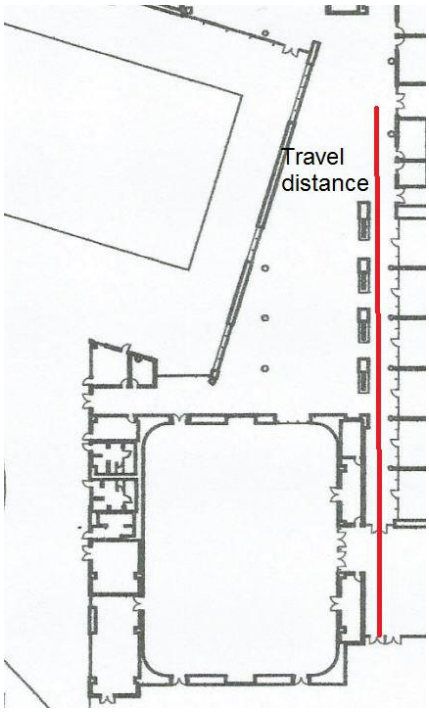


Figure 45. Longest Travel Distance.

The longest travel distance is about 220 ft, less than 250 ft requirement of the LSC; therefore, the travel distance in the entire building meet the requirements of LSC code.

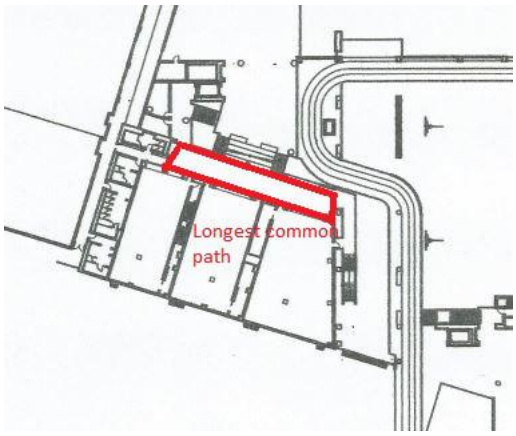


Figure 46. The Longest Common Path on 2nd floor

Figure 46 shows the longest common path is about 60 ft; therefore, less than 75 ft maximum allowed by the LSC,see Table 24. The common paths of travel in the Recreation Center meet the LSC requirement.

The only dead end in the Recreation Center is shown in Figure 47. The distance is clearly less than 50 ft of business occupancy that is allowed by the LSC, see Table 24. The Recreation Center meets the requirement for the dead end limit.

Figure 47. Dead End

The egress system meets the requirement if the second floor of the old gym is used as A-3 occupancy. If these rooms are used as A-4 fixed seating assembly occupancy, the exit capacity does not meet the requirement of LSC.

The egress system provides occupants enough time to evacuate the building, and a appropriate fire safety management plan will ensure an orderly evacuation. The fire safety management plan is discussed in next section.

Fire Safety Management Plan

Introduction:

The fire safety management plan is based on the current evacuation procedures of Cal Poly. The occupant classification of the Recreation Center is Assembly for the most part, with a few Business and storage occupancies. A fire evacuation drill shall be quarterly for the employees. One or more fire personnel shall be provided during the open hours.

Purpose

This procedure has been prepared to ensure the orderly and complete evacuation of campus buildings in the event of an emergency and/or the activation of alarm system. The primary objectives of this evacuation plan are to ensure:

1. everyone leaves the building safely;
2. a procedure is in place to safely evacuate individuals who cannot negotiate stairs;
3. building occupants are accounted for after an emergency evacuation, and
4. personnel (Building Coordinators) are selected from among building occupants, with functions to ensure plan objectives are met.

Policy

The following are emergencies for which a total or partial evacuation of a building may become necessary:

a. Fire
b. Explosion
c. Bomb threats
d. Release of hazardous chemical substance, in quantities or toxicity, which threatens human life
e. Building air contamination
f. Weather related emergencies (flood, severe storm, severe wind)
g. Earthquake. An earthquake alone is not necessarily a reason to evacuate. Evacuation is indicated if the earthquake causes apparent structural damage or creates a secondary hazard such as flooding, hazardous materials release, exposed electrical conductors, etc.

The Plan will be updated and exercised by conducting evacuation drills of selected

administrative and academic buildings on an annual basis. Evacuation drills of all residence buildings will be conducted twice a year; once in fall quarter and once in spring quarter.

Evacuation Training and drill.

Employees must receive **initial training** within 1 month of commencing work.
The initial training should contain at least:
• The location of emergency exits
• The paths of travel to exits
• The location of firefighting equipment
• The method of raising the alarm if the smoke alarms do not activate
• The procedure to guide other occupants during the fire.

The **additional training** shall include
•Fire prevent training:Proper procedures for preventing fires.
•Evacuation training:Assist people to evacuate during the fire
•Fire safety training:Proper using the fire-fighting equipment.

Drills shall be held at unexpected times and under varying conditions, records of the drills should include the following :
•Identity of the person conducting the drill
•Date and time
•Notification method used
•Employees on duty and participating
•Numbers of occupants evacuated
•Special conditions simulated.
•Problems encountered
•Weather condition
•Time required to accomplish complete evacuation

Evacuation Procedures

At the sound of the Emergency Alarm, it is the responsibility of all building occupants to evacuate immediately and proceed to the predetermined assembly points, away from the building.
Building occupants are also responsible for ensuring that their visitors follow the evacuation procedures described herein, and leave the building along with all other occupants.
Faculty members are responsible for dismissing their classes and directing students to leave the building by the nearest building exit upon hearing the building alarm or

upon being notified of an emergency.
Designated essential personnel needed to continue or shut down critical operations, while an evacuation is underway, are responsible for recognizing and determining when to abandon the operation and evacuate themselves safely.
5. Contract workers will be made familiar with the procedures outlined herein, and are expected to leave the building when the alarm sounds.

Fire and Evacuation Plan

If smoke alarms sound or other evidence of fire occurring:

1.Alert others immediately
2.If safe,close the windows and the doors of fire place
3.Contact the fire service
4.Assist people to evacuate to outside without endangering yourself.
5.Fight the fire if safe and are trained.
6.Await the arrival of the fire service.

Figures 48 and 49 show the evacuation maps for the Recreation Center.

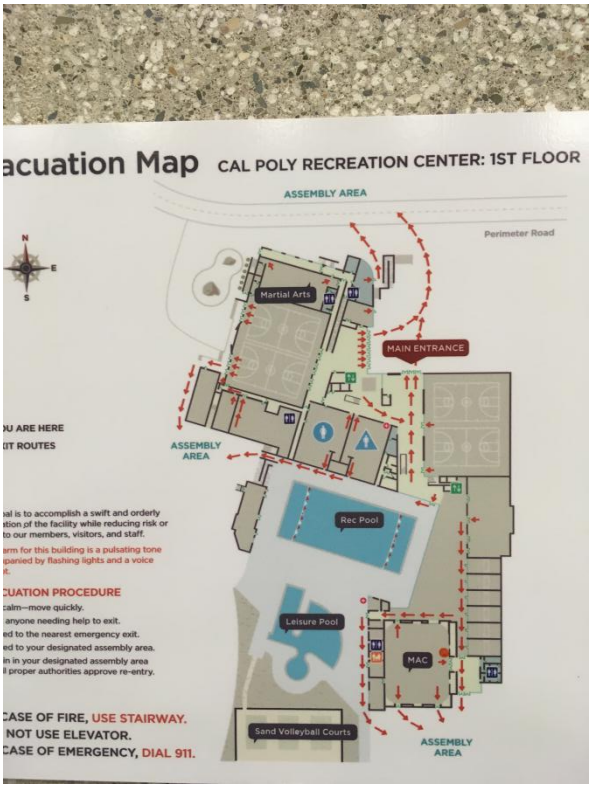


Figure 48. Evacuation Map of 1st Floor.

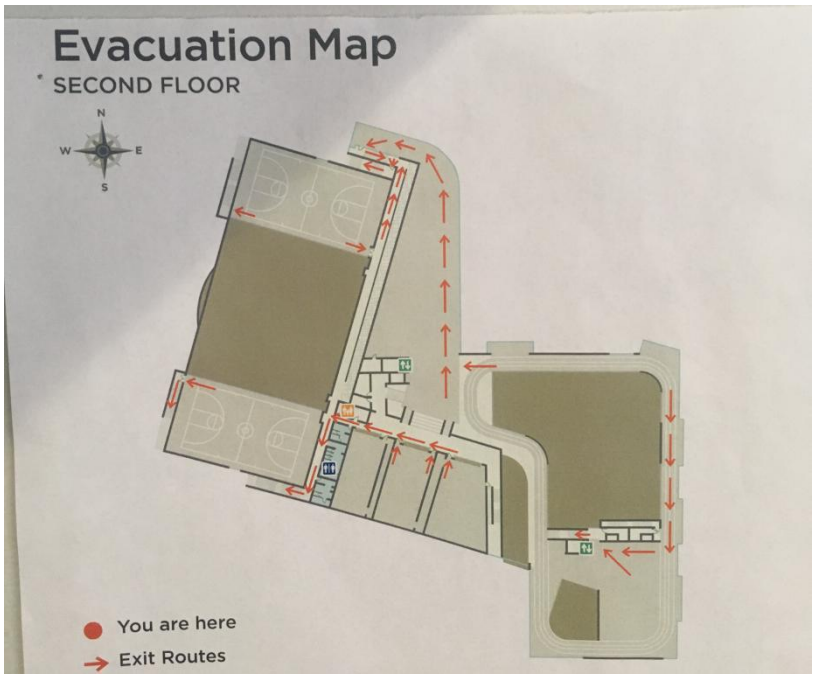


Figure 49. Evacuation Map of 2nd Floor.

Performance Based Analysis

Introduction

According to Chapter 5 of the LSC, the objective of performance-based design is to evacuate all the occupants in Recreation Center safely before it becomes untenable during the fire emergency. Therefore, the Available Safe Egress Time (ASET) should be greater than the Required Safe Egress Time(RSET).

The SFPE Handbook provides a guide for conducting a performance based analysis.

Figure 50 shows the tenability acceptance criteria. The escape time is the required safe egress time(RSET).

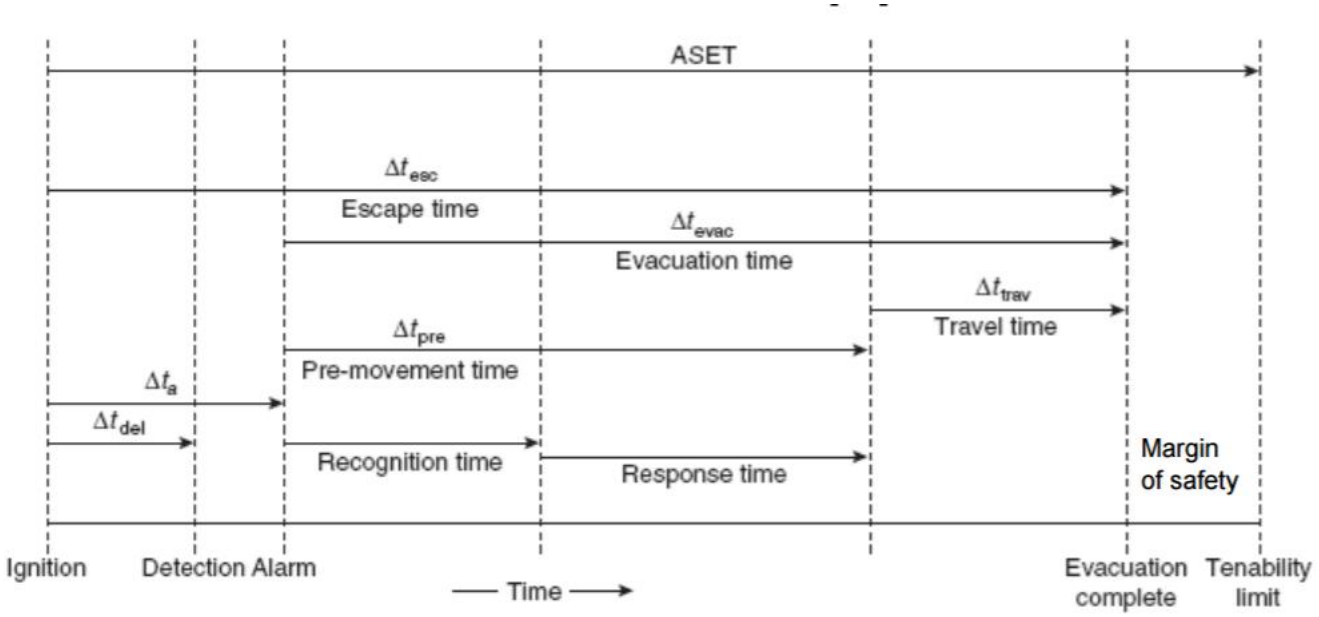


Figure 50. Tenability Acceptance Criteria

Tenability Criteria

Visibility

Visibility is the first factor that may prevent the occupants escape from building. A visibility of 13 m, 6 ft above the walking surface is required for safe egress for a person

not familiar with the surrounding, 4 m of visibility is required for safe egress for a person familiar with the surrounding,according to Table 25 of the SFPE Handbook.

Table 25. Suggested Visibility Limit with Familiarity

Table 61.3 Allowable smoke densities and visibility that permits safe escape

Degree of familiarity with inside of building	Smoke density (extinction coefficient)	Visibility
Unfamiliar	0.15 1/m	13 m
Familiar	0.5 1/m	4 m

According to the SFPE Handbook, Table 26 shows that 10m of visibility is suggested for large enclosures. The Recreation Center is mostly used as a gym building. The occupants of Recreation Center are normally familiar with the building. However, people unfamiliar with the building are there to attend concert events or graduation events in the old gym area where the construction is very simple, so 10m is used as the limit of visibility.

Table 26. Suggested Visibility Limits with Enclosure Size

Suggested tenability limits for buildings with:	
—Small enclosures and travel distances:	OD/m 0.2 (visibility 5 m)
—Large enclosures and travel distances:	OD/m 0.08 (visibility 10 m)

Carbon Monoxide

Carbon Monoxide is the main asphyxiant gas that prevent the person to absorb oxygen.According to SFPE Handbook Table 63.9, for light human activity for a 70Kg human, a value of 30,000-35,000 ppm.*min will cause incapacitation by CO.The tenability analysis for this building will assume a total evacuation time of 30 minutes,so the Instantaneous Concentration of CO should not exceed 1000-1167ppm.

Heat Exposure

According to the SFPE Handbook, for a total evacuation time of 30 minutes,the tolerance temperature should not exceed 60℃ for safe evacuation of the building. It is shown at Figure 51.

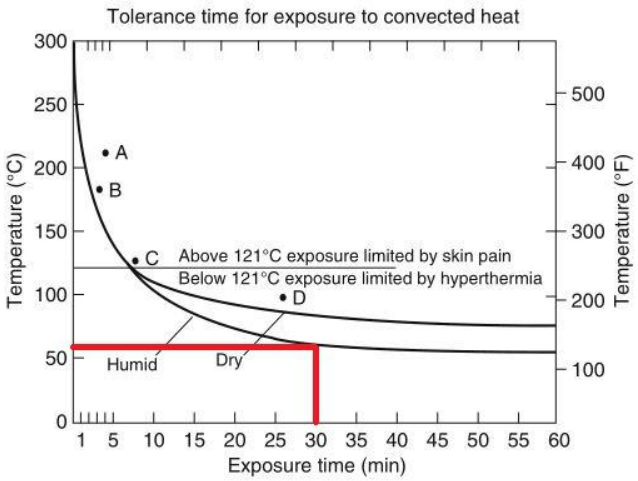


Figure 51. Tolerance Time for Exposure to Convected Heat.

Main Design Fire Scenario

This performance-based analysis will only look into one fire scenario with FDS simulation for academic purposes. But other possible fire scenarios for the building will be discussed as well. The chosen fire scenario is located in the old portion of the gym which includes bleacher seating. For this fire scenario, it is assumed the bleachers are fully extended, as shown in Figure 52, and gym mats or other materials are placed to the sides or under the bleachers. For this fire scenario, it is assumed 2 gym mattresses are located between the wall and the extended bleachers on the 2nd floor, and a fire starts with the 2 gym mattresses. The Pyrosim layout of the gym is shown in Figure 53.

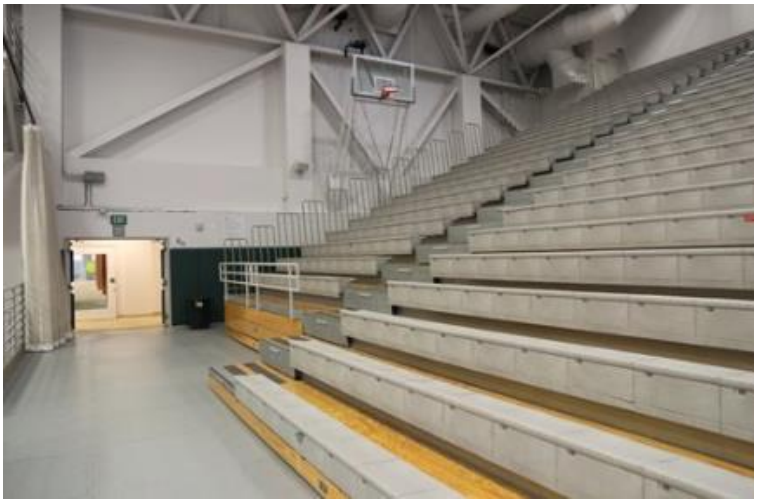


Figure 52. Fully Extended Bleachers

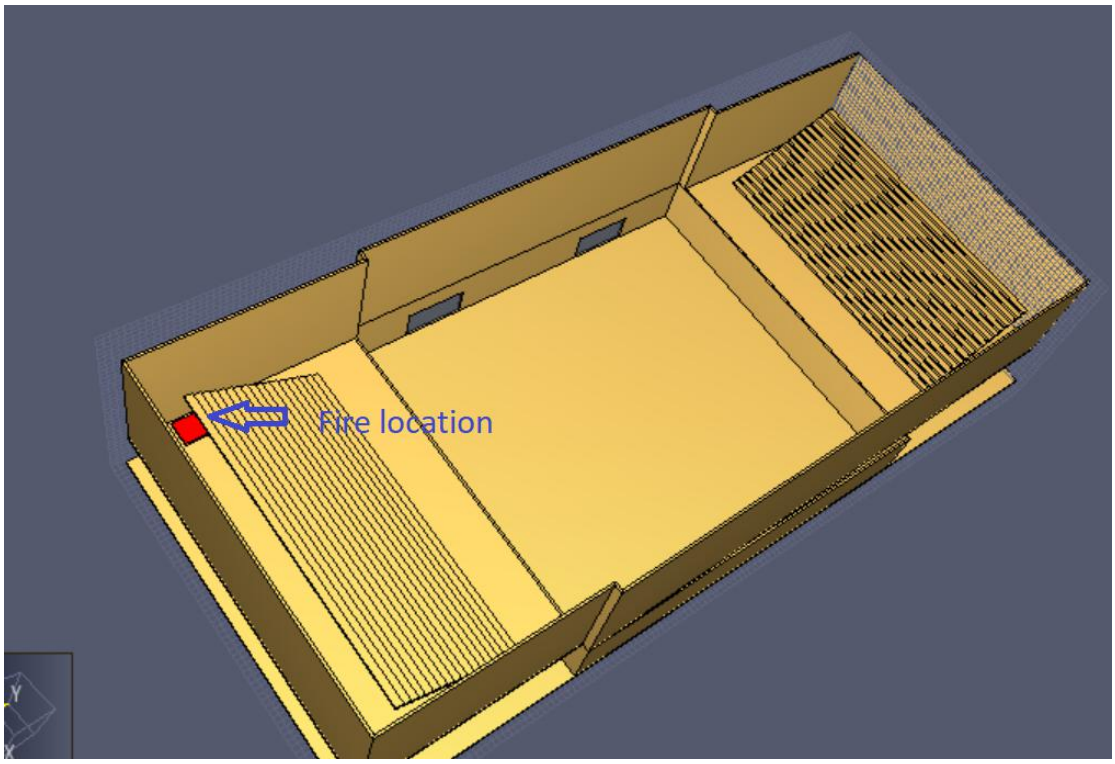


Figure 53. Pyrosim Layout of the Gym

Fuel Characteristics

HYEONG-JIN KIM and DAVID G. LILLEY did research on Heat Release Rates of Burning Items in Fires and published on American Institute of Aeronautics & Astronautics in 2000. This research provided the HRR of furniture. This simulation is using the data of a mattress burning to determine the fire growth and HRR.

The gym mat are made of Polyurethane Foam, and the mattresses used in the research are also made of Polyurethane Foam. Both the mattresses have the similar heat release rate. Figure 54 shows the Heat release rate of one mattress.

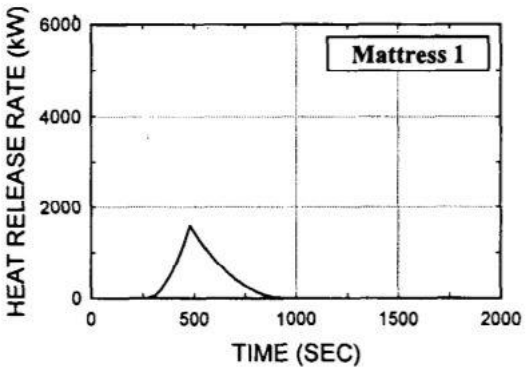


Figure 54. Heat release rate of mattress

Using Software Engauge Digitizer, the heat release rate data for the mattress is determined using Table 27.

Table 27. Heat release rate of the mattress.

time(s)	HRR(kW)
137.25	58.3
287.58	58.3
346.41	233
392.16	524.3
437.91	990.3
470.59	1427.2
483.66	1601.9
522.88	1281.6
575.16	990.3
647.06	640.8
718.95	407.8
784.31	203.9
843.14	116.5
934.64	3.55E-15

The fire is designed as a ramp fire. As two mattresses are ignited in this fire scenario, the peak heat release rate is assumed to be twice of the original data. The Polyurethane foams have different formulas, GM23 is likely to have the average formulas, heat of combustion and soot yield of the fuel, see Tables 29 and 30. GM23 is chosen to be the fuel of the simulation.

Table 29. Polyurethane foam Heat of combustion

Table A.38 (continued)

Fuel[d]	Formula[b]	ΔH_T (kJ/g)	ΔH_O^*(kJ/g)	ΔH_{CO_2} ΔH_{CO_2} (kJ/g)	ΔH_{CO}^*(kJ/g)
Flexible polyurethane foams					
GM21	$CH_{1.8}O_{0.30}N_{0.05}$	26.2[c]	12.1	11.5	8
GM23	$CH_{1.8}O_{0.35}N_{0.06}$	27.2[c]	13.7	12.5	9.7
GM25	$CH_{1.7}O_{0.32}N_{0.07}$	24.6[c]	12	11.1	7.5
GM27	$CH_{1.7}O_{0.03}N_{0.08}$	23.2[c]	11.2	10.4	6.2

Table 30. Polyurethane foam yield.

Table A.39 (continued)

Material	ΔH_T (kJ/g)	y_{CO_2} (g/g)	y_{CO} (g/g)	y_{ch} (g/g)	y_S (g/g)	ΔH_{ch} (kJ/g)	ΔH_{con} (kJ/g)	ΔH_{rad} (kJ/g)
Polyurethane (flexible) foams								
GM21	26.2	1.55	0.010	0.002	0.131	17.8	8.6	9.2
GM23	27.2	1.51	0.031	0.005	0.227	19.0	10.3	8.7
GM25	24.6	1.50	0.028	0.005	0.194	17.0	7.2	9.8
GM27	23.2	1.57	0.042	0.004	0.198	16.4	7.6	8.8

Here is a summary of Fuel Characteristics:

Q= 3.2MW
Ramp fire
CO yield 0.031g/g
Soot yield 0.227g/g
Heat of combustion 27.2KJ/g

FDS simulation Results

Visibility

The visibility in the gym drops below 10m and becomes an egress concern at 177 seconds into the model. Figure 55 shows the visibility at 177 seconds when the visibility at the other side of the gym drops below 10 m.

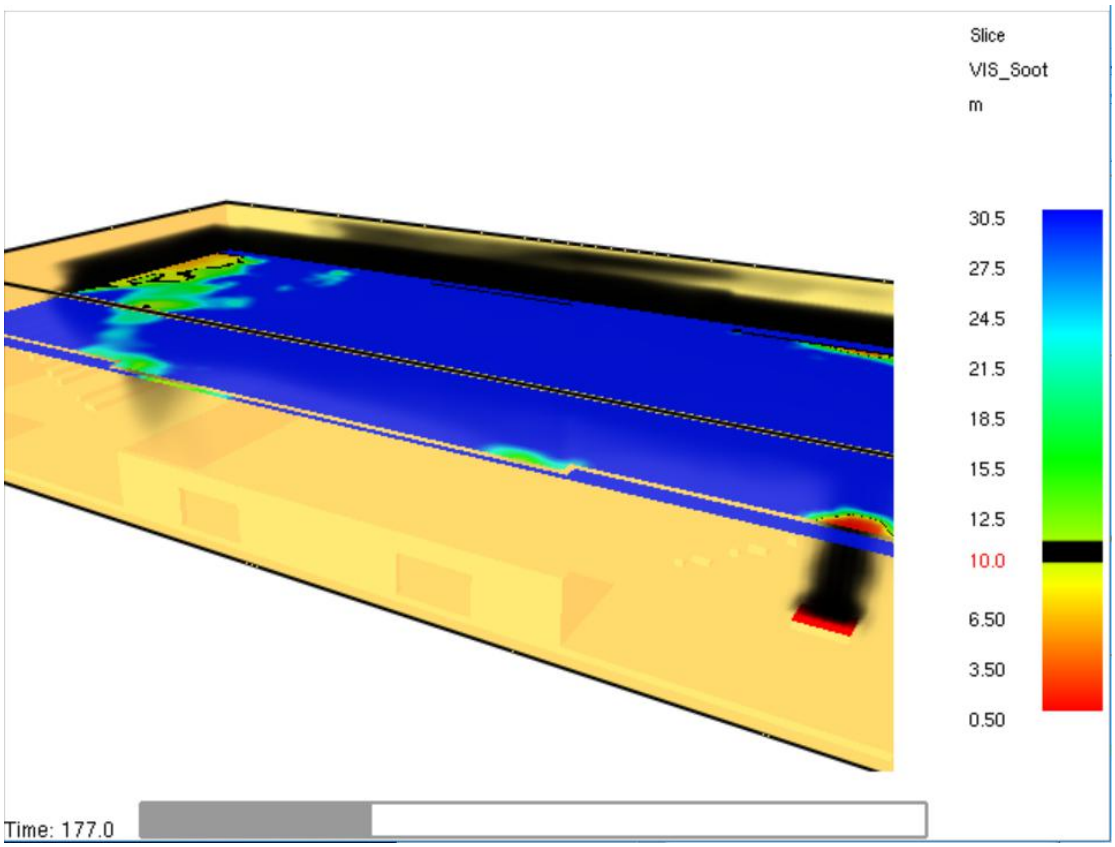


Figure 55. Smokeview Screenshot of Visibility Conditions at 177s

Temperature

The first sprinkler activates at 370s (see Figure 60) , and 6 sprinklers activate in the simulation. The temperature at 1.83m above the highest occupant elevation does not exceed 60℃.The maximum temperature of the simulation at 1.83m above the highest occupant elevation is 45℃. Figure 56 shows the temperature at 1.83m above the walking surface at 370 seconds.

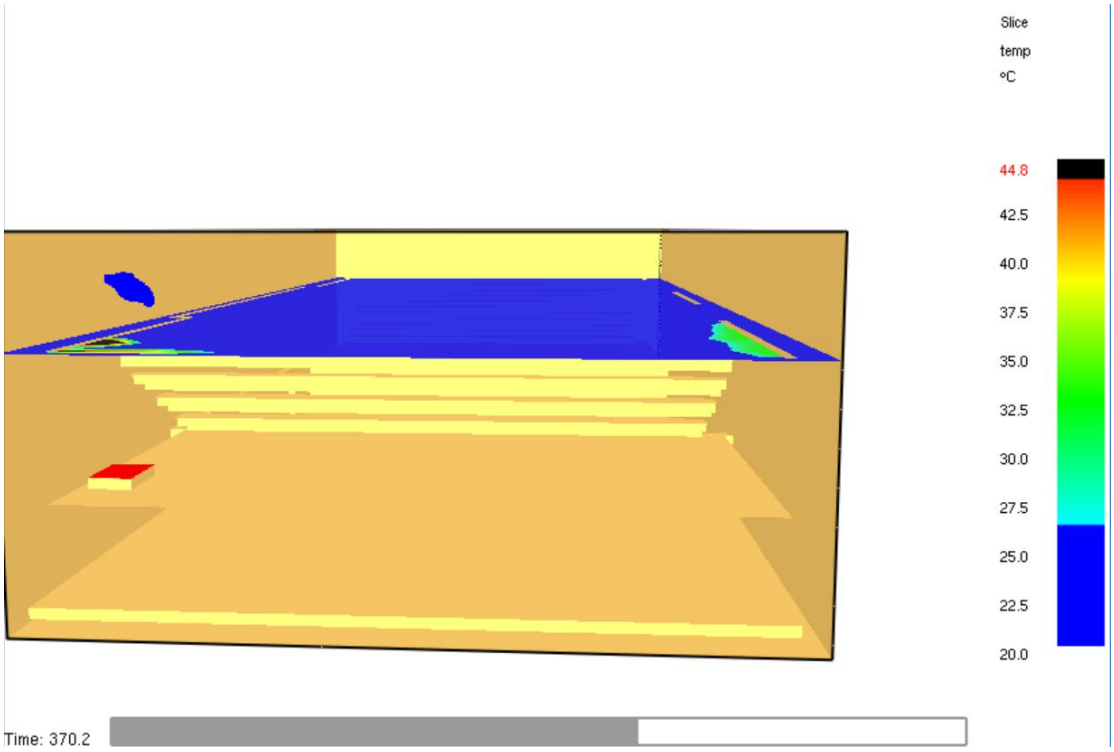


Figure 56. Smokeview Screenshot of Temperature Conditions at 370s

CO concentration

Figure 57 shows that the maximum CO concentration is 10^{-4} mol/mol,which equals about 100ppm. The CO concentration is much lower than the requirement of 1000ppm.

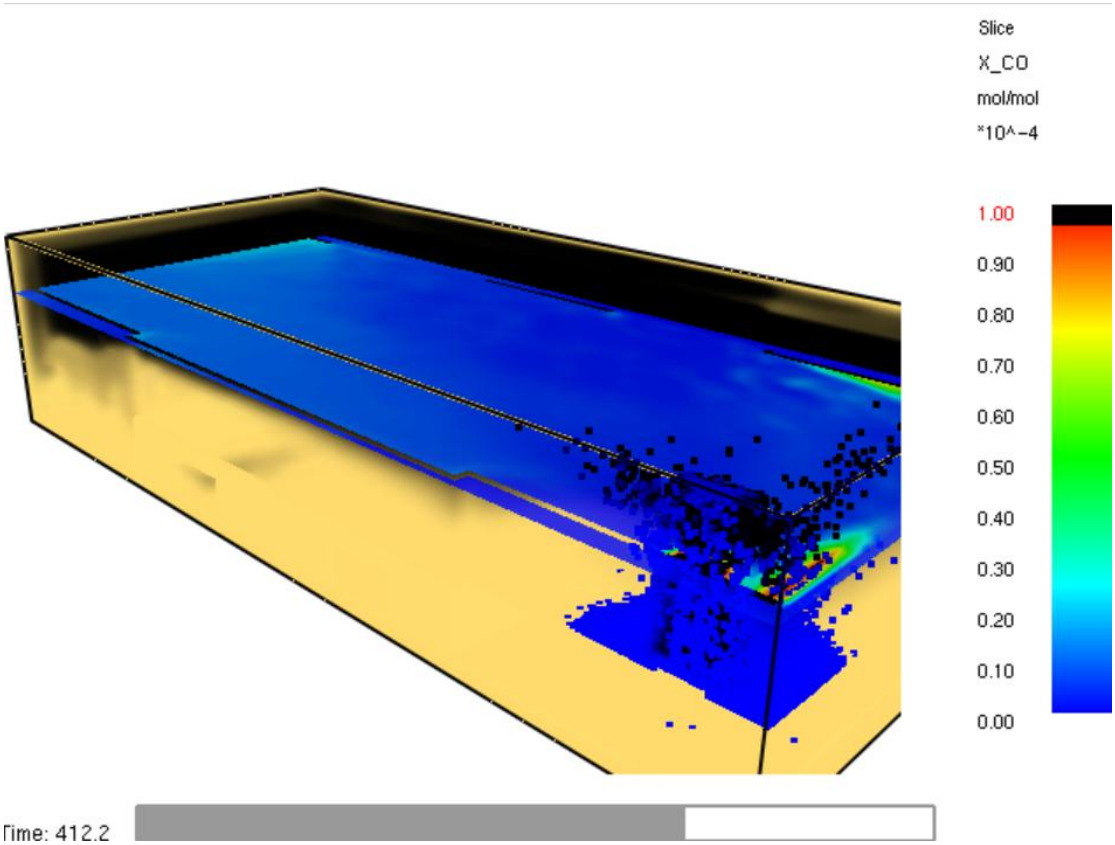


Figure 57. Smokeview Screenshot of CO Concentration at 412s

Pathfinder simulation

Introduction

Pathfinder is used for the building egress time estimation. The Pathfinder model is constructed from AutoCAD floor plan files from Cal Poly map website. Figure 58 shows the layout of the entire building.

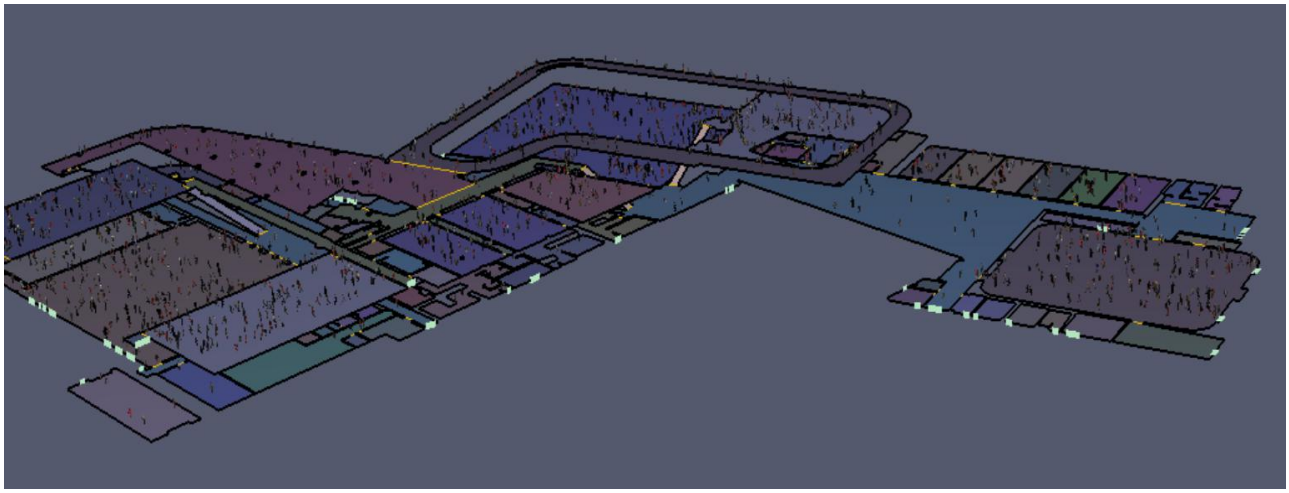


Figure 58. Pathfinder Layout of the Entire Building

Assumptions

Occupants Characteristics

The Recreation Center is primary used as a gym building. The occupants characteristics are assumed to be healthy and alert people shown here:

- Awake, Alert
- Familiar with the building,or unfamiliar in the old gym for events
- Age:18-60 (mostly 18-25)
- Fully conscious
- Speed :3.9 ft/s(default in Pathfinder)
- Behavior Mode:SFPE

The behavior mode is based on SFPE mode which allow the occupants to evacuate without avoiding other occupants and obstacles. The reason for choosing the SFPE mode is that Pathfinder can not assume someone jumping between the fixed seating which may happen in a real fire. This behavior mode may decrease the time of evacuation when compared to Steering Mode.

Travel Time of whole building(without fixed seating)

The total evacuation time of the entire building in Pathfinder is 143s(2.4min),see Figure 59. This time is only travel time, and does not include the detection time, alarm time,and the pre-movement time. It is assumed the old gym is used for normal assembly, not for fixed seating.

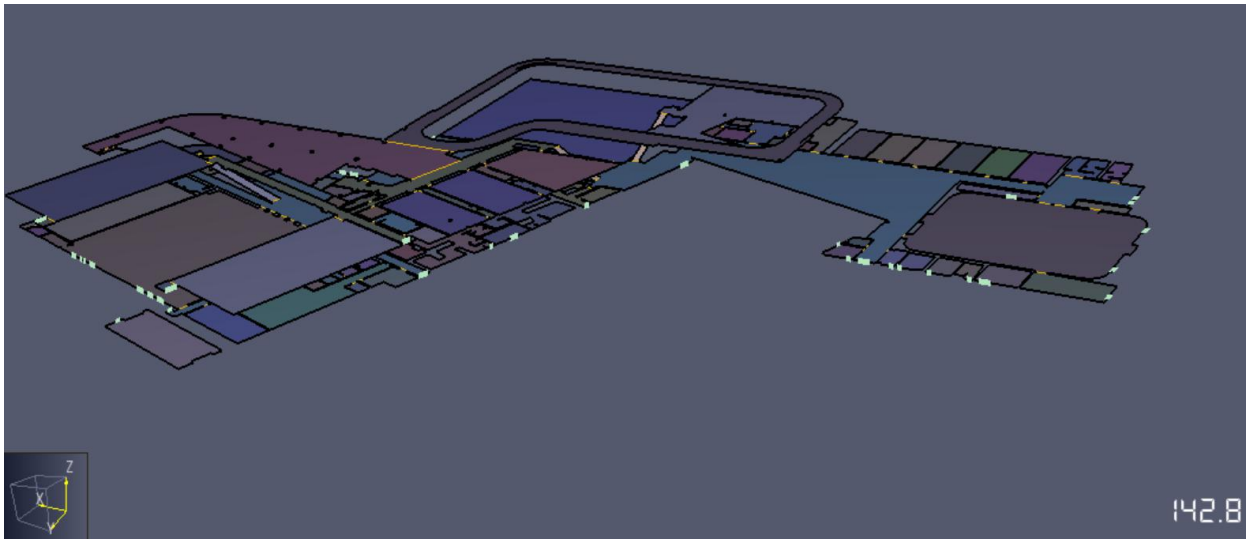


Figure 59. Travel Time of whole building(without fixed seating)

Travel Time of the Chosen Fire Scenario.

The fixing seats and the exits in the gym are symmetric.The evacuation simulation only uses 25% of the whole fixing seats area to represent the whole gym on the 2nd floor. See Figure 60. The total occupants of 25% area is 484 people.

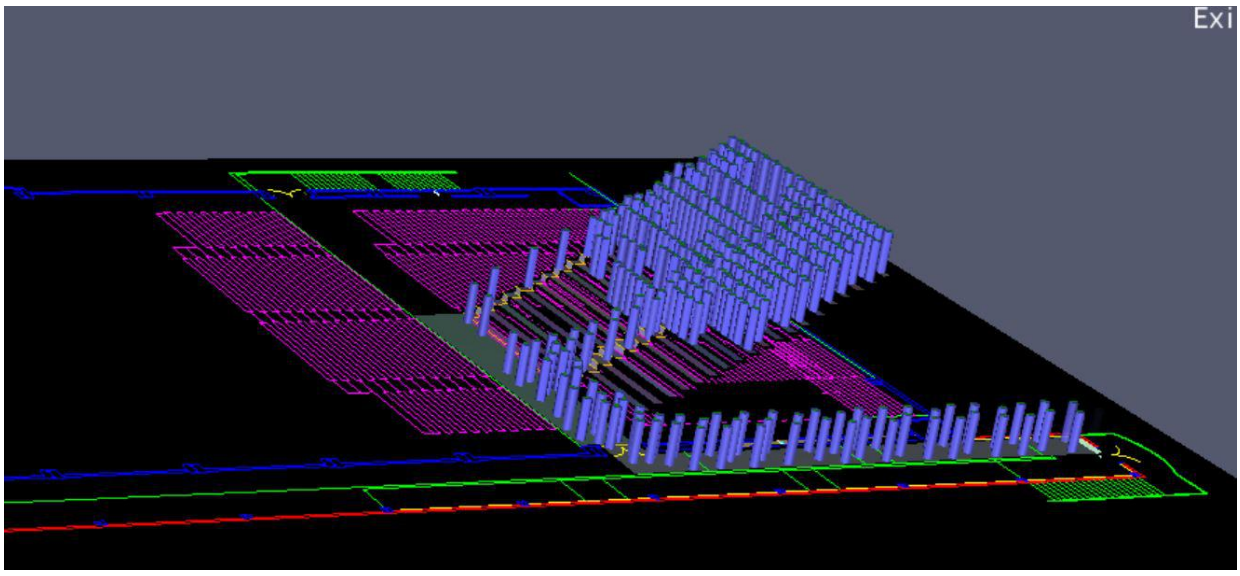


Figure 60. 25% Layout of the Fire Scenario.

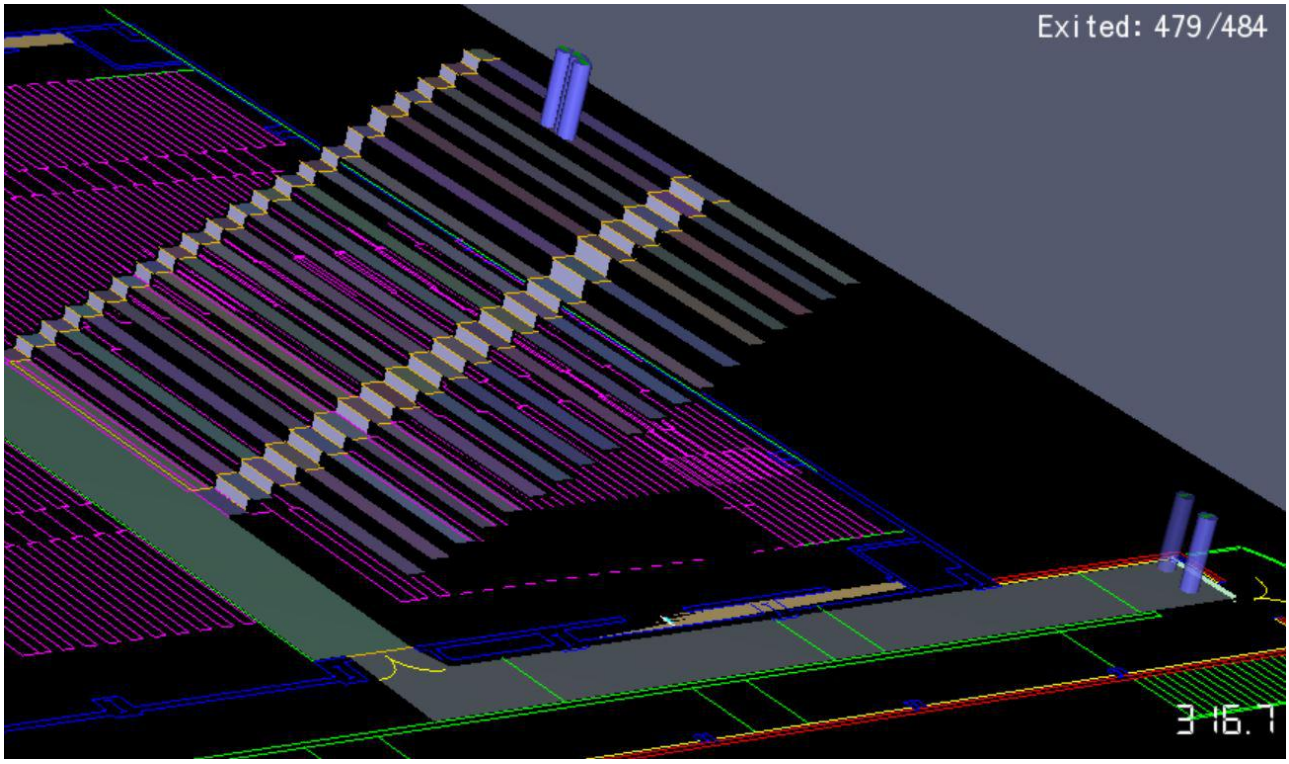


Figure 61. Travel Time of the Chosen Fire Scenario

Figure 61 shows that the total travel time of the chosen fire scenario is about 320s. Three of the occupants are obstructed by each other in the steering mode. Since this part of the gym has the longest travel distance compare to other parts, the total travel time of the whole gym should not be more than 320s (5.3min). This time is much more than the whole building travel time without fixed seating.

RSET calculation

Detection time: dt_D

The first sprinkler activated at 370s, see Figure 62; however, the first detection should not be the sprinkler activation. The detection time should be the time when the first person notices the fire. It is assumed that it would take 30s for the first person to see or smell the fire.

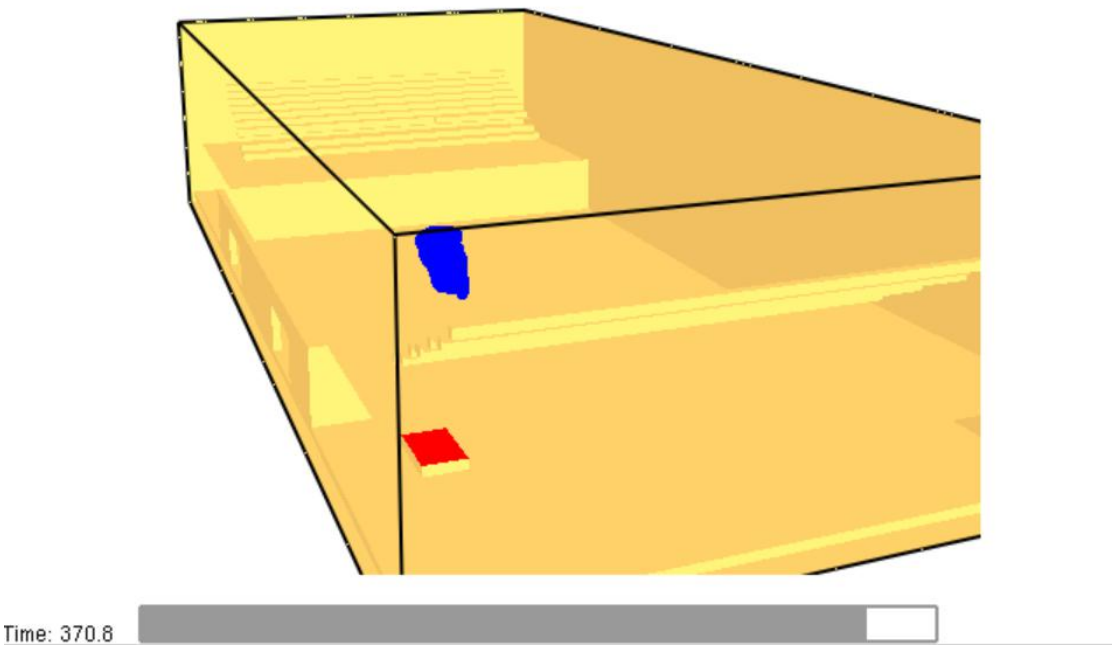


Figure 62. The First Sprinkler Activated

Alarm time: dt_a

The alarm time begins with the first detection and stops when the alarm system is activated. For this fire scenario, someone has to get out of the gym and pull the manual pull station near the exit. It is assumed that time would be about 30s depending on the travel distance from inside to the pull station located near the stairway, at a 3.9 ft/s travel speed.

Pre-movement time: dt_{pre}
There is no data for gym pre-movement time. But Table 31, extracted from SFPE Handbook shows a similar situation. The cinema, theater and the restaurant have an average pre-movement time about 30s, which will be used as the pre-movement time for this fire scenario.

Table 31. Pre-movement time for assembly occupancy

Table 64.11 Pre-evacuation time—assembly occupancy

Occupancy	Source	Observational conditions (L: location, N: nature, SC: spatial configuration, P: participants, E: environment, V: variable)	Procedure			Sample		Results (sec)
			Strategy	Staff	Technology	Collection method	Size	[Mean S.D., range]
Assembly	Tancogne-Dejean et al. [79]	L: France N: UE1–4 SC: cinema P: 122 (aged 19-63; 25% F, 75% male) V: cinema trials	Full	–	AL + PV + lights on + cessation movie	Video, observer	488 (4 × 122)	10[a] [–, 8–12]
	Purser and Bensilum [10, 26]	L: UK N: UE, 1996 SC: theatre, 3 floors P: 311 public/staff V: theatre population	Full	–	LV (from stage) + PV(5 s)	Video	–	[–, 10–36]
	Purser and Bensilium [10]; Purser and Raggio [54]	L: UK N: UE, 1995 SC:restaurant in shopping centre, 2 floors P: 432, 16 in restaurant V: restaurant population	Full	–	AL (two level-9 s) followed by PV (13 s) repeated	Video	11	48.5 [–, 41–60]

Results

The RSET is the combination of detection time, alarm time, pre-movement time and the travel time. The ASET is the minimum time of each limit for tenability. In this simulation, the visibility is the first one to be lost.

$t_{RSET}=dt_D+dt_a+dt_{pre}+dt_{tr}=30+30+30+320s=410s(6.8min)$

The visibility will be lost at 177s. Therefore, the $t_{ASET}=t_{FDS\text{-}visibility}=177s$
$t_{RSET} > t_{ASET}$, since, the occupants are unable to evacuate safely before conditions become untenable.

Other Fire Scenarios

1.Fire under bleachers(Fire spreads to the bleachers) in old gym

The bleachers are made of plywood for standing and with polyethylene plastic seats on plywood. This arrangement provides an opportunity for fire spread. Figure 63 shows the fire location under the bleachers. The fire may begin with some personal items such as jackets and bags that are left under the bleachers.

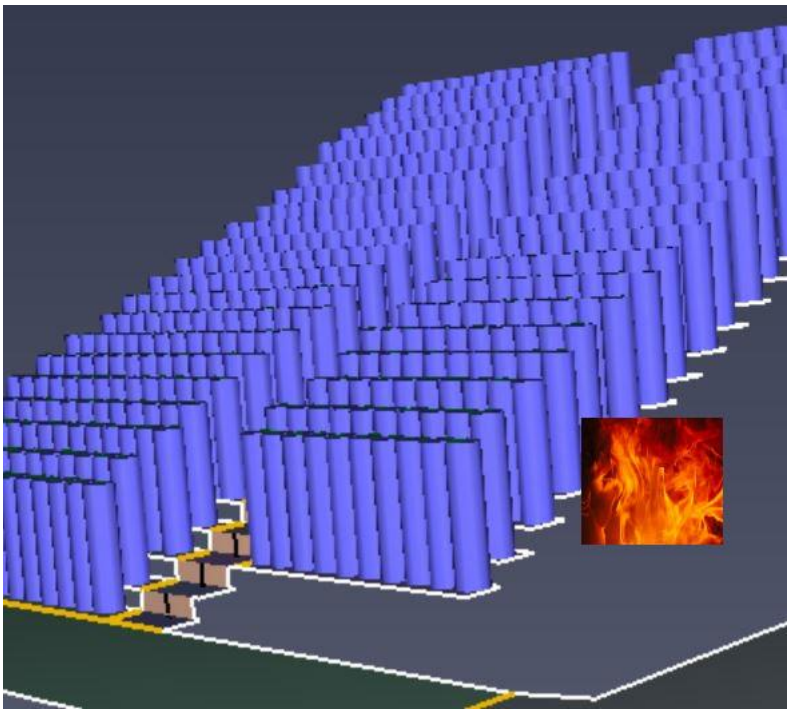


Figure 63. Fire Location

The fire will spread to the bleachers and the PE cover has a soot yield of 0.060g/g, and CO yield of 0.024g/g. The bleacher fire may be the worst case that could happen in the old gym area, because the bleachers are a large amount of fuel in the gym, and the bleachers may also block the water from the sprinkler to the fire.

2.The Bean Bag Chairs Fire

There are lots of bean bag chairs and other type of mattresses that was put at the corner of the Recreation Center as shown at Figure 64.

Figure 64. The Bean Bag Chairs

The contents of the bean bag chairs are polystyrene beads, which has the potential of being a large fuel load. The location of chairs are show Figures 64 and 65.

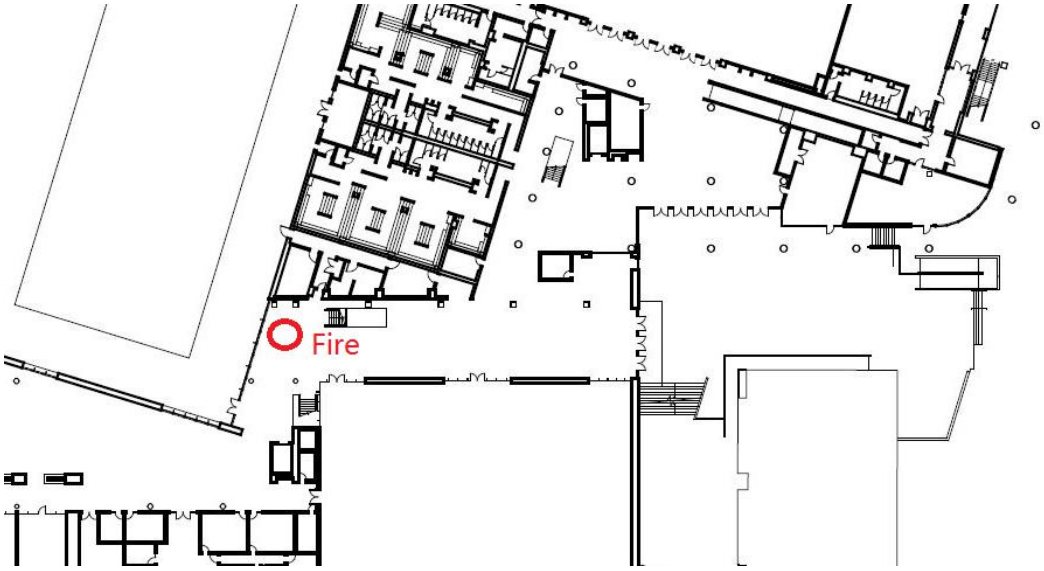


Figure 63. The Location of the Bean Bag Chairs

These chairs are located just at the end of one stairway and very near another stairway inside of the building. A fire in these chairs may block one or two exits for the second floor. That would be a significant problem other than the fire itself.

Conclusions

The visibility will drop below 10m after 117 seconds for the main fire scenario. The loss of visibility will prevent the occupants from safely evacuating from the building. Also there is a problem of Pathfinder simulation is that the occupants can not just jump from the higher seats to the lower one, and there is no obstructions between them. In reality, the occupants may just jump down and will not get impacted by the smoke layer at that time.

The temperature in the gym will not achieve 60 degree C in the main fire scenario. I believe there are two main reasons. First of all, the gym is a huge space and the 3.2MW fire is not big enough for the temperature inside of the gym to rise to 60 degree C. The second reason is that the sprinklers activate at 396s, which will suppress the fire.

The CO concentration in the gym is at 100ppm, which is much less than 1000ppm limit for tenability.

For the second fire scenario, the fire happens under the bleacher and finally will spread to the bleachers.The problem here is when the sprinklers activate, the bleachers will block the water drops down to the fire.That will limit the suppression ability of the sprinkler system.That may cause a severe fire loss.

For the recommendations, the first recommendation I would provide is do not put any combustible materials under or near the bleachers when they are fully extended. The second recommendation is the old gym need a mechanical exhaust smoke control system to make sure the visibility is above 10m at 1.83m of the highest occupant before the evacuation finished.The simulation shows that the visibility is the most significant reason that cause the occupants incapacity.

Conclusions and Recommendations

This fire safety analysis contains both the prescriptive analysis and the performance-based design analysis of the Recreation Center.

The building meets the prescriptive requirements of the applicable codes,such as structural fire protection, water-based suppression system, alarm and detection system and egress system.

The fire safety management was based on the Cal Poly Environmental Health & Safety Fire Drill & Building Evacuation Procedure. But the problem I found is on the second floor, the evacuation map could not be found. The evacuation map of the second floor I found is at the entrance of the building. The evacuation map is important during the emergency situation.

The performance-based analysis was performed using Pathfinder and FDS to simulate a chosen design fire scenario.The result shows that the visibility will drop below 10m which prevent the occupants from safely evacuate the building.

Also when I visited the building, there are some obstructions, like trash cans put in the corridor on the second floor that will block the pathway of egress. And some of the fire doors are supposed to be closed during the normal time, but were opened and obstructed by items for convenience purpose. The obstruction should be removed and the fire door should be shut.

No combustible material should be under or near the bleachers when they are fully extended in the old gym area. A mechanical exhaust smoke control system is recommended to be installed in the old gym to provide enough visibility during a fire situation.

References

NFPA 101 Life Safety Code. (2015). National Fire Protection Association.

SFPE Handbook of Fire Protection Engineering, 5th edition. Society of Fire Protection Engineers

Fire Protection Handbook, 20th Edition. National Fire Protection Association.

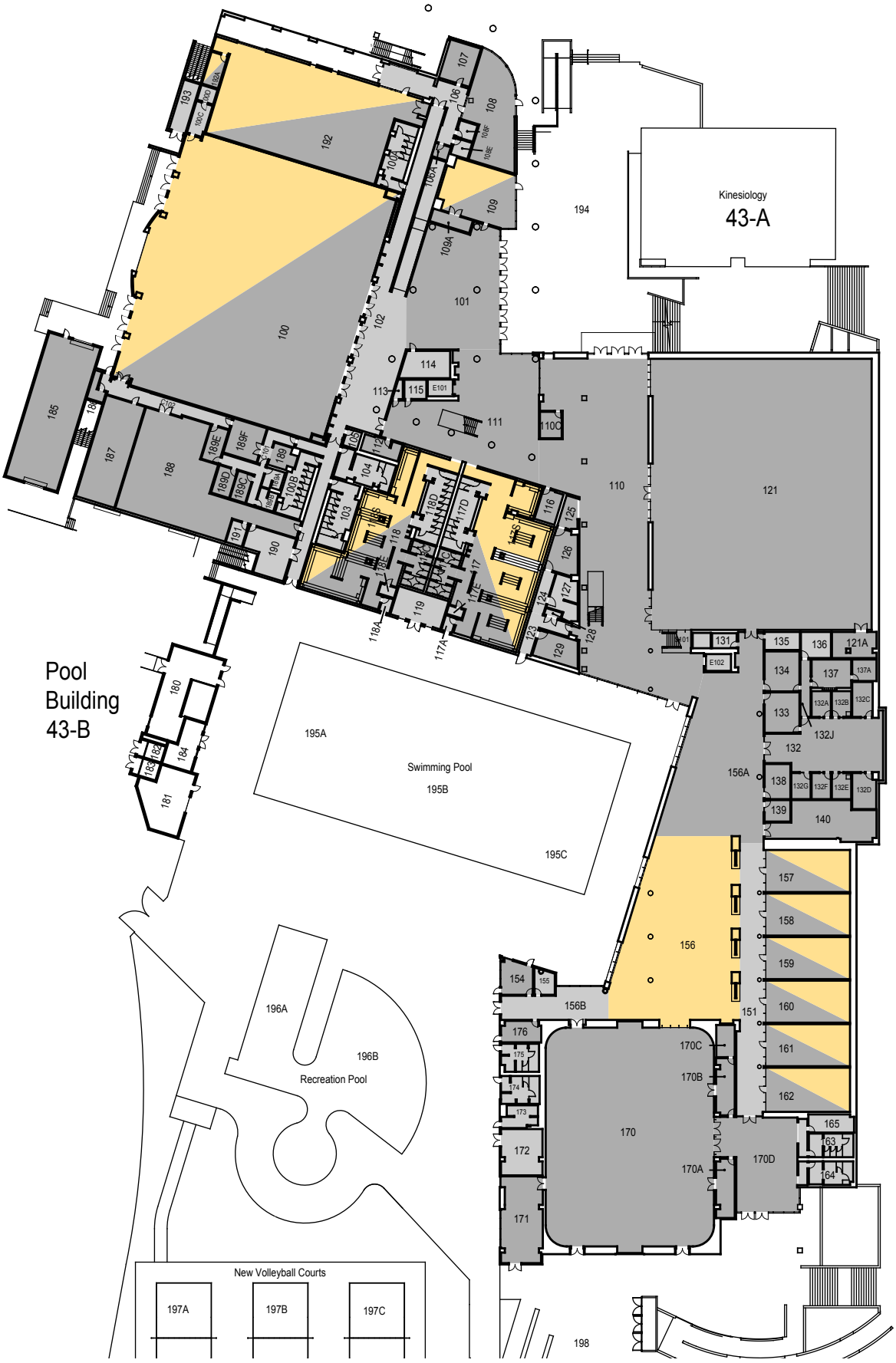
NFPA 13 Standard for Installation of Sprinkler Systems. (2016). National Fire Protection Association.

NFPA 72 National Fire Alarm and Signaling Code. (2016). National Fire Protection Association.

Emergency Procedures.Cal Poly Performing Arts Center

Kim, Hyeong-Jin, and David G. Lilley. Heat Release Rates of Burning Items in Fires. American Institute of Aeronautics and Astronautics (2000)

Appendix A Floor Plan



O:\Planroom\Database\building_Floor_Plans\Plan_Book\Building 043-0_Recreation Center.dwg

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SAN LUIS OBISPO
Facility Services | Facilities Planning and Capital Projects

Recreation Center

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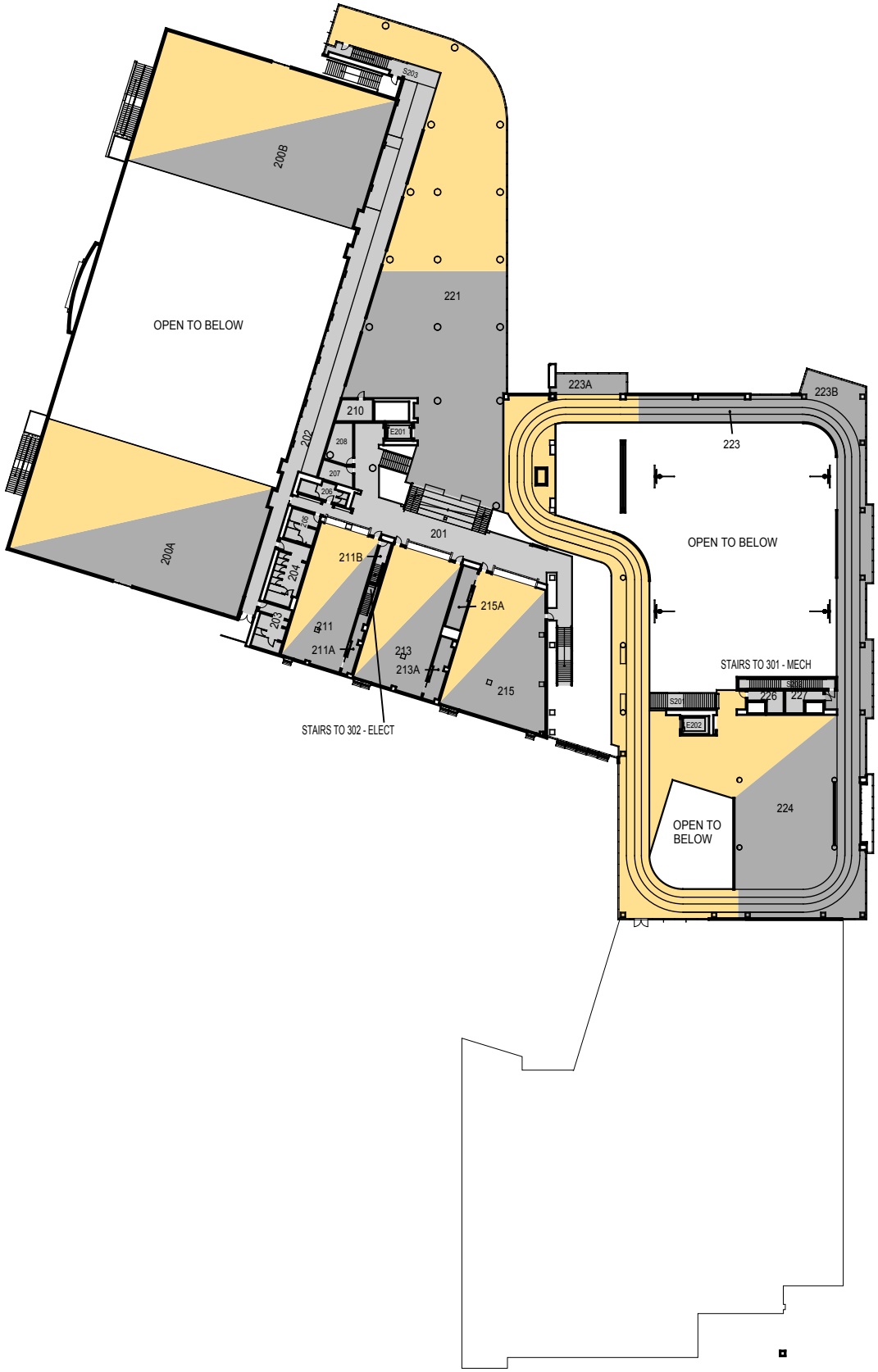
Floor 1

CAGR	CLA	
CARCH	CSM	UNIV
CBUS		ADMIN
CENGR	NON STATE	NON ASSIGNABLE

November 2012

1"=70'



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November 2012

1"=70'

Appendix B Fire Alarm As-Builts

M:\Cal Poly SLO Rec. Center_2010035\FA0.01_Cal Poly SLO Recreation Ctr_Sys.dwg, 3/28/2012 9:26:39 AM, jchavez

1. ALL WALL-MOUNTED VISUAL SIGNALING APPLIANCES SHALL BE MOUNTED SUCH THAT THE ENTIRE LENS IS NOT LESS THAN 80 IN. (2.03m) AND NOT GREATER THAN 96 IN. ABOVE THE FINISHED FLOOR (A.F.F.) PER NFPA 72 2007 CH. 7.5.4. ALL WALL MOUNTED AUDIBLE DEVICES SHALL BE A MINIMUM OF 90" A.F.F. TO TOP OF DEVICE PER NFPA 72 2007 (SECTION 7.4.7.1). AREAS HAVING MORE THAN 2 STROBES IN THE FIELD OF VIEW SHALL BE SYNCHRONIZED PER NFPA 72, SECTION 7.5.4.3.2.
2. SMOKE DETECTORS AND HEAT DETECTOR LOCATIONS ARE BASED ON SMOOTH CEILING WITH MAXIMUM HEIGHT OF 10 FEET UNLESS OTHERWISE NOTED.
3. STROBE LOCATION IS BASED ON 10 FOOT CEILING HEIGHT AND ARE INSTALLED ACCORDING TO NFPA 72 REQUIREMENTS UNLESS OTHERWISE NOTED. ANY DEVICES ON CEILINGS OVER 10 FEET WILL BE DERATED PER NFPA-72.
4. STROBES IN SLEEPING AREAS SHALL BE LOCATED WITHIN 16 FEET OF PILLOW AND HAVE MINIMUM INTENSITY OF 110cd. FOR STROBES LOCATED LESS THAN 24 INCHES FROM CEILING, MINIMUM INTENSITY SHALL BE 177cd.
5. CENTER OF MANUAL PULL STATIONS SHALL BE MOUNTED AT 48" ABOVE FLOOR LEVEL.
6. ALL EQUIPMENT SHALL BE U.L. AND C.S.F.M. LISTED.
7. ALL WIRING SHALL BE IN ACCORDANCE WITH THE N.E.C. AND AUTHORITIES HAVING JURISDICTION.
8. ALL JUNCTION BOXES SHALL BE SIZED IN ACCORDANCE WITH THE N.E.C. AND SHALL HAVE THEIR COVERS PAINTED RED WHERE APPLICABLE.
9. ELECTRICAL CONTRACTOR SHALL FURNISH ACCESS PANELS TO AREAS THAT REQUIRE SERVICING, TROUBLE SHOOTING, ETC.
10. DO NOT DEVIATE FROM CONDUIT RUNS AS SHOWN ON FLOOR PLANS WITHOUT PRIOR APPROVAL FROM SYSTEM SUPPLIER (PYRO-COMM SYSTEMS, INC., TEL (714) 902-8000). FACTORS SUCH AS EXCESSIVE VOLTAGE DROP, ADDITIONAL PARTS, ENGINEERING, ETC., THAT ARE A RESULT OF CONDUIT RUN DEVIATIONS SHALL BE THE SOLE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR.
11. DETECTORS SHALL NOT BE LOCATED IN A DIRECT AIR-FLOW, NOR CLOSER THAN 3 FEET (900mm) FROM AN AIR SUPPLY DIFFUSER.
12. ALL FAN SHUTDOWN FUNCTIONS, DAMPER CLOSURES AND ASSOCIATED MECHANICAL SYSTEM FIRE ALARM INTERFACE SHALL BE BY MECHANICAL CONTRACTOR.
13. ALL DUCT SMOKE DETECTORS SHALL BE MOUNTED BY THE MECHANICAL OR ELECTRICAL CONTRACTOR. DUCT SMOKE DETECTORS EXPOSED TO THE WEATHER SHALL BE WEATHER PROTECTED BY THE MECHANICAL CONTRACTOR. ALL AIR VELOCITY TESTING SHALL BE PERFORMED BY THE MECHANICAL CONTRACTOR.
14. ALL 120VAC POWER REQUIREMENTS FOR THE FIRE ALARM SYSTEM SHALL BE FURNISHED BY THE ELECTRICAL CONTRACTOR AND SHALL MEET ALL REQUIREMENTS OF THE AUTHORITIES HAVING JURISDICTION.
15. ALL FIRE ALARM DEVICE BACKBOXES, FIRE ALARM TERMINAL CABINETS, GUTTERS, JUNCTION BOXES AND ASSOCIATED CONDUITS SHALL BE FURNISHED AND INSTALLED BY ELECTRICAL CONTRACTOR UNLESS OTHERWISE NOTED. REFER TO FIRE ALARM SYMBOL LIST AND/OR MOUNTING DETAILS FOR ADDITIONAL INFORMATION. SYSTEM SUPPLIER PROVIDED BACKBOXES SHALL BE INSTALLED BY ELECTRICAL CONTRACTOR UNLESS OTHERWISE NOTED.
16. SMOKE DETECTOR TESTING SHALL BE ACCOMPLISHED WITH SMOKE OR LISTED AEROSOL APPROVED BY THE MANUFACTURER PER NFPA 72, AS ACCEPTABLE BY THE A.H.J.
17. ALL WIRING, INITIATING DEVICES AND ANNUNCIATOR PANEL SHALL BE SUPERVISED TO THE PRINCIPAL POINT OF ANNUNCIATION. THE FIRE ALARM CONTROL PANEL TO SUPERVISE THE ANNUNCIATOR PANEL, ALL INITIATING AND INDICATING DEVICE CIRCUITS.
18. ALL WIRING SHALL BE CUT FOR IN AND OUT. WIRING SHALL NOT BE LOOPED THROUGH DEVICES.
19. POINT AND COMMON ANNUNCIATION AND T-TAPPING ARE PROHIBITED. (T-TAPPING IS ALLOWABLE ON ADDRESSABLE STYLE 4 SLC LOOPS).
20. PROVIDE 3/4" CONDUIT WITH (2) DEDICATED TELEPHONE LINES WITH RJ-31X PHONE JACKS FROM TELEPHONE BACKBOARD FOR OWNER PROVIDED CENTRAL STATION MONITORING LOCATED ADJACENT TO FIRE ALARM CONTROL PANEL.
21. THE ALARM SYSTEM SHALL HAVE AN AUDIBILITY OF NOT LESS THAN 15dB ABOVE AMBIENT NOISE LEVELS, BUT NOT LESS THAN 75dBA THROUGHOUT AREA OF ALARM. TESTING SHALL BE ACCOMPLISHED WITH A dB METER. WHERE APPLICABLE, AUDIBLE TONE SHALL BE TEMPORAL PATTERN.
22. FIRE ALARM CONTRACTOR SHALL PROVIDE AN IMPEDANCE METER AT THE TIME OF FINAL INSPECTION WHEN REQUIRED BY THE AUTHORITY HAVING JURISDICTION.
23. FIRE ALARM SIGNAL SHALL MEET ANSI S3.41, AUDIBILITY EMERGENCY EVACUATION SIGNAL (TEMPORAL PATTERN)
24. ALL CONDUITS ARE 3/4" UNLESS OTHERWISE NOTED.
25. ALL DEVICES IN THE ALARM SYSTEM SHALL BE COMPATIBLE AND INSTALLED PER MANUFACTURER'S SPECIFICATIONS.
26. SYSTEM SHALL BE FURNISHED AND INSTALLED BY A NESCO AFFILIATE AND AUTHORIZED NOTIFIER DISTRIBUTOR.
27. FIRE ALARM SYSTEM INSTALLATION COMPANY SHALL BE UL LISTED (UUJS/UUFX).
28. TAMPER PROOF SCREWS OR OTHER APPROVED MECHANICAL MEANS SHALL BE USED ON ALL COVERS OF EXTERIOR ELECTRICAL JUNCTION BOXES IN LIEU OF ELECTRICAL SUPERVISION OF THE COVERS, PER THE 2007 NFPA72 6.8.5.11.1.
29. ELECTRICAL POWER SERVICE SHALL BE ON A DEDICATED BRANCH CIRCUIT(S). THE CIRCUIT(S) AND CONNECTIONS SHALL BE MECHANICALLY PROTECTED (CIRCUIT BREAKERS SHALL BE LOCKED IN THE ON POSITION WITH AN APPROVED MECHANICAL CLIP). CIRCUIT DISCONNECTING MEANS SHALL HAVE A RED MARKING, SHALL BE ACCESSIBLE ONLY TO AUTHORIZED PERSONNEL, AND SHALL BE IDENTIFIED AS "FIRE ALARM CIRCUIT." THE LOCATION OF THE CIRCUIT DISCONNECTING MEANS SHALL BE PERMANENTLY IDENTIFIED AT THE FIRE ALARM CONTROL UNIT.[NFPA 72,4.4.1.4.2]
30. UPON COMPLETION OF ALL INSTALLATION AND TESTING, THE CONTRACTOR SHALL PROVIDE TO THE AUTHORITY HAVING JURISDICTION AND THE BUILDING OWNER A COMPLETED AND SIGNED NFPA 72 CERTIFICATE OF COMPLETION.
31. SECTION 5.7.1.11 OF THE 2007 EDITION OF NFPA 72 STATES THAT "DETECTORS SHALL NOT BE INSTALLED UNTIL AFTER THE CONSTRUCTION CLEANUP OF ALL TRADES IS COMPLETE AND FINAL. CLEANING OR REPLACEMENT OF DEVICES THAT WERE MOUNTED AT THE REQUEST OF THE CONTRACTOR WILL NOT BE PERFORMED WITHOUT WRITTEN AUTHORIZATION THAT ASSUMES FINANCIAL RESPONSIBILITY FOR COSTS INCURRED.

GENERAL NOTES

APPLICABLE CODES AS OF AUGUST 1, 2009

2007 California Administrative Code, Part 1, Title 24

2007 California Building Code (CBC), Part 2, Title 24
(2006 International Building Code with 2007 California Amendments)

2007 California Electrical Code (CEC), Part 3, Title 24
(2005 National Electrical Code with 2007 California Amendments)

2007 California Mechanical Code (CMC), Part 4, Title 24
(2006 Uniform Mechanical Code with 2007 California Amendments)

2007 California Fire Code (CFC), Part 9, Title 24
(2006 International Fire Code with 2007 California Amendments)

2007 California Referenced Standards Code, Part 12, Title 24

PARTIAL LIST OF APPLICABLE NFPA STANDARDS:

NFPA 13–Automatic Sprinkler Systems (2002 Edition)
NFPA 14–Standpipes Systems (2002 Edition)
NFPA 72–National Fire Alarm Codes (2007 Edition)

APPLICABLE CODES & STANDARDS

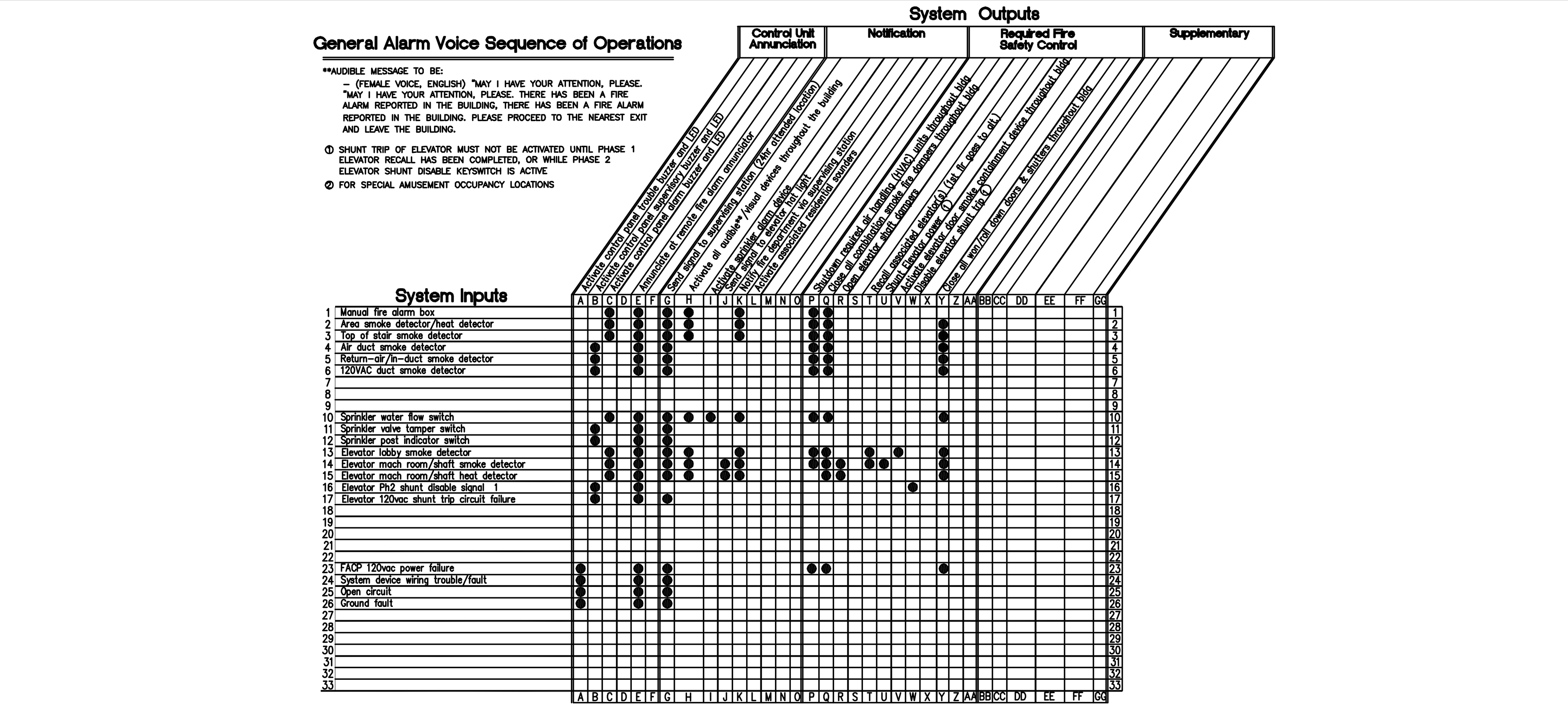
ALARM SERVICE COMPANY
AND SERVICE CENTER : (257057-001)

ADVANCED PROTECTION INDUSTRIES INC, DBA
NATIONAL MONITORING CENTER SUITE 250
26800 ALISO VIEJO PKWY
ALISO VIEJO CA, 92656
PHONE NUMBER: (800) 662-1711

FILE-VOL. NO. — CCN
S8126-1 — UUFX

LISTING CATEGORY
[SIGNAL AND FIRE ALARM EQUIPMENT AND SERVICES]
(PROTECTIVE SIGNALING SERVICES) CENTRAL STATION

MONITORING INFORMATION

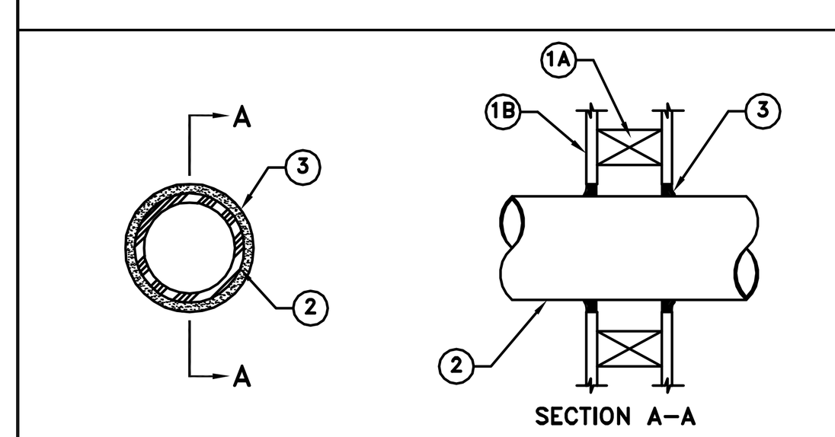


SEQUENCE OF OPERATION

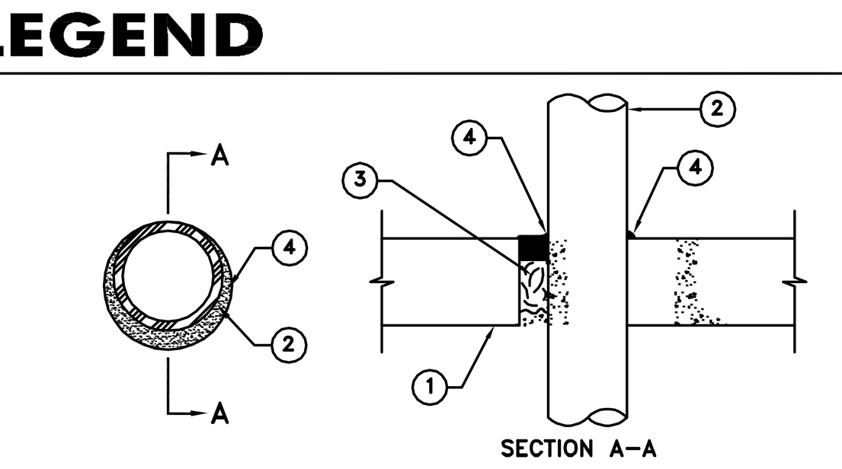
WIRE DESIGNATION	CONDUCTOR COLORS	WIRE IN CONDUIT	UNDERGROUND/WET WIRE DESIGNATION	WIRE IN CONDUIT UNDERGROUND/WET LOC.
ADDRESS. LOOP Z	RED JACKET RED/BLACK	2 CONDUCTOR #16 FPL SOLID TWISTED/UNSHIELDED WEST PENN (.039 sq.in.) #D990	ADDRESS. LOOP ZU	2 CONDUCTOR #16 FPL STRANDED TWISTED/UNSHIIELDED WEST PENN (.068 sq.in.) #AQ225
INITIATION CKT F	YELLOW/PURPLE	(2) #14 STRANDED TYPE THHN	INIT. LOOP FU	(2) #14 STRANDED TYPE THWN
ANNUN. DATA D	RED JACKET RED/BLACK	2 CONDUCTOR #18 FPL SOLID TWISTED/SHIELDED WEST PENN (.035 sq.in.) #D975	ANNUN. DATA DU	2 CONDUCTOR #16 FPL STRANDED TWISTED/SHIELDED WEST PENN (.084 sq.in.) #AQ294
ANNUN. PWR B	YELLOW/BLUE	(2) #14 STRANDED TYPE THHN	ANNUN. PWR BU	(2) #14 STRANDED TYPE THWN
24V POWER P	PINK/PURPLE	(2) #14 STRANDED TYPE THHN	POWER CKT. PU	(2) #14 STRANDED TYPE THWN
AUD/VIS CKT. V	YELLOW/BLUE ORANGE/BROWN RED/BLACK PINK/PURPLE	(2) #12 STRANDED TYPE THHN	VISUAL VU	(2) #12 STRANDED TYPE THWN
SPEAKER CKT. S	RED/BLACK	(2) #14 STRANDED TYPE THHN TWISTED	SPEAKER CKT. SU	(2) #14 STRANDED TYPE THWN TWISTED

NOTES:
ALL WIRE MODEL NUMBERS ARE WEST PENN. EQUIVALENT BY OTHER MANUFACTURER IS ACCEPTABLE.
ALL SHIELDED CABLE MUST HAVE SHIELDS CONNECTED THROUGH AND LANDED AT PANEL.
ALL SQUARE INCH MEASUREMENTS ARE CROSS-SECTION AREA FOR CONDUIT FILLS

WIRE LEGEND



PENETRATION THRU GYPSUM BOARD WALL
NO SCALE
UL #W-L-1001



PENETRATION THRU CONCRETE
NO SCALE
UL #C-AJ-1044

+When copper pipe is used, T Rating is 0 h.

3M COMPANY – CP 25WB+or FB-3000 WT

*Bearing the UL Classification Mark

(a)Min 2 in (51 mm) thickness of mineral wool batt insulation required in annular space.

(b)Min 1 in. (25 mm) thickness of mineral wool batt insulation required in annular space on both sides of floor or wall assembly. Min 1 in.(25 mm) thickness of caulk to be installed flush with each surface of floor or wall assembly.

3M COMPANY –– CP 25WB+ or FB-3000 WT.

(Note – W Rating applies only when FB-3000 WT is used.)

FIRE STOP/THRU-PENETRATION DETAIL

Dimensions of Insulated Conductors and Fixture Wires
(Based on Table 5, Chapter 9, 2007 CEC)

CONDUCTOR SIZE AWG	12 GA. THHN/THWN	14 GA. THHN/THWN	16 GA. TFN/TFFN	18 GA. TFN/TFFN
AREA (in^2)	0.0133	0.0097	0.0072	0.0055

Total Areas of Electrical Metallic Tubing.
(Based on Table 4, Chapter 9, 2007 CEC)

	1/2" CONDUIT	3/4" CONDUIT	1" CONDUIT	1 1/4" CONDUIT	1 1/2" CONDUIT	2" CONDUIT
TOTAL AREA	0.304 in^2	0.533 in^2	0.864 in^2	1.496 in^2	2.036 in^2	3.356 in^2
40% FILL	0.122 in^2	0.213 in^2	0.346 in^2	0.598 in^2	0.814 in^2	1.342 in^2

Maximum Number of Conductors in Trade Sizes of Conduit or Tubing
(Based on 40% Conduit Fill per 2007 CEC)

CONDUCTOR SIZE AWG	1/2" CONDUIT	3/4" CONDUIT	1" CONDUIT	1 1/4" CONDUIT	1 1/2" CONDUIT	2" CONDUIT
18	22	38	62	108	148	244
16	16	29	48	83	113	186
14	12	21	35	61	83	138
12	9	16	26	44	61	100

CONDUIT FILL CHART

BUILDING CONSTRUCTION: TYPE 1B (NEW REMODEL)
TYPE 11-F.R. (EXISTING GYMNASIUM)

BUILDING OCCUPANCY: A3- GYMNASIUM WITHOUT SPECTATOR SEATS (NEW REMODEL)
B- LOCKER ROOM/SHOWERS (NEW REMODEL)
A2.1/B2 (EXISTING GYMNASIUM)

OCCUPANT LOAD: A2.1 (300 OCUPANTS WITHOUT STAGE)

SPRINKLERED: YES

NO. OF STORIES: 2

AREA OF BUILDING: 165,717 S.F.

AREA OF WORK: 165,717 S.F.

PROJECT ADDRESS: CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407

OWNER: CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407

BUILDING INFORMATION

QUANTITY	SYMBOL	DESCRIPTION	MODEL	MANUFACTURER	BACKBOX	MOUNTING HEIGHT	C.S.F.M. NUMBER
1	FACP	FIRE ALARM CONTROL PANEL	NFS2-640	NOTIFIER	SBB-D4 PROVIDED	66" A.F.F. TO TOP	7165-0028:243
1	XP-1B	DIGITAL AUDIO AMPLIFIER (70 VOLT)	(1)DAA-5070	NOTIFIER	SBB-A4 PROVIDED	66" A.F.F. TO TOP	7165-0028:243
1	XP-1C	DIGITAL AUDIO AMPLIFIER (70 VOLT)	(1)DAA-5070	NOTIFIER	SBB-A4 PROVIDED	66" A.F.F. TO TOP	7165-0028:243
1	DACT	UNIVERSAL ALARM COMMUNICATOR PANEL	UDACT	NOTIFIER	INSIDE FACP	VERIFY IN FIELD	7300-0028:174
5	RPS	AUDIO/VISUAL POWER SUPPLY	FCPS-24S8	NOTIFIER	FCPS PROVIDED	66" A.F.F. TO TOP	7315-0028:225
1	ANN	FIRE ALARM ANNUNCIATOR PANEL	FDU-80	NOTIFIER	BACKBOX PROVIDED	66" A.F.F. TO TOP	7120-0028:209
1	OSY	BACKFLOW PREVENTOR TAMPER – F.B.O.	F.B.O.	F.B.O.	F.B.O.	VERIFY IN FIELD	F.B.O.
32	CR	FIRE ALARM RELAY MODULE	FRM-1	NOTIFIER	4S DEEP BOX W/ 4S EXTENSION	VERIFY IN FIELD	7300-0028:202
11	M	FIRE ALARM MONITOR MODULE	FMM-1	NOTIFIER	4S DEEP BOX W/ 4S EXTENSION	VERIFY IN FIELD	7300-0028:202
6	MD	FIRE ALARM DUAL MONITOR MODULE	FDM-1	NOTIFIER	4S DEEP BOX W/ 4S EXTENSION	VERIFY IN FIELD	7300-0028:202
7	R	24VDC RELAY	PR-1	SYSTEM SENSOR	5S DEEP BOX W/ 5S EXTENSION	VERIFY IN FIELD	7300-1653:172
4	F WP	WEATHERPROOF MANUAL PULL STATION	NBG-12LOB w/ FMM-101	NOTIFIER	SB-I/O PROVIDED	48" A.F.F. TO TOP OF BOX	7150-0028:199 7300-0028:202
19	P	AREA SMOKE DETECTOR (ADDRESSABLE – PHOTO)	FSP-851 B710LP	NOTIFIER	4S DEEP BOX W/ 3-0 RING	CEILING MOUNTED	7272-0028:206 7300-0028:173
3	P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)	FSP-851 B710LP	NOTIFIER	4S DEEP BOX W/ 3-0 RING	CEILING MOUNTED	7272-0028:206 7300-0028:173
24	ID	AREA SMOKE DETECTOR (INSIDE DUCT)	FSP-851 B501	NOTIFIER	4-0 PANCAKE BOX w/ 3-0 ADAPTER	INSIDE DUCT (AT TOP)	7272-0028:206 7300-1653:109
3	H	AREA HEAT DETECTOR (ADDRESSABLE)	FST-851 B710LP	NOTIFIER	4S DEEP BOX W/ 3-0 RING	CEILING MOUNTED	7270-0028:196 7300-0028:173
12	DD	DUCT DET. HOUSING w/ SMOKE DETECTOR HEAD	DNR w/ FSP-851	SYSTEM SENSOR NOTIFIER	DNR PROVIDED	VERIFY IN FIELD	3242-1653:209 7272-0028:206
18	F	MANUAL PULL STATION	NBG-12LX	NOTIFIER	4S DEEP BOX W/ SINGLE GANG RING	48" A.F.F. TO CENTER	7150-0028:199
23	I	REMOTE INDICATOR L.E.D.	RA100Z	SYSTEM SENSOR	4S DEEP BOX w/ 1-GANG RING	VERIFY IN FIELD	7300-1653:212
6	S WP	WEATHERPROOF SPEAKER	SPWK (WHITE)	SYSTEM SENSOR	BACKBOX PROVIDED	90" A.F.F. TO BOTTOM	7320-1653:201
17	15	FIRE ALARM SPEAKER/STROBE	SPSW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7320-1653:201
6	30	FIRE ALARM SPEAKER/STROBE	SPSW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7320-1653:201
15	75	FIRE ALARM SPEAKER/STROBE	SPSW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7320-1653:201
50	110	FIRE ALARM SPEAKER/STROBE	SPSW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7320-1653:201
11	110 WG	FIRE ALARM SPEAKER/ STROBE W/WIREGUARD	SPSW (WHITE) STI	SYSTEM SENSOR STI	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7320-1653:201
6	75 WP	WEATHERPROOF SPEAKER/STROBE	SPSWK (WHITE)	SYSTEM SENSOR	BACKBOX PROVIDED	90" A.F.F. TO BOTTOM	7320-1653:201
20	15	FIRE ALARM CEILING STROBE	SCW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	CEILING	7125-1653:186
3	30	FIRE ALARM CEILING STROBE	SCW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	CEILING	7125-1653:186
2	15 WP	FIRE ALARM CEILING STROBE	SCRK (RED)	SYSTEM SENSOR	SA-WBBC PROVIDED	CEILING MOUNTED	7300-1653:187
28	15 ¤ 15	FIRE ALARM WALL STROBE	SW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7125-1653:186
3	30 ¤ 30	FIRE ALARM WALL STROBE	SW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7125-1653:186
1	75	FIRE ALARM WALL STROBE	SW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7125-1653:186
---	110	FIRE ALARM WALL STROBE	SW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7125-1653:186
7	S	FIRE ALARM SPEAKER	SPCW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	CEILING	7320-1653:201
3 (F.B.O.)	W	SPRINKLER WATER FLOW – F.B.O.	F.B.O.	F.B.O.	F.B.O.	VERIFY IN FIELD	F.B.O.
3 (F.B.O.)	T	SPRINKLER VALVE TAMPER – F.B.O.	F.B.O.	F.B.O.	F.B.O.	VERIFY IN FIELD	F.B.O.
---	J	FIRE ALARM JUNCTION BOX	N/A	BY ELECTRICIAN	4S BOX U.O.N.	VERIFY IN FIELD	N/A
---	FATC	FIRE ALARM TERMINAL CABINET	N/A	BY ELECTRICIAN	24 x 24 x 6 U.O.N.	VERIFY IN FIELD	N/A
---	A.F.F.	ABOVE FINISHED FLOOR	N/A	N/A	N/A	N/A	N/A
---	EOL	END OF LINE RESISTOR	N/A	N/A	N/A	N/A	N/A
---	EX	EXISTING DEVICE	N/A	N/A	N/A	N/A	N/A
---	F.B.O.	FURNISHED BY OTHERS	N/A	N/A	N/A	N/A	N/A
---	N/A	NOT APPLICABLE	N/A	N/A	N/A	N/A	N/A
---	U.O.N.	UNLESS OTHERWISE NOTED	N/A	N/A	N/A	N/A	N/A
---	VL	VERIFY LOCATION IN FIELD	N/A	N/A	N/A	N/A	N/A
---	WP	WEATHERPROOF DEVICE	N/A	N/A	N/A	N/A	N/A
---	N	NEW DEVICE	N/A	N/A	N/A	N/A	N/A
---	● ○	CONDUIT DOWN CONDUIT UP	N/A	N/A	N/A	N/A	N/A
---		COMBINATION SMOKE/ FIRE DAMPER (F.B.O.)	F.B.O.	BY MECHANICAL	F.B.O.	F.B.O.	F.B.O.
---	⊠	DEDICATED PHONE LINE – F.B.O.	F.B.O.	F.B.O.	F.B.O.	F.B.O.	N/A

SYMBOLS LEGEND

PYRO-COMM SYSTEMS, INC. WILL PROVIDE:

-FIRE ALARM CONTROL PANEL
-REMOTE TRANSPONDERS
-REMOTE POWER SUPPLIES
-AREA SMOKE/HEAT DETECTION
-SMOKE DETECTOR ABOVE FACP & POWER SUPPLIES
-SMOKE DETECTION FOR DAMPER CLOSURE
-DUCT SMOKE DETECTION FOR HVAC SHUTDOWN
-ELEVATOR RECALL
-ELEVATOR SHUNT TRIP
-ELEVATOR HOISTWAY/MACHINE ROOM VISUAL SIGNAL?
-AUDIBLE & VISUAL NOTIFICATION
-MANUAL PULL STATIONS
-REMOTE ANNUNCIATION
-SPRINKLER SYSTEM MONITORING
-DIALER FOR REMOTE MONITORING (24HR ATTENDED LOCATION)

*THIS IS A NEW FIRE ALARM SYSTEM SUBMITTAL. ALL FUTURE TENANT IMPROVEMENTS TO BE SUBMITTED AND PROVIDED UNDER SEPARATE CONTRACT PLANS AND PERMITS.

ALL NEW ADDRESSABLE DEVICES WILL BE CONNECTED TO THE FIRE ALARM CONTROL PANEL INTELLIGENT LOOP. ALL VISUAL & AUDIBLE/VISUAL DEVICES WILL BE CONNECTED TO NOTIFICATION APPLIANCE CIRCUITS FROM THE FIRE ALARM CONTROL PANEL OR REMOTE POWER SUPPLIES, AND WILL BE SYNCHRONIZED IN ACCORDANCE WITH NFPA STANDARDS. ALL DEVICES ARE TO BE COMPATIBLE WITH THE HEAD-END EQUIPMENT AND OTHER DEVICES. ALL DEVICES WILL HAVE A TEXTUAL DISPLAY ON THE FIRE CONTROL PANEL DESCRIBING TYPE OF DEVICE AND LOCATION.

IF THERE ARE ANY QUESTIONS REGARDING THIS SUBMITTAL, PLEASE CONTACT THE FOLLOWING @ (714) 902-8000:
PROJECT ESTIMATOR: GENE KNUST-GRAICHEN
PROJECT SUPERINTENDENT: GREG SHEWMAN
ENGINEERING MANAGER: MARC LOPEZ
PROJECT ENGINEER: JOSE M. AREVALO

SCOPE OF WORK

SHEET INDEX

Pyro-Comm Systems, Inc.
Fire, Life Safety and Security System Design and Installation
C-10 #612153 ACO 3231

CORPORATE OFFICE
15531 Container Lane
Huntington Beach, CA 92649
T(714)902-8000 F(714)902-8001

SAN DIEGO REGIONAL OFFICE
5115 Avenida Encinas Ste.G
Carlsbad, CA 92008
T(760)930-6014 F(760)930-6015

NOTIFIER by Honeywell
FACTORY AUTHORIZED DISTRIBUTOR
NESCO Affiliate

Signatures

STATE OF CALIFORNIA
LICENSED ELECTRICAL
CONTRACTOR
C10-612153
EXP. 02-28-11

Approvals

NOTE: 0 1
If this scale is not 1", this sheet is Not To Scale

Rev	Issued For	Date	By
X	AS BUILTS	3/7/12	JC
3	PER PCO#551	12/06/11	BKR
2	FIRE DEPT. COMMENTS	12/06/11	BKR
1	ENGINEER REVIEW COMMENTS	05/10/10	MAL
X	ISSUED FOR PLAN CHECK	02/29/10	JA

Project :
CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM SYSTEM INFORMATION

Drawn By :
J.AREVALO
02/23/10
Cad File :
M:\CAL POLY SLO\ RECREATION CENTER\ FA0.01-REC CTR-SYS

Sheet Number :
FA0.01

ASBUILT SET

ASBUILT SET

M:\Cal Poly SLO Rec. Center_2010035\FA0.02_Cal Poly SLO Recreation Ctr_Calcs.dwg, 3/28/2012 9:26:53 AM, jchavez

BATTERY SIZING CALCULATION 02/23/12

CAL POLY SLO - STUDENT RECREATION CENTER
MAIN FIRE ALARM CONTROL PANEL

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	NFS2-640	CPU2-640 w/CPS-24	0.32500	0.32500	0.28500	0.28500
1	NFS2-640	KDM-R2	0.10000	0.10000	0.10000	0.10000
1	Voice	DVC&DVC-KD	0.50000	0.50000	0.50000	0.50000
32	Control Relay	FRM-1	0.00026	0.00816	0.00650	0.20800
11	Duct Det	DNR w/ FSP-851	0.00036	0.00396	0.00686	0.07546
2	Heat Det	FST-851	0.00030	0.00060	0.00650	0.01300
3	Monitor	DIMM	0.00060	0.00180	0.03000	0.09000
4	Monitor	FDM-1	0.00075	0.00300	0.00640	0.02560
9	Monitor	FMM-1	0.00035	0.00315	0.00500	0.04500
4	Pull Station	FMM-101 w/Pull Sta.	0.00038	0.00150	0.00038	0.00150
19	Pull Station	NBG-12LX	0.00038	0.00713	0.00688	0.13063
46	Smoke Det	FSP-851	0.00030	0.01380	0.00680	0.31280
4	Pull Station	NBG-12LOB	0.00000	0.00000	0.00000	0.00000
37	Speaker 25V	Speaker - 1/2 Watt Tap	0.00000	0.00000	0.02000	0.74000
1	Dialer	UDACT	0.04000	0.04000	0.10000	0.10000
7	Relay	PR-1 (Shutdown)	0.00000	0.00000	0.01500	0.10500
23	Remote LED	RA100Z	0.00000	0.00000	0.01000	0.23000
				Standby Load 1.008		Alarm Load 2.962

Standby Load: 1.008 Amps — Alarm Load: 2.962 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 24.19 Amp*Hours — Total Alarm Load: 0.74 Amp*Hours

Batteries Provided: (2) BAT-12380 — **Available Battery:** 30.40 A.H.
Battery Size: 38.00 A.H. — **Load (ALM + STBY)** 24.93 A.H.
De-Rated Size(80%): 30.40 A.H. — **Spare Capacity** 5.47 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_Main FACP-BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/06/11

CAL POLY SLO - STUDENT RECREATION CENTER
REMOTE POWER SUPPLY - RPS#1 • ELEC ROOM #136

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
1	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.06600
1	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	0.15800
10	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	2.02000
5	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.33000
1	Strobe	SW (75cd)	0.00000	0.00000	0.15800	0.15800
				Standby Load 0.065		Alarm Load 2.877

Standby Load: 0.065 Amps — Alarm Load: 2.877 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 1.56 Amp*Hours — Total Alarm Load: 0.72 Amp*Hours

Batteries Provided: (2) BAT-1270 — **Available Battery:** 5.60 A.H.
Battery Size: 7.00 A.H. — **Load (ALM + STBY)** 2.28 A.H.
De-Rated Size(80%): 5.60 A.H. — **Spare Capacity** 3.32 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #1_BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/06/11

CAL POLY SLO - STUDENT RECREATION CENTER
REMOTE POWER SUPPLY - RPS #2 • ELEC. ROOM #172

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
1	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.06600
1	S/S (Strobe ONLY)	SPSW (30cd)	0.00000	0.00000	0.09400	0.09400
1	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	0.15800
9	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	1.81800
1	S/S (WP Strobe)	SPSWK (75cd)	0.00000	0.00000	0.15800	0.15800
5	Strobe	SCW (15cd)	0.00000	0.00000	0.06600	0.33000
1	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.06600
				Standby Load 0.065		Alarm Load 2.835

Standby Load: 0.065 Amps — Alarm Load: 2.835 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 1.56 Amp*Hours — Total Alarm Load: 0.71 Amp*Hours

Batteries Provided: (2) BAT-1270 — **Available Battery:** 5.60 A.H.
Battery Size: 7.00 A.H. — **Load (ALM + STBY)** 2.27 A.H.
De-Rated Size(80%): 5.60 A.H. — **Spare Capacity** 3.33 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #2_BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/06/11

CAL POLY SLO - STUDENT RECREATION CENTER
REMOTE POWER SUPPLY - RPS#3 • ELEC ROOM #227

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
10	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	2.02000
1	S/S (WP Strobe)	SPSWK (75cd)	0.00000	0.00000	0.15800	0.15800
1	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.06600
				Standby Load 0.065		Alarm Load 2.389

Standby Load: 0.065 Amps — Alarm Load: 2.389 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 1.56 Amp*Hours — Total Alarm Load: 0.60 Amp*Hours

Batteries Provided: (2) BAT-1270 — **Available Battery:** 5.60 A.H.
Battery Size: 7.00 A.H. — **Load (ALM + STBY)** 2.16 A.H.
De-Rated Size(80%): 5.60 A.H. — **Spare Capacity** 3.44 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #3_BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/06/11

CAL POLY SLO - STUDENT RECREATION CENTER
REMOTE POWER SUPPLY - RPS#4 • ELEC. ROOM #115

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
6	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.39600
3	S/S (Strobe ONLY)	SPSW (30cd)	0.00000	0.00000	0.09400	0.28200
4	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	0.63200
5	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	1.01000
11	Strobe	SCW (15cd)	0.00000	0.00000	0.06600	0.72600
3	Strobe	SCW (30cd)	0.00000	0.00000	0.09400	0.28200
13	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.85800
2	Strobe (WP)	SCRK (15cd)	0.00000	0.00000	0.06600	0.13200
				Standby Load 0.065		Alarm Load 4.463

Standby Load: 0.065 Amps — Alarm Load: 4.463 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 1.56 Amp*Hours — Total Alarm Load: 1.12 Amp*Hours

Batteries Provided: (2) BAT-1270 — **Available Battery:** 5.60 A.H.
Battery Size: 7.00 A.H. — **Load (ALM + STBY)** 2.68 A.H.
De-Rated Size(80%): 5.60 A.H. — **Spare Capacity** 2.92 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #4_BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/07/11

CAL POLY SLO - STUDENT RECREATION CTR
REMOTE POWER SUPPLY - RPS#5 • ELEC ROOM #208

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
2	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.13200
2	S/S (Strobe ONLY)	SPSW (30cd)	0.00000	0.00000	0.09400	0.18800
7	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	1.10600
4	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	0.80800
4	S/S (WP Strobe)	SPSWK (75cd)	0.00000	0.00000	0.15800	0.63200
4	Strobe	SCW (15cd)	0.00000	0.00000	0.06600	0.26400
3	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.19800
1	Strobe	SW (30cd)	0.00000	0.00000	0.09400	0.09400
				Standby Load 0.065		Alarm Load 3.567

Standby Load: 0.065 Amps — Alarm Load: 3.567 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 1.56 Amp*Hours — Total Alarm Load: 0.89 Amp*Hours

Batteries Provided: (2) BAT-1270 — **Available Battery:** 5.60 A.H.
Battery Size: 7.00 A.H. — **Load (ALM + STBY)** 2.45 A.H.
De-Rated Size(80%): 5.60 A.H. — **Spare Capacity** 3.15 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #5_BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/07/11

CAL POLY SLO - STUDENT RECREATION CENTER
XP-1 DAA2-5025 • ELECTRICAL ROOM #136

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	Voice	DAA2-5025	0.40000	0.40000	0.50000	0.50000
37	Speaker 25V	Speaker - 1/2 Watt Tap	0.00000	0.00000	0.02000	0.74000
3	Speaker 25V	Speaker - 1 Watt Tap	0.00000	0.00000	0.04000	0.12000
				Standby Load 0.400		Alarm Load 1.360

Standby Load: 0.400 Amps — Alarm Load: 1.360 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 9.60 Amp*Hours — Total Alarm Load: 0.34 Amp*Hours

Batteries Provided: (2) BAT-12180 — **Available Battery:** 14.40 A.H.
Battery Size: 18.00 A.H. — **Load (ALM + STBY)** 9.94 A.H.
De-Rated Size(80%): 14.40 A.H. — **Spare Capacity** 4.46 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_XP-1_BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/07/11

CAL POLY SLO - STUDENT RECREATION CENTER
XP-2 + XP-3 DAA2-5025 • ELECTRICAL ROOM #115

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
2	Voice	DAA2-5025	0.40000	0.80000	0.50000	1.00000
30	Speaker 25V	Speaker - 1/2 Watt Tap	0.00000	0.00000	0.02000	0.60000
9	Speaker 25V	Speaker - 1 Watt Tap	0.00000	0.00000	0.04000	0.36000
				Standby Load 0.800		Alarm Load 1.960

Standby Load: 0.800 Amps — Alarm Load: 1.960 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 19.20 Amp*Hours — Total Alarm Load: 0.49 Amp*Hours

Batteries Provided: (2) BAT-12260 — **Available Battery:** 20.80 A.H.
Battery Size: 26.00 A.H. — **Load (ALM + STBY)** 19.69 A.H.
De-Rated Size(80%): 20.80 A.H. — **Spare Capacity** 1.11 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_XP-2_BATT.xls]BattCalc

VOLTAGE DROP CALCULATION 12/06/11

CAL POLY SLO - RECREATION CENTER
SYSTEM SENSOR — RPS #1 @ ELEC ROOM #136

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V1 QTY	V1 CURR.	SIGNAL CIRCUIT V2 QTY	V2 CURR.	SIGNAL CIRCUIT V3 QTY	V3 CURR.	SIGNAL CIRCUIT V4 QTY	V4 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (15cd)	0.066		0.000	1	0.066		0.000		0.000	1
SPSW (75cd)	0.158		0.000	1	0.158		0.000		0.000	1
SPSW (110cd)	0.202	8	1.616	2	0.404		0.000		0.000	10
Strobe										
SW (15cd)	0.066		0.000	5	0.330		0.000		0.000	5
SW (75cd)	0.158		0.000	1	0.158		0.000		0.000	1
TOTAL CURRENT ON CIRCUIT		1.616 AMPS		1.116 AMPS		0.000 AMPS		0.000 AMPS		
TOTAL WIRE LENGTH		445 FT.		300 FT.		0 FT.		0 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		2.38 VOLTS		1.11 VOLTS		0.00 VOLTS		0.00 VOLTS		
VOLTAGE @ END OF CIRCUIT		18.02 VOLTS		19.29 VOLTS		VOLTS		VOLTS		
CIRCUIT LOCATION		1ST FLOOR		1ST FLOOR		SPARE		SPARE		

VOLTAGE DROP = TOTAL CURRENT x DISTANCE x 21.6 / CIRCULAR MILS

CIRC. MILS
18 AWG = 1620
16 AWG = 2580
14 AWG = 4110
12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE - VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)
OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V-33V

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #1_VD.xls]VD FORM

VOLTAGE DROP CALCULATION 12/06/11

CAL POLY SLO - RECREATION CTR
SYSTEM SENSOR — REMOTE POWER SUPPLY - RPS#2 @ ELEC ROOM #172

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V5 QTY	V5 CURR.	SIGNAL CIRCUIT V6 QTY	V6 CURR.	SIGNAL CIRCUIT V7 QTY	V7 CURR.	SIGNAL CIRCUIT V8 QTY	V8 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (15cd)	0.066		0.000	1	0.066		0.000		0.000	1
SPSW (30cd)	0.094	1	0.094		0.000		0.000		0.000	1
SPSW (75cd)	0.158	1	0.158		0.000		0.000		0.000	1
SPSW (110cd)	0.202	3	0.606	6	1.212		0.000		0.000	9
Speaker/Strobe (WP Strobe ONLY)										
SPSWK (75cd)	0.158	1	0.158		0.000		0.000		0.000	1
Strobe										
SCW (15cd)	0.066	2	0.132	3	0.198		0.000		0.000	5
SW (15cd)	0.066		0.000	1	0.066		0.000		0.000	1
TOTAL CURRENT ON CIRCUIT		1.148 AMPS		1.542 AMPS		0.000 AMPS		0.000 AMPS		
TOTAL WIRE LENGTH		400 FT.		490 FT.		0 FT.		0 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		1.52 VOLTS		2.50 VOLTS		0.00 VOLTS		0.00 VOLTS		
VOLTAGE @ END OF CIRCUIT		18.88 VOLTS		17.90 VOLTS		VOLTS		VOLTS		
CIRCUIT LOCATION		1ST FLOOR		1ST FLOOR		SPARE		S[ARE		

VOLTAGE DROP = TOTAL CURRENT x DISTANCE x 21.6 / CIRCULAR MILS

CIRC. MILS
18 AWG = 1620
16 AWG = 2580
14 AWG = 4110
12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE - VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)
OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V-33V

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #2_VD.xls]VD FORM

VOLTAGE DROP CALCULATION 12/06/11

CAL POLY SLO - RECREATION CTR
SYSTEM SENSOR — REMOTE POWER SUPPLY - RPS#3 @ ELEC ROOM #227

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V9 QTY	V9 CURR.	SIGNAL CIRCUIT V10 QTY	V10 CURR.	SIGNAL CIRCUIT V11 QTY	V11 CURR.	SIGNAL CIRCUIT V12 QTY	V12 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (110cd)	0.202	5	1.010	5	1.010		0.000		0.000	10
Speaker/Strobe (WP Strobe ONLY)										
SPSWK (75cd)	0.158	1	0.158		0.000		0.000		0.000	1
Strobe										
SW (15cd)	0.066	1	0.066		0.000		0.000		0.000	1
TOTAL CURRENT ON CIRCUIT		1.234 AMPS		1.010 AMPS		0.000 AMPS		0.000 AMPS		
TOTAL WIRE LENGTH		500 FT.		340 FT.		0 FT.		0 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		2.04 VOLTS		1.14 VOLTS		0.00 VOLTS		0.00 VOLTS		
VOLTAGE @ END OF CIRCUIT		18.36 VOLTS		19.26 VOLTS		VOLTS		VOLTS		
CIRCUIT LOCATION		2ND FLOOR		2ND FLOOR		SPARE		SPARE		

VOLTAGE DROP = TOTAL CURRENT x DISTANCE x 21.6 / CIRCULAR MILS

CIRC. MILS
18 AWG = 1620
16 AWG = 2580
14 AWG = 4110
12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE - VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)
OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V-33V

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #3_VD.xls]VD FORM

VOLTAGE DROP CALCULATION 12/06/11

CAL POLY SLO - RECREATION CTR
SYSTEM SENSOR — REMOTE POWER SUPPLY- RPS#4 @ ELEC ROOM #115

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V13 QTY	V13 CURR.	SIGNAL CIRCUIT V14 QTY	V14 CURR.	SIGNAL CIRCUIT V15 QTY	V15 CURR.	SIGNAL CIRCUIT V16 QTY	V16 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (15cd)	0.066	1	0.066	2	0.132		0.000	3	0.198	6
SPSW (30cd)	0.094		0.000	1	0.094	2	0.188		0.000	3
SPSW (75cd)	0.158	2	0.316	1	0.158		0.000	1	0.158	4
SPSW (110cd)	0.202	2	0.404	1	0.202	1	0.202	1	0.202	5
Strobe										
SCW (15cd)	0.066	2	0.132	1	0.066	3	0.198	5	0.330	11
SCW (30cd)	0.094		0.000		0.000	2	0.188	1	0.094	3
SW (15cd)	0.066	3	0.198	7	0.462	2	0.132	1	0.066	13
Strobe (WP)										
SCRK (15cd)	0.066		0.000		0.000	2	0.132		0.000	2
TOTAL CURRENT ON CIRCUIT		1.116 AMPS		1.114 AMPS		1.040 AMPS		1.048 AMPS		
TOTAL WIRE LENGTH		300 FT.		350 FT.		575 FT.		880 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		1.11 VOLTS		1.29 VOLTS		1.98 VOLTS		3.05 VOLTS		
VOLTAGE @ END OF CIRCUIT		19.29 VOLTS		19.11 VOLTS		18.42 VOLTS		17.35 VOLTS		
CIRCUIT LOCATION		1ST FLOOR		1ST FLOOR		1ST FLOOR		1ST FLOOR		

VOLTAGE DROP = TOTAL CURRENT x DISTANCE x 21.6 / CIRCULAR MILS

CIRC. MILS
18 AWG = 1620
16 AWG = 2580
14 AWG = 4110
12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE - VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)
OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V-33V

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #4_VD.xls]VD FORM

VOLTAGE DROP CALCULATION 12/07/11

CAL POLY SLO - RECREATION CTR
SYSTEM SENSOR — REMOTE POWER SUPPLY #5 @ ELEC ROOM #208

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V17 QTY	V17 CURR.	SIGNAL CIRCUIT V18 QTY	V18 CURR.	SIGNAL CIRCUIT V19 QTY	V19 CURR.	SIGNAL CIRCUIT V20 QTY	V20 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (15cd)	0.066		0.000		0.000	2	0.132		0.000	2
SPSW (30cd)	0.094	1	0.094	1	0.094		0.000		0.000	2
SPSW (75cd)	0.158	1	0.158	4	0.632	2	0.316		0.000	7
SPSW (110cd)	0.202	3	0.606	1	0.202		0.000		0.000	4
Speaker/Strobe (WP Strobe ONLY)										
SPSWK (75cd)	0.158		0.000		0.000		0.000	4	0.632	4
Strobe										
SCW (15cd)	0.066		0.000		0.000	4	0.264		0.000	4
SW (15cd)	0.066	1	0.066		0.000	2	0.132		0.000	3
SW (30cd)	0.094		0.000	1	0.094		0.000		0.000	1
TOTAL CURRENT ON CIRCUIT		0.924 AMPS		1.022 AMPS		0.844 AMPS		0.632 AMPS		
TOTAL WIRE LENGTH		355 FT.		625 FT.		325 FT.		600 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		1.09 VOLTS		2.11 VOLTS		0.91 VOLTS		1.25 VOLTS		
VOLTAGE @ END OF CIRCUIT		19.31 VOLTS		18.29 VOLTS		19.49 VOLTS		19.15 VOLTS		
CIRCUIT LOCATION		2ND FLOOR		2ND FLOOR		2ND FLOOR		ROOF		

VOLTAGE DROP = TOTAL CURRENT x DISTANCE x 21.6 / CIRCULAR MILS

CIRC. MILS
18 AWG = 1620
16 AWG = 2580
14 AWG = 4110
12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE - VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)
OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V-33V

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #5_VD.xls]VD FORM

dB LINE LOSS CALCULATION 02/23/12

CAL POLY SLO - RECREATION CENTER
SPEAKERS — XP-1 @ ELEC ROOM #136 (S1–S4); XP-2 @ ELEC ROOM #115 (S5–S8)

	DEVICE POWER (WATTS)	S1 QTY	S1 WATTS	S2 QTY	S2 WATTS	S3 QTY	S3 WATTS	S4 QTY	S4 WATTS	S5 QTY	S5 WATTS	S6 QTY	S6 WATTS	S7 QTY	S7 WATTS	S8 QTY	S8 WATTS	QTY TOTAL
Speaker 25V																		
Speaker - 1/2 Watt Tap	0.50	6	3.00	10	5.00	6	3.00	4	2.00	5	2.50	3	1.50	11	5.50	7	3.50	52
Speaker - 1 Watt Tap	1.00	4	4.00	1	1.00	5	5.00	4	4.00	1	1.00	4	4.00	3	3.00	2	2.00	24
TOTAL POWER ON CIRCUIT		7.00 WATTS		6.00 WATTS		8.00 WATTS		6.00 WATTS		3.50 WATTS		5.50 WATTS		8.50 WATTS		5.50 WATTS		
LOAD RESISTANCE		89 OHMS		104 OHMS		78 OHMS		104 OHMS		179 OHMS		114 OHMS		74 OHMS		114 OHMS		
TOTAL WIRE LENGTH		650 FT.		925 FT.		700 FT.		475 FT.		900 FT.		960 FT.		800 FT.		800 FT.		
WIRE SIZE		14 AWG		14 AWG		14 AWG		14 AWG		14 AWG		14 AWG		14 AWG		14 AWG		
TOTAL WIRE RESISTANCE		4.238 OHMS		6.031 OHMS		4.564 OHMS		3.097 OHMS		5.868 OHMS		6.2592 OHMS		5.216 OHMS		5.216 OHMS		
POWER LINE LOSS (dB)		-0.40 dB		-0.49 dB		-0.49 dB		-0.25 dB		-0.28 dB		-0.47 dB		-0.60 dB		-0.39 dB		
CIRCUIT LOCATION		1ST FLOOR		1ST FLOOR		2ND FLOOR		SPARE		1ST FLOOR		1ST FLOOR		2ND FLOOR		2ND FLOOR		

WIRE RESISTANCE (OHM / 1000 FT)
18 AWG = 8.08
16 AWG = 5.08
14 AWG = 3.26
12 AWG = 2.05

LOAD RESISTANCE = (VOLTAGE x VOLTAGE) / POWER

POWER LINE LOSS (dB) = 20xLog LOAD RESISTANCE / (LOAD RESISTANCE + TOTAL WIRE RESISTANCE)

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_XPs_Lineloss.xls]dB LINE LOSS

BATTERY SIZING CALCULATION 12/07/11

CAL POLY SLO - STUDENT RECREATION CENTER
EXISTING REMOTE POWER SUPPLY

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
7	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.46200
2	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	0.31600
23	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	4.64600
8	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.52800
2	Strobe	SW (30cd)	0.00000	0.00000	0.09400	0.18800
				Standby Load 0.065		Alarm Load 6.285

Standby Load: 0.065 Amps — Alarm Load: 6.285 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 1.56 Amp*Hours — Total Alarm Load: 1.57 Amp*Hours

Batteries Provided: (2) BAT-1270 — **Available Battery:** 5.60 A.H.
Battery Size: 7.00 A.H. — **Load (ALM + STBY)** 3.13 A.H.
De-Rated Size(80%): 5.60 A.H. — **Spare Capacity** 2.47 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #EX_BATT.xls]BattCalc

dB LINE LOSS CALCULATION 02/23/12

CAL POLY SLO - RECREATION CENTER
SPEAKERS — XP-3 @ ELEC ROOM #115

	DEVICE POWER (WATTS)	S9 QTY	S9 WATTS	SPARE QTY	SPARE WATTS	SPARE QTY	SPARE WATTS	SPARE QTY	SPARE WATTS	QTY TOTAL
Speaker 25V										
Speaker - 1/2 Watt Tap	0.50	7	3.50		0.00	0	0.00		0.00	7
Speaker - 1 Watt Tap	1.00	4	4.00		0.00		0.00		0.00	4
TOTAL POWER ON CIRCUIT		7.50 WATTS		0.00 WATTS		0.00 WATTS		0.00 WATTS		
LOAD RESISTANCE		83 OHMS		0 OHMS		0 OHMS		0 OHMS		
TOTAL WIRE LENGTH		450 FT.		0 FT.		0 FT.		0 FT.		
WIRE SIZE		14 AWG		14 AWG		14 AWG		14 AWG		
TOTAL WIRE RESISTANCE		2.934 OHMS		0 OHMS		0 OHMS		0 OHMS		
POWER LINE LOSS (dB)		-0.30 dB		dB		dB		dB		
CIRCUIT LOCATION		1ST FLOOR		1ST FLOOR		2ND FLOOR		SPARE		

WIRE RESISTANCE (OHM / 1000 FT)
18 AWG = 8.08
16 AWG = 5.08
14 AWG = 3.26
12 AWG = 2.05

LOAD RESISTANCE = (VOLTAGE x VOLTAGE) / POWER

POWER LINE LOSS (dB) = 20xLog LOAD RESISTANCE / (LOAD RESISTANCE + TOTAL WIRE RESISTANCE)

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_XP3_Lineloss.xls]dB LINE LOSS

SYSTEM BATTERY AND VOLTAGE DROP CALCULATIONS

Pyro-Comm Systems, Inc.
Fire, Life Safety and Security System Design and Installation
C-10 #612153 ACO 3231

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NOTIFIER by Honeywell — FACTORY AUTHORIZED DISTRIBUTOR — NESCO Affiliate

Signatures

STATE OF CALIFORNIA LICENSED ELECTRICAL CONTRACTOR
C10-612153
EXP. 02-28-11

Approvals

NOTE: 0 — 1
If this scale is not 1", this sheet is Not To Scale

Rev	Issued For	Date	By
X	AS BUILTS	3/7/12	JC
3	PER PCO#551	12/06/11	BKR
2	FIRE DEPT. COMMENTS	12/06/11	BKR
1	ENGINEER REVIEW COMMENTS	05/10/10	MAL
X	ISSUED FOR PLAN CHECK	02/29/10	JA

Project : CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

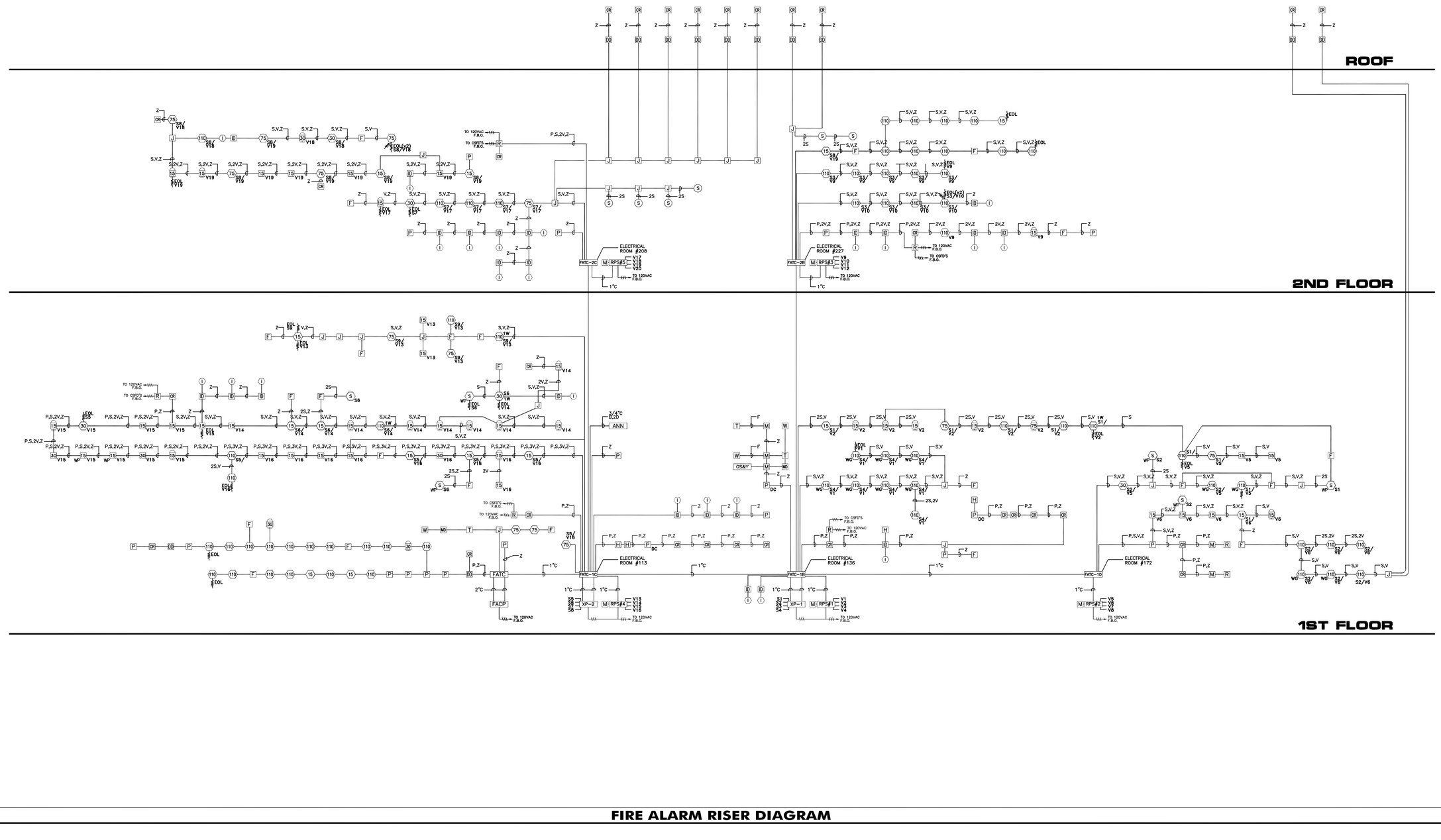
Sheet Title : **FIRE ALARM SYSTEM CALCULATIONS**

Drawn By : **J.AREVALO** 02/23/10
Cad File : M:\CAL POLY SLO\RECREATION CENTER\FA0.02-REC CTR-CALCS

Sheet Number : **FA0.02**

ASBUILT SET

ASBUILT SET



FIRE ALARM RISER DIAGRAM

Pyro-Comm Systems, Inc.
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C-10 #612153 ACO 3231

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Signatures

STATE OF CALIFORNIA
LICENSED ELECTRICAL CONTRACTOR
C10-612153
EXP. 02-28-11

Approvals

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Rev	Issued For	Date	By
X	AS BUILTS	3/7/12	JC
3	PER PCO#551	12/06/11	BKR
2	FIRE DEPT. COMMENTS	12/06/11	BKR
1	ENGINEER REVIEW COMMENTS	05/10/10	MAL
X	ISSUED FOR PLAN CHECK	02/29/10	JA

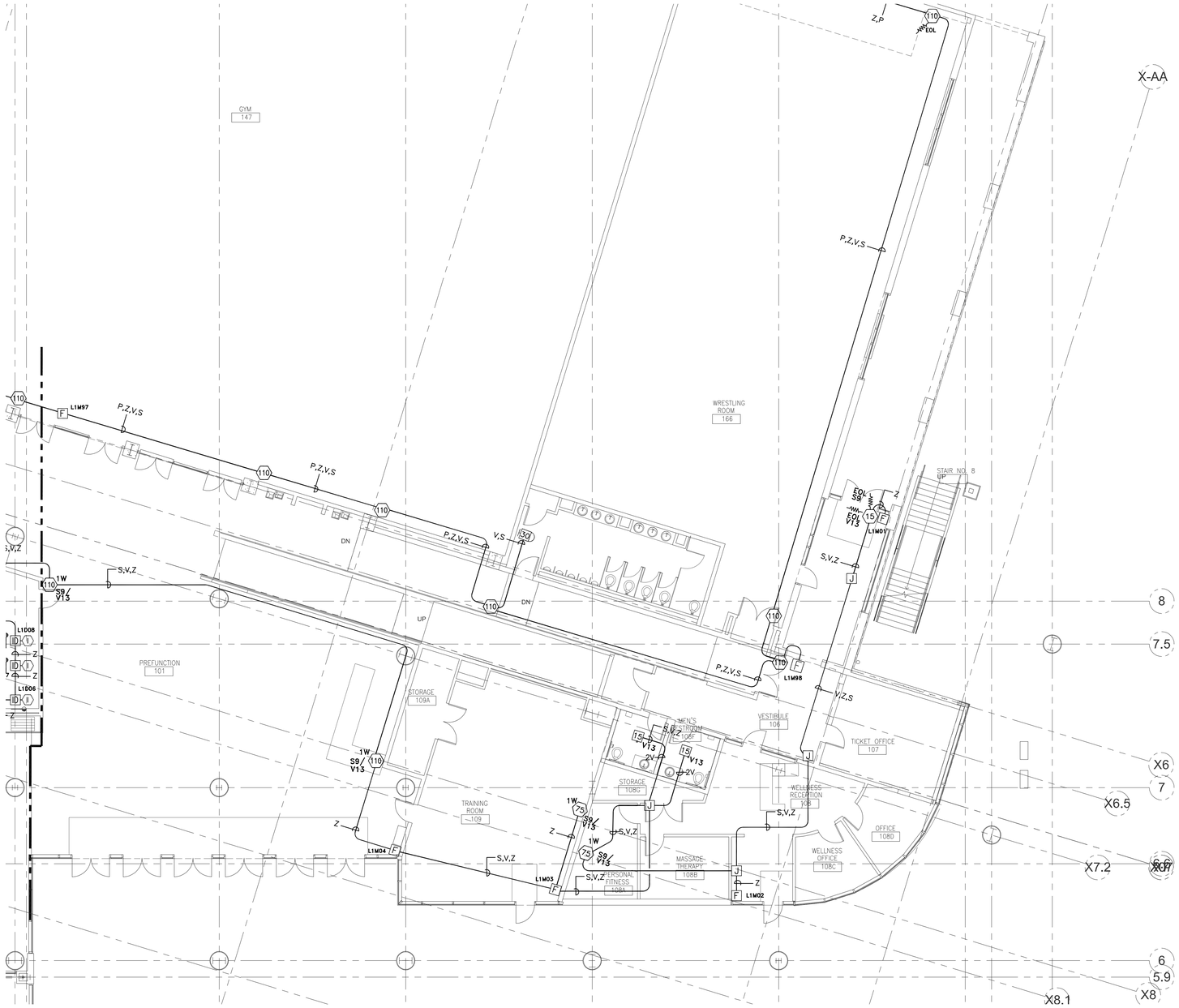
Project :
CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM RISER DIAGRAM

Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA0.03-REC CTR-RISER

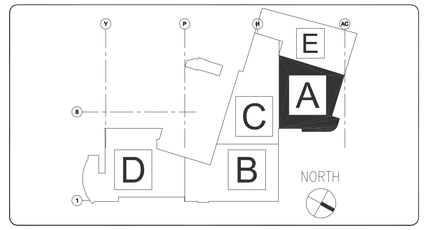
Sheet Number :
FA0.03
ASBUILT SET

ASBUILT SET



LEVEL 1 FLOOR PLAN - AREA 'A'

SCALE: 1/8"=1'-0"



KEY PLAN

SCALE: NONE

SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N
   ALL SPEAKERS TO BE TAPPED AT 1/2W 70V UNLESS OTHERWISE NOTED.
2. N/A
3. FOR POST INDICATOR VALVE (PIV) - VERIFY LOCATION.
4. FOR BACKFLOW PREVENTER (DDCV) - VERIFY LOCATION.

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX — XX DENOTES CANDELA RATING	FIRE ALARM CEILING STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM WALL STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM CEILING AUDIBLE/STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM WALL AUDIBLE/STROBE
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW — F.B.O.
T	SPRINKLER VALVE TAMPER — F.B.O.
PIV	SPRINKLER POST INDICATOR — F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHER'S
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
	CONDUIT DOWN CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
	PREFIX "M" — MC CABLE
	PREFIX "C" — CI CABLE
	SUFFIX "U" — UNDERGROUND/ WET LOCATION

WIRE LEGEND

Pyro-Comm Systems, Inc.
Fire, Life Safety and Security System Design and Installation
C-10 #612153 ACO 3231
CORPORATE OFFICE
15531 Container Lane
Huntington Beach, CA 92649
T(714)902-8000 F(714)902-8001
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C10-612153
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CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 1 - A

Drawn By : J.AREVALO 02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA1.10-REC CTR-1ST-A

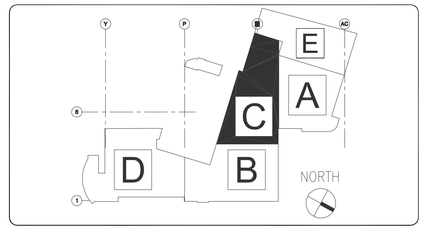
Sheet Number :
FA1.10

ASBUILT SET

ASBUILT SET

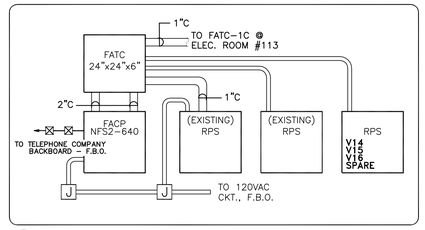
LEVEL 1 FLOOR PLAN - AREA 'C'

SCALE: 1/8"=1'-0"



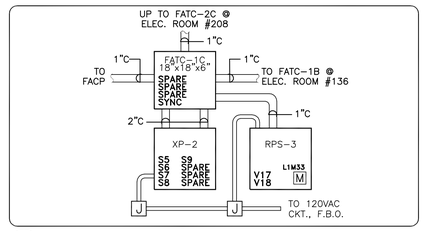
KEY PLAN

SCALE: NONE



1 FA1.11 FIRE ALARM CONTROL PANEL DETAIL

SCALE: NONE



2 FA1.11 ELECTRICAL ROOM #113 DETAIL

SCALE: NONE

SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N
   ALL SPEAKERS TO BE TAPPED AT 1/2W 70V UNLESS OTHERWISE NOTED.
2. FOR ACTUATION OF COMBINATION SMOKE/FIRE DAMPERS.
3. FOR ACTUATION OF GATE CONTROLLER DOOR SWING.
4. FOR PIV AND BACKFLOW PREVENTER TAMPER SWITCHES.
5. MOUNT IN SUPPLY AIR DUCT.
6. TO FAN SHUTDOWN - F.B.O.
7. TO PRIMARY ELEVATOR RECALL
8. TO ALTERNATE ELEVATOR RECALL
9. TO BATTERY SHUNT TRIP
10. TO THE ELEVATOR HAT

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P_{DC}	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX XX DENOTES CANDELA RATING	FIRE ALARM CEILING STROBE
XX XX DENOTES CANDELA RATING	FIRE ALARM WALL STROBE
XX XX DENOTES CANDELA RATING	FIRE ALARM CEILING AUDIBLE/STROBE
XX XX DENOTES CANDELA RATING	FIRE ALARM WALL AUDIBLE/STROBE
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW - F.B.O.
T	SPRINKLER VALVE TAMPER - F.B.O.
PIV	SPRINKLER POST INDICATOR - F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
	CONDUIT DOWN / CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
	PREFIX "M" - MC CABLE
	PREFIX "C" - CI CABLE
	SUFFIX "U" - UNDERGROUND/ WET LOCATION

WIRE LEGEND

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1	ENGINEER REVIEW COMMENTS	05/10/10	MAL
A	ISSUED FOR PLAN CHECK	02/29/10	JA

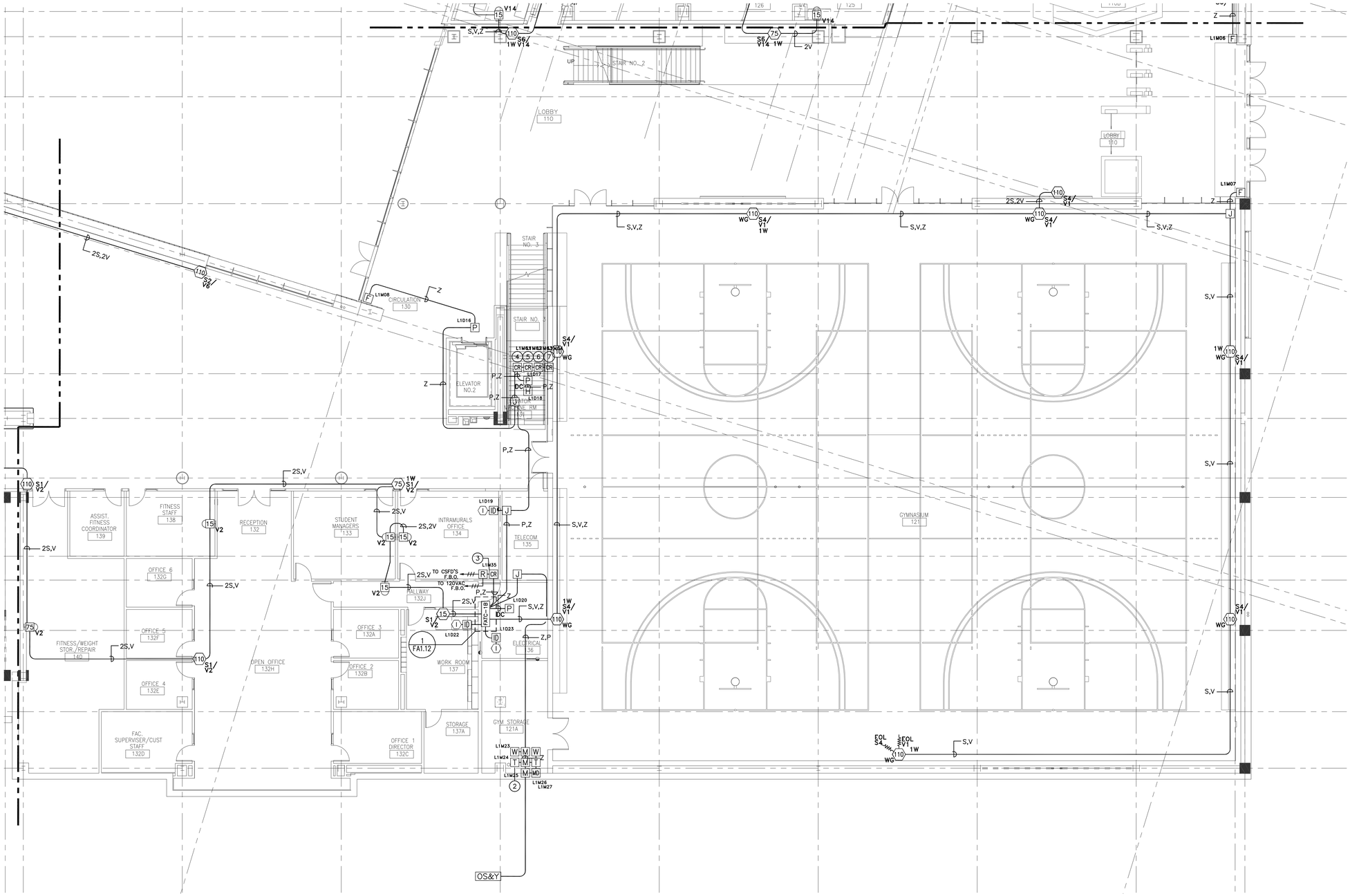
Project :
CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 1 - 'C'

Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA1.11-REC CTR-1ST-C

Sheet Number :
FA1.11

ASBUILT SET

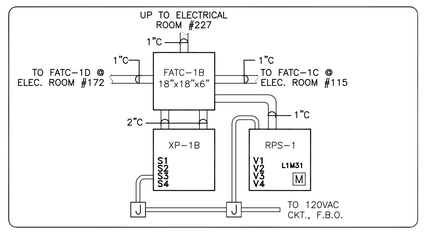


SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N
   ALL SPEAKERS TO BE TAPPED AT 1/2W 25V UNLESS OTHERWISE NOTED.
2. BUILDING FIRE SPRINKLER RISER.
3. FOR ACTUATION OF SMOKE FIRE DAMPERS.
4. TO PRIMARY ELEVATOR RECALL
5. TO ALTERNATE ELEVATOR RECALL
6. TO BATTERY SHUNT TRIP
7. TO ELEVATOR HAT

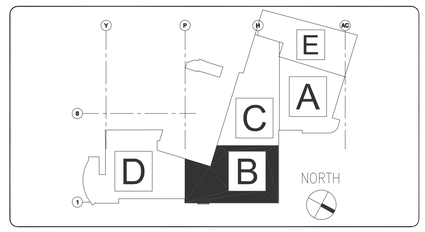
LEVEL 1 FLOOR PLAN - AREA 'B'

SCALE: 1/8"=1'-0"



1/FA1.12 ELECTRICAL ROOM #136 DETAIL

SCALE: NONE



KEY PLAN

SCALE: NONE

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P_{DC}	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX	FIRE ALARM CEILING STROBE (XX DENOTES CANDELA RATING)
XX	FIRE ALARM WALL STROBE (XX DENOTES CANDELA RATING)
XX	FIRE ALARM CEILING AUDIBLE/STROBE (XX DENOTES CANDELA RATING)
XX	FIRE ALARM WALL AUDIBLE/STROBE (XX DENOTES CANDELA RATING)
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW - F.B.O.
T	SPRINKLER VALVE TAMPER - F.B.O.
PIV	SPRINKLER POST INDICATOR - F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
	CONDUIT DOWN / CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
	PREFIX "M" - MC CABLE
	PREFIX "C" - CI CABLE
	SUFFIX "U" - UNDERGROUND/ WET LOCATION

WIRE LEGEND

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Project :
CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 1 - 'B'

Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA1.12-REC CTR-B1-B

Sheet Number :
FA1.12

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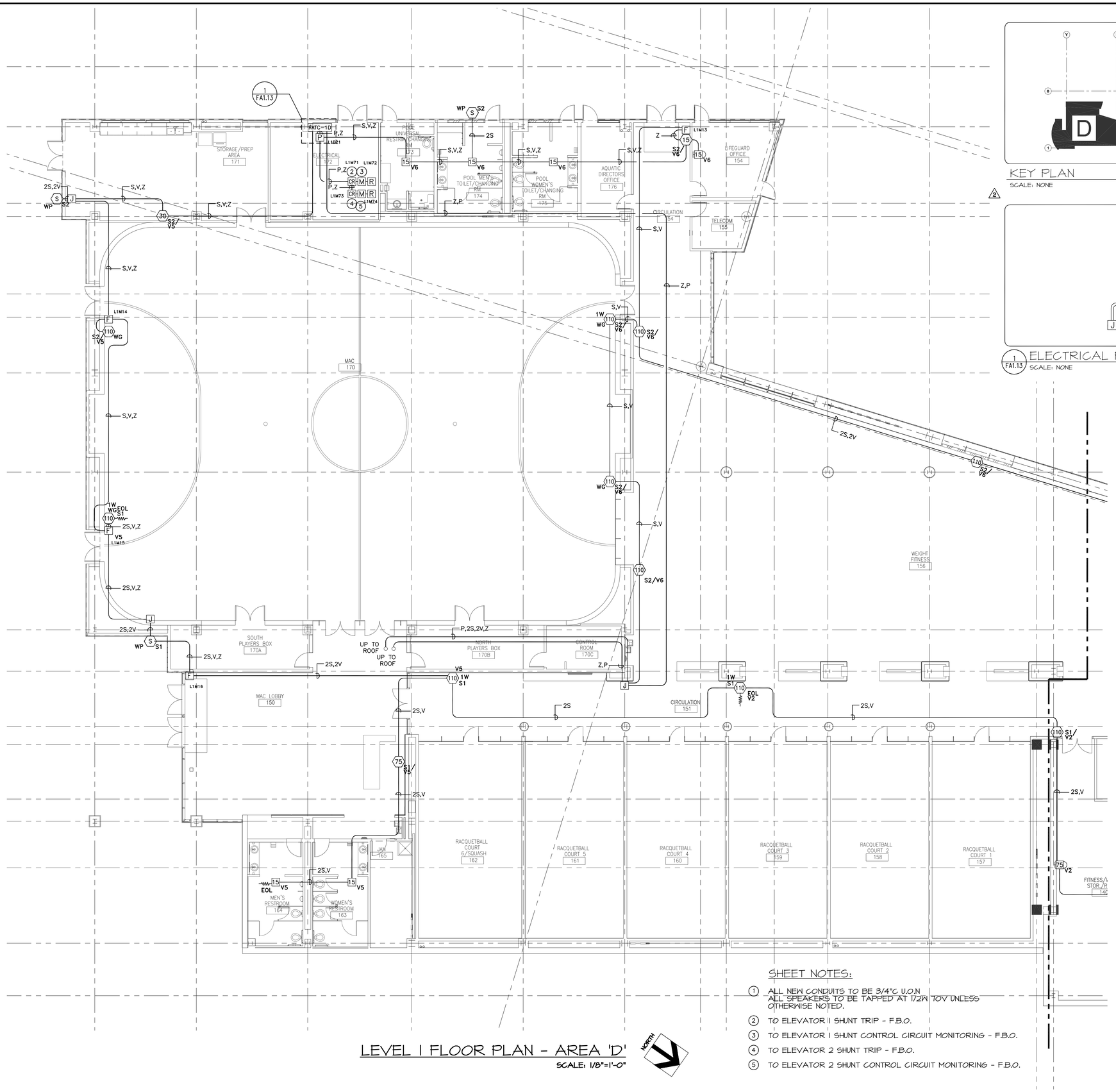
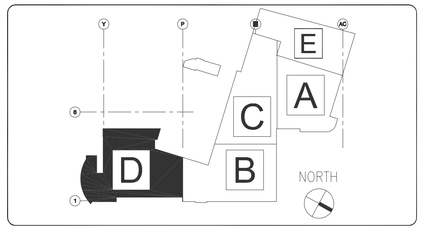


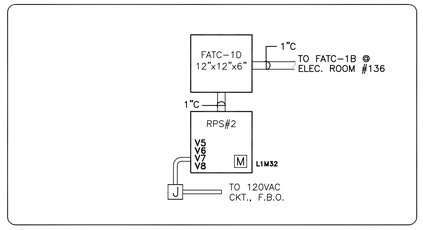
LEVEL 1 FLOOR PLAN - AREA 'D'

SCALE: 1/8"=1'-0"



KEY PLAN

SCALE: NONE



1 FA1.13 ELECTRICAL ROOM #172 DETAIL

SCALE: NONE

SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N
   ALL SPEAKERS TO BE TAPPED AT 1/2W 70V UNLESS OTHERWISE NOTED.
2. TO ELEVATOR 1 SHUNT TRIP - F.B.O.
3. TO ELEVATOR 1 SHUNT CONTROL CIRCUIT MONITORING - F.B.O.
4. TO ELEVATOR 2 SHUNT TRIP - F.B.O.
5. TO ELEVATOR 2 SHUNT CONTROL CIRCUIT MONITORING - F.B.O.

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX (XX DENOTES CANDELA RATING)	FIRE ALARM CEILING STROBE
XX (XX DENOTES CANDELA RATING)	FIRE ALARM WALL STROBE
XX (XX DENOTES CANDELA RATING)	FIRE ALARM CEILING AUDIBLE/STROBE
XX (XX DENOTES CANDELA RATING)	FIRE ALARM WALL AUDIBLE/STROBE
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW – F.B.O.
T	SPRINKLER VALVE TAMPER – F.B.O.
PIV	SPRINKLER POST INDICATOR – F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
	CONDUIT DOWN / CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
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CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 1 - D

Drawn By : J.AREVALO 02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA1.13-REC CTR-1ST-D

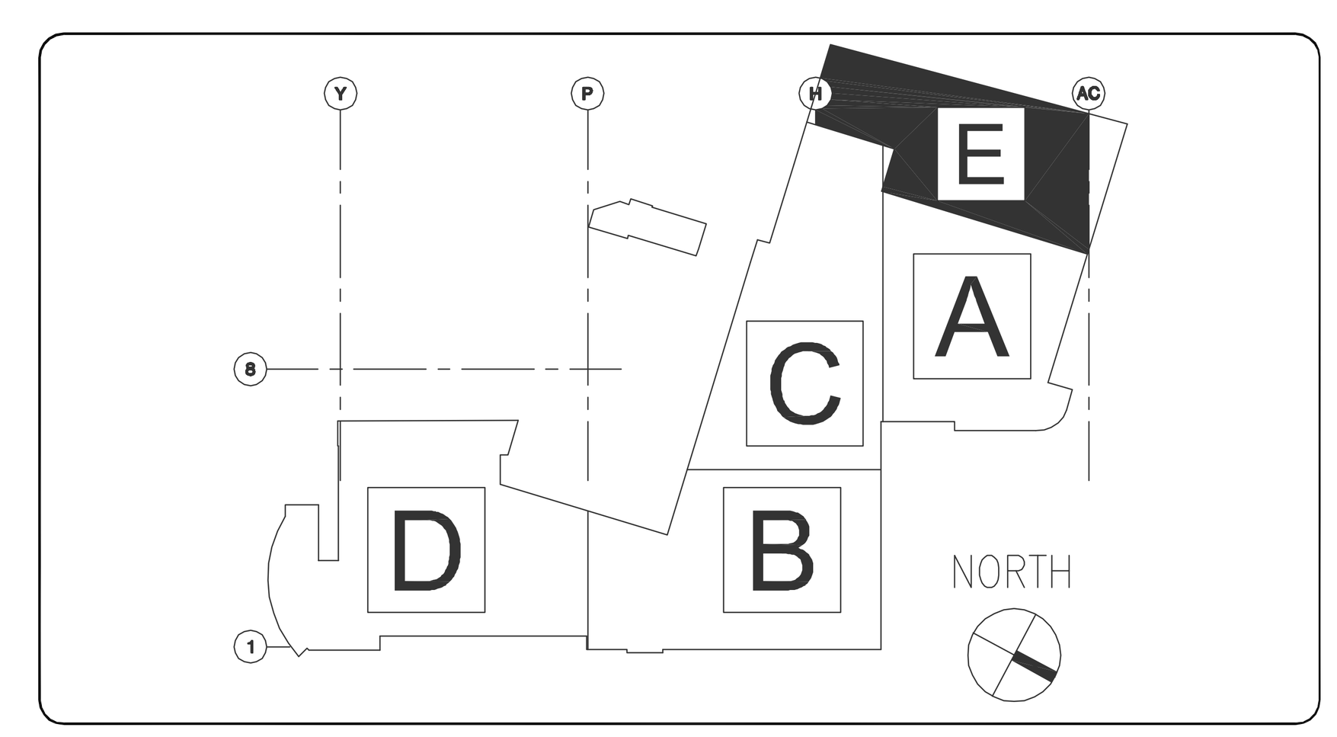
Sheet Number :
FA1.13

ASBUILT SET

ASBUILT SET

LEVEL 1 FLOOR PLAN - AREA 'E'

SCALE: 1/16"=1'-0"



KEY PLAN

SCALE: NONE

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
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P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
(I)	REMOTE INDICATOR L.E.D.
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W	SPRINKLER WATER FLOW - F.B.O.
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PIV	SPRINKLER POST INDICATOR - F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
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VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
● ○	CONDUIT DOWN CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
PREFIX "M" -	MC CABLE
PREFIX "C" -	CI CABLE
SUFFIX "U" -	UNDERGROUND/ WET LOCATION

WIRE LEGEND

Pyro-Comm Systems, Inc.
Fire, Life Safety and Security System Design and Installation
C-10 #612153 ACO 3231

CORPORATE OFFICE
15531 Container Lane
Huntington Beach, CA 92649
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X	AS BUILTS	3/7/12	JC
3	PER PCO#551	12/06/11	BKR
2	FIRE DEPT. COMMENTS	12/06/11	BKR
1	ENGINEER REVIEW COMMENTS	05/10/10	MAL
	ISSUED FOR PLAN CHECK	02/29/10	JA

Project :
CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

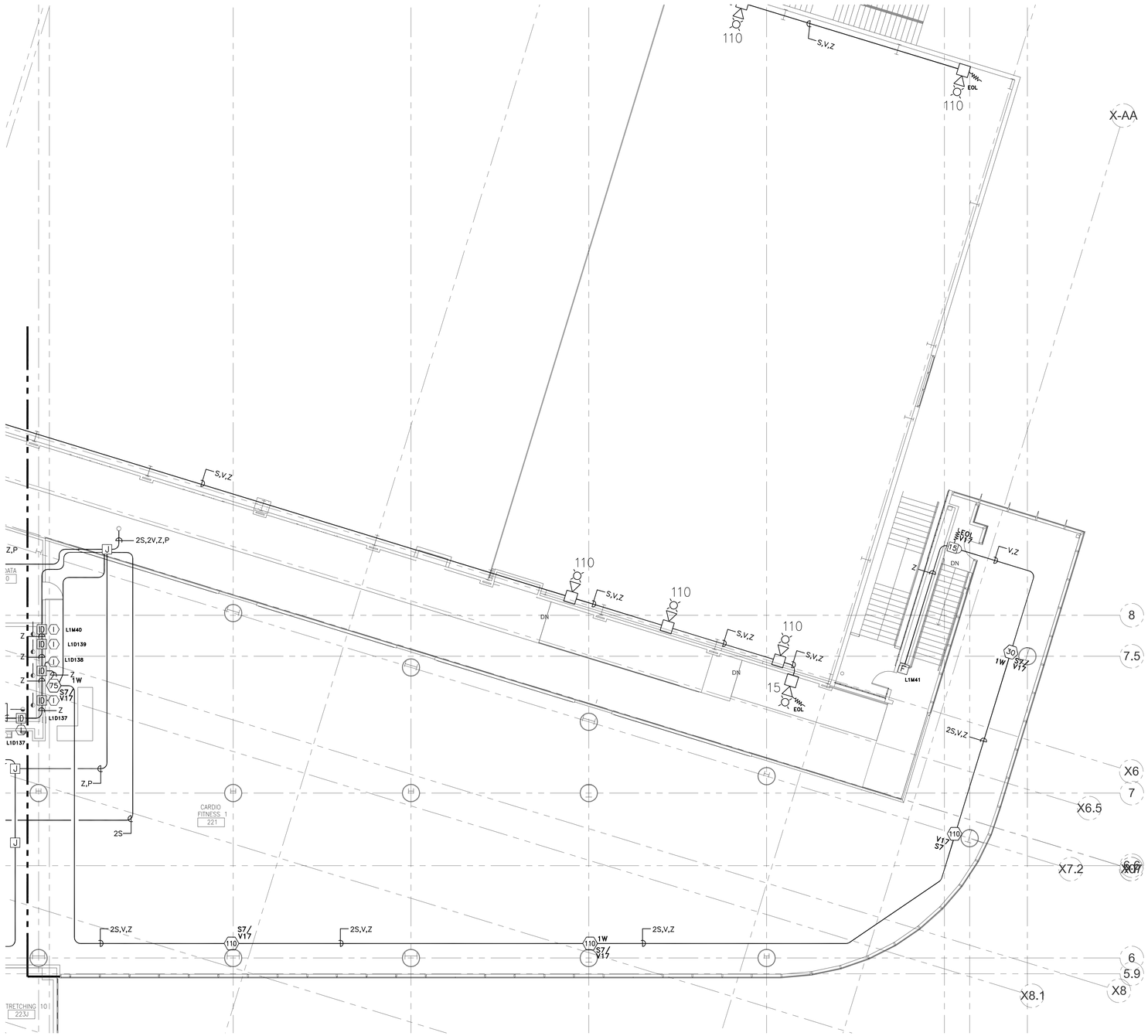
Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 1 - E

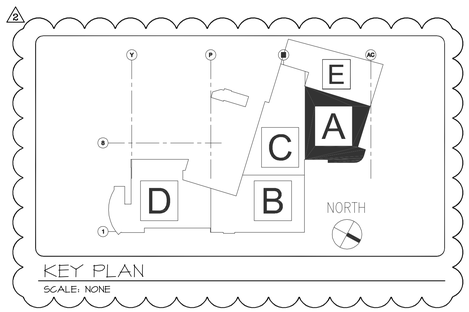
Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA1.14-REC CTR-1ST-E

Sheet Number :
FA1.14

ASBUILT SET

ASBUILT SET





SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N
   ALL SPEAKERS TO BE TAPPED AT 1/2W 70V UNLESS OTHERWISE NOTED.

LEVEL 2 FLOOR PLAN - AREA 'A'

SCALE: 1/8"=1'-0"

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX (XX DENOTES CANDELA RATING)	FIRE ALARM CEILING STROBE
XX (XX DENOTES CANDELA RATING)	FIRE ALARM WALL STROBE
XX (XX DENOTES CANDELA RATING)	FIRE ALARM CEILING AUDIBLE/STROBE
XX (XX DENOTES CANDELA RATING)	FIRE ALARM WALL AUDIBLE/STROBE
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW – F.B.O.
T	SPRINKLER VALVE TAMPER – F.B.O.
PIV	SPRINKLER POST INDICATOR – F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
	CONDUIT DOWN / CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
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Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
	PREFIX "M" – MC CABLE
	PREFIX "C" – CI CABLE
	SUFFIX "U" – UNDERGROUND/ WET LOCATION

WIRE LEGEND

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CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

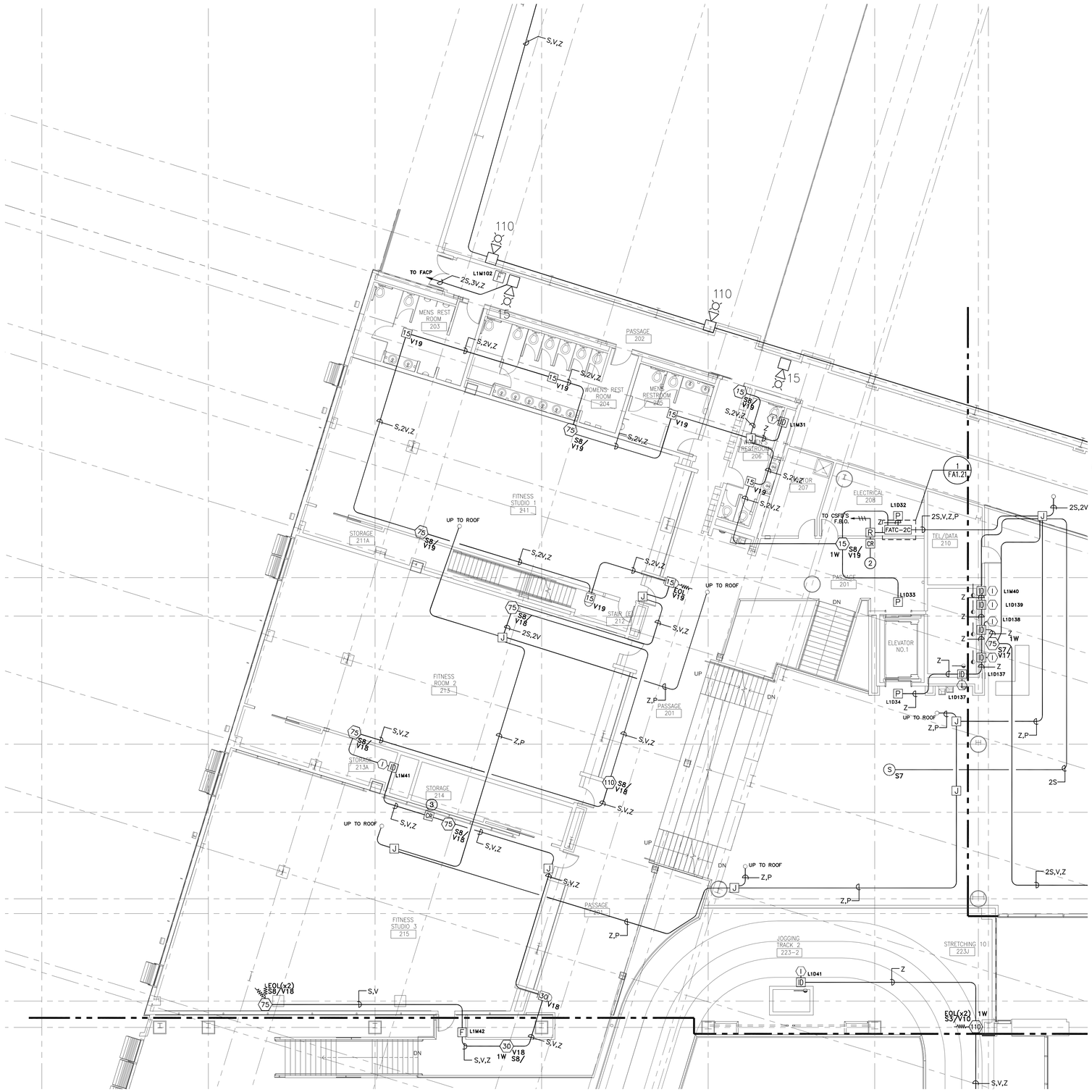
Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 2 - A

Drawn By :
J.AREVALO
02/23/10
Cad File :
M:\CAL POLY SLO\ RECREATION CENTER\ FA1.20-REC CTR-2ND-A

Sheet Number :
FA1.20

ASBUILT SET

ASBUILT SET



LEVEL 2 FLOOR PLAN - AREA 'C'

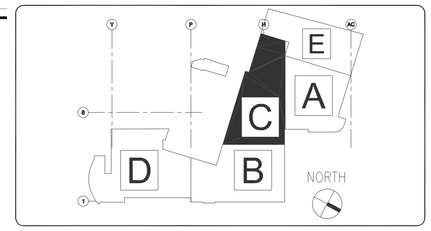
SCALE: 1/8"=1'-0"

1 FA1.21 ELECTRICAL ROOM #206 DETAIL

SCALE: NONE

SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N ALL SPEAKERS TO BE TAPPED AT 1/2W 70V UNLESS OTHERWISE NOTED.
2. FOR ACTUATION OF SMOKE FIRE DAMPERS.
3. FOR SHUTDOWN OF AUDIO/VISUAL IN THIS AREA.



KEY PLAN

SCALE: NONE

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX	FIRE ALARM CEILING STROBE (XX DENOTES CANDELA RATING)
XX	FIRE ALARM WALL STROBE (XX DENOTES CANDELA RATING)
XX	FIRE ALARM CEILING AUDIBLE/STROBE (XX DENOTES CANDELA RATING)
XX	FIRE ALARM WALL AUDIBLE/STROBE (XX DENOTES CANDELA RATING)
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW - F.B.O.
T	SPRINKLER VALVE TAMPER - F.B.O.
PIV	SPRINKLER POST INDICATOR - F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
	CONDUIT DOWN / CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
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R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
	PREFIX "M" - MC CABLE
	PREFIX "C" - CI CABLE
	SUFFIX "U" - UNDERGROUND/ WET LOCATION

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STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

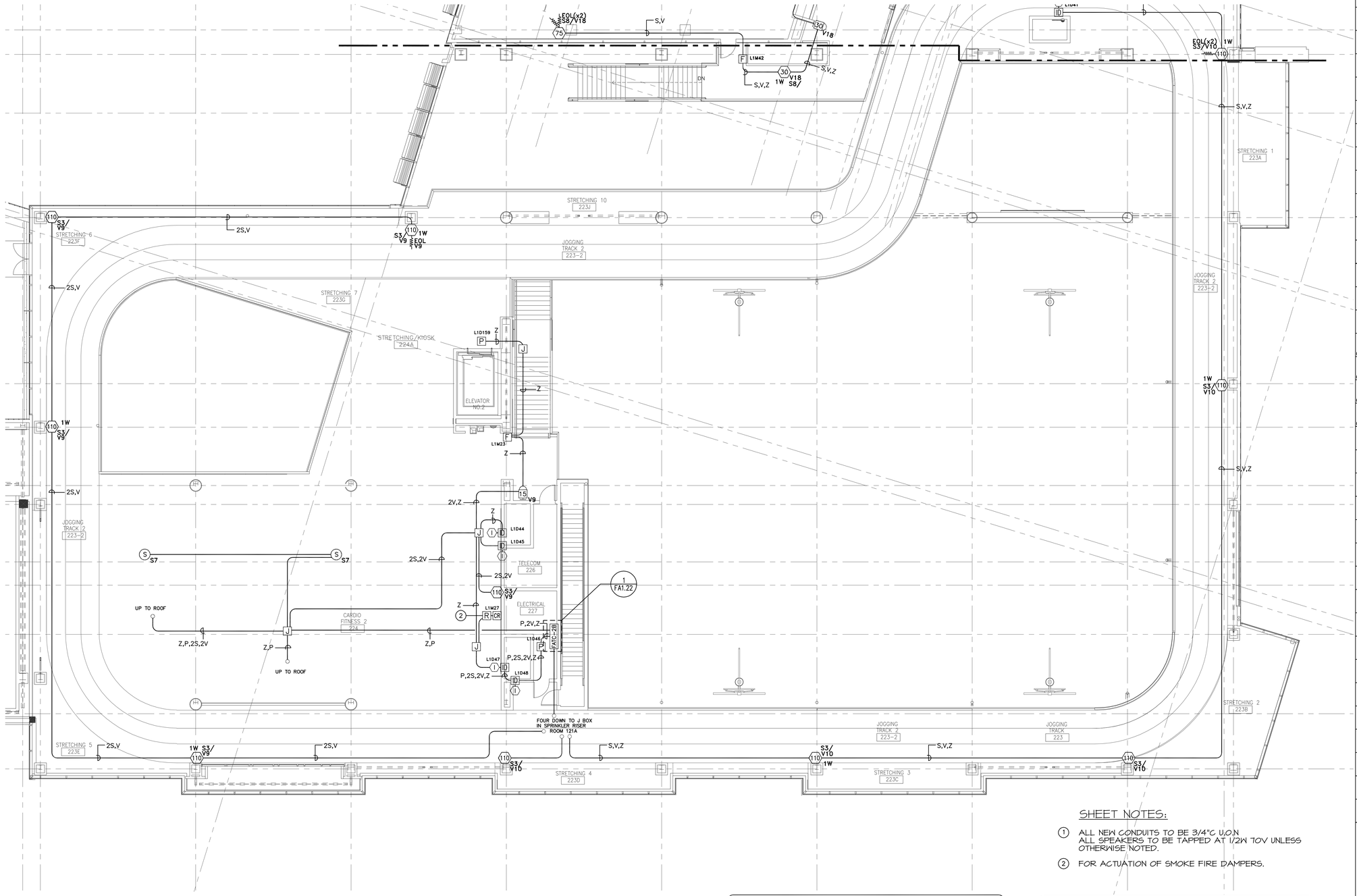
Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 2 - 'C'

Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA\21-REC CTR-2ND-C

Sheet Number :
FA1.21

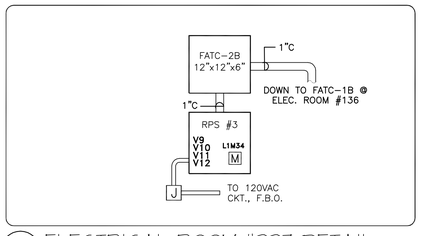
ASBUILT SET

ASBUILT SET

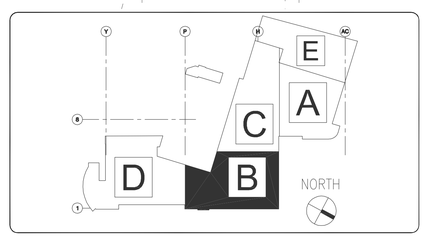


SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N
   ALL SPEAKERS TO BE TAPPED AT 1/2W 70V UNLESS OTHERWISE NOTED.
2. FOR ACTUATION OF SMOKE FIRE DAMPERS.



1/FA1.21 ELECTRICAL ROOM #227 DETAIL
SCALE: NONE



KEY PLAN
SCALE: NONE

LEVEL 2 FLOOR PLAN - AREA 'B'
SCALE: 1/8"=1'-0"

NORTH

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX XX DENOTES CANDELA RATING	FIRE ALARM CEILING STROBE
XX XX DENOTES CANDELA RATING	FIRE ALARM WALL STROBE
XX XX DENOTES CANDELA RATING	FIRE ALARM CEILING AUDIBLE/STROBE
XX XX DENOTES CANDELA RATING	FIRE ALARM WALL AUDIBLE/STROBE
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW – F.B.O.
T	SPRINKLER VALVE TAMPER – F.B.O.
PIV	SPRINKLER POST INDICATOR – F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
	CONDUIT DOWN CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
	PREFIX "M" – MC CABLE
	PREFIX "C" – CI CABLE
	SUFFIX "U" – UNDERGROUND/ WET LOCATION

WIRE LEGEND

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CALIFORNIA POLYTECHNIC STATE UNIVERSITY
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STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 2 - 'B'

Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA122-REC CTR-2ND-B

Sheet Number :
FA1.22

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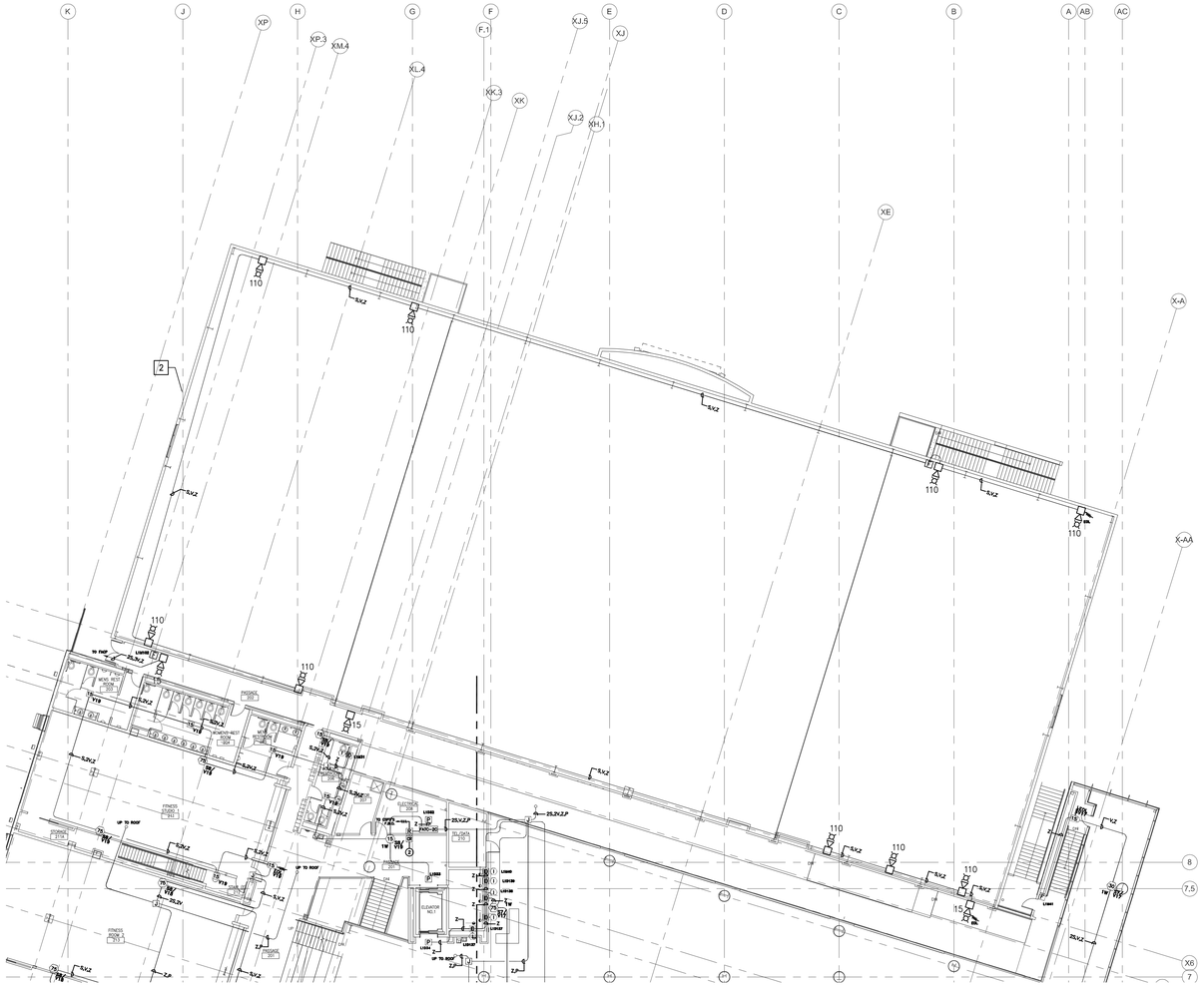
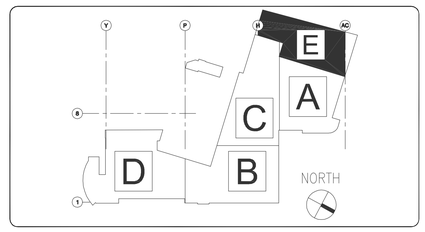


LEVEL 2 FLOOR PLAN - AREA 'E'

SCALE: 1/16"=1'-0"



KEY PLAN

SCALE: NONE

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
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P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX — XX DENOTES CANDELA RATING	FIRE ALARM CEILING STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM WALL STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM CEILING AUDIBLE/STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM WALL AUDIBLE/STROBE
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW — F.B.O.
T	SPRINKLER VALVE TAMPER — F.B.O.
PIV	SPRINKLER POST INDICATOR — F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
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VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
● / ○	CONDUIT DOWN / CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
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D	ANNUNCIATOR DATA
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R	24V RESET. POWER
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	PREFIX "C" — CI CABLE
	SUFFIX "U" — UNDERGROUND/ WET LOCATION

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SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 2 - E

Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA1.20-REC CTR-2ND-E

Sheet Number :
FA1.23

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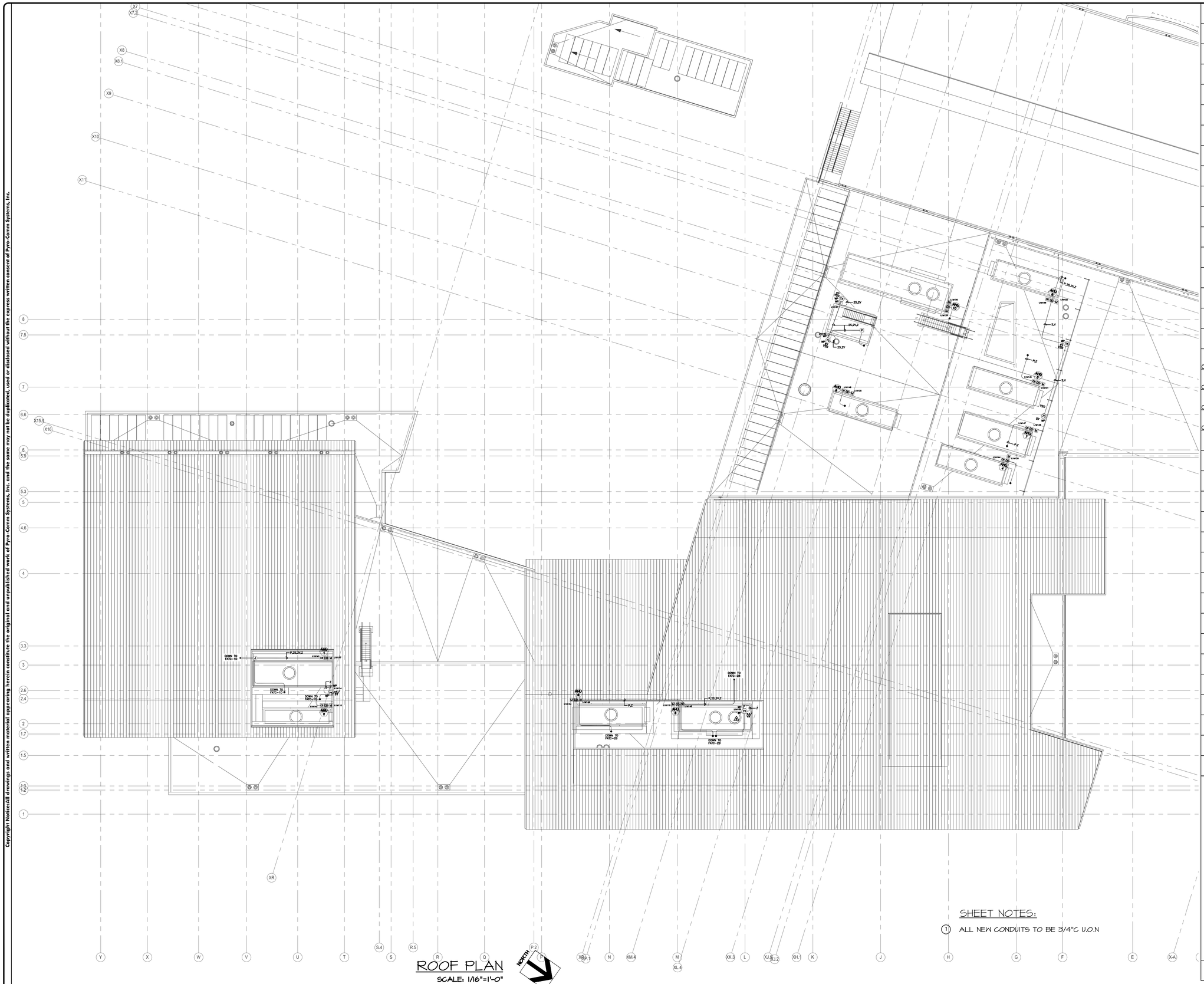

ROOF PLAN
SCALE: 1/16"=1'-0"

NORTH

SHEET NOTES:

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FACP	FIRE ALARM CONTROL PANEL
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Signatures

STATE OF CALIFORNIA
LICENSED ELECTRICAL CONTRACTOR
C10-612153
EXP. 02-28-11

Approvals

NOTE: 0 1"
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Rev	Issued For	Date	By
X	AS BUILTS	3/7/12	JC
3	PER PCO#551	12/06/11	BKR
2	FIRE DEPT. COMMENTS	12/06/11	BKR
1	ENGINEER REVIEW COMMENTS	05/10/10	MAL
A	ISSUED FOR PLAN CHECK	02/29/10	JA

Project :
CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN ROOF LEVEL

Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA130-REC CTR-ROOF

Sheet Number :
FA1.30

ASBUILT SET

ASBUILT SET

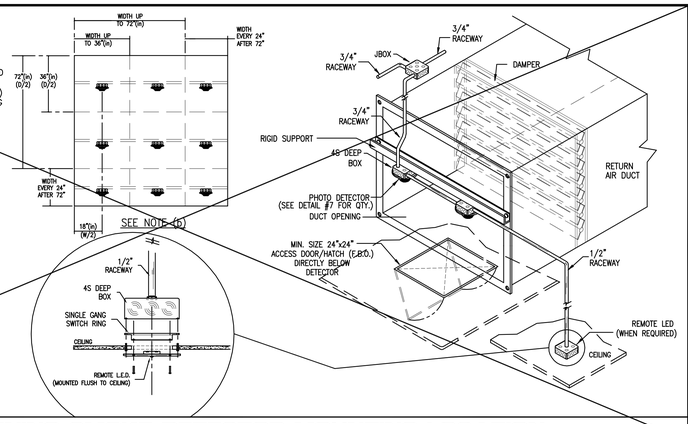
NFPA 72, 2007 ed.
A.5.16.4.2.2– DETECTORS LISTED FOR THE AIR VELOCITY PRESENT CAN BE PERMITTED TO BE INSTALLED AT THE OPENING WHERE THE RETURN AIR ENTERS THE COMMON RETURN AIR SYSTEM. THE DETECTORS SHOULD BE INSTALLED UP TO 300mm (12 in.) ON FRONT OF OR BEHIND THE OPENING AND SPACED ACCORDING TO THE FOLLOWING OPENING DIMENSIONS:

(1) WIDTH (a) UP TO 914mm (36in.) – ONE DETECTOR CENTERED IN OPENING
(b) UP TO 1.829m (72in) – TWO DETECTORS LOCATED AT THE ONE–QUARTER POINTS OF THE OPENING
(c) OVER 1.829m (72in.) – ONE ADDITIONAL DETECTOR FOR EACH FULL 610mm (24in.) OF OPENING

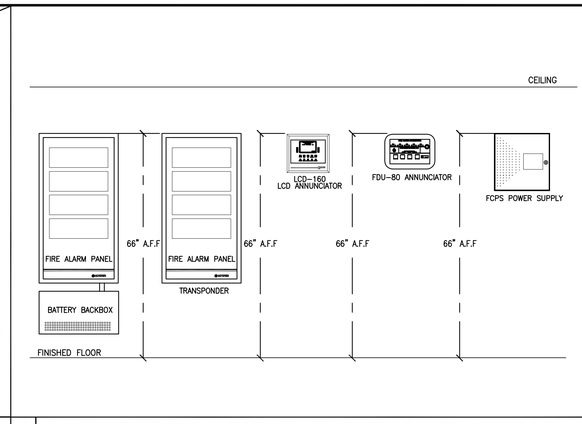
(2) DEPTH THE NUMBER AND SPACING OF DETECTOR(S) IN THE DEPTH (VERTICAL) OF THE OPENING SHOULD BE THE SAME AS THOSE GIVEN FOR THE WIDTH (HORIZONTAL) IN A.5.16.4.2.2(1).

(3) ORIENTATION DETECTORS SHOULD BE ORIENTED IN THE MOST FAVORABLE POSITION FOR SMOKE ENTRY WITH RESPECT TO THE DIRECTION OF AIRFLOW. THE PATH OF A PROJECTED BEAM–TYPE DETECTOR ACROSS THE RETURN AIR OPENINGS SHOULD BE CONSIDERED.

RETURN AIR SMOKE DUCT DETECTOR LOCATION/MOUNTING (RETURN AIR OPENING)

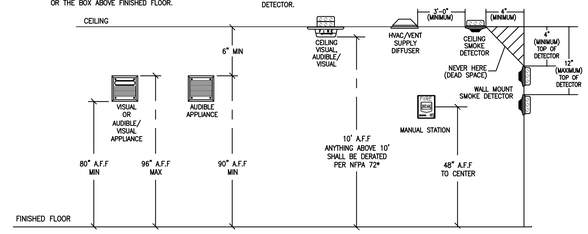


1 RETURN AIR OPENING SMOKE DETECTOR MOUNTING LOCATION



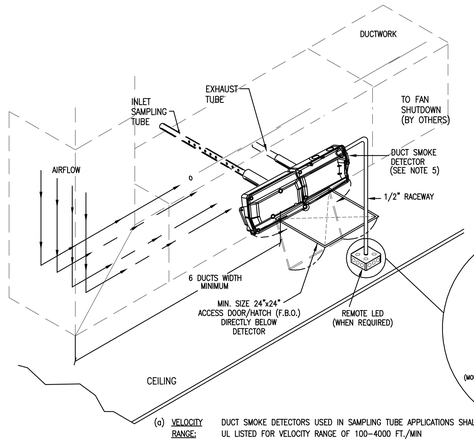
2 BACKBOX MOUNTING ELEVATION DETAIL

NOTES:
1. ALL WALL–MOUNTED VISUAL SIGNALING APPLIANCES SHALL BE MOUNTED SUCH THAT THE ENTIRE BOTTOM LENS IS NOT LESS THAN 80 IN. AND TOP OF LENS IS NOT GREATER THAN 96 IN. ABOVE THE FINISHED FLOOR (A.F.F.) PER NFPA 72 2007 SECTION 7.5.4. ALL WALL MOUNTED AUDIBLE DEVICES SHALL BE A MINIMUM OF 90 IN. A.F.F. TO TOP OF DEVICE PER NFPA 72 2007 CH. 7.4.7.1. AREAS HAVING MORE THAN 2 STROBES IN THE FIELD OF VIEW SHALL BE SYNCRONIZED PER NFPA 72 2007 SECTION 7.5.4.3.2.
2. MANUAL STATION SHALL BE INSTALLED AT 48" CENTER OR THE BOX ABOVE FINISHED FLOOR.
3. WEATHERPROOF HORN/STROBE SHALL BE WALL MOUNTED A MINIMUM OF 90" ABOVE FLOOR OR 6" MINIMUM BELOW THE CEILING, WHICHEVER IS LOWER. MEASUREMENTS ARE TO BE TAKEN FROM THE HIGHEST PORTION OF THE HORN.
4. PER NFPA–72 2007 EDITION, SECTION 5.7.3.2.1 SPOT–TYPE SMOKE DETECTORS SHALL BE LOCATED ON THE CEILING NOT LESS THAN 100mm (4 in.) FROM A SIDEWALL TO THE NEAR EDGE OR, IF ON A SIDEWALL, BETWEEN 100mm AND 300mm (4 in. AND 12 in.) DOWN FROM FROM THE CEILING TO THE TOP OF THE DETECTOR.



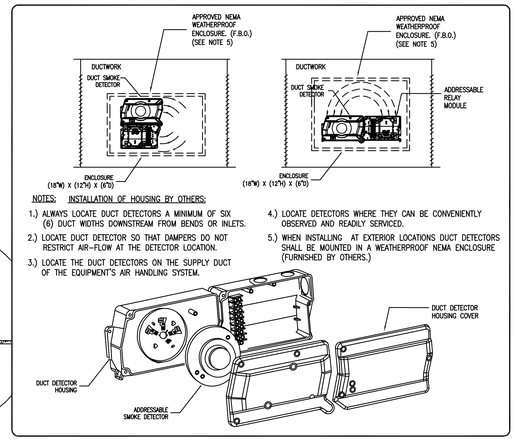
* DE–RATED STROBES SHALL MEET THE REQUIREMENTS OF SECTION 7.5.4.3. "PERFORMANCE – BASED ALTERNATIVE".

3 DEVICE MOUNTING ELEVATION DETAILS



(a) VELOCITY RANGE: DUCT SMOKE DETECTORS USED IN SAMPLING TUBE APPLICATIONS SHALL BE UL LISTED FOR VELOCITY RANGE OF 100–4000 FT./MIN

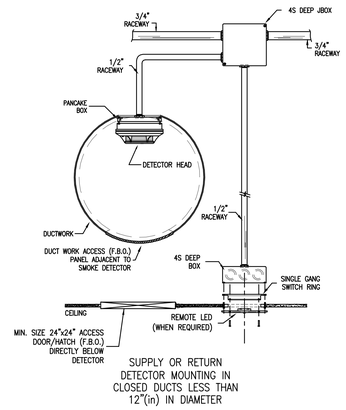
NFPA–72, 2007 EDITION, 5.16.5.8 – WHERE IN–DUCT SMOKE DETECTORS ARE INSTALLED IN CONCEALED LOCATIONS MORE THAN 3m (10ft) ABOVE THE FINISHED FLOOR OR IN ARRANGEMENTS WHERE THE DETECTOR'S ALARM OR SUPERVISORY INDICATOR IS NOT VISIBLE TO RESPONDING PERSONNEL, THE DETECTORS SHALL BE PROVIDED WITH REMOTE ALARM OR SUPERVISORY INDICATION IN A LOCATION ACCEPTIBLE TO THE AUTHORITY HAVING JURISDICTION.



NOTES: INSTALLATION OF HOUSING BY OTHERS:
1.) ALWAYS LOCATE DUCT DETECTORS A MINIMUM OF SIX (6) DUCT WIDTHS DOWNSTREAM FROM BENDS OR INLETS.
2.) LOCATE DUCT DETECTOR SO THAT DAMPERS DO NOT RESTRICT AIR–FLOW AT THE DETECTOR LOCATION.
3.) LOCATE THE DUCT DETECTORS ON THE SUPPLY DUCT OF THE EQUIPMENT'S AIR HANDLING SYSTEM.
4.) LOCATE DETECTORS WHERE THEY CAN BE CONVENIENTLY OBSERVED AND READILY SERVICED.
5.) WHEN INSTALLING AT EXTERIOR LOCATIONS DUCT DETECTORS SHALL BE MOUNTED IN A WEATHERPROOF NEMA ENCLOSURE (FURNISHED BY OTHERS.)

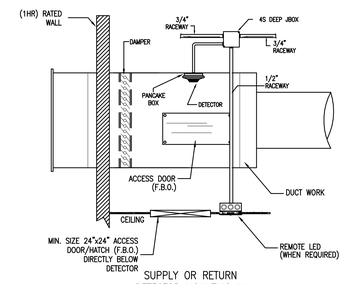
4 DUCT SMOKE DETECTOR MOUNTING/LOCATION INFORMATION

(a) VELOCITY RANGE: DETECTORS TO BE USED FOR IN–DUCT APPLICATIONS SHALL BE UL LISTED FOR VELOCITY RANGE OF 0–4000 FT./MIN

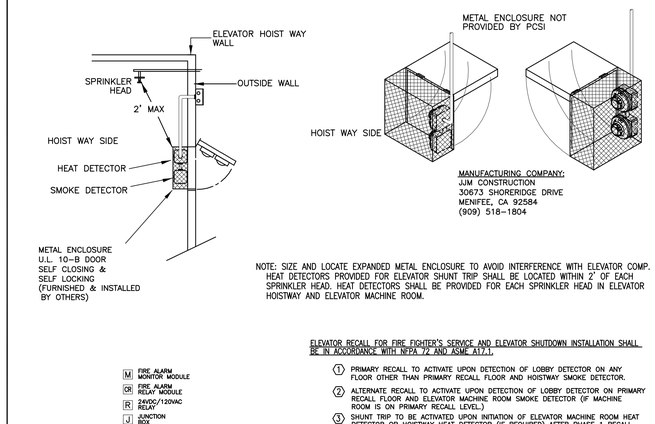


SUPPLY OR RETURN DETECTOR MOUNTING IN CLOSED DUCTS LESS THAN 12"(in) IN DIAMETER

NFPA–72, 2007 EDITION, 5.16.5.8 – WHERE IN–DUCT SMOKE DETECTORS ARE INSTALLED IN CONCEALED LOCATIONS MORE THAN 3m (10ft) ABOVE THE FINISHED FLOOR OR IN ARRANGEMENTS WHERE THE DETECTOR'S ALARM OR SUPERVISORY INDICATOR IS NOT VISIBLE TO RESPONDING PERSONNEL, THE DETECTORS SHALL BE PROVIDED WITH REMOTE ALARM OR SUPERVISORY INDICATION IN A LOCATION ACCEPTIBLE TO THE AUTHORITY HAVING JURISDICTION.



SUPPLY OR RETURN DETECTOR MOUNTING IN CLOSED DUCTS GREATER THAN 12"(in) IN DIAMETER



MANUFACTURING COMPANY:
JJM CONSTRUCTION
30673 SHORERIDGE DRIVE
MENIFEE, CA 92584
(909) 518–1804

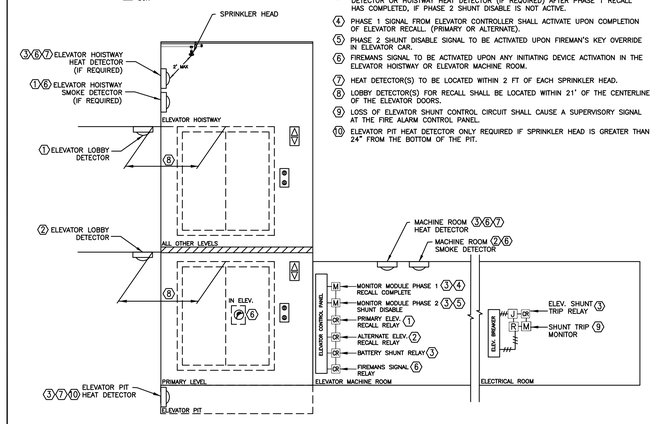
NOTE: SIZE AND LOCATE EXPANDED METAL ENCLOSURE TO AVOID INTERFERENCE WITH ELEVATOR COMP. HEAT DETECTORS PROVIDED FOR ELEVATOR SHUNT TRIP SHALL BE LOCATED WITHIN 2' OF EACH SPRINKLER HEAD. HEAT DETECTORS SHALL BE PROVIDED FOR EACH SPRINKLER HEAD IN ELEVATOR HOISTWAY AND ELEVATOR MACHINE ROOM.

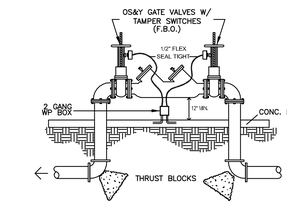
8 ELEVATOR EQUIPMENT DETAIL

ELEVATOR RECALL FOR FIRE FIGHTER'S SERVICE AND ELEVATOR SHUTDOWN INSTALLATION SHALL BE IN ACCORDANCE WITH NFPA 72 AND ASME A17.1.

1. PRIMARY RECALL TO ACTIVATE UPON DETECTION OF LOBBY DETECTOR ON ANY FLOOR OTHER THAN PRIMARY RECALL FLOOR AND HOISTWAY SMOKE DETECTOR.
2. ALTERNATE RECALL TO ACTIVATE UPON DETECTION OF LOBBY DETECTOR ON PRIMARY RECALL FLOOR AND ELEVATOR MACHINE ROOM SMOKE DETECTOR (IF MACHINE ROOM IS ON PRIMARY RECALL LEVEL.)
3. SHUNT TRIP TO BE ACTIVATED UPON INITIATION OF ELEVATOR MACHINE ROOM HEAT DETECTOR OR HOISTWAY HEAT DETECTOR (IF REQUIRED) AFTER PHASE 1 RECALL HAS COMPLETED, IF PHASE 2 SHUNT DISABLE IS NOT ACTIVE.
4. PHASE 1 SIGNAL FROM ELEVATOR CONTROLLER SHALL ACTIVATE UPON COMPLETION OF ELEVATOR RECALL. (PRIMARY OR ALTERNATE).
5. PHASE 2 SHUNT DISABLE SIGNAL TO BE ACTIVATED UPON FIREMAN'S KEY OVERRIDE IN ELEVATOR CAR.
6. FIREMANS SIGNAL TO BE ACTIVATED UPON ANY INITIATING DEVICE ACTIVATION IN THE ELEVATOR HOISTWAY OR ELEVATOR MACHINE ROOM.
7. HEAT DETECTOR(S) TO BE LOCATED WITHIN 2 FT OF EACH SPRINKLER HEAD.
8. LOBBY DETECTOR(S) FOR RECALL SHALL BE LOCATED WITHIN 21' OF THE CENTERLINE OF THE ELEVATOR DOORS.
9. LOSS OF ELEVATOR SHUNT CONTROL CIRCUIT SHALL CAUSE A SUPERVISORY SIGNAL AT THE FIRE ALARM CONTROL PANEL.
10. ELEVATOR PIT HEAT DETECTOR ONLY REQUIRED IF SPRINKLER HEAD IS GREATER THAN 24" FROM THE BOTTOM OF THE PIT.

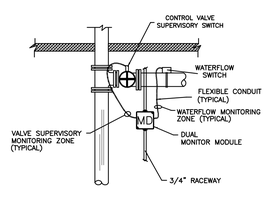
M FIRE ALARM MONITOR MODULE
CR FIRE ALARM RELAY MODULE
R 24VDC/120VAC RELAY
J JUNCTION BOX



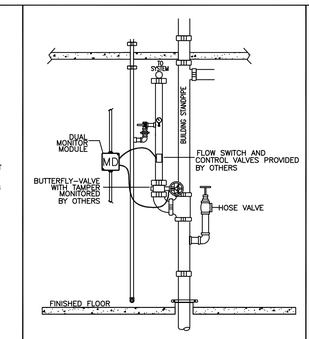


**MODULE FOR OS&Y VALVE TO BE MOUNTED ON THE INSIDE OF THE BUILDING

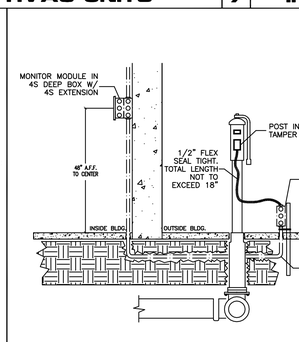
9 OS & Y VALVE



10 HORIZONTAL RISER

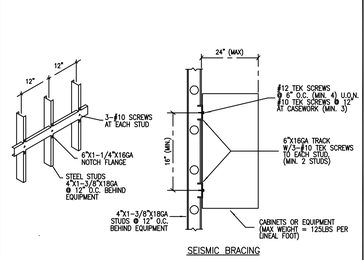


11 VERTICAL RISER



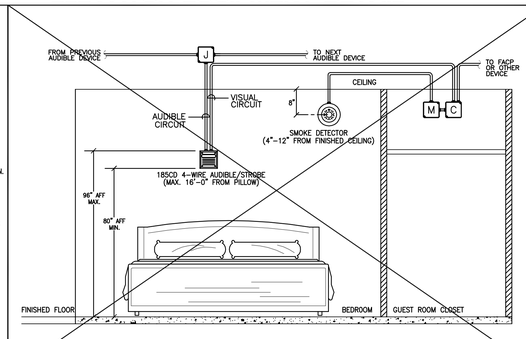
12 PIV VALVE

WORST CASE OPERATING WEIGHTS:
FACP: 175 lbs. IN CABINET SBB–D4
VOICE TRANSPONDER: 227 lbs. IN CABINET SBB–D4
BATTERY CABINET: 114 lbs. IN CAB NFS–LBB
FCPS POWER SUPPLY: 35 lbs.



SEISMIC BRACING

13 SEISMIC BRACING DETAIL



14 HANDICAP/HEARING IMPAIRED RM DETAIL

Pyro-Comm Systems, Inc.
Fire, Life Safety and Security System Design and Installation
C-10 #612153 ACO 3231

CORPORATE OFFICE
15531 Container Lane
Huntington Beach, CA 92649
T(714)902-8000 F(714)902-8001

SAN DIEGO REGIONAL OFFICE
5115 Avenida Encinas Ste.G
Carlsbad, CA 92008
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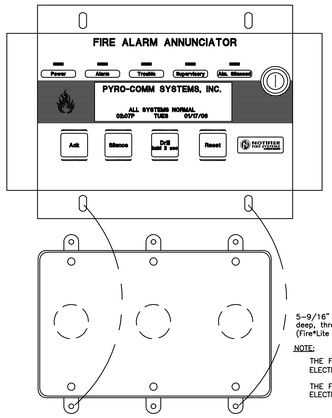
W.O. # : 2010035

Sheet Title :
FIRE ALARM MOUNTING DETAILS

Drawn By :
J.AREVALO
02/23/10
Cad File :
M:\CAL POLY SLO\ RECREATION CENTER\ FA2.01-REC CTR-MTG

Sheet Number :
FA2.01

ASBUILT SET

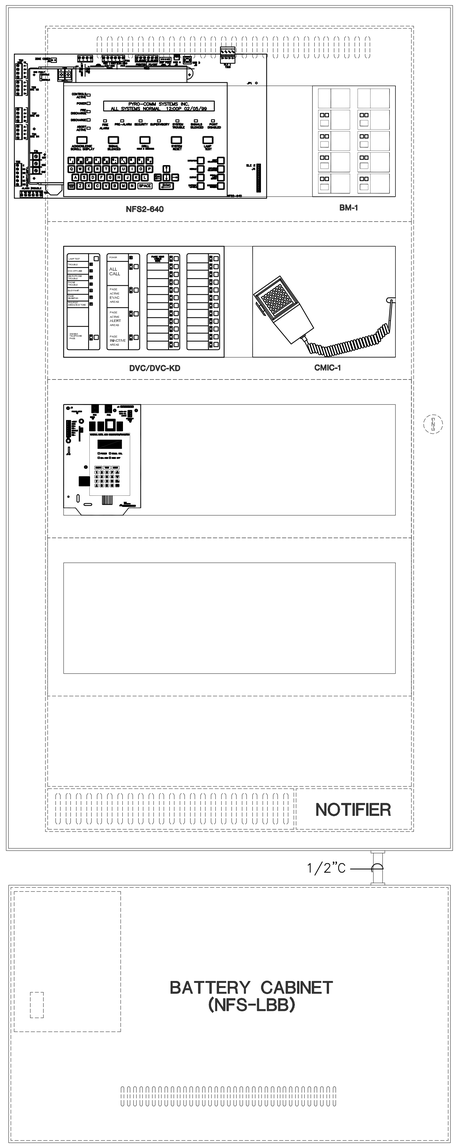


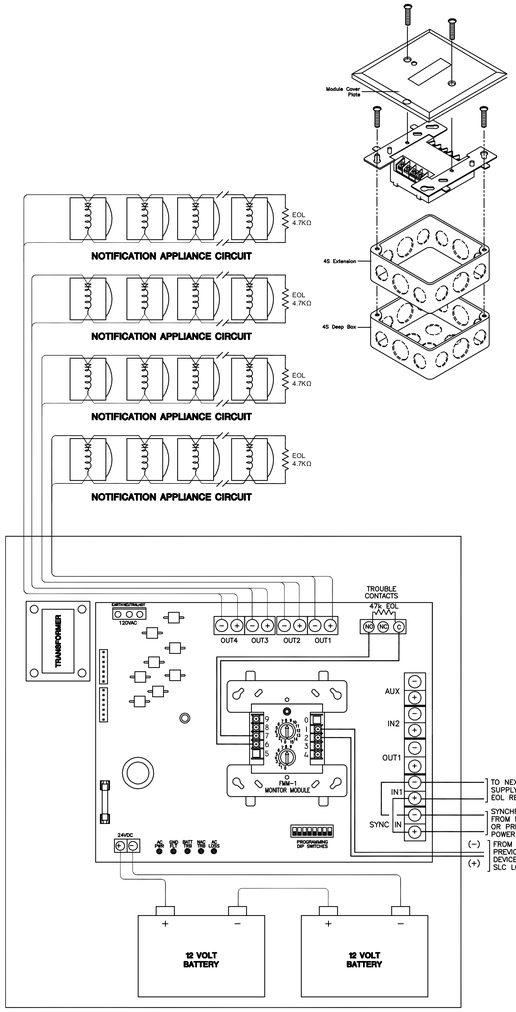
5-9/16" wide x 3-3/4" high x 2-1/2" deep, three-gang electrical box (FireLite P/N 10103 or equivalent)

NOTE:
THE FDU-80 CAN ONLY BE MOUNTED IN A 3-GANG ELECTRICAL BOX WITH A MINIMUM DEPTH OF 2-1/2".

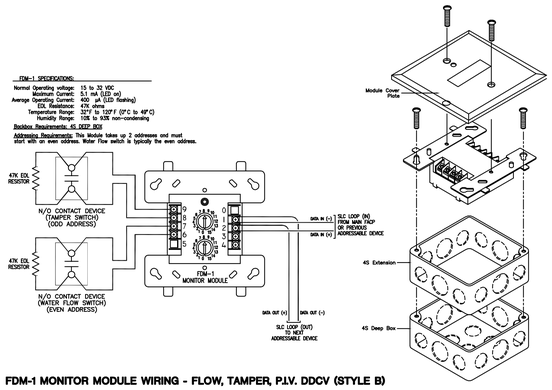
THE FDU-80 CANNOT BE MOUNTED IN THREE GANGABLE ELECTRICAL SWITCH BOXES CONNECTED TOGETHER.

FDU-80 FIRE ALARM ANNUNCIATOR

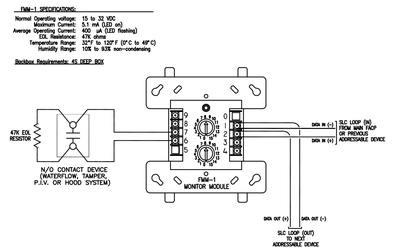




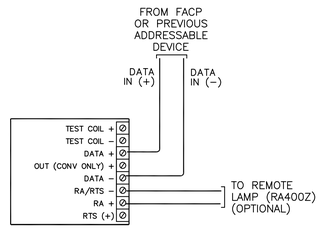
POWER SUPPLY WIRING (SYNC TURN-ON)



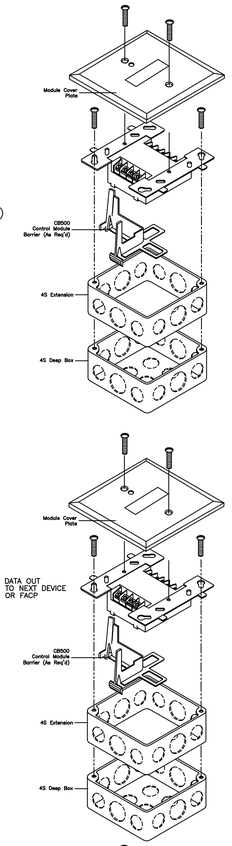
FDM-1 MONITOR MODULE WIRING - FLOW, TAMPER, P.I.V. DDCV (STYLE B)

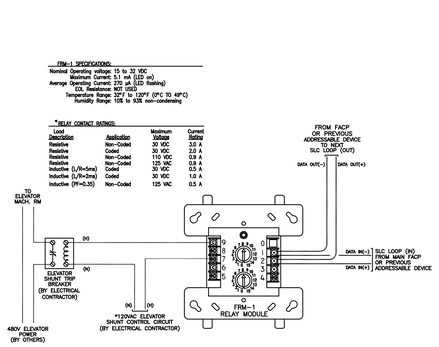


FMM-1 MONITOR MODULE WIRING - FLOW, TAMPER, P.I.V. (STYLE B)



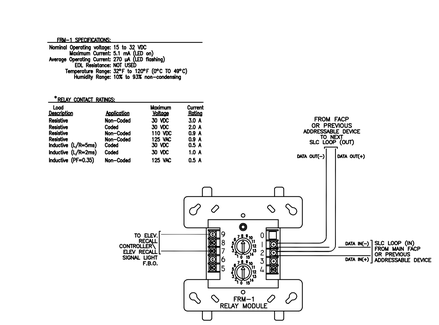
DNR DUCT DETECTOR WIRING (WITH OPTIONAL REMOTE LED)



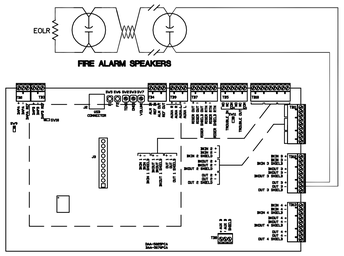


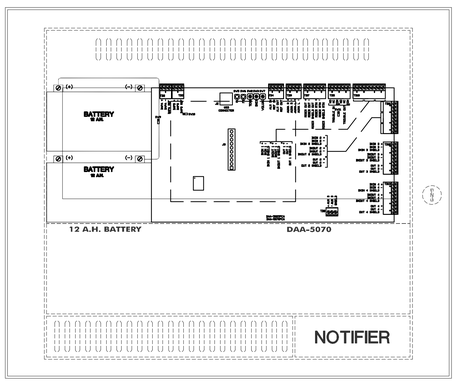
FRM-1 RELAY MODULE WIRING (ELEVATOR SHUNT TRIP)

NBG-12LX MANUAL STATION WIRING

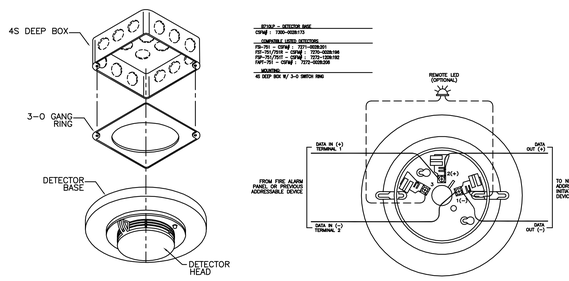


FRM-1 RELAY MODULE WIRING (ELEVATOR RECALL\RECALL SIGNAL LIGHT)

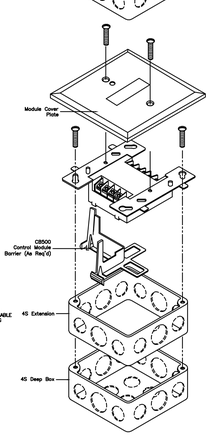


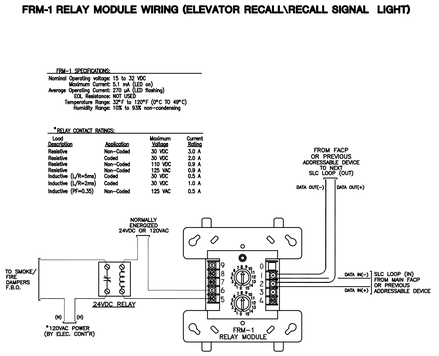


TRANSPONDER (TYP)



B710LP ADDRESSABLE SMOKE/HEAT DETECTOR BASE WIRING





FRM-1 RELAY MODULE WIRING (DAMPER CONTROL)

Pyro-Comm Systems, Inc.
Fire, Life Safety and Security System Design and Installation
C-10 #612153 ACO 3231

CORPORATE OFFICE
15531 Container Lane
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FIRE ALARM WIRING DETAILS

Drawn By : J.AREVALO
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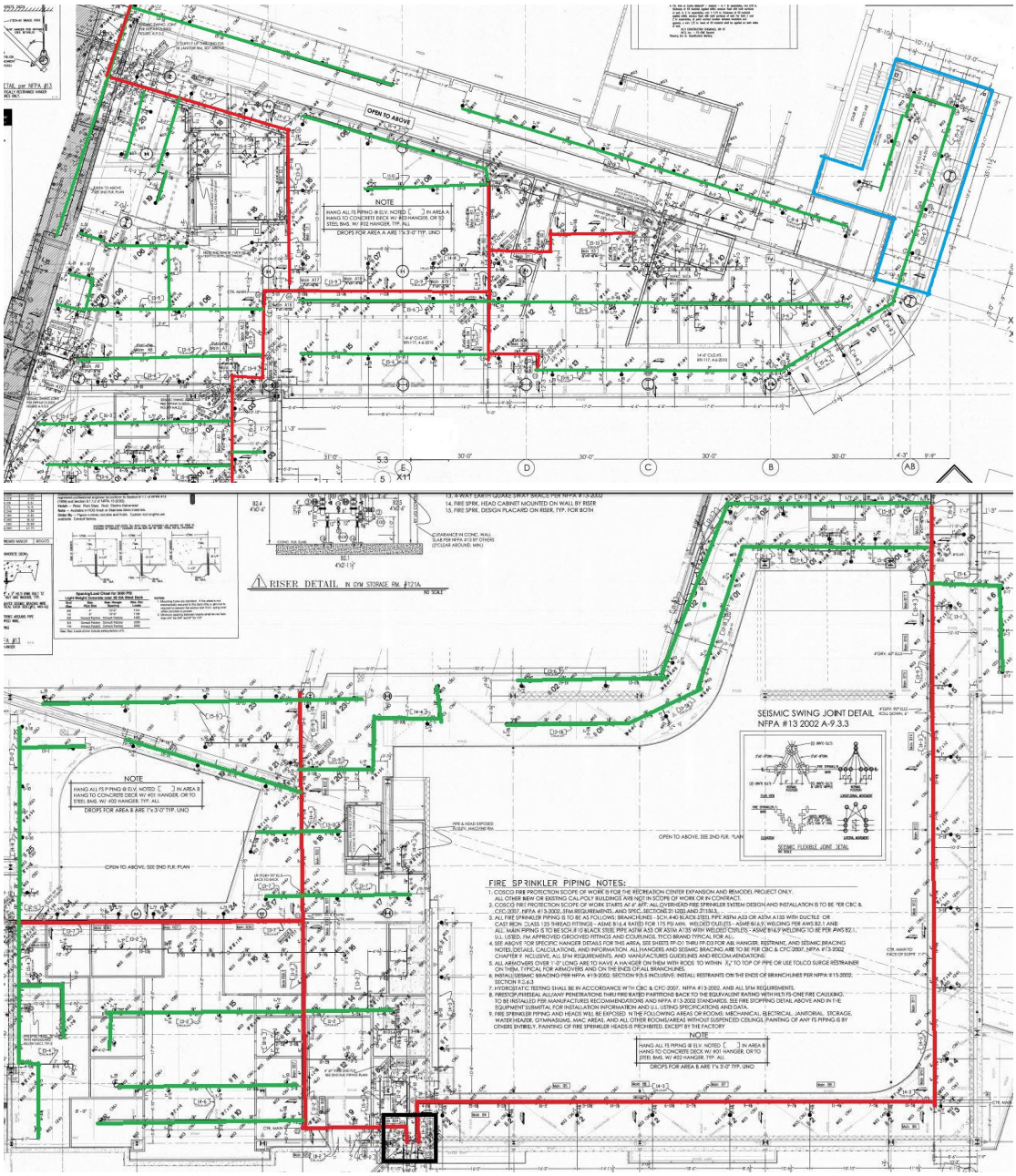
Sheet Number :
FA2.02

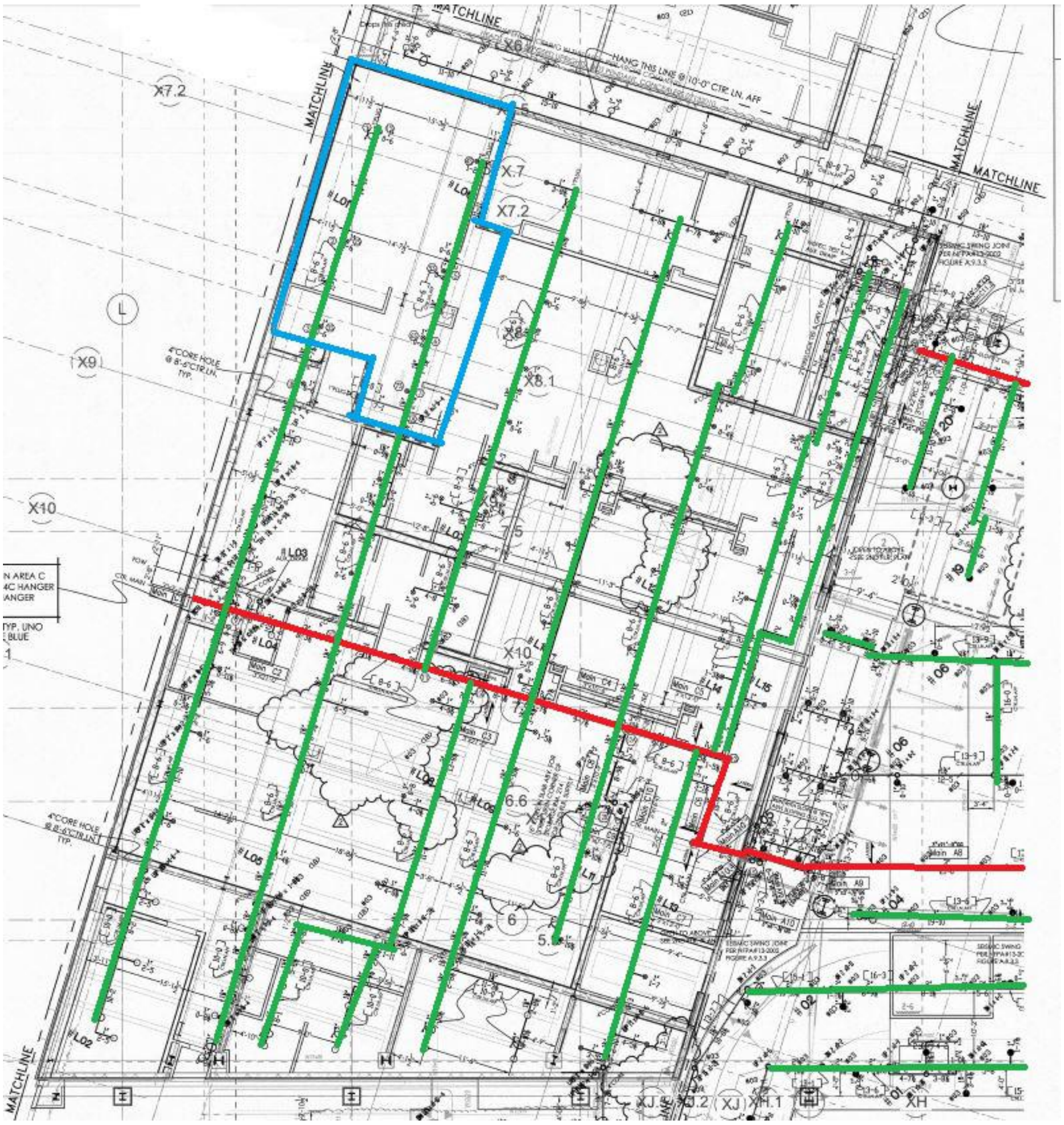
ASBUILT SET

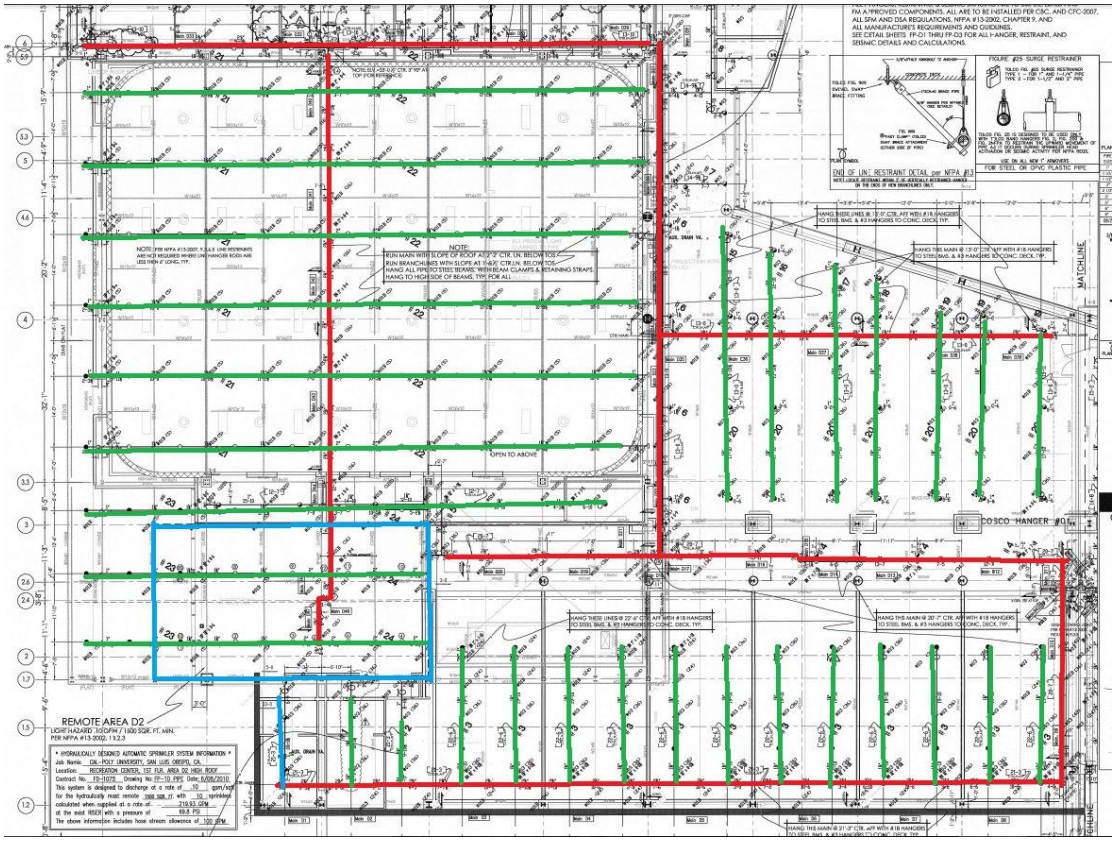
ASBUILT SET

Appendix C Sprinkler System As-Builts

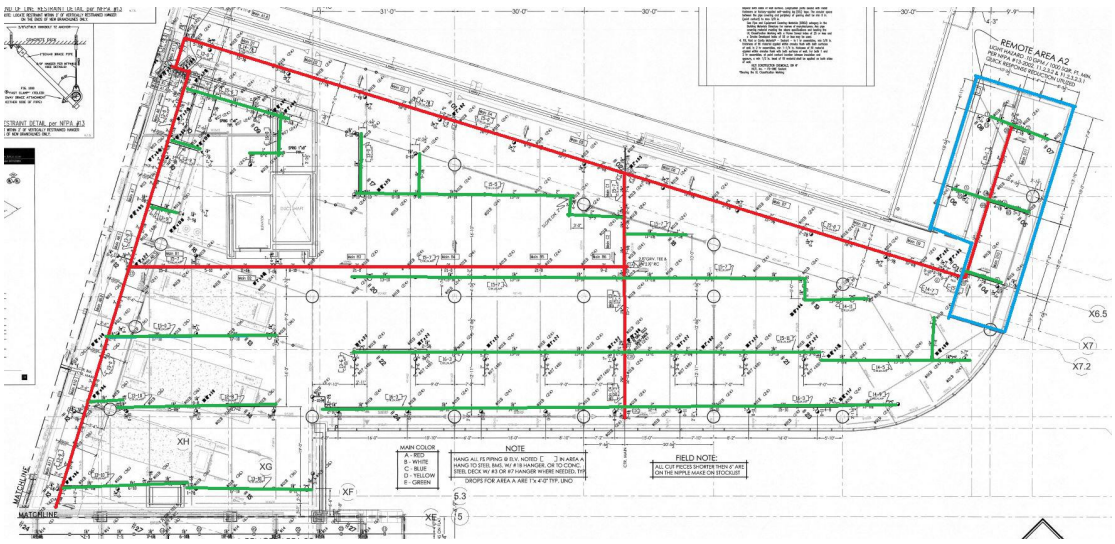
1ST FLOOR

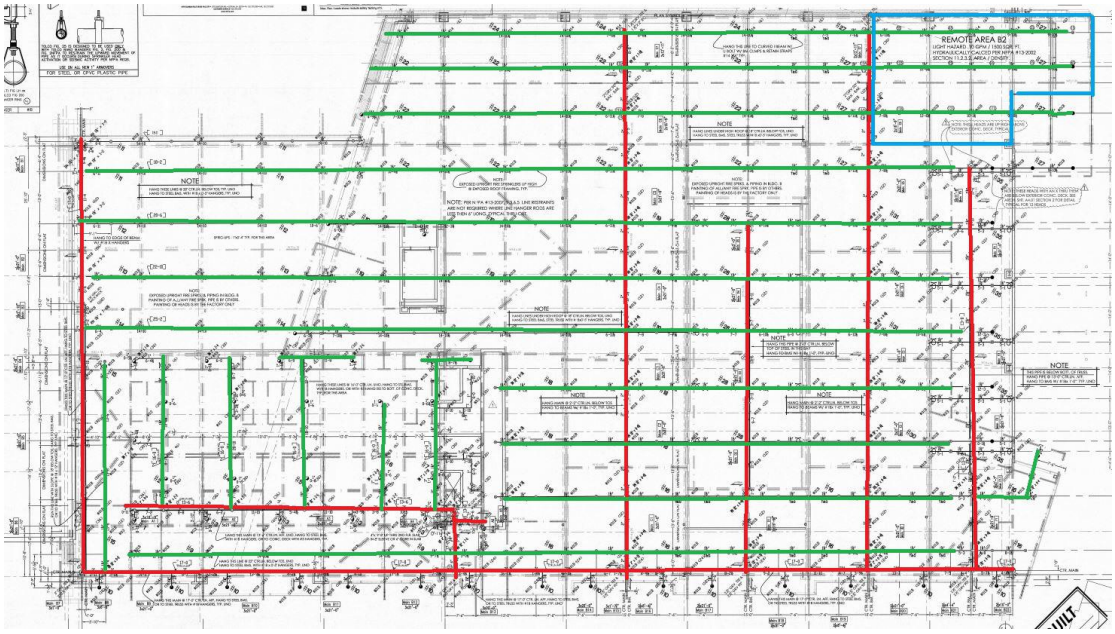


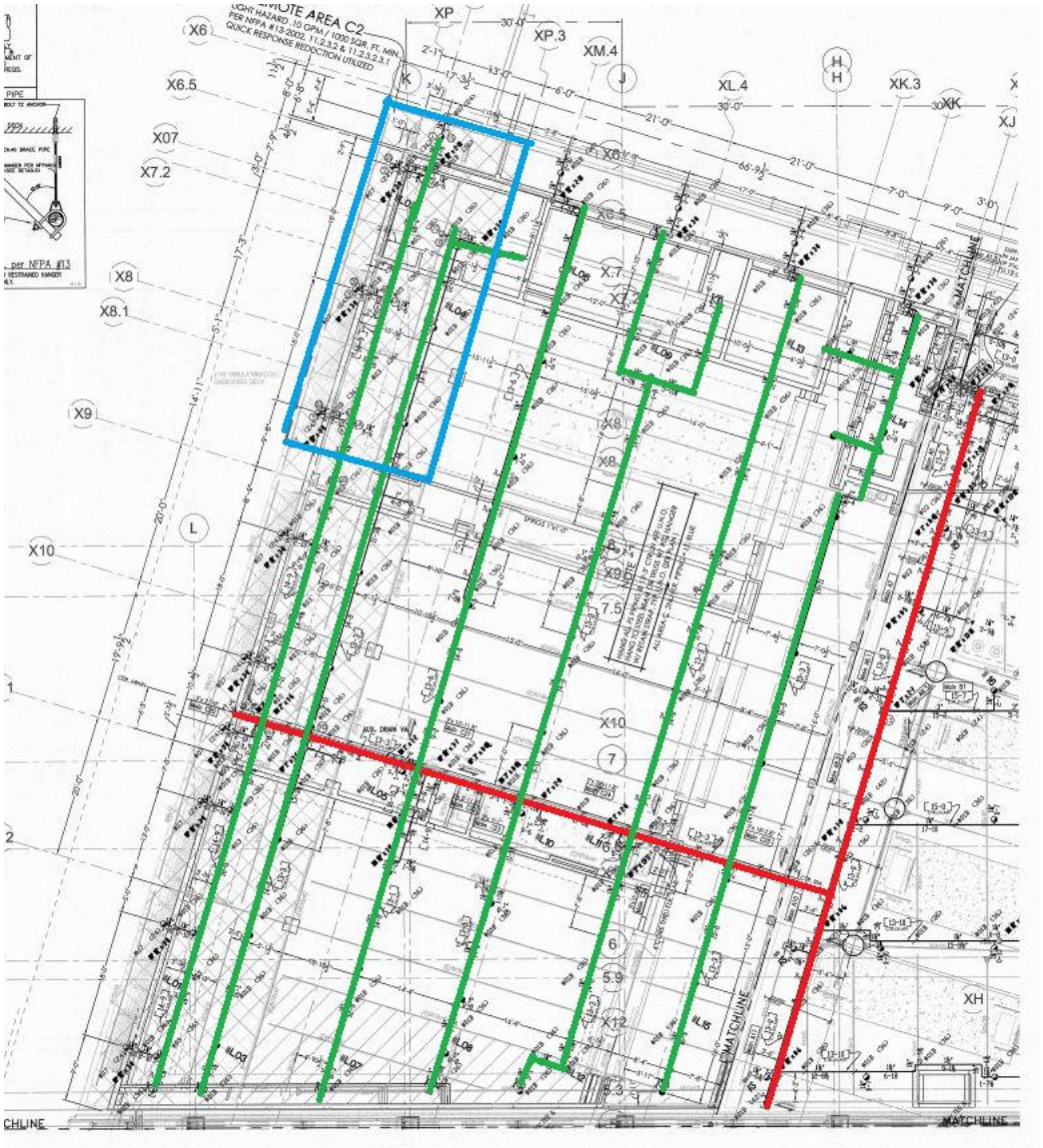

MATCHLINE
X7.2
X9
X10
X7
X8.1
4"CORE HOLE @ 8'-6" CTR LN, TYP.
N AREA C
XH

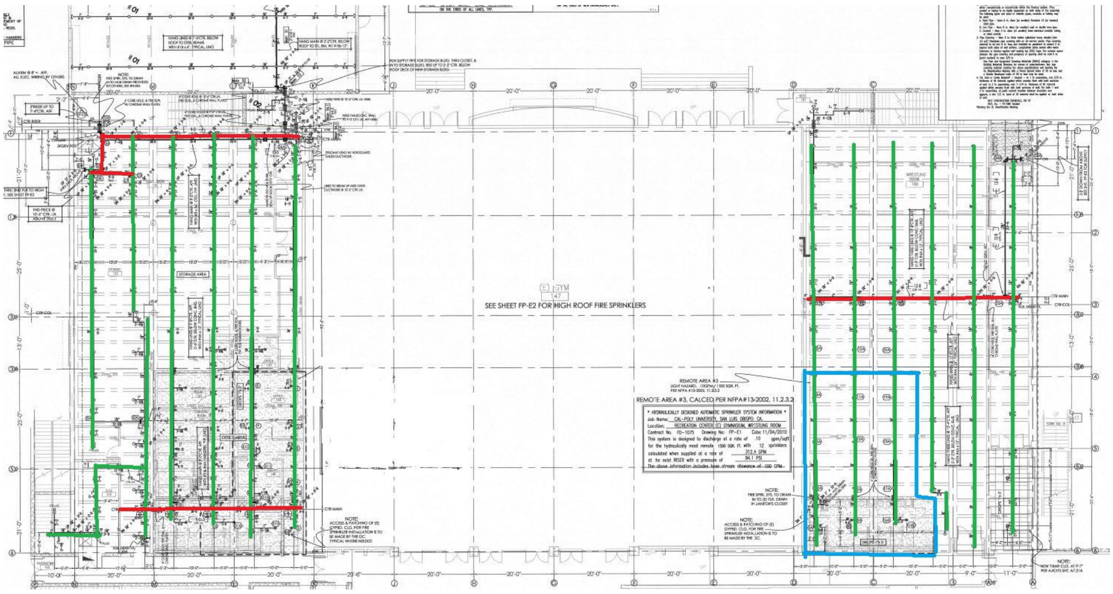

REMOTE AREA D2
LIGHT HAZARD: 30 GPM / 1500 SQR. FT. MIN.
PER NFPA #13-2002, 11.2.3
OPEN TO ABOVE
COSCO HANGER #0
MATCHLINE

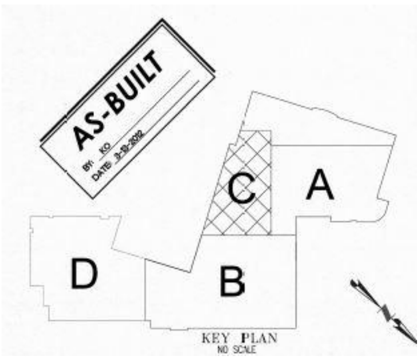
2ND FLOOR


REMOTE AREA A2
MATCHLINE
XH
XG
XF
XE


REMOTE AREA B2
LIGHT HAZARD, 30 GPM / 1500 SQR. FT.
HYDRAULICALLY CALCED PER NFPA #13-2002
SECTION 11.2.3.2, AREA / DENSITY
NOTE


REMOTE AREA C2
LIGHT HAZARD, 10 GPM / 1000 SQR. FT. MIN
PER NFPA #13-2002, 11.2.3.2 & 11.2.3.2.3.1
QUICK RESPONSE REDUCTION UTILIZED
XP
XP.3
XM.4
XL.4
XK.3
XK
XJ
X6
X6.5
X07
X7.2
X8
X8.1
X9
X10
X7.1
X8.1
X9.1
X10.1
X12
XH
MATCHLINE
per NFPA #13


SEE SHEET FP-E2 FOR HIGH ROOF FIRE SPRINKLERS
REMOTE AREA #3, CALCED PER NFPA#13-2002, 11.2.3.2


AS-BUILT
C
A
D
B
KEY PLAN
NO SCALE

Appendix D Sprinkler Calculations

1st Floor

Part A

Occupancy Hazard Classification = Light Hazard

Sprinkler System Design Criteria Density = 0.10 gpm/ft^2
Area of Operation = 1013ft^2(with 32.5% area reduction utilizing quick response sprinklers with 15’ ceilings)

7 sprinklers, max area per sprinkler 144.8 ft^2

K=8.0

Hose Stream Allowance = 100 gpm
Demand at riser from sprinklers(includes 100gpm hose stream) = 269.89 GPM, 102.9 PSI

Part B

Part B at the 1st floor is associate with the part A.Most parts of the part

B sprinkler system is open to the next floor.

Part C

Occupancy Hazard Classification = Light Hazard

Sprinkler System Design Criteria Density = 0.10 gpm/ft^2
Area of Operation = 900ft^2(with 40.0% area reduction utilizing quick response sprinklers with 8’ ceilings)

7 sprinklers, max area per sprinkler 128.6 ft^2

K=5.6

Hose Stream Allowance = 100 gpm
Demand at riser from sprinklers(includes 100gpm hose stream) = 217.65 GPM, 59.28 PSI

Part D

Occupancy Hazard Classification = Light Hazard

Sprinkler System Design Criteria Density = 0.10 gpm/ft^2
Area of Operation = 1500ft^2

10 sprinklers, max area per sprinkler 150 ft^2

K=8.0

Hose Stream Allowance = 100 gpm
Demand at riser from sprinklers(includes 100gpm hose stream) = 219.93 GPM, 69.8 PSI

2nd Floor

Part A

Occupancy Hazard Classification = Light Hazard

Sprinkler System Design Criteria Density = 0.10 gpm/ft^2
Area of Operation = 1000ft^2(with 34% area reduction utilizing quick response sprinklers with 14’ ceilings)

5 sprinklers, max area per sprinkler 200 ft^2

K=8.0

Hose Stream Allowance = 100 gpm
Demand at riser from sprinklers(includes 100gpm hose stream) = 218.2 GPM, 89.88 PSI

Part B

Occupancy Hazard Classification = Light Hazard

Sprinkler System Design Criteria Density = 0.10 gpm/ft^2
Area of Operation = 1500ft^2

13 sprinklers, max area per sprinkler 115.4 ft^2

K=1@5.6 12@8.0

Hose Stream Allowance = 100 gpm
Demand at riser from sprinklers(includes 100gpm hose stream) = 283.7 GPM, 67.68 PSI

Part C

Occupancy Hazard Classification = Light Hazard

Sprinkler System Design Criteria Density = 0.10 gpm/ft^2
Area of Operation = 1000ft^2(with 34% area reduction utilizing quick response sprinklers with 14’ ceilings)

9 sprinklers, max area per sprinkler 111.1 ft^2

K=8.0

Hose Stream Allowance = 100 gpm
Demand at riser from sprinklers(includes 100gpm hose stream) = 324.1 GPM, 90.13 PSI

Part D

Occupancy Hazard Classification = Light Hazard

Sprinkler System Design Criteria Density = 0.10 gpm/ft^2
Area of Operation = 1500ft^2

12 sprinklers, max area per sprinkler 125 ft^2

K=5.6

Hose Stream Allowance = 100 gpm
Demand at riser from sprinklers(includes 100gpm hose stream) = 312.4 GPM, 94.1 PSI

Appendix E Occupants Load Calculations

1st Floor	CLASSIFICATION	AREA	Calculated Occupant load
	Business	288	5
	Business	1052	20
	Business	50	1
	Business	82	1
	Business	82	1
	Business	144	2
	Business	123	2
	Business	104	2
	Business	316	6
	Business	255	5
	Business	113	2
	Business	162	3
	Business	133	2
	Business	205	4
	Business	114	2
	Business	114	2
	Business	115	2
	Business	191	3
	Business	126	2
	Business	1286	25
	total	5055	92
	Storage	1810	5
	Storage	961	3
	Storage	2447	8
	Storage	271	2
	Storage	260	0
	Storage	119	0
	Storage	809	2
	total	6677	20
	Gym(fixing seats)	6546	300
	Gym(fixing seats)	6593	300
	Gym	13472	260
	Gym	4710	94
	Gym	8308	166
	Gym	4800	90
	total	44429	1210

2nd Floor	CLASSIFICATION	AREA	Calculated Occupant load	
	Gym(fixing seats)	3211	484	98
	Gym(fixing seats)	3194	484	98
	Gym(fixing seats)	3182	484	98
	Gym(fixing seats)	3202	484	98
	Gym	846	16	
	Gym	845	16	
	Gym	983	19	
	Gym	982	19	
	Gym	949	17	
	Gym	1538	30	
	Gym	5246	104	
	Gym	2198	43	
	Gym	2649	52	
	Gym	429	8	
	Gym	293	5	
	Exercice room(equi	5407	108	
	total	35154	2373	
	Storage	197	0	
	Storage	198	0	
	Storage	201	0	
	total	596	0	

Appendix F Fire Hydrant Flow and Pressure Test

Cannon

Fire Hydrant Flow & Pressure Test

Date of test: 3/8/2010 **Time of test:** 4:40 PM
Hydrant Site ID#: 47 **Class**_____ **Elev. @ Hydrant:** 330.57
Street Address Adjacent to Hydrant: Campus Way
Number of ports flowed: 1

Static:	150	*psi before flowing*
Residual:		*psi while flowing*
Pitot:	50	*pitot gauge reading*
Nozzle Coefficient:	0.9	*(Note 3)*
Diameter:	2.5	*size of opening tested*
This hydrant is flowing:	1186.48	*GPM from the test outlet*
Projected available hydrant flow @ 20psi:		*GPM (Note 1)*
2nd Static: (with handheld pitot gauge)		*secondary psi before flowing*
2nd Residual:		*secondary psi while flowing*
The main can be expected to flow about:		*GPM*

Number of Tanks in System: 2
Tank No. 1: N/A
Tank No. 2: N/A
Water Main Size:__12"_____

Pumps:

Notes:

1. Projected available flows calculated at 20 psi residual, or ½ the static pressure for low pressure hydrants having static pressures of less than 40 psi.

2. This calculator is based on established Hazen-Williams formulas and is provided for convenience and estimation purposes only. The author and Cannon express no warranty for its suitability for any particular purpose.

3. Since hydrant nozzles typically don't produce perfect discharge columns, this is a correction factor which is often used to compensate for errant pitot readings. Hydrant manufacturers should be able to provide coefficients for their products. For hydrants where the coefficient is unknown, we use .95 or .9 depending upon how uniform the discharge stream looks when the hydrant is opened.

Field Notes:

Cannon

Fire Hydrant Flow & Pressure Test

Date of test: 3/8/2010 **Time of test:** 5:00 PM
Hydrant Site ID#: 51 **Class**_____ **Elev. @ Hydrant:** 346.00
Street Address Adjacent to Hydrant: Adjacent to new pool
Number of ports flowed: 1

Static:	140	*psi before flowing*
Residual:	132	*psi while flowing*
Pitot:		*pitot gauge reading*
Nozzle Coefficient:	0.9	*(Note 3)*
Diameter:	2.5	*size of opening tested*
This hydrant is flowing:	0.00	*GPM from the test outlet*
Projected available hydrant flow @ 20psi:		*GPM (Note 1)*
2nd Static: (with handheld pitot gauge)		*secondary psi before flowing*
2nd Residual:		*secondary psi while flowing*
The main can be expected to flow about:		*GPM*

# of Tanks in System: 2
Tank No. 1: N/A
Tank No. 2: N/A
Water Main Size:___12"_____

Pumps:

Notes:

1. Projected available flows calculated at 20 psi residual, or ½ the static pressure for low pressure hydrants having static pressures of less than 40 psi.

2. This calculator is based on established Hazen-Williams formulas and is provided for convenience and estimation purposes only. The author and Cannon express no warranty for its suitability for any particular purpose.

3. Since hydrant nozzles typically don't produce perfect discharge columns, this is a correction factor which is often used to compensate for errant pitot readings. Hydrant manufacturers should be able to provide coefficients for their products. For hydrants where the coefficient is unknown, we use .95 or .9 depending upon how uniform the discharge stream looks when the hydrant is

Field Notes: