Fire and Life Safety Evaluation & Analysis

Bonderson Engineering Projects Center

Building 197

Cal Poly, San Luis Obispo CA

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Keywords
Performance Based Design
Prescriptive Design
Bonderson Projects Center
Fire Protection
Life Safety

2 EXECUTIVE SUMMARY

A Fire and Life Safety Analysis of the Bonderson Engineering Projects Center, (BEPC) Building 197 on the California Polytechnic State University, San Luis Obispo (Cal Poly) Campus is performed. Both prescriptive and performance based methods and metrics are utilized to evaluate the facility with respect to current fire and building standards and codes.

Prescriptive fire protection features and systems analyzed include:

- Building Construction Type and Design
- Structural Fire Protection Features and Requirements
- Occupancy Classification and Egress Analysis
- Fire Detection, Alarm, and Communication Systems
- Fire Suppression Systems

The prescriptive based design requirements largely met the code and installation requirements with the following deficiencies discovered during the analysis.

- Sprinkler system branch-lines are missing end of line restraints.
- Sprinkler system upright sprinklers are installed too far down from deck in several areas.
- Sprinkler system upright sprinklers are obstructed by mechanical process piping in first floor hallway.
- Fire alarm system horns in Machine Shop and Wood Shop do not produce 15 dBA above ambient conditions (may have AHJ exemption).
- The single-leaf door for Conference Room 104 does not swing in the direction of egress travel.

A performance-based analysis of (BEPC) is performed. The analysis involves the evaluation of three design fire scenarios pursuant to NFPA 101 Chapter 5; these scenarios are modeled using the computer programs Pyrosim, FDS, and Pathfinder. The tenability results of the computer fire models are compared to established tenability thresholds to determine the available safe egress time (ASET) for each scenario. This time is compared to the required safe egress time (RSET) defined by the Pathfinder software egress model of the building with its full occupant load. The three scenarios considered include: a fire in the entry lobby / atrium by way of a spill of acetonitrile, a fire in an HDPE trash container in the machine shop ignited by hot work, and finally, ignition of two pallets of miscellaneous computer items being stored in the high bay Projects Integration area. Of the three performance-based scenarios tested, only one scenario, the machine shop trash container fire, passed the final RSET vs ASET test with an acceptable factor of safety.

BEPC largely meets or exceeds all of the prescriptive requirements for NFPA 101 and the California Building code for egress and structural systems. It also meets requirements and installation codes for fire sprinklers and alarms with the exception of the deficiencies previously determined. It is recommended that the fire sprinkler deficiencies for end of line restraints, obstructions to spray pattern development and the deflector distances be rectified via retroactive repairs to the systems involved. For fire alarms it is recommended that the AHJ exemption for audible notification in the shops be verified.

From a performance based standpoint, the two scenarios that failed the RSET vs ASET could be avoided through the strict application and continued enforcement of a fire safety management plan. Such a plan could reduce both the probability and impact of fires in (BEPC). A proposed plan is included in appendix A.

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3 CODES CITED

The prescriptive design requirements for both the fire life safety systems and general building requirements for the Bonderson Engineering Projects Center (BEPC) were established by the prevailing building and fire life safety codes and standards of the time. Said codes and standards applied to this project occur on both a state and federal level and are catalogued below.

The Bonderson Engineering Projects Center was constructed under the following standard fire and building codes:

- CBC (California Building Code) 2001
- CFC (California Fire Code) 2001
- UBC (Uniform Building Code) 1997
- NFPA 13: Installation of Sprinkler System 1999
- NFPA 72: National Fire Alarm and Signaling Code 2002
- NFPA 101: Life Safety Code (2003)

The performance of the building and its systems in this report are analyzed against the current versions or iterations of the above-listed codes as academic evaluation. These codes and standards are detailed below:

- IBC (International Building Code) 2012 – Replaced the UBC
- CBC (California Building Code) 2013
- CFC (California Fire Code) 2013
- NFPA 13 (Installation of Sprinkler Systems) 2013
- NFPA 72 (National Fire Alarm and Signaling code) 2013
- NFPA 101 Life Safety Code (2012)

4 BUILDING DESIGN & STRUCTURAL FIRE PROTECTION ANALYSIS

4.1 BUILDING DESIGN & HISTORY OVERVIEW

Bonderson Engineering Projects Center (BEPC) is a two-story building on the Cal Poly campus. The building was commissioned in 2006 at a cost of $7.5 million. The total square footage of the building is 19,000 ft^2.

Bonderson Engineering Projects Center is constructed on a 2'-0" thick concrete mat foundation on top of compacted remediated soil. The building is steel frame construction utilizing both braced-frame and moment frame construction. The primary structure is a conventional braced-frame design, while the large exterior overhangs utilize moment frame construction. Exterior finishes include a glass curtain wall along the north elevation of the building with CFRM composite panels over steel stud exterior walls making up the balance of the exterior finishes.

BEPC serves multiple purposes with the first floor dedicated to senior project lab rooms, and exhibition spaces as well as being home to a 2,800 ft^2 student machine and wood shop at the rear (East end) of the building. Computer labs, classrooms, and a conference room occupy the second floor.

Unique architectural features include an open 2-story entry atrium, and a two story high project integration lab with full height glazing on three sides and high roll-up doors for access on the west and north sides of the building.

4.2 OCCUPANCY CLASSIFICATION

Bonderson Engineering Projects Center is an educational facility. However, because it is a university level educational facility and not a K-12 institution, the default occupancy classification for this building is B-Business according to the 2012 IBC Section 304.1.

From the 2012 IBC Code commentary: "Because this is a college and will be occupied by adults who are not expected to require special supervision, direction, or instruction in a fire or other emergency…Therefore classrooms and laboratories located in colleges, universities and academies for students above 12th grade are classified as group B."

Group B occupancies do not have any "special detailed requirements based on use" under Chapter 4 of the IBC.

The machine shop at the East end of the first floor represents the only area in the building-which may need to be classified under a different occupancy classification. This area could be considered a group F occupancy depending on the interpretation of the code. Fabrication and manufacturing processes occur in that space as students work to build their senior projects.

4.3 CONSTRUCTION TYPE

Acceptable construction types for this occupancy according to the 2012 IBC are determined by the height, story and area requirements set forth in table 503 these limitations are summarized in Table 2.

4.3.1 Bonderson Engineering Projects Center Building Information:

Table 1 Bonderson Projects Center Information

First Floor Area	13,253 ft^2
Second Floor Area	5,747 ft^2
Total Floor Area	19,000
Building Height	30’ with Mechanical privacy wall

4.3.2 Acceptable Construction Types

From Table 503 of the 2012 IBC for a business occupancy of two stories and a maximum area per story of 13,253 ft^2, the following construction types would be allowed or disallowed with respect to the (BEPC) building’s specifications shown in Table 1 above.

Type V-B Construction is not allowed, as the building in question does not meet the maximum story requirements (1 story maximum) and the maximum area limitations (9,000ft^2). However, if the building is sprinklered throughout, the use of automatic sprinkler height (IBC 504.2) and area (IBC 506.3) increases for this construction type raises the maximum area to 18,000 ft^2 and increases maximum height by one story which would make this construction type acceptable.

Type V-A construction would be acceptable for this structure as the maximum number of stories (3), the maximum per story area (18,000), as well as the building height above grade plane (50’) are all greater than the Bonderson Engineering Project Centers specifications shown in the Table 1 above.

The same is true for the rest of the construction types, with Types I through II, both A and B, all being acceptable for this building’s floor area, total height, number of stories, and occupancy classification without the need for height or area increases in all cases.

The construction type chosen for this building by its designers is II-B. As a steel frame building utilizing lightweight concrete over metal decking construction with no SFRM, it meets that definition.

Table 2 Construction Types Per 2012 IBC

Construction Type	Height / Area Limitations	Acceptable?
I-A	UL / UL	Yes
I-B	11 / UL	Yes
II-A	5 / 37,500 ft^2	Yes
II-B	3 / 23,000 ft^2	Yes
III-A	5 / 28,500 ft^2	Yes
III-B	3 / 19,000 ft^2	Yes
IV	5 / 36,000 ft^2	Yes
V-A	3 / 18,000 ft^2	Yes
V-B	2 / 9,000 ft^2	No (Area Limited) *Acceptable with the use of automatic sprinkler building area and height increases.*

4.4 Structural Fire Protection Requirements

Based on the fact that several construction types are acceptable for this building and that the building's actual construction type is II-N per the1997 UBC under which it was constructed. This corresponds to the II-B Construction type in the current IBC. This construction type requires very little structural fire protection per the IBC.

Structural fire protection requirements are outlined in section 601 of the IBC shown in Table 3 below. For Type II-B construction, all construction elements including the primary structural frame, bearing walls, interior walls and floor/ceiling systems are all allowed to have a 0-hr fire rating.

Table 3 Fire Resistance Ratings - Section 601 IBC

SECTION 601 GENERAL

TABLE 601 FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A[d]	B	A[d]	B	HT	A[d]	B
Primary structural frame[g] (see Section 202)	3[a]	2[a]	1	0	1	0	HT	1	0
Bearing walls									
Exterior[f, g]	3	2	1	0	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[e]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and associated secondary member (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	$1^1/_2$[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	HT	1[b,c]	0

The fire resistance requirements for the exterior walls based on the fire separation distance are determined utilizing Table 602 of the IBC (Table 4). Because this structure stands alone in the Engineering IV Quad area, (Figure 1) with outdoor project integration area followed by North Perimeter Road on its south side, the parking lot on its East side, and the Engineering IV Quad to its North and West sides, all 4 building exposures have a fire separation distance of greater than 30 feet.

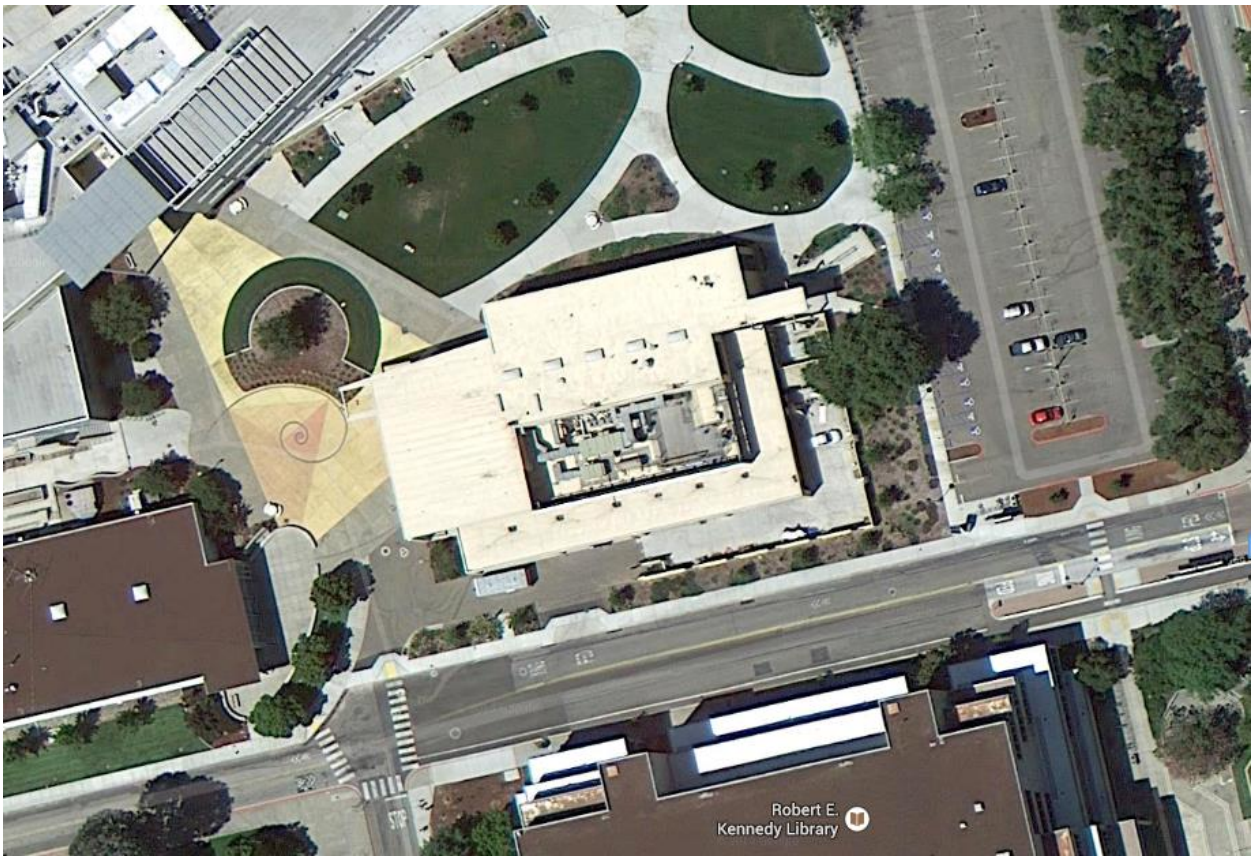
Table 4 Required Fire Separation Distances – 2012 IBC

TABLE 602 FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE[a, e, h]

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H[f]	OCCUPANCY GROUP F-1, M, S-1[g]	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2[g], U[b]
X < 5[c]	All	3	2	1
5 ≤ X < 10	IA Others	3 2	2 1	1 1
10 ≤ X < 30	IA, IB IIB, VB Others	2 1 1	1 0 1	1[d] 0 1[d]
X ≥ 30	All	0	0	0

Because the fire separation distances are greater than 30 feet, the exterior walls do not need to carry a fire resistance rating greater than 0-hrs in accordance with Table 602 of the IBC.

Figure 1 Site Plan For Fire Separation Distances



Because the construction type of this building does not require fire protection, the provisions of the IBC section 704 pertaining to fire resistance ratings of structural members do not apply.

An Automatic Fire Sprinkler System is not expressly required for Group B occupancies per IBC 903.2 However, the California Fire Code requires a manual or automatic fire alarm system in all Group B occupancies being used for education purposes, including colleges.

4.5 Breakdown of Building Structure and Features

4.5.1 Fire Protection Systems

The building is protected throughout by an automatic wet-pipe fire sprinkler system utilizing quick response sprinklers. It is also fully fire alarmed with manual pull stations, horns/strobes and multi heat/smoke detectors in all areas. The system is fully monitored by the campus-wide remote station.

4.5.2 Foundation

The building sits on a 2'-0" thick reinforced concrete mat foundation. This was in response to uneven soil conditions at the site which would have made driving foundation piles un-ideal. The first seven feet of soil was excavated and re-compacted in advance of pouring the concrete slab, which also acts as a thermal mass to help cool the building in the summer and warm it in the winter.

4.5.3 Primary Structure

Constituent to its type II-B construction type, Bonderson Engineering Projects Center is non-combustible construction, utilizing steel W-Beams and steel composite decking with lightweight concrete fill for the second floor slab. The structure is a brace frame design rather than a moment frame, (with the exception of the large moment frame supporting the East facing exterior overhang, and another, smaller frame supporting the overhang covering the east side staircase), and was designed to focus seismic energy at the braces in the braced frame construction—which can be removed and replaced after a large seismic event if necessary.

None of the structural members, nor the underside of the steel decking, have an SFRM coating as it is not required per IBC.

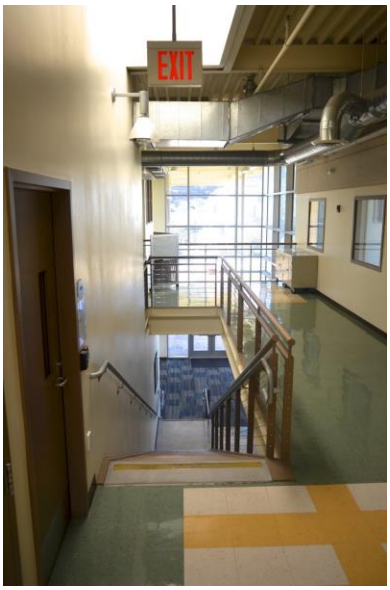
Figure 2 Projects Integration High Bay Area

Figure 2 is a photograph of the high ceiling project integration area; note the lack of SFRM on the beams, underside of roof deck, and secondary members. Also, note the fact that the space is fully sprinklered and fire alarmed.

4.5.4 Interior Walls and Features

Stairways:
The interior stair (Figure 3) is not enclosed and is thus not rated. This stair is separated from the shop of the building by a smoke barrier on the first floor. This interior stair is allowed per LSC 38.3.1.1 (2), which allows interior exit-access stairs to be unenclosed in a two-story business occupancy that is occupied by a single tenant, is fully sprinklered and has a total common-path of travel distance of less than 100 feet.

Figure 3 Interior Stair



The wall / door assembly exiting to the exterior stair at the east end of the building should be of a 1-hr construction, per LSC 2012 A 7.2.2.5.2 and 7.1.3.2.1. (Figure 4). This was not required under the prevailing codes at the time BEPC was built however.

Figure 4 Rating of Exit Stair Wall

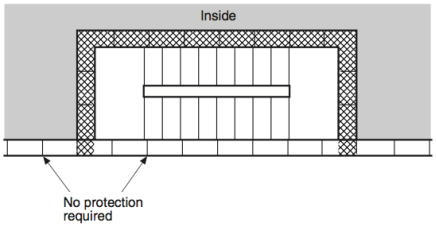


FIGURE A.7.2.2.5.2(a) Stairway with Nonrated Exterior Wall in Same Plane as Building Exterior Wall.

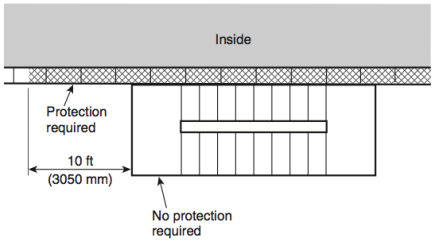


FIGURE A.7.2.2.5.2(b) Stairway with Unprotected Exterior Perimeter Protruding Past Building Exterior Wall.

Floor plans indicating the rated assemblies for the first floor (Figure 5) and second floor (Figure 6) are shown below.

Figure 5 Rated Assemblies First Floor

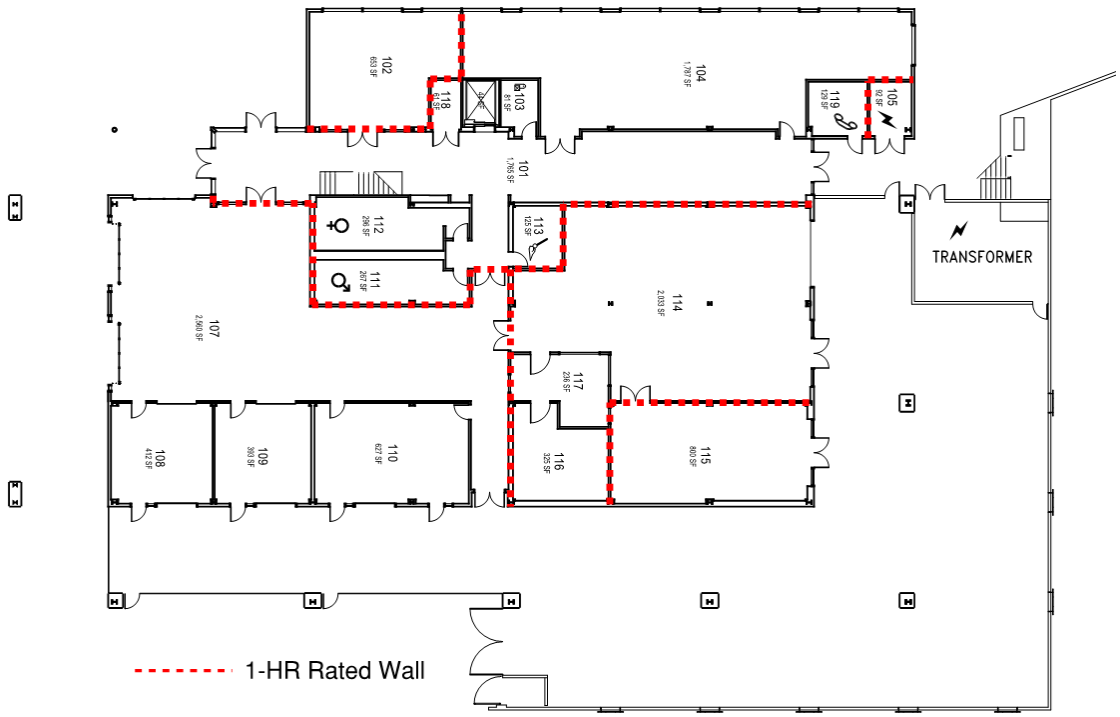
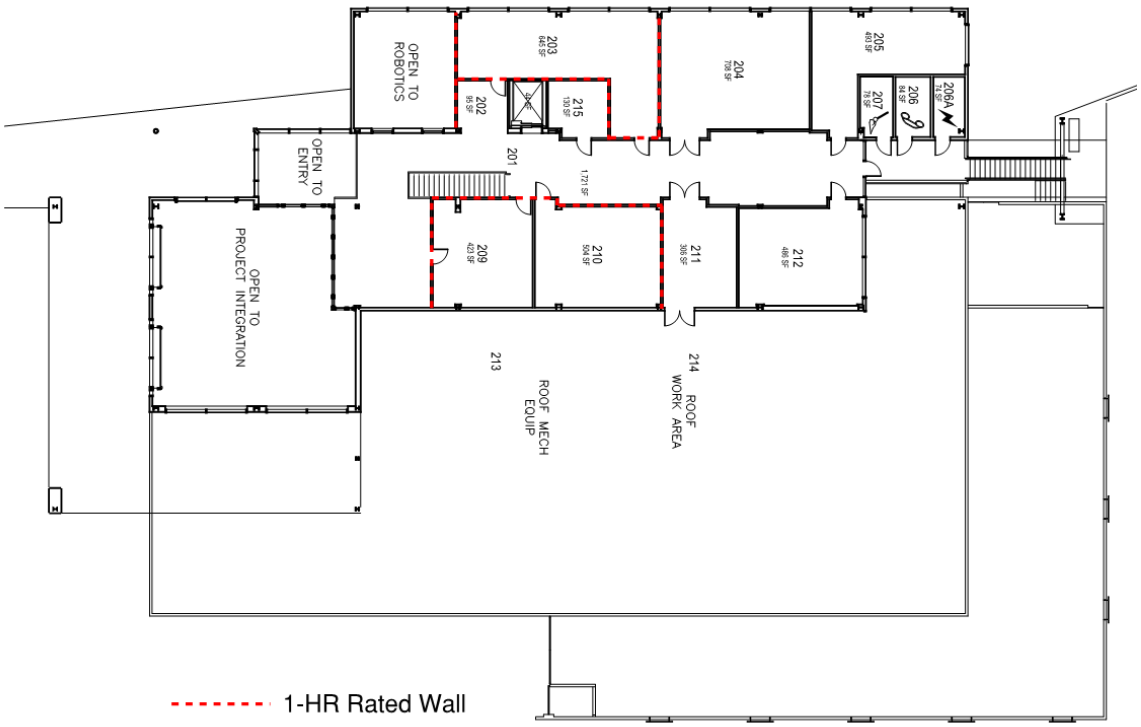


Figure 6 Rated Assemblies Second Floor



Corridors and Walls:
The main longitudinal corridor on the first and second floor as well as the lateral corridor on the first floor avoids the need to be 1-hr rated due to the fact that the building is sprinklered throughout and only 2 stories in height per the LSC 38.3.6.1 (3).

The areas and spaces originally designated as labs are separated from the rest of the building by 1-hr rated walls consisting of 5/8" Type-X gypsum board over steel studs. All penetrations through rated assemblies are fully fire-stopped / sealed. There is a significant penetration in one of these one-hour rated separations at the tool checkout roll-up window (Figure 7) of the Machine Shop. This window is 1-hr rated and tied into the fire alarm system such that upon activation it automatically closes to maintain the rating of the wall.

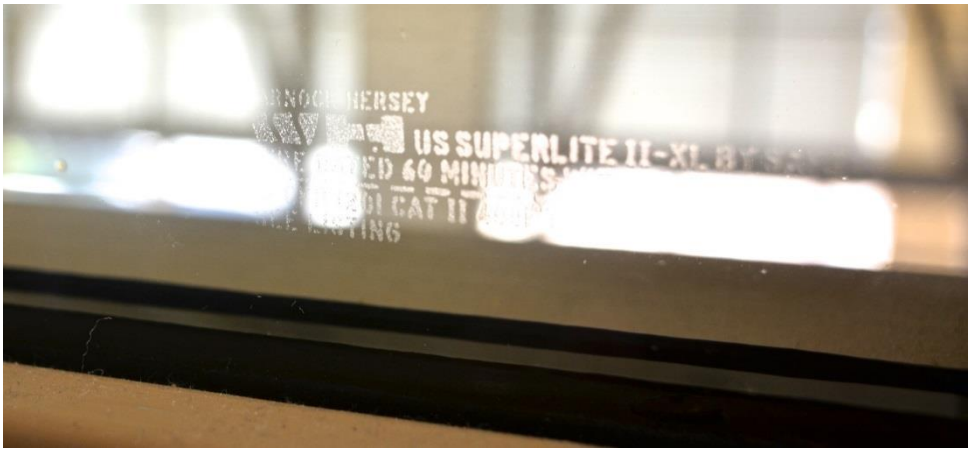
Figure 7 Tool Checkout Window

Atrium:
The Entry Atrium is open to the second floor, creating a vertical opening that requires a 2-hr rated separation from the rest of the building in an un-sprinklered building. (BEPC) has a fire sprinklers throughout, precluding the need for a 2-hr barrier around the atrium per IBC 404.3 exception 1.

Atriums are required to be monitored by smoke detection. Because (BEPC) is equipped with smoke detection throughout, it meets this atrium requirement.

Per IBC 404.6, the Atrium must be separated from adjacent spaces by a 1-hr barrier. The glazed wall and double door plan right of the entry lobby and the doors in the lateral hall are part of this 1-hr barrier. IBC requirements state window sprinklers should be provided on both sides of the glass on a six-foot spacing to protect the glazing; however, there are none installed in this building. The AHJ must have allowed an exception or equivalence clause to remove the window sprinkler requirement since all the glazing used is 1-hr rated as shown in Figure 8 below.

Figure 8 One Hour Rated Glazing at Atrium and Projects Integration



Floor plans showing the rated assemblies for the first and second floor can be found in the appendix.

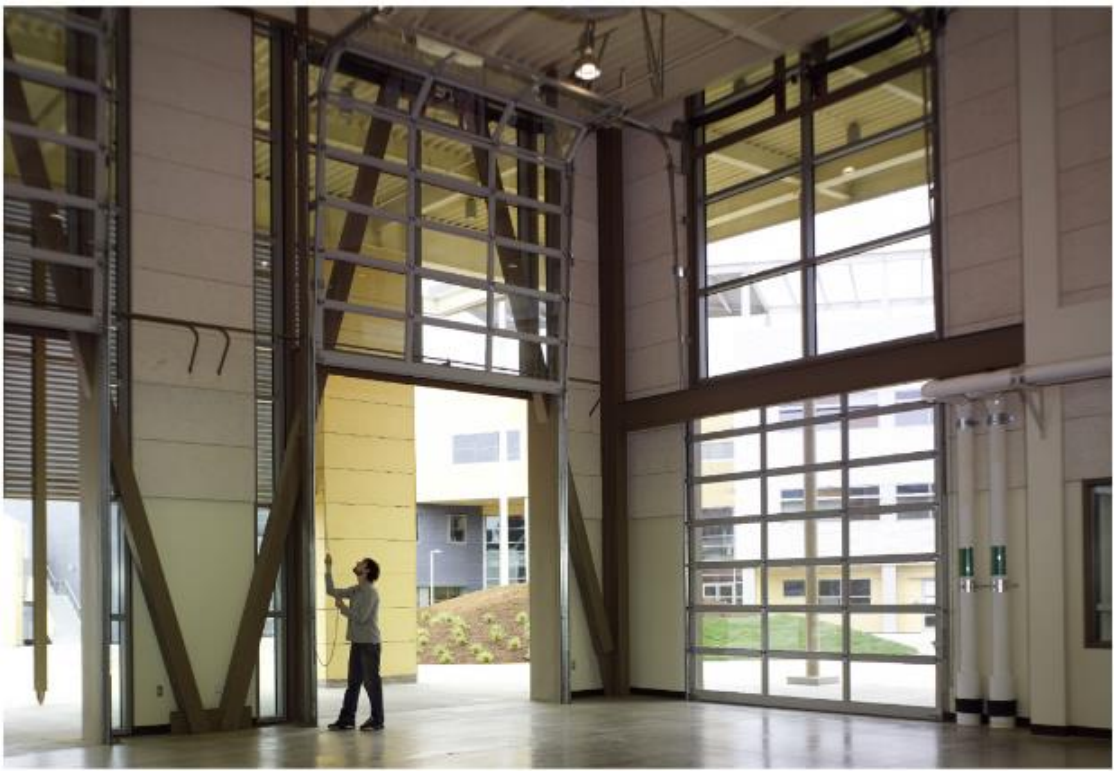
4.5.5 Floor and Roof Assemblies

The floor assemblies are 20 gauge metal decks with 2-1/2" flutes and 2-1/2" of lightweight concrete covering them.

The portion of the first floor roof that is occupied by the mechanical units is concrete over metal deck, while the rest of the first floor roof and the second floor roof have a foam insulation topping over a narrow-flute metal deck with a high-albedo thermoplastic roofing membrane.

The roof system on the West, South and East sides of the building extend out past the exterior walls, providing a covered exterior area. All of these covered exterior roof awnings are also fully sprinklered.

Figure 9 Projects Integration Roll Up Doors



4.5.6 Exterior Walls

Like most steel-frame buildings, the exterior walls of Bonderson Engineering Projects Center are curtain walls and bear no load. They are furred out with steel studs, vapor barriers, and gypsum board for the interior side, while the exterior receives composite paneling. Insulation was inserted between the two. Because of the fire separation distance of this building, these exterior walls do not need to carry a fire rating. The high bay Projects Integration space features roll-up glass panel doors as shown in Figure 9

4.5.7 Interior Finishes

LSC Table A10.2.2 indicates the required finish classifications for business occupancies. The interior finish requirements for the (BEPC) are shown in Table 5 below:

- Exits and Exit access corridors: A
- Other Spaces: A or B.

Table 5 Interior Finish Classifications - 2012 LSC

Table A.10.2.2 Interior Finish Classification Limitations

Occupancy	Exits	Exit Access Corridors	Other Spaces
Assembly — New			
>300 occupant load	A	A or B	A or B
	I or II	I or II	NA
≤300 occupant load	A	A or B	A, B, or C
	I or II	I or II	NA
Assembly — Existing			
>300 occupant load	A	A or B	A or B
≤300 occupant load	A	A or B	A, B, or C
Educational — New	A	A or B	A or B; C on low partitions†
	I or II	I or II	NA
Educational — Existing	A	A or B	A, B, or C
Day-Care Centers — New	A	A	A or B
	I or II	I or II	NA
Day-Care Centers — Existing	A or B	A or B	A or B
Day-Care Homes — New	A or B	A or B	A, B, or C
	I or II		NA
Day-Care Homes — Existing	A or B	A, B, or C	A, B, or C
Health Care — New	A	A	A
	NA	B on lower portion of corridor wall†	B in small individual rooms†
	I or II	I or II	NA
Health Care — Existing	A or B	A or B	A or B
Detention and Correctional — New (sprinklers mandatory)	A or B	A or B	A, B, or C
	I or II	I or II	NA
Detention and Correctional — Existing	A or B	A or B	A, B, or C
	I or II	I or II	NA
One- and Two-Family Dwellings and Lodging or Rooming Houses	A, B, or C	A, B, or C	A, B, or C
Hotels and Dormitories — New	A	A or B	A, B, or C
	I or II	I or II	NA
Hotels and Dormitories — Existing	A or B	A or B	A, B, or C
	I or II†	I or II†	NA
Apartment Buildings — New	A	A or B	A, B, or C
	I or II	I or II	NA
Apartment Buildings — Existing	A or B	A or B	A, B, or C
	I or II†	I or II†	NA
Residential Board and Care — *(See Chapters 32 and 33.)*			
Mercantile — New	A or B	A or B	A or B
	I or II		NA
Mercantile — Existing			
Class A or Class B stores	A or B	A or B	Ceilings — A or B; walls — A, B, or C
Class C stores	A, B, or C	A, B, or C	A, B, or C
Business and Ambulatory Health Care — New	A or B	A or B	A, B, or C
	I or II		NA
Business and Ambulatory Health Care — Existing	A or B	A or B	A, B, or C
Industrial	A or B	A, B, or C	A, B, or C
	I or II	I or II	NA
Storage	A or B	A, B, or C	A, B, or C
	I or II		NA

4.6 CODE COMPLIANCE

4.6.1 Code Compliant Features

From a structural fire protection standpoint, the structural features of BEPC are in accordance with IBC and LSC Requirements. There is no fire protection needed on structural members per the Type II-B construction type utilized. The exposure fire hazard is not a concern because of the great distance to adjacent buildings. The required rated interior separations are all fire rated for the duration required by code.

Going beyond structural fire protection, the building is equipped with both a fully monitored fire alarm system and also an automatic fire sprinkler system throughout, both of which will be analyzed in a subsequent section.

Possible Code Non-Compliant features:

Atrium glazing does not have window sprinklers to maintain rating of separation. A possible exception may have been made for the fact that the windows themselves carry a 1-hr rating, which may have negated the need for window sprinklers.

Exit door to the exterior stair on the East side of the building may require a 1-hr rating per current LSC requirements LSC A 7.2.2.5.2 and 7.1.3.2.1.

Conclusion

Based on this analysis, the structural fire protection features of Bonderson Engineering Projects Center are adequate and in conformance with the 2012 IBC and 2012 LSC regulations regarding this occupancy with the exception of the possible minor compliance deficiencies previously stated.

5 OCCUPANCY AND EGRESS ANALYSIS

5.1 OCCUPANCY CLASSIFICATION

Bonderson Engineering Projects Center was originally designed under the II-N occupancy classification of the 1997 Uniform Building Code (UBC). This occupancy classification corresponds to a type II-B occupancy under the currently recognized standard, the International Building Code (IBC) 2012.

All educational occupancies beyond K-12 are classified by the IBC as B – Business. The 1997 version of the UBC this facility was constructed under also makes this distinction.

However, due to the mixed use and variety of facilities in this space, per the 2012 IBC, the building should be classified as a mixed occupancy building. As such, it will be analyzed in this report per the standards for each of the occupancies within the building.

The floor plans in Figures 10 and 11 below illustrate the different occupancy classifications of the rooms on the first and second floor of the BEPC respectively.

Figure 10 First Floor Occupancy Classification Map

Figure 11 Second Floor Occupancy Classification Map

5.2 OCCUPANT LOAD

The occupancy classifications are assigned an occupancy load factor (OLF) in accordance with NFPA 101 Table 7.3.1.2 and IBC Table 1004.1 Some of the OLF's utilized in the building can be found in Table 6 below.

Table 6 Occupant Load Factors - IBC & LSC

LSC / (IBC) Classification	**LSC / (IBC) Occupant Load Factors (ft^2/Person)**
Business Use	100 Gross
Assembly Use – Less concentrated	15 Net
Storage Use – Other than Mercantile	500 Gross
Shops, Labs, Vocational Rooms	50 Net
(Mechanical Spaces)	(300 Gross) IBC
Industrial	(100 Gross) IBC

5.2.1 First Floor:

The first floor of this building is mostly devoted to Senior Project Labs / project rooms and large project integration spaces, as well as the "Mustang 60" Machine and woodshop. The remaining areas of the first floor include restrooms, the robotics club-room and a large exhibition / conference room on the North side of the Main Longitudinal Corridor.

Each room was assigned an occupancy classification and a corresponding Occupancy Load Factor (OLF) from the LSC 2012. For several of the rooms, the LSC did not have an applicable OLF for the occupancy of the space. For these cases, the analysis defers to OLFs in the 2012 IBC, which contains applicable OLFs for some occupancies not covered in the LSC.

For spaces without a specified OLF in either code, the overall occupancy classification of the building (Business) was used (OLF of 100 ft^2/Person). This OLF is on the conservative (higher occupant load) side for most of these spaces.

For the conference / assembly occupancy (Room 104), a less-concentrated assembly OLF of 15 was chosen for this space, as its normal configuration includes non-fixed chairs for conference or presentations, or during the end of quarter senior project expo by the Mechanical Engineering department. In either case, standing room only conditions would be unlikely to occur, and thus an OLF of 15 is representative of typical conditions. However, the AHJ would make the final determination on the OLF to be utilized for this space.

In addition, the labs and assembly occupancy load factors use net area, but the corridors themselves are designated as rooms. As a result and with regard to the fact that the building is a B-Business occupancy, the corridors are deducted to get the net floor area. This means the floor area and subsequent occupant load for the corridor "rooms" in the table are equal to 0.

5.2.2 Second Floor:

The second floor is occupied mainly by additional labs, an indoor mechanical room and several rooftop mechanical "Rooms" consisting of mechanical areas on the roof with a slatted aluminum privacy screen encompassing them (Figure 12). These areas are on the first floor roof above the south side laboratories and are open to sky above. These spaces are typically never occupied unless maintenance on the HVAC systems is being performed. Even though this space is outdoors, anyone in the space would still need to evacuate through the building because of the privacy screens and the lack of any ladder access to this roof. In light of this, the occupancy load from this area was considered as well, using the OLF of 300 for Mechanical Equipment rooms found in the IBC Table 1004.1.2.

Figure 12 Rooftop Mechanical Area

There is also an area classified as "Waiting." This area has some chairs and side tables for people to wait or congregate. It is labeled as a Waiting area on the floor plans, but the use of the space does not fit the definition defined in sections 12.1.7.1 and 13.1.7.2 of the LSC which contains OLF's for situations where people are waiting to be seated in another room or when the other spaces are at capacity. The waiting area in this building is more of a lounge or lobby type space and its use does not meet the criteria of a waiting area. It is therefore classified in this report as a Business occupancy with an OLF of 100.

The resulting calculations for the occupant loads of both the first and second floors of the building are tabulated in Figures 13 & 14 Below.

Reference LSC 2012 - Table 7.3.1.2 Occupancy Load Factors
Reference IBC - 2012 - Table 1004.1.2 Occupancy Load Factors

	Room / Space	Room Useage	Net Area (Sqft)	Gross Area	Corridor Area assigned to the space	Calcuated Area (Sqft)	LSC - Useage Category	Net	O.L.F.	Occup
First Floor	101	Entry Lobby & Corridor	319	1765	0	319	Vocational - Labs / Shops	y	50	
	102	Robotics Club Room	653		0	653	Vocational - Labs / Shops	y	50	
	103	Elevator Mech Room	81		72	153	Mech Eq Room- IBC	n	300	
	104	Conference / Ehibition	1787		0	1787	Assembly - Less Conc	y	15	1
	105	Electrical Room	92		51	143	Mech Eq Room- IBC	n	300	
	106	Elevator	44		0	44	# of Occupants	n/a	n/a	
	107	Project Integration	2208	2560	0	2208	Eduactional - Labs / Shops	y	50	
	108	Project Lab	412		0	412	Eduactional - Labs / Shops	y	50	
	109	Project Lab	393		0	393	Eduactional - Labs / Shops	y	50	
	110	Project Lab	627		0	627	Eduactional - Labs / Shops	y	50	
	111	Mens Restroom	267		36	303	Business	n	100	
	112	Womens Restroom	296		36	332	Business	n	100	
	113	Janitorial Storage	125		0	125	Other than Merc Storage	n	300	
	114	Metal Shop	2033		0	2033	Eduactional - Labs / Shops	y	50	
	115	Wood Shop	800		0	800	Eduactional - Labs / Shops	y	50	
	116	Tool Storage	325		0	325	Other than Merc Storage	n	300	
	117	Shop Office	236		0	236	Business	n	100	
	118	Storage	81		72	153	Other than Merc Storage	n	300	
	119	Telecom	129		72	201	Mech Eq Room- IBC	n	300	
	N/A	Outdoor Project Space	129		72	8000	Industrial	n	100	
									Floor Total	3

Figure 13 Occupancy Load - First Floor

Second Floor	201	Waiting	451		72	523	Business	n	100	5
	202	Vestibule	95		0	95	Educational - Labs / Shops	y	50	2
	203	Device Control Lab	545		0	545	Educational - Labs / Shops	y	50	1
	204	Conference Room	706		0	706	Educational - Labs / Shops	y	15	4
	205	Computer Cluster Lab	493		0	493	Educational - Labs / Shops	y	50	1
	206	Telecom Room	84		48	132	Mech Eq Room - IBC	n	300	1
	206A	Telectom Room 2	74		48	122	Mech Eq Room - IBC	n	300	1
	207	Janitorial Storage	78		48	126	Other than Merc Storage	n	300	1
	208	Corridor	0		0	0	Educational - Labs / Shops	y	50	0
	209	Chemistry Lab	423		0	423	Educational - Labs / Shops	y	50	9
	210	Electronics Repair	504		0	504	Educational - Labs / Shops	y	50	1
	211	Enclosed Mechanical	306		0	306	Educational - Labs / Shops	y	50	7
	212	Systems Computer Lab	486		0	486	Educational - Labs / Shops	y	50	1
	213	Exterior Mech Equip	1326		0	1326	Mech Eq Room - IBC	n	300	5
	214	Exterior Mech Equip	1554		0	1554	Mech Eq Room - IBC	n	300	6
									Floor Total	12

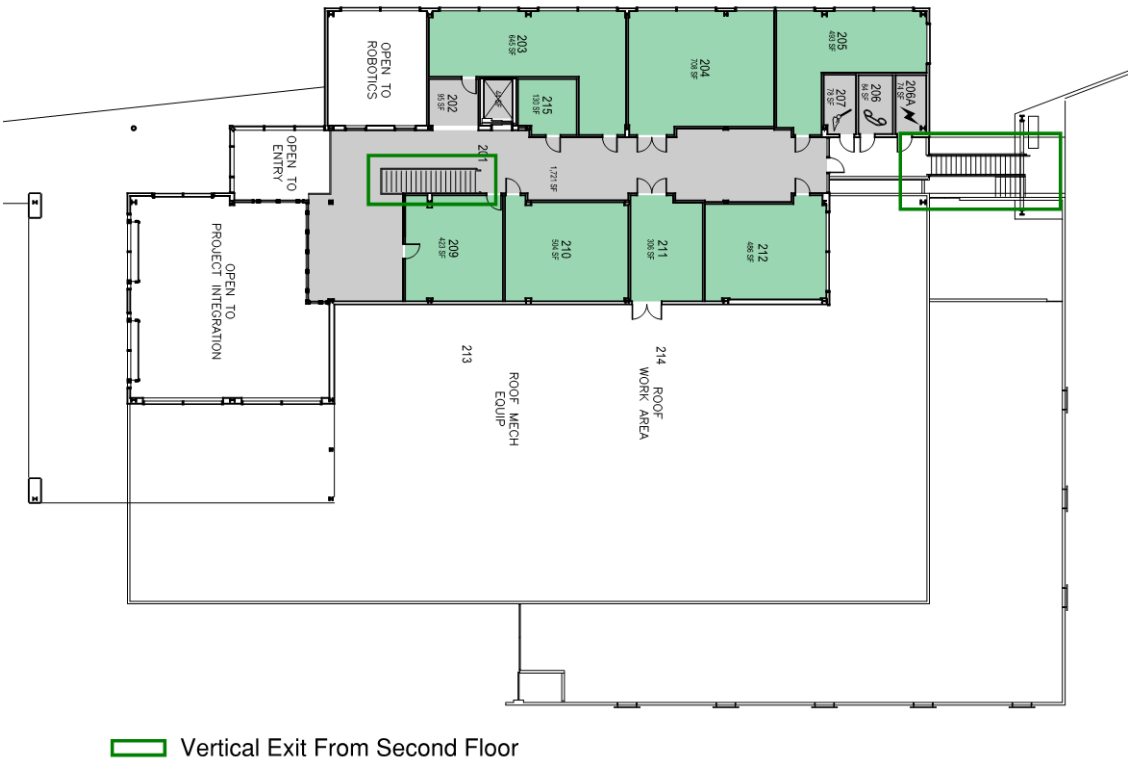
Figure 14 Occupancy Load Second Floor

5.3 EGRESS CAPACITY

Floor plans indicating various egress systems available to occupants on the first floor (Figure 15) and second floor (Figure 16)

Figure 15 Egress Systems First Floor

Figure 16 Egress Systems Second Floor



5.3.1 Door Egress Capacity

The egress capacity of the doors for each of the rooms in the building and the building itself as a whole was analyzed to ensure capacity of these systems was adequate for the occupant load that they serve. The analysis is detailed below.

Table 7.3.3.1 of the 2012 LSC provides capacity factors for use in determining the capacity of individual components of a means of egress such as doors and ramps. The capacities used in this analysis are summarized in the Table 7 below.

Table 7 2012 LSC Table 7.3.3.1 Capacity Factors for Various Components

Area	Stairways (Width / Person) in.	Level Components & Ramps (Width / Person) in.
Other than Board Care, Health Care and High Hazard	0.3	0.2

The formula for utilizing these capacity factors to determine the egress capacity of a component is straightforward and can be determined as follows:

$$Door\ Capacity\ = \frac{Door\ Clear\ Width\ (inches)}{Door\ Capacity\ Factor\ (inches/person)}$$

5.3.1.1 Single Leaf Doors

All single leaf doors in the building are 36" wide with a clear exit width of 34.5" Based on this width and the capacity factors found in the 2012 LSC table 7.3.3.1, the egress capacity of all single doors in the facility is as follows in Table 8

Table 8 Single-Leaf Door Egress Capacity

Door Width	Door Clear Exit Width	Capacity Factor	Capacity of Door
36"	34.5"	.2 (in/person)	172 Persons

5.3.1.2 Double Leaf Doors

All of the double leaf doors in (BEPC) are 6'-0" (72") wide with a clear width of 5'9" or (69") with no center mullion between leafs. Again, utilizing the capacity factors and the clear width of the egress component, the egress capacity of the double leaf doors was found to be 345 persons (Table 9).

Table 9 Double-Leaf Door Egress Capacity

Door Width	Door Clear Exit Width	Capacity Factor	Capacity of Door
72"	69"	.2 (in/person)	345

There are several roll-up doors servicing the project integration room, the metal shop and the senior project lab rooms. However, due to the time and dexterity required to operate these doors, they will not be considered as a means of egress in this analysis.

5.3.2 Corridor Capacity:

The main longitudinal corridor on the first and second floor of the (BEPC) is nominally 12'-0" in width, but has a pinch point at the interior stair location where the width constricts down to 8'-0". As the most constricted area of the corridor, this pinch-point dimension was utilized in the egress capacity calculations, rendering a corridor egress capacity of 480 persons. This capacity is adequate to serve the entire building's occupancy load including the second floor occupants. The second floor corridor, with its lower occupant load and the same corridor dimensions thus also has adequate corridor egress capacity.

Table 10 First and Second Floor Main Corridor Egress Capacity

$$Corridor\ Capacity\ = \frac{Corridor\ Clear\ Width\ (inches)}{Level\ Components\ Capacity\ Factor\ (inches/person)}$$

Corridor Width	Corridor Clear Width	Capacity Factor	Capacity of Corridor
144"	96"	.2 (in/person)	480

Lateral Corridor: The lateral corridor serves approximately half the population of the metal shop, the Senior Project labs 108-110, and half the population of project integration room 107. The corridor is 8' wide, giving it the same 480 person capacity of the longitudinal corridor; again, this easily serves the entire population if need be.

Table 11 First Floor Lateral Corridor Capacity

Corridor Width	Corridor Clear Width	Capacity Factor	Capacity of Corridor
144"	96"	.2 (in/person)	480

The following table summarizes the door egress capacities for each space for the first (Table 12) and second (Table 13) floors. Each of the rooms is very well served; even the assembly occupancy on the first floor has almost double the door egress capacity as its occupant load. With an occupancy load of fewer than 500, its two exits are adequate. However, the second single-leaf door to the assembly occupancy does not swing in the direction of egress and is in violation of code.

Table 12 First Floor Door Capacity Tabulation

Reference LSC 2012 - Table 7.3.1.2 Occupancy Load Factors Reference IBC - 2012 - Table 1004.1.2 Occupancy Load Factors							
	Room / Space	**Room Useage**	**Occupant Load**	**No. Exit Doors**	**Total Exit Clear Width (in)**	**Total Door Exit Capacity**	**Exit Door Capacity > Occ Load**
First Floor	101	Entry Lobby & Corridor	6	2	69	345	y
	102	Robotics Club Room	13	1	69	345	y
	103	Elevator Mech Room	1	1	34.5	172.5	y
	104	Conference / Ehibition	119	2	103.5	517.5	y
	105	Electrical Room	1	1	34.5	172.5	y
	106	Elevator	0	n/a	n/a	n/a	y
	107	Project Integration	44	1	138	690	y
	108	Project Lab	8	1	34.5	172.5	y
	109	Project Lab	8	1	34.5	172.5	y
	110	Project Lab	13	2	69	345	y
	111	Mens Restroom	3	1	34.5	172.5	y
	112	Womens Restroom	3	1	34.5	172.5	y
	113	Janitorial Storage	0	1	34.5	172.5	y
	114	Metal Shop	41	2	69	345	y
	115	Wood Shop	16	1	69	345	y
	116	Tool Storage	1	1	34.5	172.5	y
	117	Shop Office	2	1	34.5	172.5	y
	118	Storage	1	1	34.5	172.5	y
	119	Telecom	1	1	34.5	172.5	y
	N/A	Outdoor Project	80	3	103.5	517.5	y
		Occupant Load	360				

Table 13 Second Floor Door Capacity Tabulation

Second Floor	201	Waiting	5	n/a part of corridor	n/a	n/a	n/a
	202	Vestibule	2	n/a part of corridor	n/a	n/a	n/a
	203	Device Control Lab	11	2	69	345	y
	204	Open Computer Lab	14	1	34.5	172.5	y
	205	Computer Cluster Lab	10	1	34.5	172.5	y
	206	Telecom Room	1	1	34.5	172.5	y
	206A	Telectom Room 2	1	1	34.5	172.5	y
	207	Janitorial Storage	1	1	34.5	172.5	y
	208	Corridor	0	n/a part of corridor	n/a	n/a	n/a
	209	Chemistry Lab	9	2	69	345	y
	210	Electronics Repair	11	1	34.5	172.5	y
	211	Enclosed Mechanical	7	1	69	345	y
	212	Systems Computer Lab	10	1	34.5	172.5	y
	213	Exterior Mech Equip	5	1	69	345	y
	214	Exterior Mech Equip	6	1	69	345	y
		Occupant Load	93				

5.3.3 Stair Egress Capacity

Bonderson Engineering Projects Center has 2 stairs, one interior stair and one exterior stair, that serve the second floor; both the interior and exterior stairs are 50" wide. Using this information along with stair capacity factors in table 7.3.3.1, the capacity of each of these stairs is calculated as follows:

$$Stair\ Capacity = \frac{Stair\ Clear\ Width\ (inches)}{Stairway\ Capacity\ Factor\ (inches/person)}$$

However, the capacity of a stair may be increased if it is greater than 44" in width by using the equation specified in 7.3.3.2 of the 2012 LSC:

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

where,

C = capacity, in persons rounded to the nearest integer

W_n = nominal width of the stair

The results of the original stair capacity calculation and subsequent application of the capacity increase equation are tabulated in Table 14 below.

Table 14 Stair Egress Capacity

	Stair Width	Stair Clear Width	Capacity Factor	Capacity of Corridor
Without Capacity Increase	50"	50"	.3	146
With Capacity Increase	50"	-	-	174

Both stairs have a capacity of 174 persons, which is > 93 person occupant load for the second floor, so either stair can accommodate the entire occupant load of the second floor if need be.

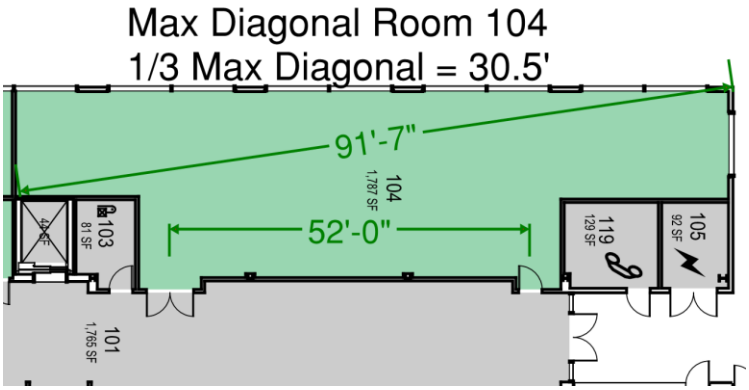
The exterior stair is accessed by a single leaf door with 34.5" inches of clear width, giving it the same 172 person capacity as the single leaf door calculations performed earlier. This indicates that the egress system as a whole for the exterior stair system is door egress capacity limited. There is a 2-person difference between the capacity of the stair and the capacity at door accessing it respectively; they are evenly matched egress components.

5.3.4 Arrangement of Exits

Rooms with more than one exit are required to have their separate exits located greater than 1/3 of the largest diagonal of the room apart for fully sprinklered buildings and greater than 1/2 the diagonal apart for un-sprinklered buildings. The intent of this requirement is to avoid dead-ends in rooms that could trap occupants from being able to reach the second exit in the event one becomes inaccessible. It also helps reduce the chances that a single fire will compromise both exits at once. These requirements are dictated by sections 7.5.1.3.3 and 7.5.1.3.2 of the 2012 LSC.

A good example of this is Conference Room 104 on the first floor; its two exits are greater than 1/3 the maximum diagonal of the room apart, as illustrated in Figure 17, and tabulated in Tables 15 and 16 below.

Figure 17 Maximum Diagonal of Room 104



All of the rooms in (BEPC) with more than one exit are tabulated and evaluated for compliance against the separation of exits requirements of the LSC by floor.

5.3.4.1 First Floor

Table 15 Exit Separation First Floor

Room Name	**Exits Greater Than 1/3 the Diagonal Apart?**
Conference Exhibition	Yes
Project Integration	Yes
Metal Shop	Yes
Wood Shop	Yes
Project Lab 110	Yes

Tool Storage 116 may have a non-compliant egress arrangement, as it requires exit through the shop office. Depending on the AHJ, this may not be considered an "Accessory Space", meaning it does not keep in accordance with the requirements of LSC 7.5.1.6, which specifies the requirements for exit access from adjoining rooms. If the AHJ determines it does not meet these requirements, then it should have its own exit to the first floor lateral corridor.

5.3.4.2 Second Floor

Table 16 Exit Separation Second Floor

Room Name	Exits Greater Than 1/3 the Diagonal Apart?
Device Control Lab 203	Yes
Chemistry Lab	Yes

Device Control Lab 203 has two exits greater than 1/3 the diagonal apart. The L shape of the room necessitates a second exit because occupants could be trapped at the end of the L in the event of a fire.

5.3.5 Arrangement of Stairs

The two stairs to the second story are greater than 1/3 the diagonal apart.

5.3.6 Travel Distance

Travel distance maximums are set by the Life Safety Code Table A7.6 and are specific to the occupancy classification of the building and whether or not automatic sprinklers are installed.

From inspection, most of the buildings rooms meet the requirements for a business occupancy that is fully sprinklered ~200'. For rooms that were given their own occupancy classification and require an analysis beyond inspection the travel distances allowed per the LSC and the actual travel distances are expressed and tabulated in Table 17.

Table 17 Travel Distances For Specific Occupancies

Room	Occupancy Classification	Travel Distance Limit Per LSC	Travel Distance in (BEPC)
Conference Room 104	Assembly	250'	54'
Projects Integration	Educational - Labs	200'	58'
Metals Shop	Educational - Labs	200'	42'
Wood Shop	Educational - Labs	200'	24'

Conference Room 104 - From table A7.6 of the LSC, for an assembly occupancy which is sprinklered, the maximum travel distance is 250' from the drawing, while the actual maximum travel distance is only 54 feet.

Project Integration Labs - From table A7.6, there is no occupancy type for this specific occupancy type, so Industrial General Purpose was used as the most applicable occupancy type. Maximum travel distance is 200' for new fully sprinklered building. Maximum travel distance in Bonderson Projects Center was found to be 58 feet.

The travel distances for the rest of the rooms on the ground floor can easily be seen by inspection to be less than 200'.

Second Floor - From inspection, none of the travel distances for any of the rooms exceed the 200' allowed by the LSC.

5.3.7 Dead Ends and Common Path Limits

The majority of the dead ends occur in the halls of the building—which are classified as business occupancy along with the building as a whole. As such, the dead end limits for this building were analyzed for Business Occupancy (Table 18).

Per the LSC Table A7.6 the dead end limit for new Business Occupancies, which are fully sprinklered, is 50 feet.

Table 18 Dead Ends

First Floor Longest Dead End Room	**Longest Dead End (Feet)**
Restrooms	32'
Second Floor Longest Dead End Rooms	**Longest Dead End (Feet)**
Room 205 Computer Cluster	36'
Waiting Room	31'

Common path limits for New Business Occupancies that are fully sprinklered are 100' per LSC Table A7.6.

5.4 OCCUPANT CHARACTERISTICS

5.4.1 Typical Occupant Characteristics and Behavioral Tendencies.

1.) The occupants of this building are typically students working on their Senior Projects in the labs and shop area or utilizing the computer labs on the second floor. The assembly occupancy on the first floor may host people unfamiliar to the campus or to the building, as they hold presentations and conferences in that space. The behavioral tendencies of these different occupants contribute to the pre-movement times and activities for occupants of this building that will be used in calculating egress times. In addition, the major demographic for occupants of this facility is college-age students, so an assumption that they are on average younger and able-bodied means their egress times may be faster than the average population as a whole.

2.) For students working in the shop area, pre-movement activities and time could include time to hear the alarm over machinery, while wearing hearing protection. Time required shutting down any tools or machinery they are currently using in a safe manner and possible removal protective equipment (ie. welding helmets and jackets, etc.) may slow their egress. Pre-movement activity for this scenario is assumed to be in the 30 second to 1 minute range.

For students in the computer labs, pre-movement activity might include saving their work and packing up school supplies. This could also be in the 30 second to 1 minute range.

From the NFPA handbook, utilizing table 4-54, the assumption of a delay time based on the mid-rise office building category can be made. This time delay is .6 minutes or 36 seconds. This value is shown in the excerpted table from the NFPA Handbook Table 4-54 shown below (Figure 18).

Figure 18 Occupant Delay Times - NFPA Handbook

TABLE 4.2.1 Delay Times (Minutes) Derived from Actual Fires and Evacuation Exercises Reported in the Referenced Literature

Event Description	*N*	*Min*	*1st Q*	*Median*	*3rd Q*	*Max*	*Mean*	*Factors*
High-rise hotel[14]	536	0	3.3	60.0	130.9	290.0	NA*	MGM Grand Hotel fire, no alarm notification, grouped data from questionnaires
High-rise hotel[15]	47	0	2.0	5.0	17.5	120.0	NA	Westchase Hilton Hotel fire, no alarm in early stages, grouped data from questionnaires
High-rise office building[16]	85	0	2.0	5.0	10.0	245.0	11.3	World Trade Center explosion and fire, no alarm notification (building closer to explosion)
High-rise office building[16]	46	0	4.5	10.0	31.5	185.0	28.4	World Trade Center explosion and fire, no alarm notification (building further from blast)
High-rise office building[17]	107	1.0	1.0	1.0	1.0	~6.0	NA	Fire incident, no alarms, data from interviews with occupants of four floors of building (11 interviewees were trapped)
High-rise office building[18]	12	0.5	NA	1.0	NA	2.3	1.2	Unannounced drill on three floors; data for first person to reach each of four stairwell doors to wait for voice instruction; trained staff; data from video recordings
Mid-rise office building[19]	92	0	0.4	0.6	0.8	<4.0	0.6	Unannounced drill, good alarm performance; fire wardens; warm day
Mid-rise office building[19]	161	0	0.5	0.9	1.4	<5.0	1.1	Unannounced drill, good alarm performance; fire wardens; cool day
One-story department store[20,21]	95	1.0	0.2	0.3	0.5	0.9	0.4	Unannounced drill; trained staff; data here derived from grouped data for 95 participants
Three-story department store[21]	122	0.05	NA	NA	NA	1.6	0.6	Unannounced drill; trained staff; times distilled from analysis of videotapes
One-story department store[21]	122	0.07	NA	NA	NA	1.7	0.5	Unannounced drill; trained staff; times distilled from analysis of videotapes
One-story department store[21]	71	0.03	NA	NA	NA	1.0	0.4	Unannounced drill; trained staff; times distilled from analysis of videotapes
High-rise apartment building[22]	NA	0	NA	NA	NA	NA	10.5	Forest Laneway fire; for occupants who attempted to evacuate in the first hour,

5.5 EGRESS TIME

The egress time for BEPC was analyzed using hand calculations and the SFPE method. The assumptions made and analysis is shown by floor below.

5.5.1 Egress time for occupants on the 2nd floor

To calculate the egress time of the second floor, several assumptions were made to use the SFPE method for analyzing egress time. The assumptions are detailed below:

- 50% of the occupants use each stair (47 persons per stair)
- 1/3 of the ground level occupants use each of the three ground level main corridor exits.

5.5.1.1 Stair 1 (Interior)

The interior stair has an effective width of 50" as determined earlier. This width must be reduced using the SFPE Handbook Boundary Layer Table 3-13.1 (Table 19) The boundary layer for stairs was found to be 6 inches.

Effective width of the Stair = 50" – 6" each side of door → 38" → .9652m

Table 19 SFPE Boundary Layer Widths

Table 3-13.1 Boundary Layer Widths	
Exit Route Element	**Boundary Layer (in)**
Stairways – wall or side of tread	6
Railings, handrails	3.5
Theater chairs, stadium benches	0
Corridor, ramp walls	8
Wide concourses, passageways	<18
Door, archways	6

Utilizing Table 3-13.5 of the SFPE Handbook, Maximum Specific Flow (Table 20) is used to determine the maximum flow of occupants down a stair given the pitch of the stair with consideration to the boundary layer conditions previously determined.

Table 20 Maximum Specific Flows

Exit Route Element		**Maximum Specific Flow (persons/sec/m effective width)**
Corridor, Ramp, Doorway		1.3
Stairs		1.01
Stair Riser Height (in)	Stair Tread Width (in)	
7	11	

Maximum specific flow for a stair with a rise of 7 and a run of 11 is 1.01 persons/sec/m effective width.

The equations below solve for time with an occupant load of 47 persons (half the second floor's total occupancy load) assigned to Stair 1.

$$Seconds = \left(\frac{Persons}{(1.01\ persons/second/m\ width) \times\ (m\ width)}\right)$$

$$Seconds = \left(\frac{47\ Persons}{(1.01\ persons/second/m\ width) \times\ (.952m\ width)}\right)$$

$$Seconds = \ 48.8\ seconds \sim 1\ minute$$

5.5.1.2 Stair 2 (Exterior)

Stair 2 has the same dimensions as Stair 1 but it is accessed via a door 36" wide. As determined earlier, this egress is door capacity limited rather than stair capacity limited in outright egress capacity. The following calculation shows that the door is also the limiting factor with regard to egress time.

$$Door\ Width - (Boundary\ Layer\ on\ Each\ Side\ of\ Door)$$

36" – (2 x 6") = 24"

24" → .6096m

The same Maximum Specific Flow constant from table 3-13.5 for doors is utilized for this case well.

$$Seconds = \left(\frac{47\ Persons}{(1.3\ persons/second/m\ width) \times\ (.6096m\ width)}\right)$$

$$Seconds = \ 59.3\ Seconds \sim 1\ minute$$

5.5.2 Ground Level:

Total occupants: 360

Assuming 1/3 of the occupants use each of the three main exits, the exit from the lateral corridor will be the most restrictive exit on the ground floor; it will be the basis of analysis for the ground level egress time. The main exit has two sets of double doors and the East exit (Plan North), which is serviced by the larger East-West hallway.

360/3 = 120 persons

$$Door\ Width - (Boundary\ Layer\ on\ Each\ Side\ of\ Door)$$

72" – 6" each side of door → 60"

60" → 1.524m

Maximum specific flow for a door is 1.3 persons/sec/m effective width as shown in table 3-13.5 of the SFPE Handbook and the table above.

Solving for time with an occupant load of (120) persons yields the following:

$$Seconds = \left(\frac{Persons}{(1.3\ persons/second/m\ width) \times\ (m\ width)}\right)$$

$$Seconds = \left(\frac{120\ Persons}{(1.3\ persons/second/m\ width) \times\ (1.524m\ width)}\right)$$

$$Seconds =\ 60.57\ Seconds \sim 1\ minute$$

5.5.3 First Floor and 2nd Floor Simultaneously

Analysis of a simultaneous egress from first and second floor assumes that 50% of the occupants of the 2nd floor will utilize the interior stair (stair 1) and exit out through the first floor. Because the stair discharges occupants directly in-line and within 20 feet of the main exit for the first floor corridor, it was assumed that all of the occupants from the second floor who utilize this stair would naturally utilize this main exit. Along with the second floor occupants, 1/3 of the first floor occupants will also exit through the main exit at the west end of the main first floor corridor.

Given a total population to exit of 167 persons, there are two double door exits at the main Entrance / Lobby.

$$Door\ Width - (Boundary\ Layer\ on\ Each\ Side\ of\ Door)$$

Effective width of the door = 72" – 6" each side of door → 60" x 2 door sets = 120"

120" → 3.048m

Again, using the maximum specific flow for a door which is 1.3 persons/sec/m of effective width and solving for time given the occupant load (176 persons) yields the following egress time:

$$Seconds = \left(\frac{Persons}{(1.3\ persons/second/m\ width) \times\ (m\ width)}\right)$$

$$Seconds = \left(\frac{167\ Persons}{(1.3\ persons/second/m\ width) \times\ (3.048m\ width)}\right)$$

$$Seconds =\ 42.14\ Seconds \sim 1\ minute$$

There are several other factors to consider when calculating the total egress time. Approximately one minute needs to be added to take into consideration the travel time for people descending from the second floor using the stairs. Combined with the estimated pre-movement activity times, approximately one to two minutes is added to the egress time. This yields a resulting egress time of approximately three-four minutes. This time does not include perception or interpretation times, which would add an additional delay.

$$Travel\ time\ for\ people\ descending\ from\ second\ floor = 1\ min$$

$$Travel\ time\ for\ occupant\ load\ to\ exit\ at\ first\ floor = 1\ min$$

$$Pre\ Movement\ Time = 1 - 2\ min$$

$$Total\ Egress\ Time = 3 - 4\ min$$

The egress times calculated using the SFPE method may seem quite expedient. However, when weighed against the relatively small size of the building, its modest occupancy loading and its

generous egress capacity, it would logically only take about 3-4 minutes to evacuate the entire facility.

The large and plentiful doorways may be partially a result of the buildings function as a projects lab where large equipment needs to be moved in and out of the space frequently. As a result, the capacity of many of these doors is greatly above that which is required for egress.

Other Assumptions.

- The exit speed was based on the maximum specific flow. It is possible that the flow could be less depending on the typical age demographic of occupants, the presence of obstructions in the path of exit to reach the stairs, etc.
- These answers also assume that the occupants are not being hindered or otherwise slowed by the presence of smoke.
- There is some debate as to whether the SFPE values for specific flow rate are too high. A FSJ article published experimental data which showed actual specific flow rates were significantly lower than the rates listed in Section 1.3 of theSFPE Handbook.

5.6 TENABILITY ANALYSIS METHODOLOGY

The methodology of conducting tenability analysis should be as follows:

The AHJ shall approve the parameters involved in the design-fire scenario goals. From the prescribed 8 design fire scenarios described in the Life Safety Code, a subset is modeled that best represents the hazards and conditions of the building in question. The performance results of those models shall be in accordance to LSC 5.2.2 where any occupant shall not be exposed to instantaneous or cumulative untenable conditions.

The ASET must be greater than RSET for all of the following tenability analyses. For example, there must be sufficient time to egress before the smoke layer descends to a level 6' above the floor.

To analyze whether the building meets performance objectives outlined in section 5.2 of the LSC, FED would be used to model and analyze toxic gases and the available safe egress time based on time to incapacitation.

This would include analyzing the effects of asphyxiant fire products such as Carbon Monoxide, Hydrogen Cyanide etc., the effect of low oxygen due to the unavailable free hemoglobin because of conversion to carboxyhemogloben by carbon monoxide, as well effects caused by HCN. It will also take into account the increase in respiration due to high concentrations of CO_2 and the fact that at over 5%, CO_2 is an asphyxiant.

In addition, irritant fire products and the fractional irritant concentration (FIC) from those smoke products (Hydrogen Chloride, Acrolein, etc.) can be modeled. These irritants alone can also cause toxic effects in high enough doses. For example HCL has a 5 min lethal exposure at 15,000 ppm.

Another tenability analysis is smoke density effects and its impacts on decision-making, way finding ability, and speed of occupants. These factors are in addition to the obvious negative effects on the eyes and respiratory system.

The final aspect of the tenability analysis is the heat effects of fire-mainly heat stroke, surface burns and respiratory tract burns. Data on the tenability limits for this can be found in the SFPE manual, from Pages 2-125. For example, if radiation is above 2.5 kw/m^2, limiting tenability conditions occur in just 30 seconds.

A performance-based tenability analysis using design fire scenarios as specified in the LSC section 5.2.2 and computer modeling using FDS in conjunction with an egress analysis using the Pathfinder software is included in a subsequent section of this report.

6 FIRE SUPPRESSION SYSTEMS

6.1 FIRE SPRINKLER SYSTEMS

Bonderson Engineering Projects Center is equipped with an automatic fire sprinkler system throughout (Figure 18.5) in accordance with CFC 2001-1003.2.2.

The sprinkler system was designed using the following specifications:

- Sprinkler system utilizes Quick Response k5.6 sprinklers
- Light hazard occupancy classification in classrooms, hallways
- Ordinary Hazard Group I for storage and equipment areas

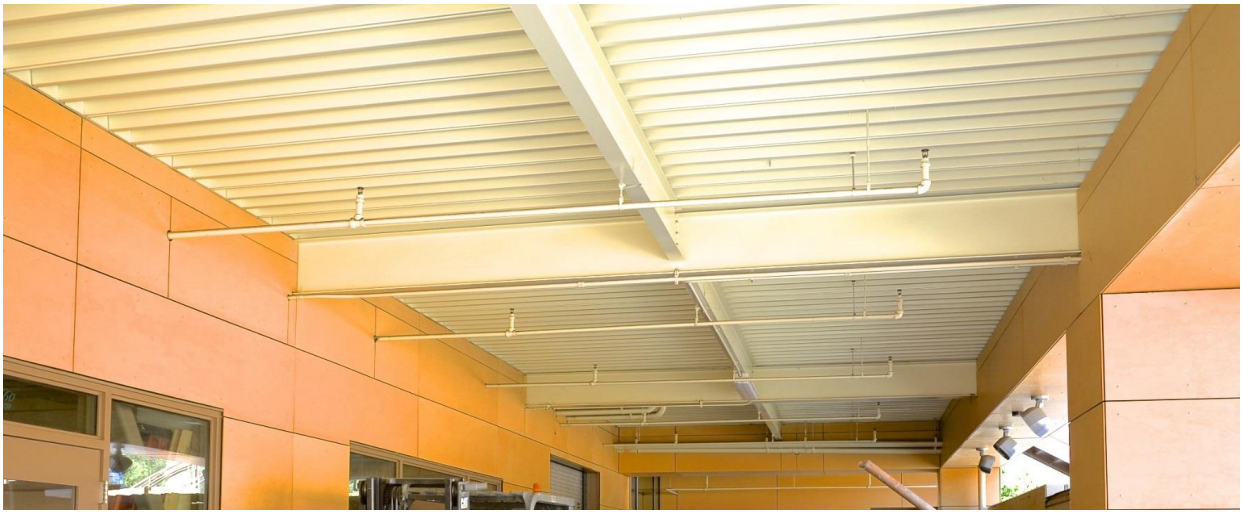
The two remote areas used in the hydraulic calculations of the sprinkler system were as follows:

- Machine shop area, calculated to Ordinary Hazard Group I
- Second Floor Classrooms at the east end of the building was calculated to light hazard.

While the projects integration high bay area was not one of the areas calculated in the fire sprinkler drawings or expressly designated Ordinary Hazard Group I. The area has sprinklers spaced at 10' by 11' feet which would indicate an Ordinary Hazard sprinkler spacing of less than 130 ft^2 of coverage per sprinkler was utilized, and thus that the systems designer designed the projects integration space to the Ordinary Hazard Group I Hazard Classification used else where in the building.

A single 4" fire sprinkler riser in the South West corner of the building supplies the entire building and both floors. The riser is fed via a 6" underground fire water supply line through a 6" double detector check backflow preventer (Figure 19).

Figure 18.5 Automatic Fire Sprinklers Outside Machine Shop



The fire sprinkler system was installed under the 1999 version of NFPA 13 and the installation is in accordance with the standard with a few exceptions that will be noted at the conclusion of this section.

An interesting point to note is that the sprinkler system utilizes Sch.10 for the grooved mains, which is typical, but it also uses Threaded Sch.30 Branch-lines. While threaded light wall pipe is not disallowed per NFPA 13, many jurisdictions in California have disallowed the use of thread-able light wall piping as of around 2010.

Figure 19 6" Double Detector Check Backflow Preventer

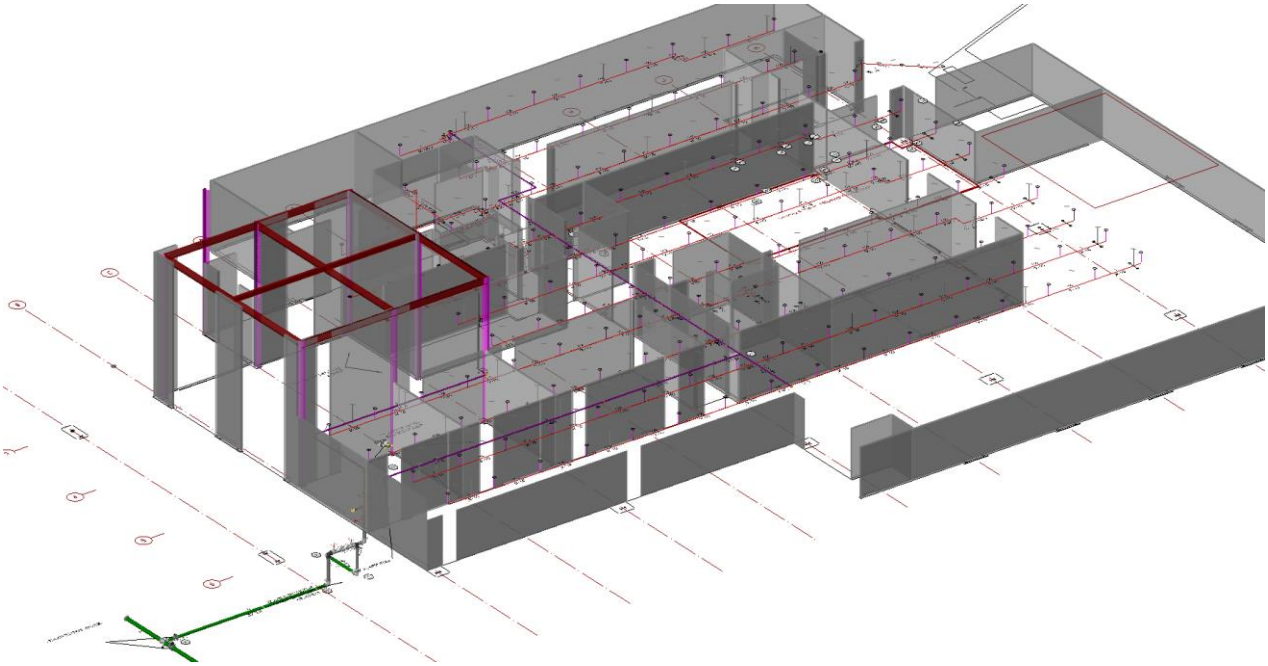
6.2 FIRE SPRINKLER SYSTEM CALCULATIONS

6.2.1 Computer Modeling of Fire Sprinkler System

The fire sprinkler system was modeled in 3D utilizing the AutoSprink fire sprinkler CAD Program. The sprinkler system was modeled in its entirety using the pipe and fittings utilized in the buildings fire sprinkler system, including the underground fire service connection from the fire water main at North Perimeter Road.

A picture of the modeled fire sprinkler system for the first floor is shown in Figure 20 for reference.

Figure 20 3D Modeled Fire Sprinklers in AutoSprink



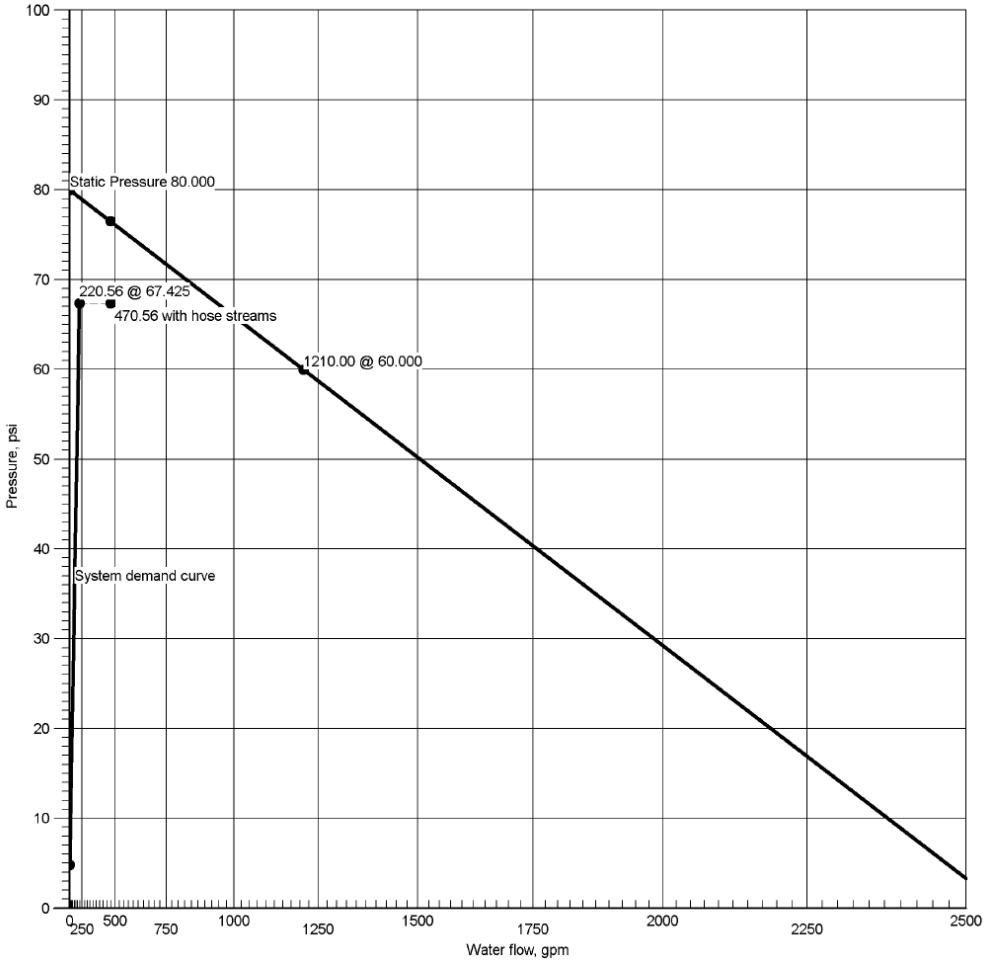
6.2.2 Hydraulic Calculation

Once modeled the sprinkler system was calculated back to the hydrant from which flow data was recorded utilizing the same computer program. The hydrant flow data provided by Cal Poly is shown below (Figure 21) along with the accompanying calculation for the most demanding remote area in the building, which is the machine shop on the first floor-which was designed to Ordinary Hazard Group I.

Figure 21 Water Supply Information

Test Hydrant No. 26	No. I-05-06
Static Pressure: 80 psi	
Residual Pressure: 60	1210 gpm

Figure 22 Sprinkler System Hydraulic Demand at Water Supply Connection



As shown in Figure 22 above, the fire sprinkler system demand is below the supply curve at the point of water supply connection by a margin of about 11%. This means that there is 11% more pressure available from the supply than is needed by the sprinklers in the most remote area.

6.2.3 Water Supply and Hose Allowance

The total system demand includes the 250 gallon per minute hose stream allowance required by the Ordinary Group I occupancy hazard group (Table 21) The water supply must be able to sustain the hose stream allowance for the durations specified in NFPA 13-2013 Table 11.2.3.1.2.

Table 21 Hose Stream Allowances for Various Occupancy Hazard Classifications

Occupancy	Inside Hose (gpm)	Combined Inside and Outside Hose (gpm)	Water Supply Duration (min)
Light Hazard	0, 50, or 100	100	30
Ordinary Hazard	0, 50, or 100	250	60-90
Extra Hazard	0, 50, or 100	500	90-120

6.3 FIRE SPRINKLER SYSTEM DEFICIENCIES

Several deficiencies were uncovered after a site survey of the facility. Among the more prominent deficiencies is the lack of branch line "End of Line Restraints" on the majority of the sprinkler systems branch-lines (Figure 23). This makes the sprinkler branchlines susceptible to damage in an earthquake as unrestrained branchlines have been known to "whip" in earthquakes, damaging the sprinkler system and also other mechanical equipment around it, rendering the system unfit for fire suppression duties post-seismic event. Since the (BEPC) was constructed under the 1999 version of NFPA 13, which requires End of Line Restraints, their absence is a violation of the prevailing installation code at the time of construction.

The second deficiency noted was the fact that the upright sprinkler heads were installed too far down from the ceiling / second floor deck above. Per NFPA 13, "w*here unobstructed construction defined as construction in which the structural elements are greater than 7'-6,"* the sprinkler deflector should be within 12" of the underside of the roof / second floor deck for a building such as (BEPC), which utilizes unobstructed construction. A consequence of the sprinklers being installed lower than required is an increase in the response time of the sprinkler heads during a fire.

Finally, several of the upright sprinklers along the first floor corridor have their spray obstructed by mechanical piping (Figure 24).

Figure 23 Branch Lines Missing End of Line Restraints

Figure 24 Sprinkler Obstructed by Mechanical Piping

Generally speaking, the automatic fire sprinkler system installed in Bonderson Projects Center is installed per the requirements of NFPA 13, with the exception of the deficiencies enumerated in the section above.

7 FIRE ALARM COMMUNICATION AND NOTIFICATION SYSTEMS

Bonderson Engineering Projects Center is protected throughout by a smoke detection and alarm system with smoke detectors, manual pull stations, as well as audio / visual horns and strobes throughout. A fire alarm system is required in all educational occupancies, even those above K-12 per the California Fire Code CFC 1006.2.4.1.2.

7.1 FACP

The Fire Alarm Control Panel (FACP) for Bonderson Engineering Projects Center (197) is located on the first floor in an exterior electrical room on the East side of the building (Figure 25). The panel is a Notifier Fire Warden -100-2 FACP. There is also an 80 character LCD remote enunciator for the FACP mounted on the wall near the main entrance on the west side of the building. For detailed specifications of both, see the attached cut sheets with highlighted data in the Appendix of the report. The FACP has four NAC circuits rated at 2.5 Amps each, which provide adequate power to all the notification devices.

Figure 25 FACP Remote Enunciator

7.2 SMOKE DETECTORS

(BEPC) incorporates two primary types of fire detection devices other than sprinklers. The first is a multi-sensor detector manufactured by Notefier— which is an intelligent plug in photoelectric smoke detector and heat detector combined (Figure 27). There are also Notefier model HPX 751 Harsh Condition smoke detectors (Figure 26). The Harsh condition smoke detectors are limited to the project rooms on the first floor as well as the machine shop, woodshop and the low covered exterior area of the machine shop. All other detectors are the multi-sensor type. The location of all detectors is shown on the attached building drawings. Note that the building drawings do not differentiate between the two types of detectors used in the building. This may be the result of a design change during the construction phase of the project that was not captured on this iteration of the fire alarm drawings. Because of this omission, the Harsh Condition smoke detectors are highlighted on the drawings in blue.

7.2.1 Detector Spacing

Because of the building's exposed steel construction and the presence of several full-height high ceiling areas, several spacing reductions apply to certain areas of the building.

Listed spacing of the detectors is 30'.

Smoke detector spacing in the project rooms on the first floor meet the requirements of less than 900 ft^2 and thus are permitted to use the smooth ceiling spacing ~ 30', according to NFPA 72 - 17.7.3.2.4.2 (5).

The spacing in the largest project room is 15', which is well within this requirement.

The steel floor joists of the second floor and the roof extend 16 inches below the ceiling, which is greater than .1H, where H is defined as the ceiling height. As such, the smoke detectors on the first floor in the project rooms and the machine shop must follow section 17.7.3.2.4.2 (2b):

- Smooth ceiling spacing in direction parallel to beams and .5 x smooth ceiling spacing perpendicular to beams.

Typical spacing in the building reflects this requirement with spacing of about 15' between smoke detectors in the direction perpendicular to the beams.

Figure 26 Harsh Condition Smoke Detector

Figure 27 Multi-Sensor Smoke & Heat Detector

7.3 HEAT DETECTION

7.3.1 Fire Sprinkler Heat Detection

The fire sprinklers in the building consist of two temperature ranges. In the drop ceiling locations on the second floor, as well as in the high ceiling of the entrance atrium / lobby on the west side of the building, the sprinkler heads are ordinary temperature classification and rated at 155 degrees F, and are of the pendant type. In the rest of the building (corridors and labs), the sprinklers are of the upright type with an intermediate classification of (200) degrees F. Sprinklers are installed per NFPA 13 requirements for spacing. The multi-detector heat detectors are spaced per the following section.

7.3.2 Multi-Detector Heat Detector

Multi-Detector Heat detector spacing is as follows:

- The ceiling mounted detectors in high bay are smoke detectors only and are not subject to the heat detector spacing reductions for high ceilings,
- The multi sensor heat detectors in the hallways and lecture/computer lab areas must follow NFPA 72 - 17.6.3.6. “Multi-sensor detectors spaced not less than 50’ apart.” 15’-20’ is typical spacing in BEPC, well within the required spacing.

7.3.3 DETACT Analysis of Detector Response

A DETACT model for response of the heat detectors was conducted. Assuming a medium fire growth rate of .012 kw/sec^2, the input parameters and results are shown below:

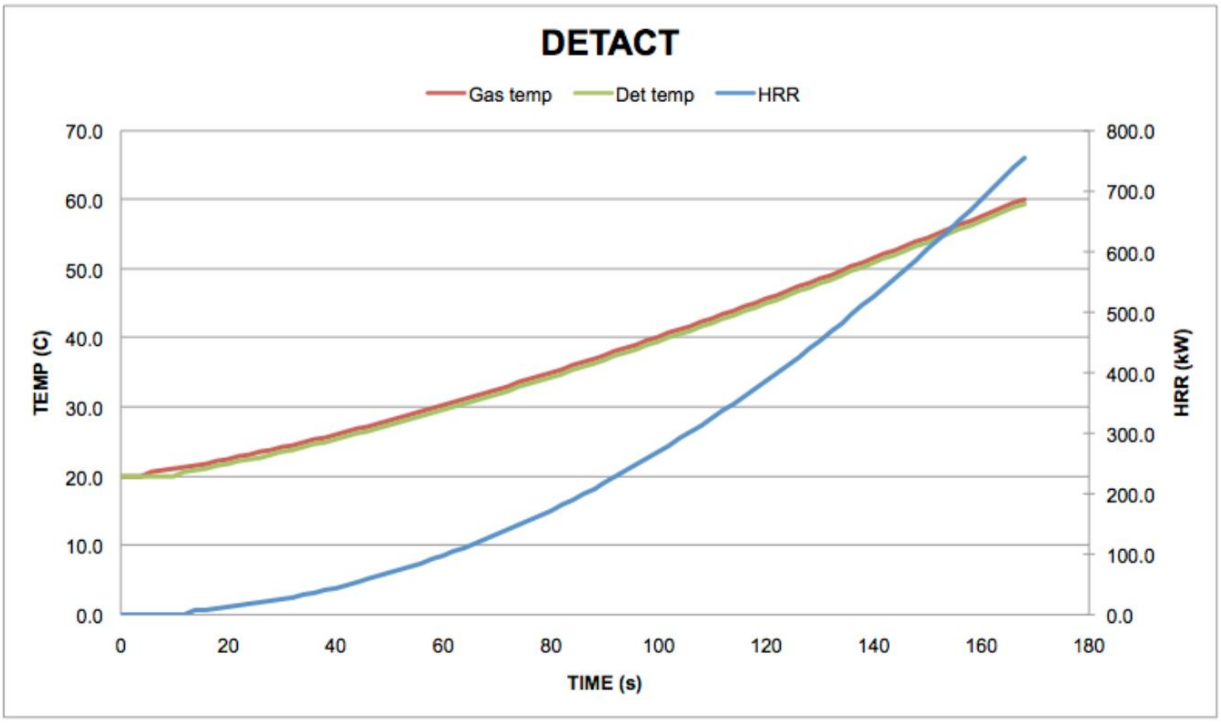
Ceiling height for these cases is 12’

Max radial distance = 16’

Response Temperature of detector = 135F = 57.2 C

Based on the DETACT Model, the heat detectors would respond in approximately 162 seconds, when the fire has reached a size of 702 kW (Figure 28).

Figure 28 DETACT Heat Detection Calculation



7.4 ALARM DISPOSITION

7.4.1 Disposition of the Alarms

26.4.5.6.1 Alarms. Upon receipt of an alarm signal, the proprietary supervising station operator shall initiate action to perform the following:

(1) Immediately notify the fire department, the emergency response team, and such other parties as the authority having jurisdiction requires.

(2) Dispatch a runner or technician to the alarm location to arrive within 2 hours after receipt of a signal.

(3) Restore the system as soon as possible after disposition of the cause of the alarm signal.

7.4.2 Disposition of a supervisory signals

26.4.5.6.3 Supervisory Signals. Upon receipt of sprinkler system and other supervisory signals, the proprietary supervising station operator shall initiate action to perform the following, if required:

(1) Communicate immediately with the designated person(s) to ascertain the reason for the signal.

(2) Dispatch personnel to arrive within 2 hours to investigate, unless supervisory conditions are promptly restored.

(3) Notify the fire department if required by the authority having jurisdiction.

(4) Notify the authority having jurisdiction when sprinkler systems are wholly or partially out of service for 8 hours or more.

(5) Provide written notice to the authority having jurisdiction as to the nature of the signal, time of occurrence, and restoration of service when equipment has been out of service for 8 hours or more.

7.4.3 Disposition of fire alarm trouble signals

26.4.5.6.4 Trouble Signals. Upon receipt of trouble signals or other signals pertaining solely to matters of equipment maintenance of the alarm system, the proprietary supervising station operator shall initiate action to perform the following, if required:

(1) Communicate immediately with the designated person(s) to ascertain reason for the signal.

(2) Dispatch personnel to arrive within 4 hours to initiate maintenance, if necessary.

(3) Notify the fire department if required by the authority having jurisdiction.

(4) Notify the authority having jurisdiction when interruption of service exists for 4 hours or more,

(5) When equipment has been out of service for 8 hours or more, provide written notice to the authority having jurisdiction as to the nature of the signal, time of occurrence, and restoration of service.

7.5 NOTIFICATION APPLIANCES

Bonderson Engineering Projects Center uses a variety of horns, strobes, and horn/strobe combinations as its notification appliances. It utilizes System Sensors "SpectrAlert" appliances: Horn Strobes model number P1224MC, Strobes Model Number S1224MC, and Horns model H12/24K. In addition to these notification appliances, there is also a bell on the exterior of the buildings southwest corner near the fire riser and a fire sprinkler water flow alarm. The H12/24K horn-only device is an exterior grade device mounted on the exterior of the structure outside the second floor entrance on the East side of the building. For location of all notification devices, see the fire alarm drawings included in the appendix. Horn Strobes are designated by the horn symbol with the rectangle inscribed with AV. Strobes alone are designated with the rectangle with V inscribed and light "rays" emanating from them. Finally, horns alone are just the horn symbol without the AV rectangle.

7.5.1 Audible Signaling

The following Table 22 is a list of all the rooms in the building and their respective average Audibility Sound Levels according to their location type based on Table A.18.4.3 in NFPA 72. The table also applies the 15 dBA above ambient required for audible signaling, as well as sound pressure loss over distance from the horn. All of the rooms of the building were compliant with the exception of the machine / woodshop area. The room by room results are tabulated in the table below.

Because the machine shop and wood shop area are classified as an Industrial occupancy the AAS is 80 dBA. 80 dBA +15dBA = 95 dBA would be required from the horn in the wood shop and machine shop areas.

With 95 dBA required in the machine and wood shops, the notification appliances used in this area of the building are not "loud" enough to meet that required dBA. Unless that room is using an atypical horn from the rest of the building (does not seem different from the rest of the devices upon visual inspection), then the room may not be in compliance.

It is also possible that the AHJ allowed visual notification only because the dBA required would be so high for these spaces that it could cause hearing damage. This is allowed for such situations in NFPA 72. Alternatively the power to machines in the space could be tied into the fire alarm system to facilitate an automatic shutdown of equipment being used when the fire alarm activates, and by doing so, allows the horns to be readily heard by occupants of the space.

Table 22 Audible Signaling Adequacy Tabulation

Bonderson Projects Center Audiability

ROOM	Location Type per Table A.18.4.3	Average Ambient Sound Level (dBA)	Average Sound level + 15 dBA	Maximum Distance from Horn for room in question	Horn dBA @ 10'	Horn dBA at Max Distance	Difference Between Horn dBA at Distance and dBA Required
101	Foyer - Educational	45	60	30	80	71	11
102	Robotics - Educational	45	60	40	80	68	8
103	Elevator Equipment NA	NA	NA	NA	NA		NA
104	Room - Educational	45	60	60	80	65	5
105	Electrical Room NA	NA	NA	NA	NA		NA
106	Hallway - Educational	45	60	70	80	63	3
107	Main High Bay - Educational	45	60	55	80	64	4
108	Project Room - Educational	45	60	18	80	74	14
109	Project Room - Educational	45	60	18	80	74	14
110	Project Room - Educational	45	60	28	80	71	11
111	Mens Room	45	60	12	80	79	19
112	Womens Room	45	60	12	80	79	19
113	Custodian NA	NA	NA	NA	NA	NA	NA
114	Machine Shop - Industrial	80	95	50	80	63	-32
115	Wood Shop - Industrial	80	95	40	80	68	-27
116	Tool Storage - Storage	30	45	18	80	74	29
117	Tech Support - Business	55	70	15	80	77	7
201	Waiting Room - Educational	45	60	40	80	68	8
202	NA	NA	NA	NA	80	NA	NA
203	Controls Lab - Educational	45	60	50	80	63	3
204	Computer Lab - Educational	NA	NA	NA	NA	NA	NA
205	Cluster Computer - Educational		15	28	80	71	56
206	NA	NA	NA	NA	NA	NA	NA
207	NA	NA	NA	NA	NA	NA	NA
208	Hallway - Educational	45	60	50	80	63	3
209	Chemistry Lab - Educational	NA	NA	NA	NA	NA	NA
210	Electronics Repair - Educational	NA	NA	NA	NA	NA	NA
211	Room-Educational	NA	NA	NA	NA	NA	NA
212	Computer Lab - Educational	NA	NA	NA	NA	NA	NA

7.5.2 Visible Signaling

Visible signaling is conducted by strobes of various intensities throughout the building. (See the appendix for the location of each of the strobes.) For strobes placed in hallways, NFPA 72 - 18.5.4.4.5 applies: “visible notification appliances shall be located not more than 15’ from the end of the corridor with a separation not greater than 100.” From building drawings, this requirement is met with strobes being mounted on the walls at the end of the main East-West hallway, on both floors with one in between to meet the spacing requirements. For the shorter North-South hallway on the first floor, there are wall mounted appliances less than 15’ from both ends of the corridor on opposing walls, per NFPA 72 - 18.5.4.4.8. In addition, the clause that corridor signaling is permitted by direct viewing of lower intensity devices applies to this space. Rooms are visually signaled in accordance with 18.5.4.3.1 (a) for a breakdown of their intensity checks; see the following table. The power rating for each of the strobes was confirmed through the viewing window on their side. Some of them were inaccessible (behind delicate projects etc.), and a few of the rooms did not provide access to the facilities contact. For those few rooms, assumptions were made based on similarly sized rooms strobe ratings and what would be appropriate per table 18.5.4.3.1(a) based on the room size. A tabulation is shown in Table 23

Table 23 Visual Signaling Adequacy Tabulation

Bonderson Projects Center Visible Signaling								
ROOM	Location	Square that enscribes room	Candela Required (1 Strobe)	Candela Required (2 strobes)	Number of Strobes	Candela of Strobe Installed	Difference (Installed-Required)	Notes
101	Foyer	20x20	15	NA	1	15	0	
102	Robotics	28x28	30	NA	1	30	0	
103	Elevator Equipment	NA	NA	NA	NA	NA	NA	
104	Room	80x80	240	135	3	110	OK	Two 110cd Strobes one 110cd Horn/strobe
105	Electrical Room	NA	NA	NA	NA	NA	NA	
106	Hallway	< 100' spacing 18.5.4.4.5 Applies		15	3	15	15	Two Horn/Strobes, one Strobe 15, 15, 15/75 cd West to east
107	Main High Bay	50x50	94	60	1	110	16	
108	Project Room	20x20	15	NA	1	15	0	
109	Project Room	20x20	15	NA	1	15	0	
110	Project Room	30x30	34	15	1	75	41	
111	Mens Room	30x30	34	15	1	75	41	
112	Womens Room	30x31	34	15	1	75	41	
113	Custodian	NA	NA	NA	NA	NA	NA	
114	Machine Shop	60x60	135	95	2	110	15	One 110 cd Horn/strobe one 110 cd strobe
115	Wood Shop	40x40	60	30	1	75	15	
116	Tool Storage	20x20	15	NA	1	15	0	
117	Tech Support	20x20	15	NA	1	15	0	
201	Waiting Room/hall	45x45	75	unknown	1	75	0	
202	NA	NA	NA	NA	NA	NA	NA	
203	Controls Lab	40x40	60	30	1	75	15	
204	Computer Lab	30x30	34	15	1	75	41	
205	Cluster Computer	30x30	34	15	1	75	41	
206	NA	NA	NA	NA	NA	NA	NA	
207	NA	NA	NA	NA	NA	NA	NA	
208	Hallway	< 100' spacing 18.5.4.4.5 Applies		15	2	30	30	Two Horn/Stronbes One 75cd (west) and one 30cd (east)
209	Chemistry Lab	20x20	15	NA	1	15	0	
210	Electronics Repair	28x28	30	unknown	1	30	0	
211	Room	20x20	15		1	15	0	
212	Computer Lab	28x28	30	unknown	1	30	0	

7.5.3 Mass Notification System

Bonderson Projects Center is not equipped with a mass notification system. Because of the buildings function, there are relatively few occupants. In addition, its small size and ample egress options suggest that the benefit to life safety of a mass notification system would probably not be enough to justify its additional cost.

7.6 Fire Alarm Battery Backup Requirements

3.94 Amp-Hours of capacity is required to sustain the system through 24 hours without AC power and 5 minutes of alarm signaling (Table 24). The secondary power supply consisting of two 7 Ah and two 12 Ah sealed lead acid batteries is more than adequate to power the system through a 24 hour AC power failure and subsequent 5 min activation period.

Table 24 Fire Alarm Battery Backup Capacity Calculation

Item	Description	Standby Current /unit (amps)		QTY		Total standby current (amps)	Total alarm current/ unit (amps)		QTY		Total System alarm current (amps)
A	Horn Strobe	0	X	13	=	0	.21	X	13	=	2.73
B	Strobe	0	X	16	=	0	.209	X	16	=	3.34
C	Horn	0	X	2	=	0	.040	X	2	=	.08
D	Multi-Sensor	.0003	X	20	=	.006	.0006	X	20	=	.012
E	Harsh Environment Smoke Detector	.006	x	18	=	.108	.027	x	18	=	.486
		Total System Standby Current (amps)				.114	Total System Alarm Current (amps)				6.648

Required Operating time of secondary power source from NFPA 72, 10.5.6.3

STANDBY:_____24_____ HOURS ALARM:_____5_____MINUTES X 1/60 _____0.0833 HOURS_____

Required Standby time (hours)		Total standby current (AMPS)		Required standby capacity (amp-hours)	Required alarm time (hours)		Total system alarm current (amps)		Required alarm current (amp-hours)
24	x	.114	=	2.736	.0833	x	6.648	=	.5537

Required Standby capacity (amp-hours)		Required alarm capacity (amp-hours)		Total Required capacity (amp-hours)		Factor of safety		Required Battery capacity (amp-Hours)
2.736	+	.5537	=	3.289	x	1.2	=	3.94

7.7 Commissioning and Inspections Testing and Maintenance of Alarm Systems

When the building was commissioned, a record of completion was completed by the administrating AHJ. The system was commissioned in accordance with NFPA 3 with a 2006 Project approval date.

The Fire alarms system is visually inspected in accordance with NFPA 72 table 14.3.1 annually. In addition, each initiating device (smoke/heat detector and manual pull station) is manually triggered and checked for proper reporting at the control panel. Backup batteries and fire alarm control panel and remote enunciator trouble signals are checked every month, as is the singular water flow device.

Attached in the appendix is a copy of the first 2 pages of the annual testing report form used by the inspector to check all of the devices.

8 PERFORMANCE BASED ANALYSIS

In this section, a performance-based analysis of the Bonderson Engineering Projects Center will be conducted. The performance-based design is pursuant to the requirements set forth in NFPA 101-2012 and other fire protection texts.

The performance-based design will analyze several different design fire scenarios to determine whether:

- The fire suppression system activates in response to the design fire,
- The fire alarm system activates in response to the design fire,
- Egress time for the occupants is achieved before untenable conditions occur,
- Temperatures inside the space during the fire event do not compromise the structural integrity of the building,
- and, the fire is contained to the area / room of origin.

8.1 SOFTWARE TOOLS UTILIZED

The following software tools were utilized in the performance-based modeling and analysis of the Bonderson Projects Center:

- Pyrosim
- Pathfinder
- FDS

These software tools were utilized to determine whether the performance criteria set forth were met by Bonderson Engineering Projects Center's systems and building design.

8.2 PERFORMANCE CRITERIA

The following performance criteria shown in Table 25 were set as the minimum requirements to be tested against in the performance-based analysis. These performance requirements include both life safety metrics as well as metrics to ensure the structural integrity of (BEPC) throughout the fire event.

Table 25 Performance Criteria

Stakeholder	**Performance Metric**	**Performance Criteria**
No life loss not intimate with ignition source	Visibility	>20 ft
No life loss not intimate with ignition source	Carbon Monoxide	CO <1,400 PPM
No life loss not intimate with ignition source	Tenable Temperature	Temperature < 60 ∘C
Minimize building damage	Prevent Flashover	Upper Layer Temp < 500∘C
Emergency Crews	Structural Integrity	Steel Temperature < 538∘C

Additionally the following structural performance criteria were used:

- Steel Temperature < 538 C
- No Flashover: Hot gas layer < 500 C

8.3 Design Fire Scenarios

Design fire scenarios to be used in performance-based design are specified by NFPA 101 in chapter 5. This chapter provides 8 different design fire scenarios with which to choose from and apply to the building being analyzed.

The following scenarios were evaluated in this analysis:

- Scenario 1: Occupancy Specific fire
- Scenario 2: Fast Developing Fire in the primary means of egress.

Three design fire scenarios and locations were chosen. These locations are shown on the floorplan in Figure 29 below.

Figure 29 Design Fire Location Map

8.4 DESIGN FIRE 1 ENTRY LOBBY & ATRIUM

This design fire is assumed to be a student spill of Acetonitrile in the entrance and lobby area of the Bonderson Projects Center. This spill then ignites, blocking the primary means of egress for the building, and in doing so, fulfills the definition of NFPA 101 design fire scenario 2.

Figure 30 Acetonitrile In Shipping Packaging at BEPC

Acetonitrile is used in the machine shop as a solvent for machine processes. The storage of pallet loads of Acetonitrile have been historically inconsistent with pallets seen being stored under the exterior covered roof areas of the building (Figure 30) as well as in the projects integration area. Because of the prevalence of this fuel and the various places it has been stored, a spill in transport is the most probable cause for a fire to occur in the entry lobby atrium.

8.4.1 Design Fire 1 HRR Curve

Acetonitrile is a nitrogenated form of standard acetone. It is not as prevalent as regular acetone; there is very limited research into the fire behavior of liquid nitrogenated solvents such as Acetonitrile. Furthermore, the fact that the entry lobby/atrium of (BEPC) has a carpeted flooring creates a challenging fire modeling exercise.

The Heat Release Rate (HRR) curve that was entered into the fire modeling programs was based on data spanning several different repots including the NIJ report 604-00, which conducted fire tests of flammable liquids spilled on a variety of floor coverings including carpeting as found in entrance lobby of the (BEPC). The HRR curve also includes data from "*A review of large-scale fire testing foxusing on the fire behavior of chemicals-interflam 96",* which provides empirical fire test data on the HRR (Figure 31) and combustions properties of Acetonitrile (Figure 33).

Figure 31 HRR For Acetonitrile – Guy Marlair Interflam 96, Cambridge, United Kingdom

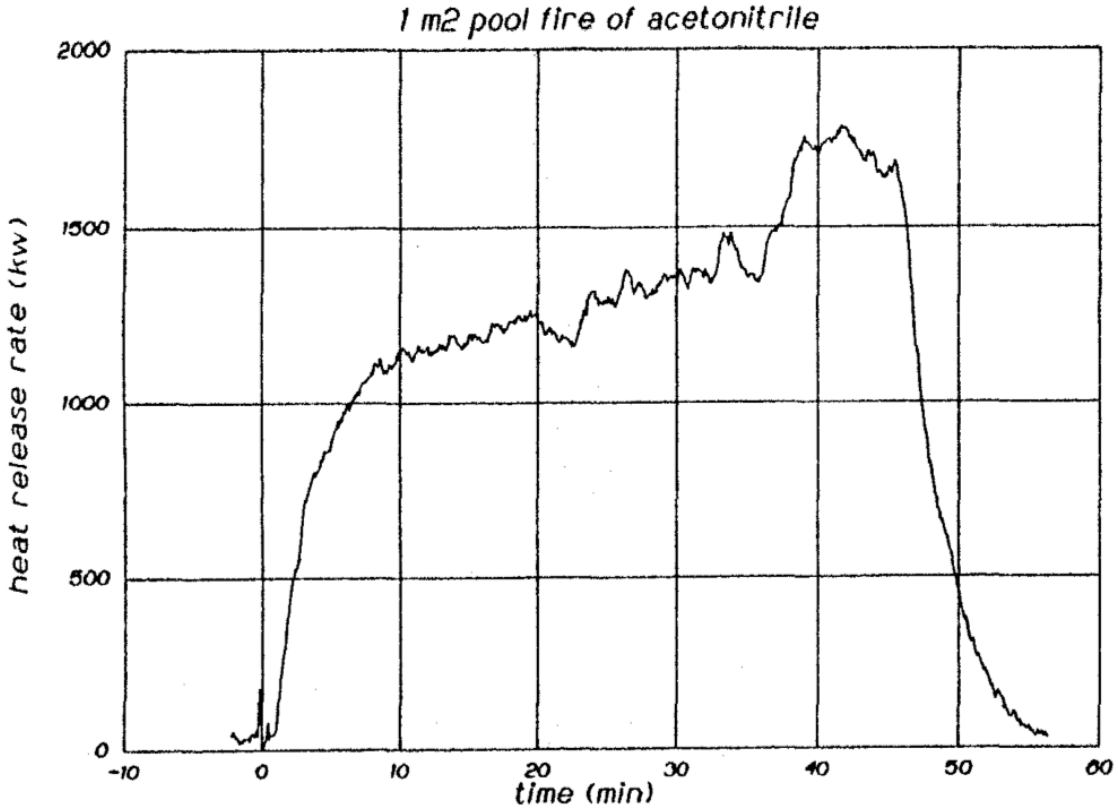
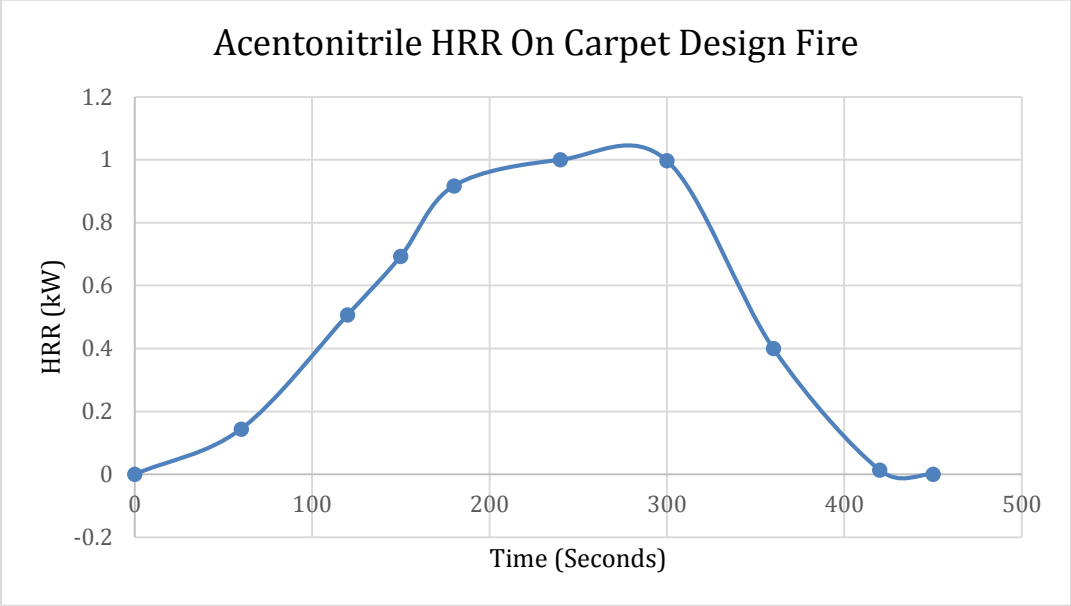


Figure 3 : HRR curve of a 1 m² pool fire of Acetonitrile

Figure 32 Design HRR for Acetonitrile



The curve above (Figure 32) is the design HRR utilized for the first run of the FDS model for this fire scenario. This design curve was subsequently revised after the first simulation provided data on sprinkler activation times to reflect a constant HRR after sprinkler activation.

Figure 33 Thermal Parameters of Experimental Pool Fires

	toluene diisocyanate TDI (c)			adiponitrile ADN		acetonitrile ACN		ethylene diamine EDA		
pool area (m^2)	0.25	1.00	2.00	1.00	2.00	0.66	1.00	0.66	1.00	1.66
burning rate ($g.m^{-2}s^{-1}$) :	(0.023)	(0.034)	(0.033)	0.029 (0.036)	0.030	0.051 (0.063)	0.050 (0.058)	0.018	0.021	n.s;
T_{max} above pool (°C)	700	800	900	850	900	n.a.	900	n.a.	n.a.	n.a.
T_{max} under roof (°C)	60	120	240	210	370	> 90	320	150	120	170
T_{max} at tower (°C)	35	90	150	115	250	90	170	65	95	125
eff. HRR (kW)	122	560	1250	920	(a)	750	1300	400	(b)	(b)
"conv". HRR (kW)	90	300	480	350	(a)	320	600	(b)	(b)	(b)

Combustions byproduct yield data was also provided by the Interflam report (Figure 33).

Figure 34 Combustion Byproduct Yields

Theoretical Yields	
CO Yield (g/g)	1.36
CO2 Yield (g/g)	2.15
Imperical Yields From Fire Tests	For 1 m^2 pool fires only
CO yield (mg/g)	2.4
CO2 yield (mg/g)	2370

One of the challenges with this design fire was how to reconcile the standard and well documented pool fires commonly associated with liquid fuel spills with the absorption characteristics of the carpeted flooring. Data from the NIJ Report 604-00 (Figure 35) was utilized to predict the spill pool size on carpet for the given volume of acetonitrile spilled.

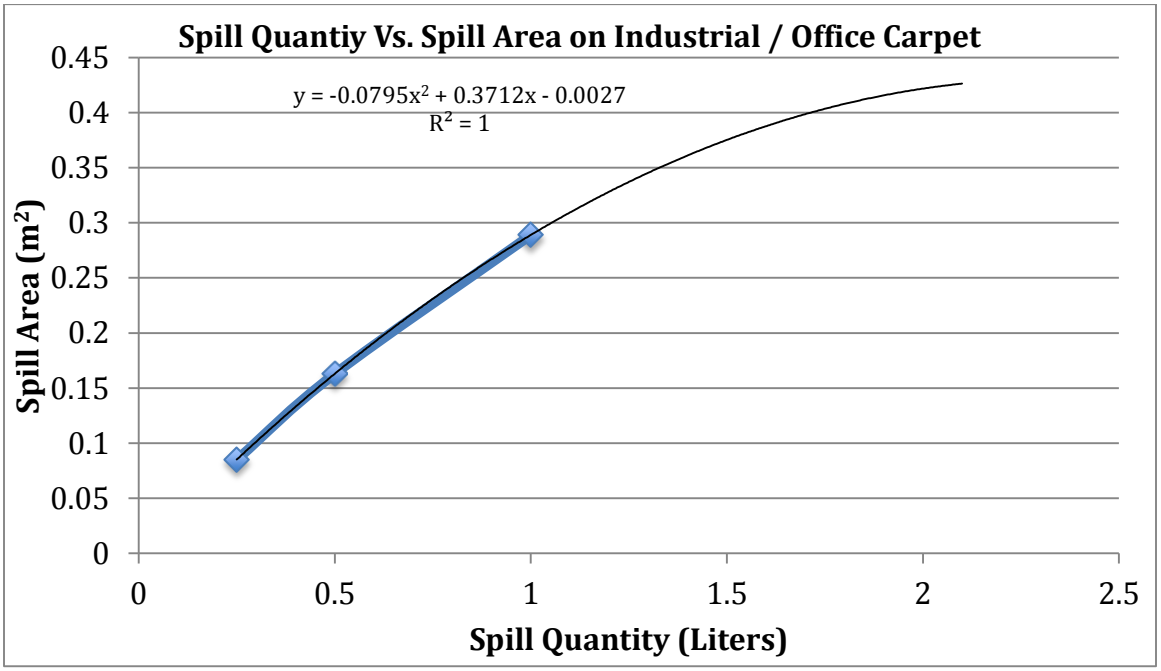
Figure 35 Carpet Spill Areas - NIJ Report 604-00

Table 5. Carpet spill areas

Carpet Type	*Spill Quantity mL (gal.)*	*Spill Area, m^2 (sq. ft.)*
1	250 (0.066)	$8.51 \times 10^{-2} \pm 0.00$ $(0.916 \pm 0.00)^*$
1	500 (0.13)	$1.63 \times 10^{-1} \pm 3.33 \times 10^{-2}$ (1.76 ± 0.359)
1	1000 (0.26)	$2.89 \times 10^{-1} \pm 1.49 \times 10^{-2}$ (3.11 ± 0.161)
2	250 (0.066)	$3.95 \times 10^{-2} \pm 1.05 \times 10^{-2}$ (0.425 ± 0.113)
2	500 (0.13)	$5.95 \times 10^{-2} \pm 6.44 \times 10^{-3}$ $(0.640 \pm 6.93 \times 10^{-2})$
2	1000 (0.26)	$1.07 \times 10^{-1} \pm 1.20 \times 10^{-2}$ (1.15 ± 0.129)

From this data, the expected fire spill area was determined for the 2.12 liter quantity associated with one of the individual jugs from an in-transport pallet of acetonitrile spilling on the carpet of the atrium as shown in the graph (Figure 36) below.

Figure 36 Spill Area for One 2.12l Jug

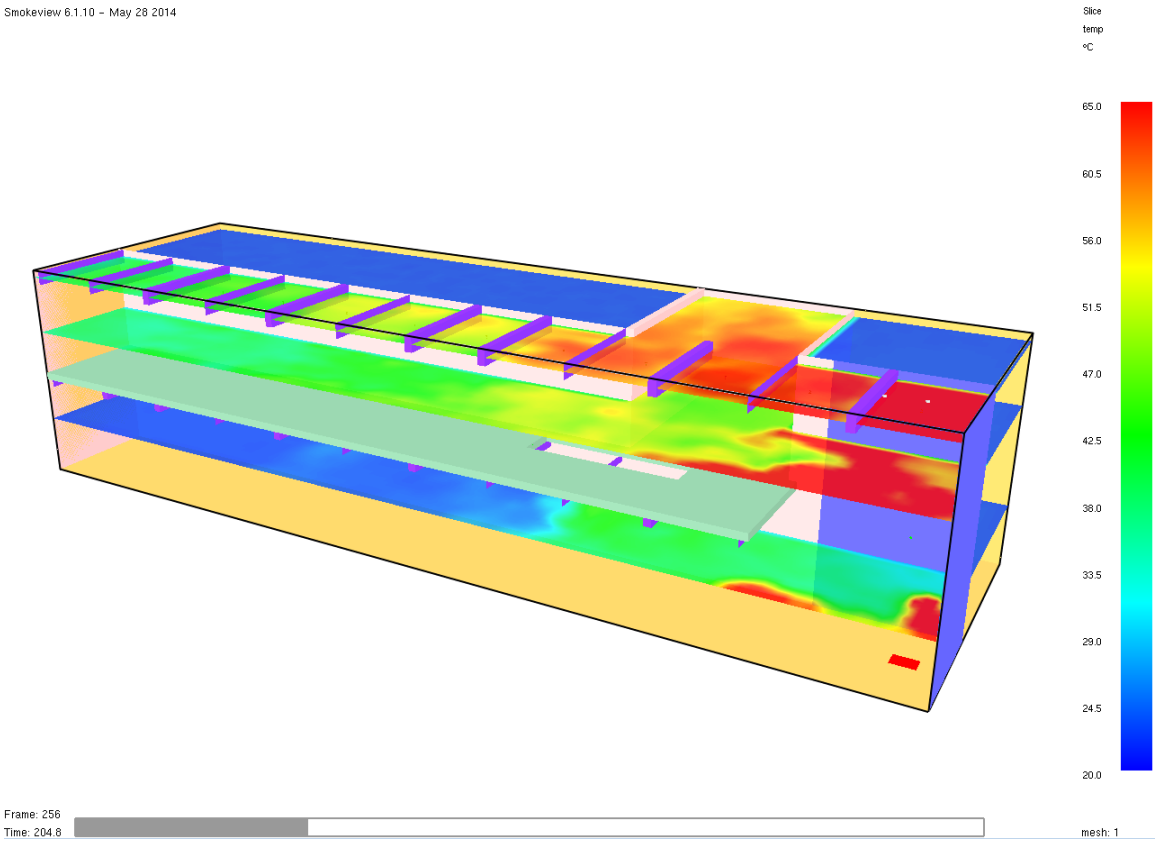


From this analysis, the spill area is approximately 0.425 m^2 for this design fire scenario. This data for the base-size of the fire along with the projected HRR for Acetonitrile was input into the FDS model of the atrium itself and the simulation run for 400 seconds. The results from the model are detailed in the following section.

8.4.1.1 FDS Model Results

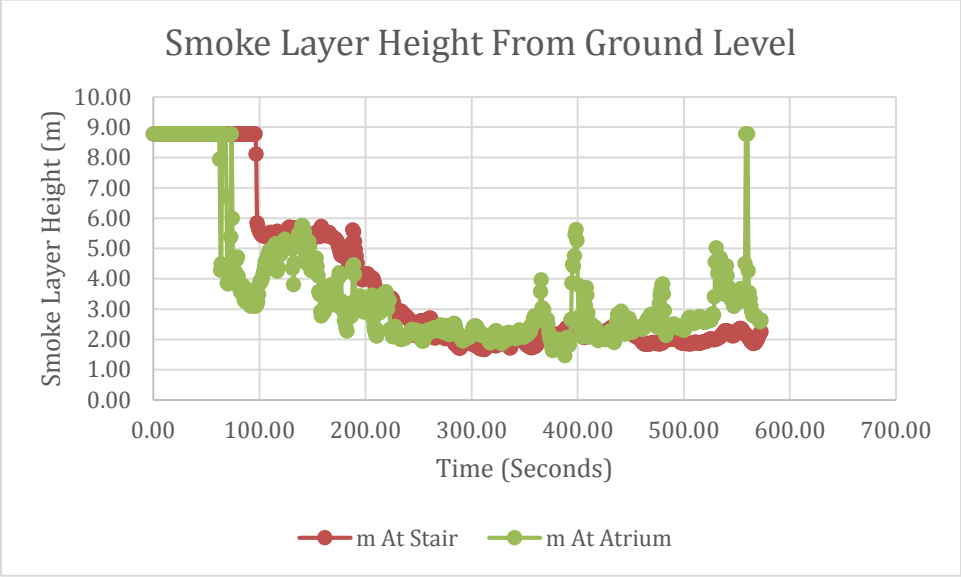
Once the HRR for the design fire was determined, the geometry and material properties of the room were entered into the Pyrosim model of the room and the computer simulation was run for an event time of 400 seconds. The following are slice files from the simulation, showing tenability data in the form of both temperatures (Figure 37) and smoke obscuration.

Figure 37 Temperature Slice at 6' Above Floors



Because the first and second floor are connected through the entry atrium, second floor tenability occurs first in the PyroSim FDS model results. Temperature tenability reached at 205 seconds as shown in the graphic above displaying the temperature gradients at slice locations 6 feet above the ground on the first and second floor.

Figure 38 Atrium Smoke Layer Height Over Time - Atrium



Visibility tenability was also reached first on the second floor, with tenability limits reached at 101 seconds as displayed in the graphic below (Figure 39) displaying the visibility gradient at the same 6 foot slice locations, and the smoke layer height graph (Figure 38).

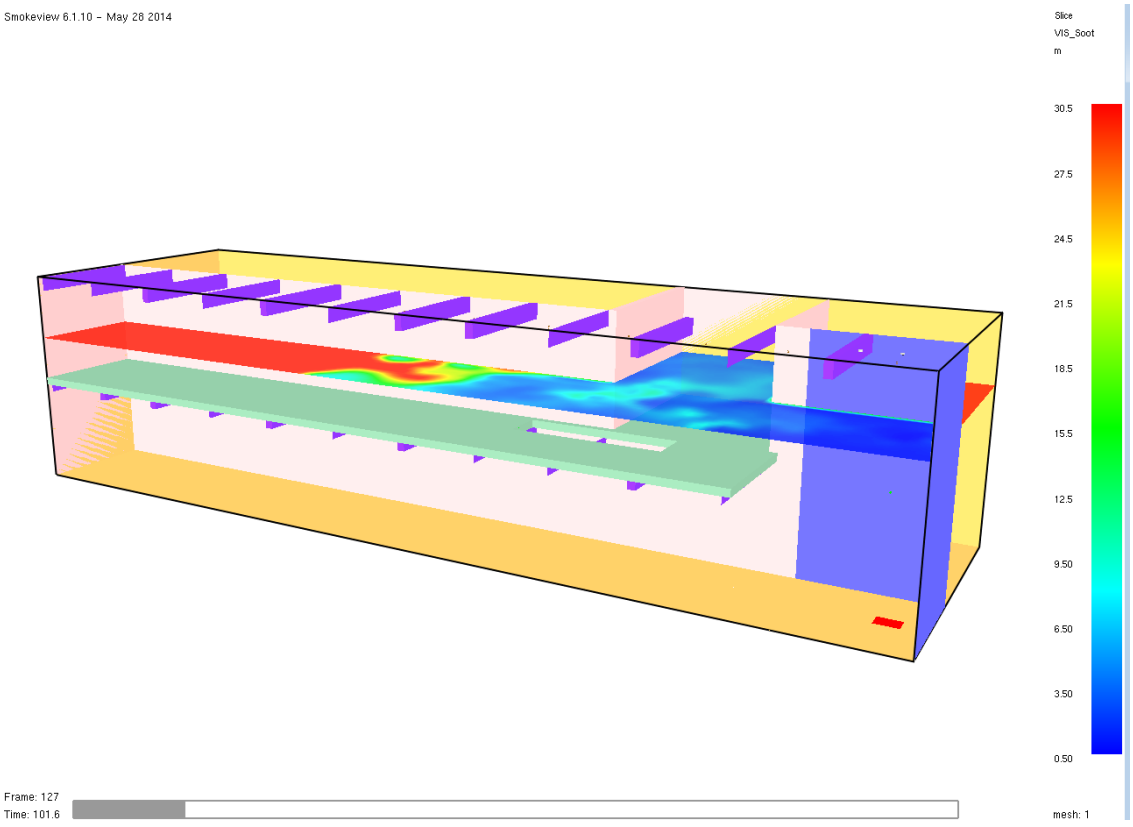
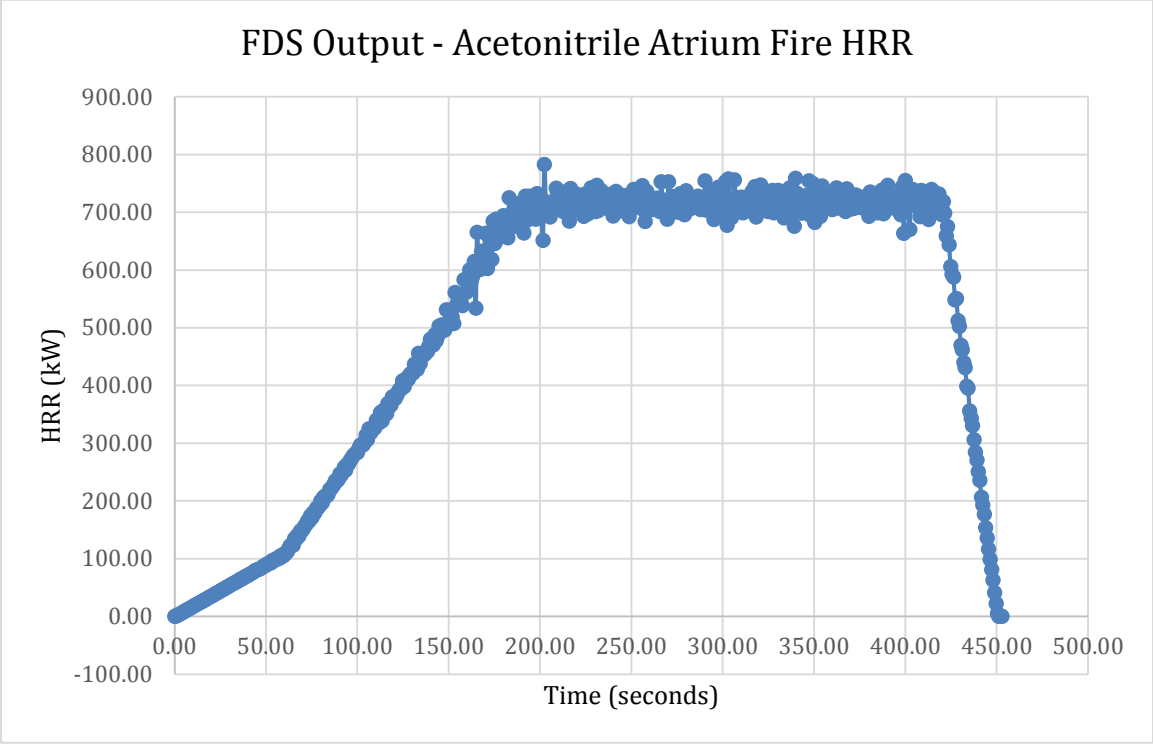


Figure 39 Visibility Slices at 6' Above Floor

The output HRR of the final Pyrosim / FDS model, is shown in Figure 40 below. Note how the fire's HRR was modeled as being constant after sprinkler activation. This was done iteratively with the first FDS simulation being utilized to determin sprinkler activation time, and the subsequent FDS simulations utilizing a modified input HRR that remains constant after sprinkler activation.

Figure 40 FDS Output HRR – Atrium Acentonitrile Fire



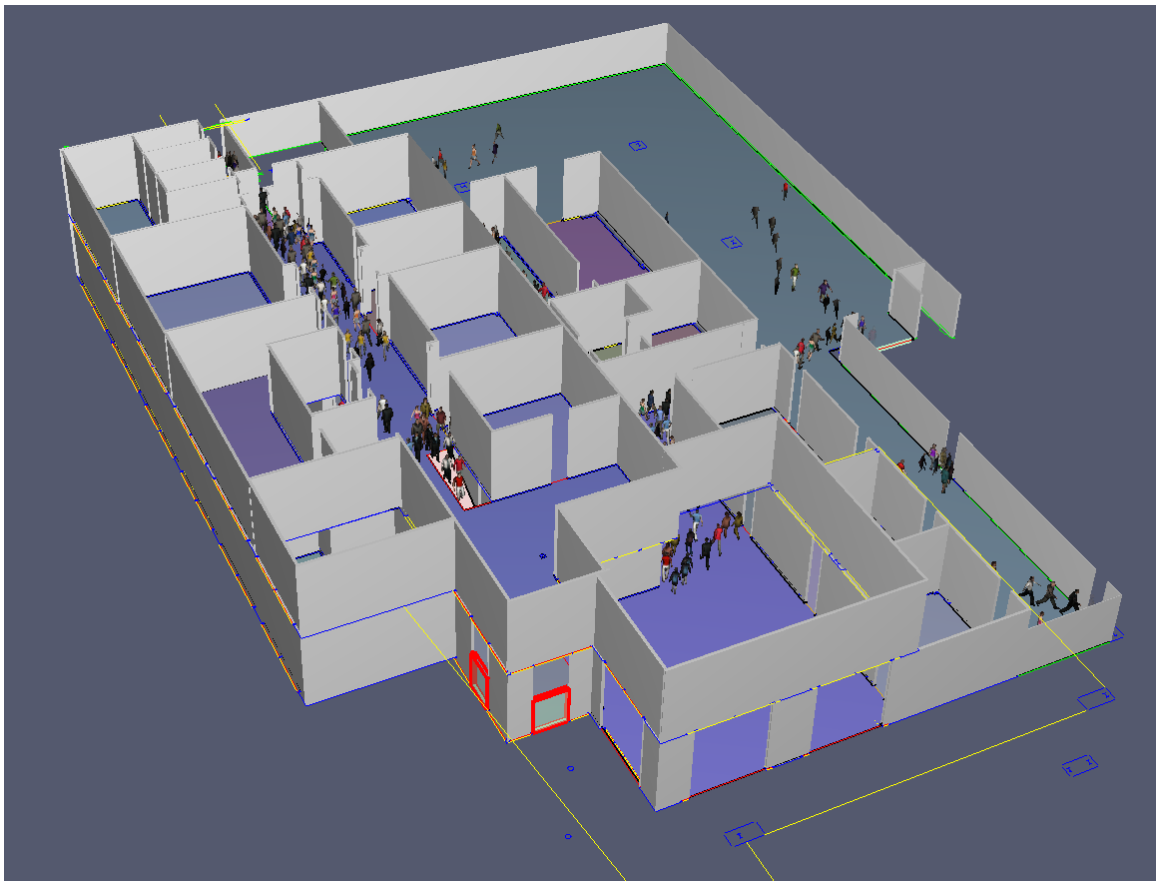
In addition to tenability results, the model predicted the activation time of the automatic fire sprinklers and smoke detectors.

- A single fire sprinkler (155 Deg Quick Response Pendent) activating at time t=206 seconds.
- Smoke detector activation preceded sprinkler activation at t=17.6 seconds.

From these results, along with values for egress from the pathfinder model, the RSET or Required Egress Time for the space can be determined.

8.4.1.2 Pathfinder Model Results

Figure 41 Pathfinder Model of Occupant Egress



The building and the occupant load as determined in section 5 were input into the Pathfinder software (Figure 41). The software then calculated the egress time of the building using the steering method and the occupant load of the entire building.

The Model also assumed that for this fire scenario, the two main exits at the entrance lobby were not accessible due to the fire blocking those exits. Said doors can be seen in red in the picture above.

The results for this scenario were an egress of time of 88 seconds for the entire building, utilizing the other unaffected exits of the building.

8.4.1.3 Design Fire Scenario 1 ASET vs. RSET

With both the tenability information and the egress information from the modeling, the Available Safe Egress Time is compared against the Required Safe Egress Time to determine whether the building meets the performance criteria.

RSET

Detection Time: 18 s

Notification Time: 1 s

Pre Movement Time: 36 s

Movement Time: 93 s

RSET = 148s

ASET = 101s

ASET > RSET Performance Failure

The required safe egress time is determined by summing the egress time specified in Pathfinder with the notification time, pre movement time, and detection time. Where notification time is considered to be 1s because of the virtually instantaneous notification time of modern alarms, pre Movement time of 36s as determined by table 4-54 of the NFPA Handbook, (Table 26) and an 18s detection time as determined by FDS.

Table 26 Occupant Delay Times

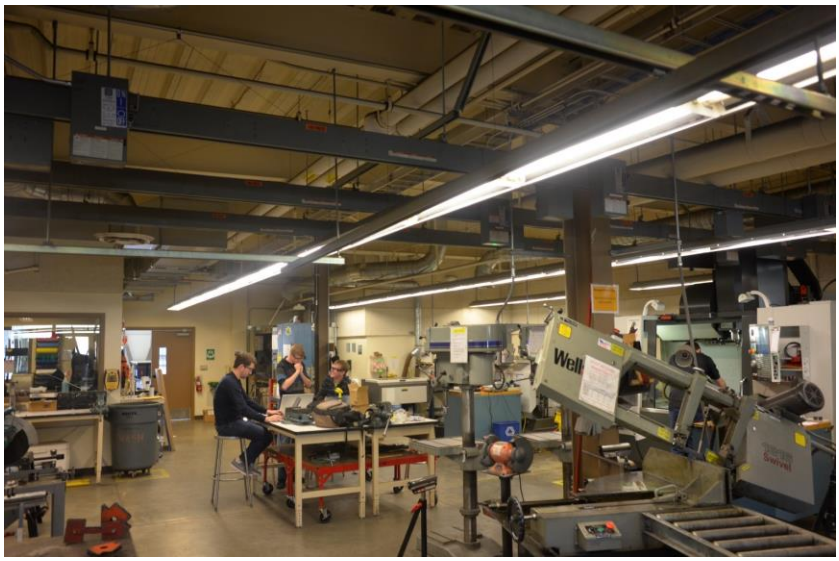
TABLE 4.2.1 Delay Times (Minutes) Derived from Actual Fires and Evacuation Exercises Reported in the Referenced Literature

Event Description	*N*	*Min*	*1st Q*	*Median*	*3rd Q*	*Max*	*Mean*	*Factors*
High-rise hotel[14]	536	0	3.3	60.0	130.9	290.0	NA*	MGM Grand Hotel fire, no alarm notification, grouped data from questionnaires
High-rise hotel[15]	47	0	2.0	5.0	17.5	120.0	NA	Westchase Hilton Hotel fire, no alarm in early stages, grouped data from questionnaires
High-rise office building[16]	85	0	2.0	5.0	10.0	245.0	11.3	World Trade Center explosion and fire, no alarm notification (building closer to explosion)
High-rise office building[16]	46	0	4.5	10.0	31.5	185.0	28.4	World Trade Center explosion and fire, no alarm notification (building further from blast)
High-rise office building[17]	107	1.0	1.0	1.0	1.0	~6.0	NA	Fire incident, no alarms, data from interviews with occupants of four floors of building (11 interviewees were trapped)
High-rise office building[18]	12	0.5	NA	1.0	NA	2.3	1.2	Unannounced drill on three floors; data for first person to reach each of four stairwell doors to wait for voice instruction; trained staff; data from video recordings
Mid-rise office building[19]	92	0	0.4	0.6	0.8	<4.0	0.6	Unannounced drill, good alarm performance; fire wardens; warm day
Mid-rise office building[19]	161	0	0.5	0.9	1.4	<5.0	1.1	Unannounced drill, good alarm performance; fire wardens; cool day
One-story department store[20,21]	95	1.0	0.2	0.3	0.5	0.9	0.4	Unannounced drill; trained staff; data here derived from grouped data for 95 participants
Three-story department store[21]	122	0.05	NA	NA	NA	1.6	0.6	Unannounced drill; trained staff; times distilled from analysis of videotapes
One-story department store[21]	122	0.07	NA	NA	NA	1.7	0.5	Unannounced drill; trained staff; times distilled from analysis of videotapes
One-story department store[21]	71	0.03	NA	NA	NA	1.0	0.4	Unannounced drill; trained staff; times distilled from analysis of videotapes
High-rise apartment building[22]	NA	0	NA	NA	NA	NA	10.5	Forest Laneway fire; for occupants who attempted to evacuate in the first hour,

8.4.2 Design Fire Scenario 2

Design Fire Scenario 2 is a fire in the machine shop. The fire is in a 30 gallon HDPE trash container that is in the corner of the room and is used for miscellaneous scrap from the machine shop. The scenario assumes that the trash container is ignited via hot work from welding and cutting processes (Figure 41.1). This fire is considered design fire scenario 1, an occupancy specific fire by NFPA 101.

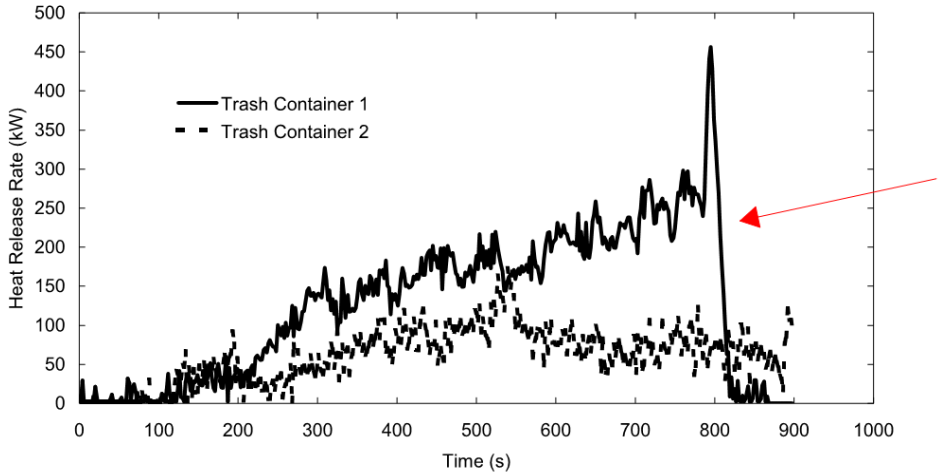
Figure 41.1 Machine Shop Trash Container



8.4.2.1 Heat Release Rate

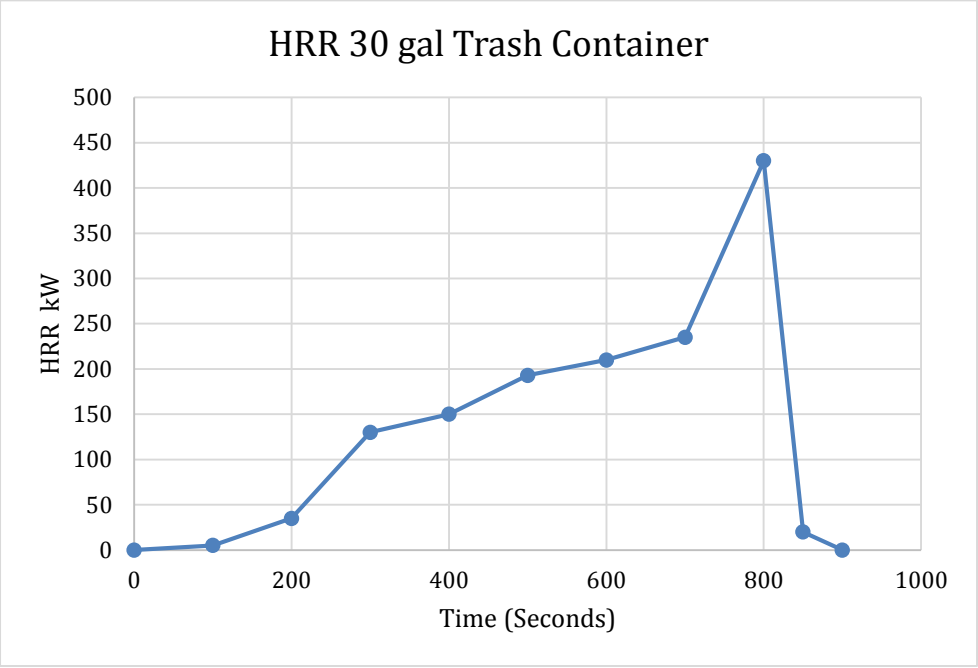
The heat release rate used in modeling of this design fire was based on data by Stroup and Madrzykowski, who did a variety of fire tests on typical 30 gallon HDPE trash containers. The design fire for this scenario uses a HRR curve provided in their research paper for the HRR of a trash container fire (Figure 41.2).

Figure 41.2 HRR for 30 Gallon Trash Containers – Stoup & Madrzykowsi



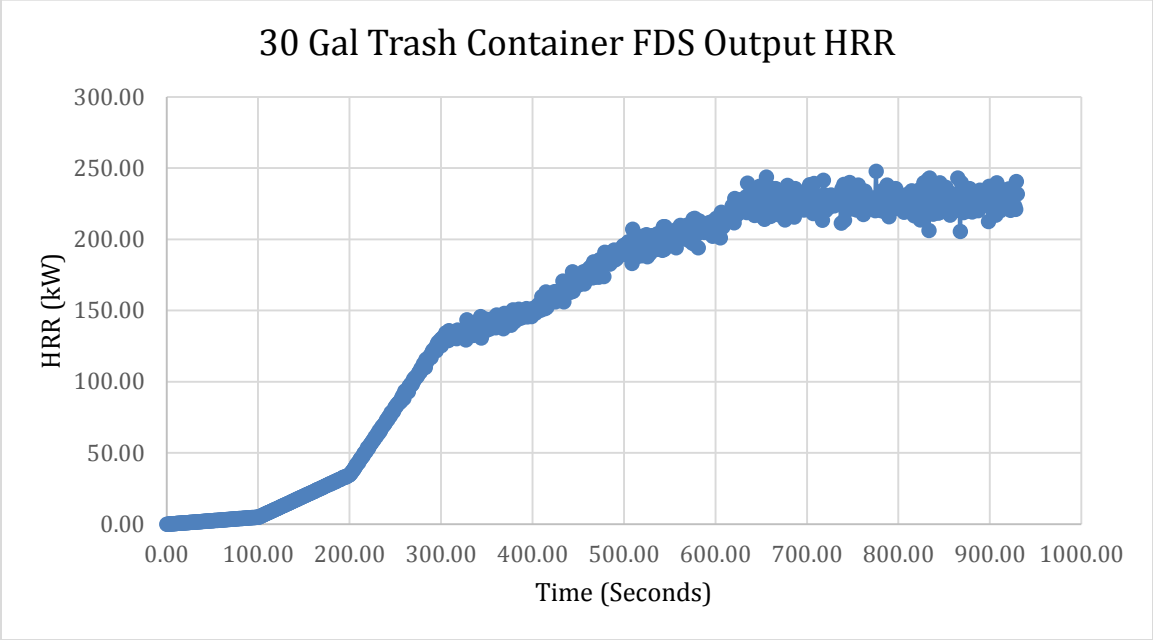
The following curve (Figure 41.3) was created from mirroring the results of Stroup and Madrzykowski as a ramp input for the Pyrosim/FDS Model.

Figure 41.3 Design Fire Curve



As before, the fire HRR curve was modified iteratively after the first simulation run to hold the HRR constant after activation of the fire sprinklers. The Pyrosim / FDS Output HRR graph is shown below in Figure 42.

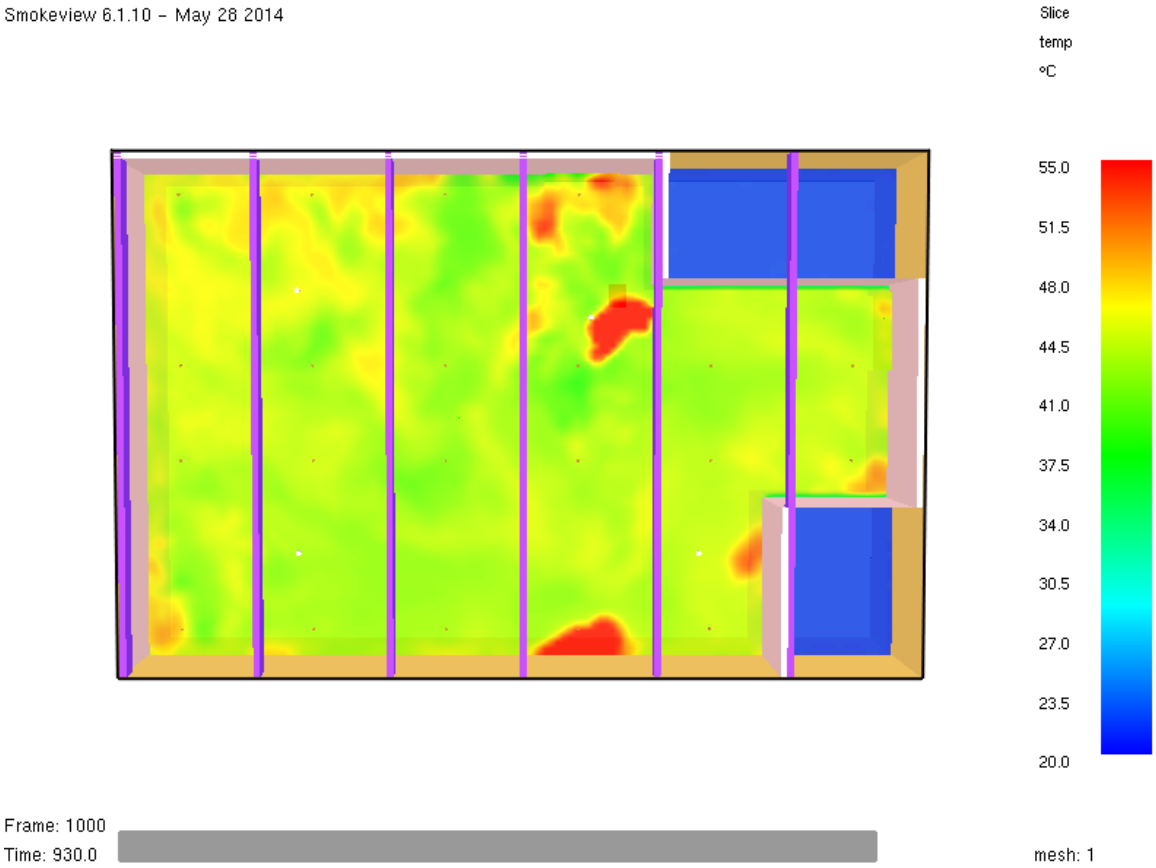
Figure 42 FDS Output HRR – Trash Container



8.4.2.2 FDS Results

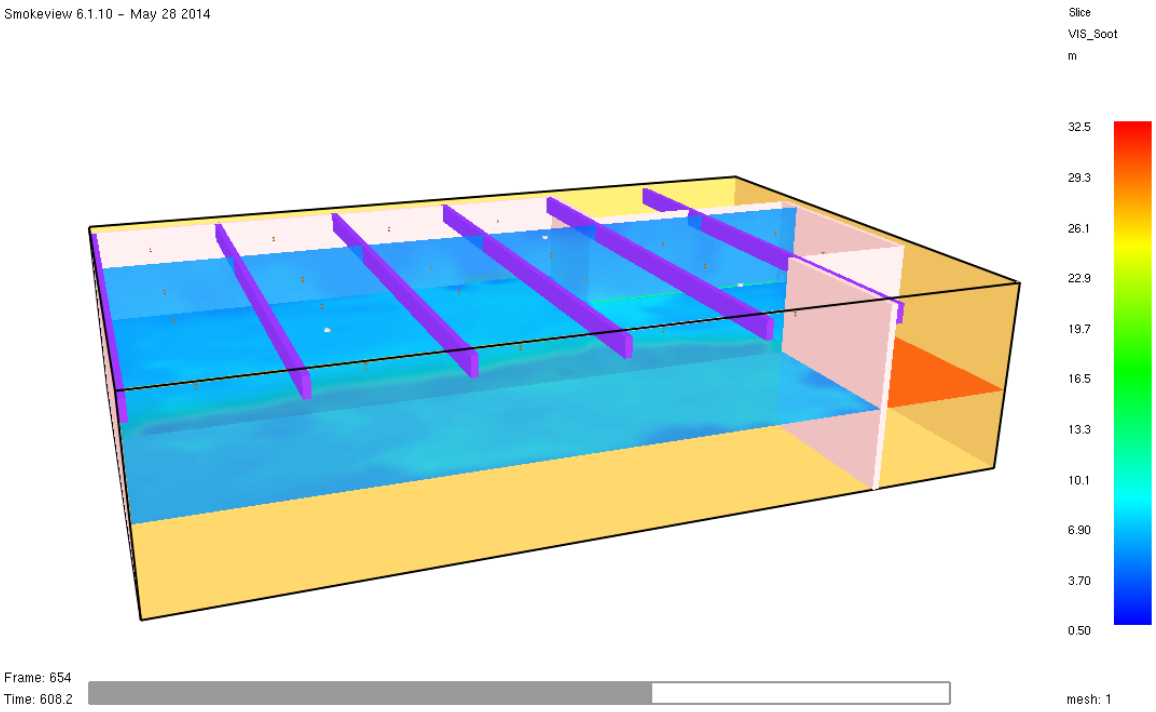
The FDS results of this fire model yielded the following tenability results:

Figure 43 Temperature Slice at 6' Above Floor



Temperature tenability was never reached during the duration of the test. The picture above (Figure 43) is a slice file for the temperature at 6'-0" above the floor at the hottest point in the simulation. The model never exceeded 60 degrees Celsius at this 6-foot elevation, implying temperature tenability for occupants still has not occurred after over 930 seconds.

Figure 44 Visibility Tenability at 6' Above Floor

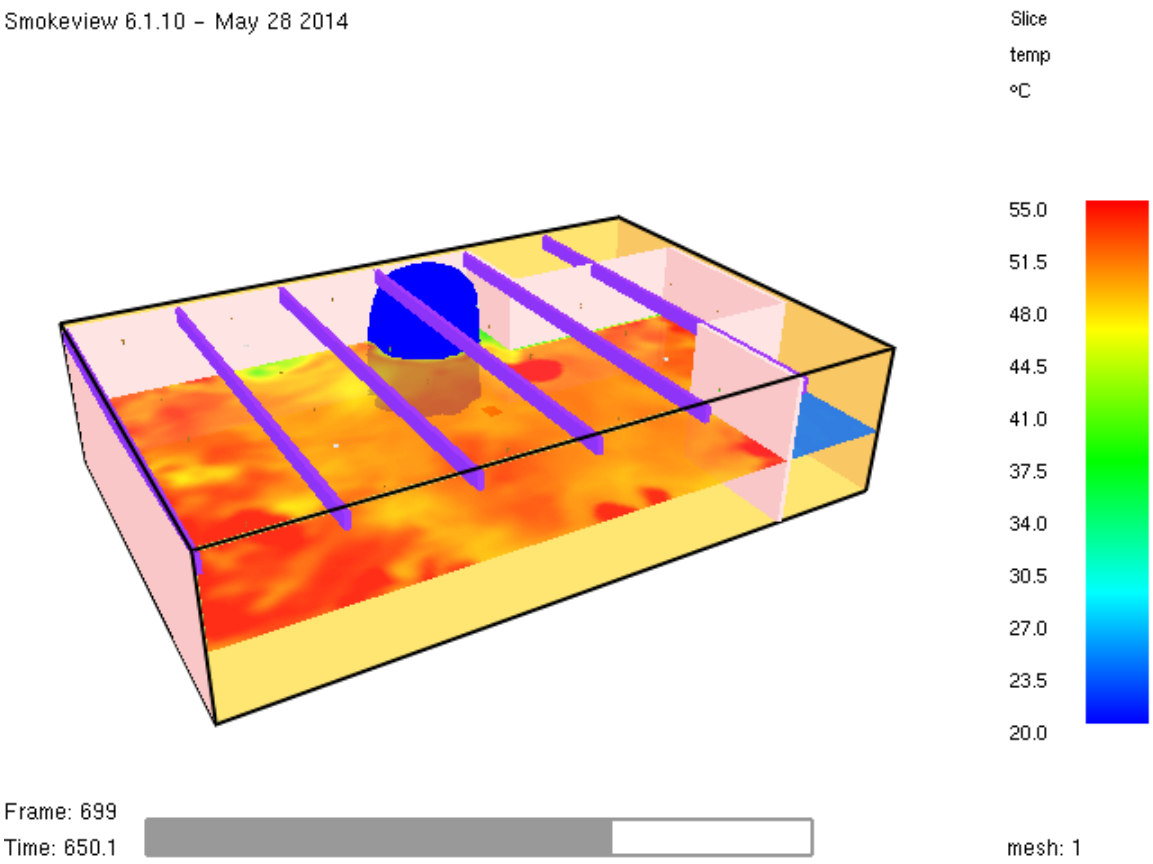


Visibility tenability was reached in 608 seconds (Figure 44). From inspection alone one can determine that this fire did not produce soot and smoke at a great enough rate to fill the entire machine shop and descend down to 6 feet above floor level in a time that would threaten egress from the space. This will be verified by the ASET vs RSET test to follow.

In addition, the following fire alarm and suppression features activated during the test:

- Smoke Detector Activation – 85 seconds (Figure 45)
- Sprinkler Activation – 598 seconds (1) sprinkler activates

Figure 44 FDS Model Showing Sprinkler Activation



A layer-zoning device was also implemented in this Pyrosim model. This device measures the smoke layer height as it descends over time. The output data from this device is plotted against time (Figure46) and provides further information on when tenability limits are likely to occur, i.e. smoke layer descends below 6 feet above the floor.

Figure 45 Smoke Layer Height at Room Center – Machine Shop

8.4.2.3 Pathfinder Results & ASET vs RSET

Pathfinder yields an egress time for this room of 28 seconds. For this scenario, RSET and ASET for this room only are compared because the entire space is enclosed in 1-hr rated construction. An assumption can be made that the occupants will be out of harm's way once they exit the room of the fire.

RSET

Detection Time: 85 s

Notification Time: 1 s

Pre Movement Time: 10 s

Movement Time: 28 s

RSET = 124 s

ASET = 608 s

ASET > RSET

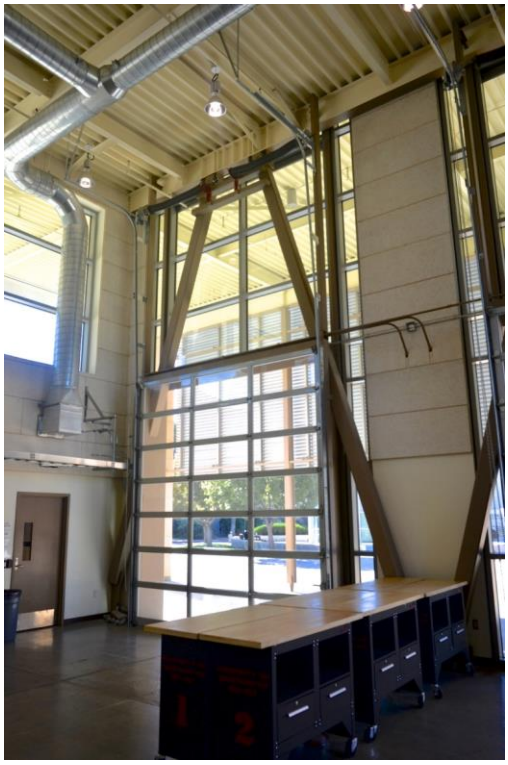
This scenario passes the performance based requirements, as the occupants have 405 seconds to egress the space before conditions become untenable, though the requirements asks for 68 seconds to do so.

8.4.3 Design Fire Scenario 3 Project Integration

This design fire scenario takes place in the high bay Project Integration space (Figures 47 & 48) of the Bonderson Projects Center. It assumes that two pallet loads of miscellaneous computer items are being stored in the space to be used in a student project. The pallets are placed equi-distant between sprinklers to create the worst possible scenario for the response of the fire suppression system.

Figure 46 Projects Integration Looking East

Figure 48 Projects Integration Looking West



8.4.3.1 Heat Release Rate

The heat release rate for this fire model was based on HRR test conducted on pallets of miscellaneous computer items found in the SFPE Handbook (Figure 49). An input HRR curve was extrapolated from this HRR graph in the SFPE Handbook (Figure 50).

Figure 49 HRR of Misc Pallets

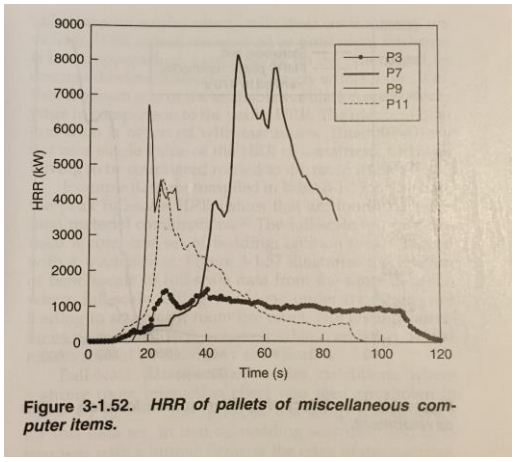
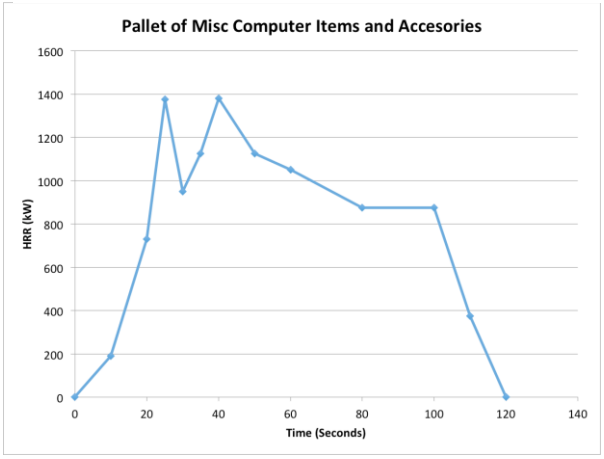


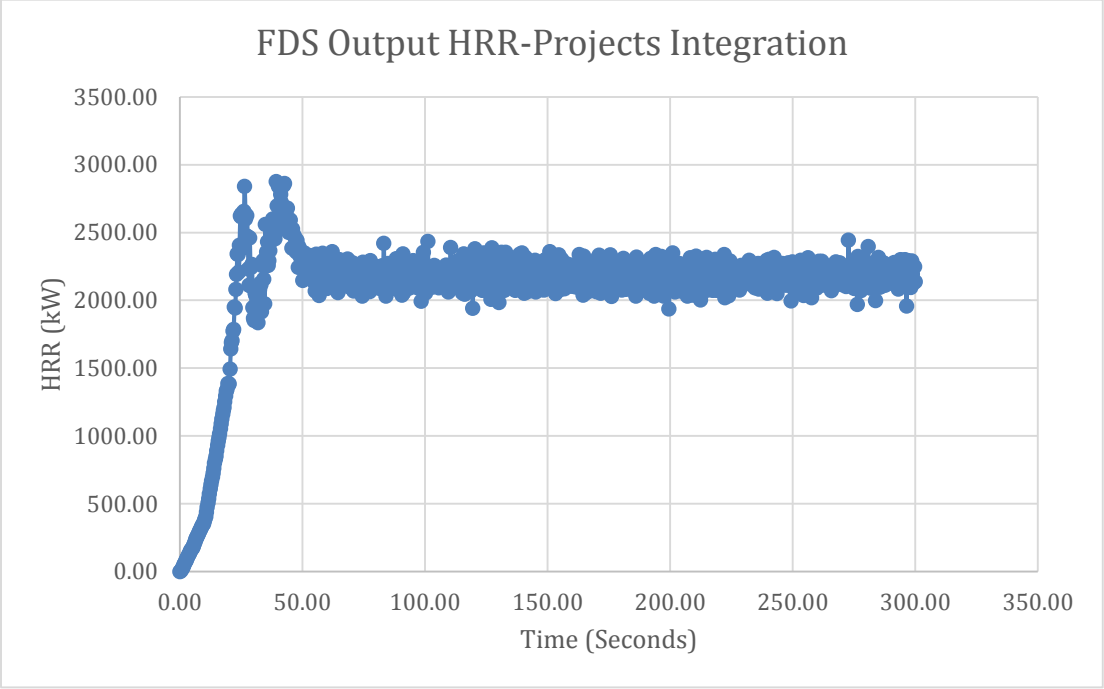
Figure 3-1.52. ***HRR of pallets of miscellaneous computer items.***

Figure 50 Design HRR – For Each Pallet



The design HRR was applied to both pallet "fires" and the simulation was run for a duration of 300 seconds in FDS. As before, the sprinkler activation time was determined from this first iteration and the FDS input HRR curve was modified to reflect a constant HRR thereafter for the second FDS simulation run. The output HRR plot reflecting the FDS output from this adjusted curve is shown below in Figure 51.

Figure 51 FDS Output HRR-Projects Integration (2) Pallets



8.4.3.2 FDS Model Results

Temperature tenability limits are reached in just 88 seconds from the FDS model. This is to be expected with a fire approaching 2.8 MW. This large fire also results in a rapid deterioration of visibility tenability. With tenability occurring in just 63 seconds.

The temperature in the Projects Integration space rose rapidly, with tenability occuring at just 88 seconds at a height of 6 feet above the floor (Figure 52).

Figure 47 Temperature Tenability at 6' Above Floor

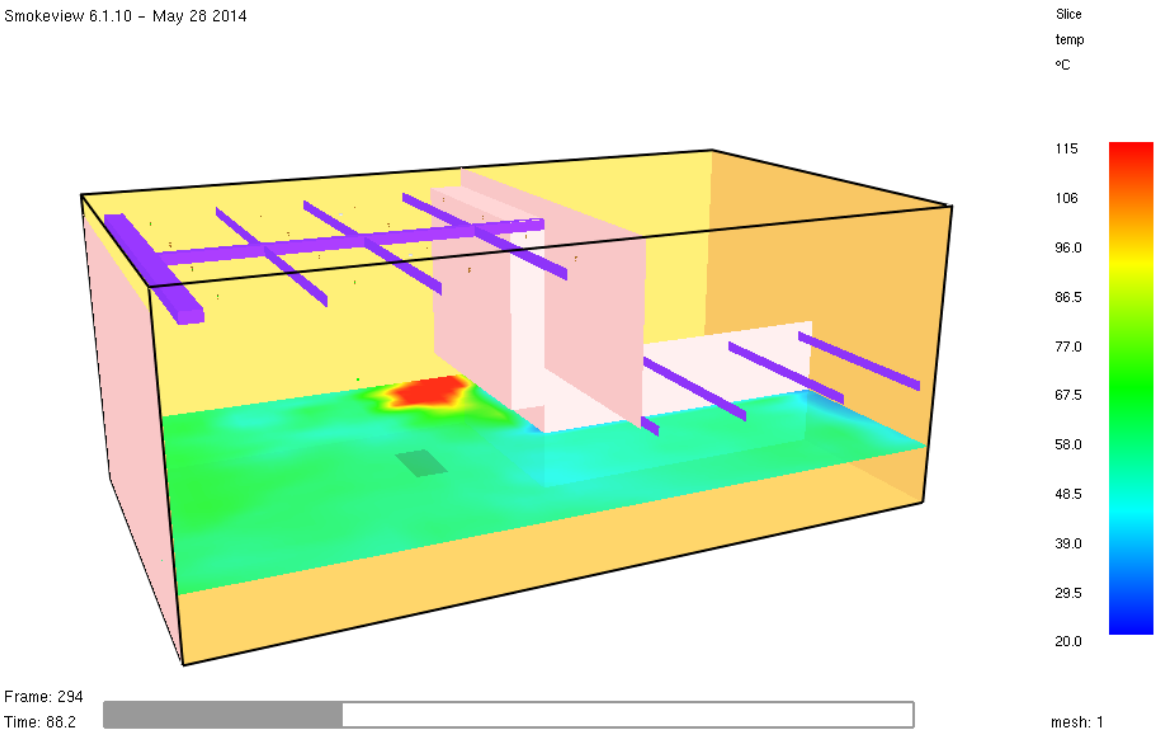
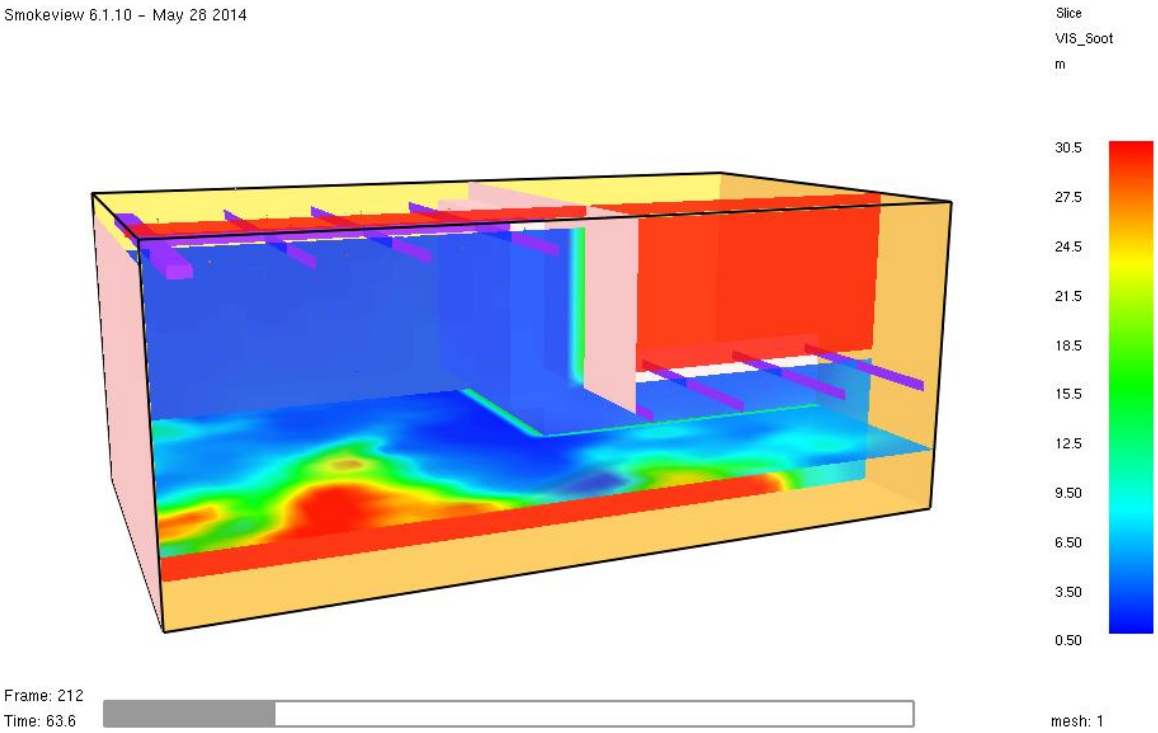
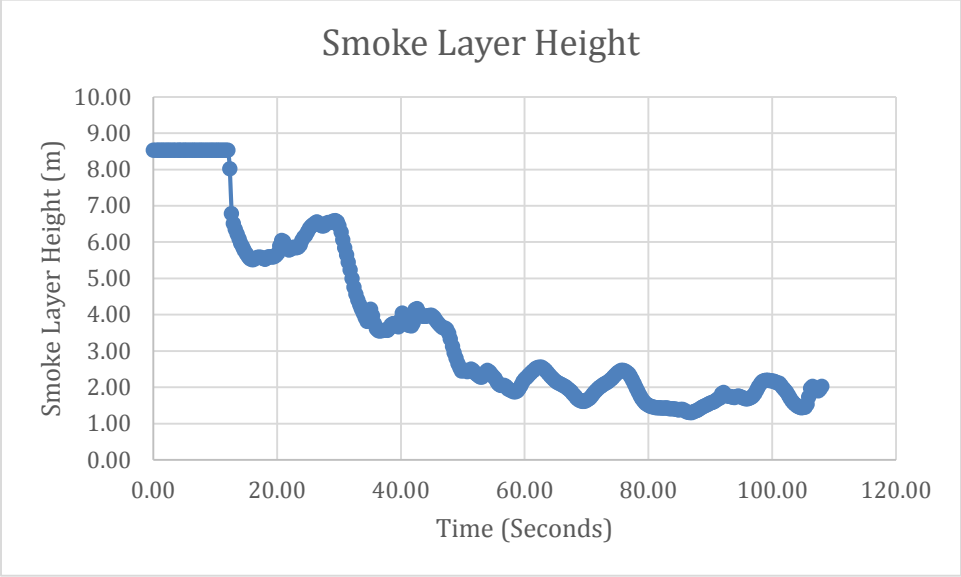


Figure 53 Visibiltiy Tenability at 6' Above Floor



Visibility tenability deteriorated rapidly as the smoke layer descended to less than 6 feet above the floor un just over a minute. Tenability occurs at 63 seconds (Figure 53). A plot of the smoke layer descent over time is shown in Figure 54 below, illustrating how fast it dropped to a dangerous height. The values returned by the layer-zoning device in FDS became very erratic after approximately 105 seconds, so the chart stops before the data returned from the device became erratic.

Figure 54 Smoke Layer Height Over Time - Projects Integration



The results from the FDS model showed the following detection and suppression activations for the Projects Integration design fire (Figure 54.1):

- Sprinkler Activation: (6) Sprinklers Activated
- 55 Seconds – 124 seconds
- Smoke Detector Activation: 12 s

Figure 54.1 Sprinkler Activations - Project Integration

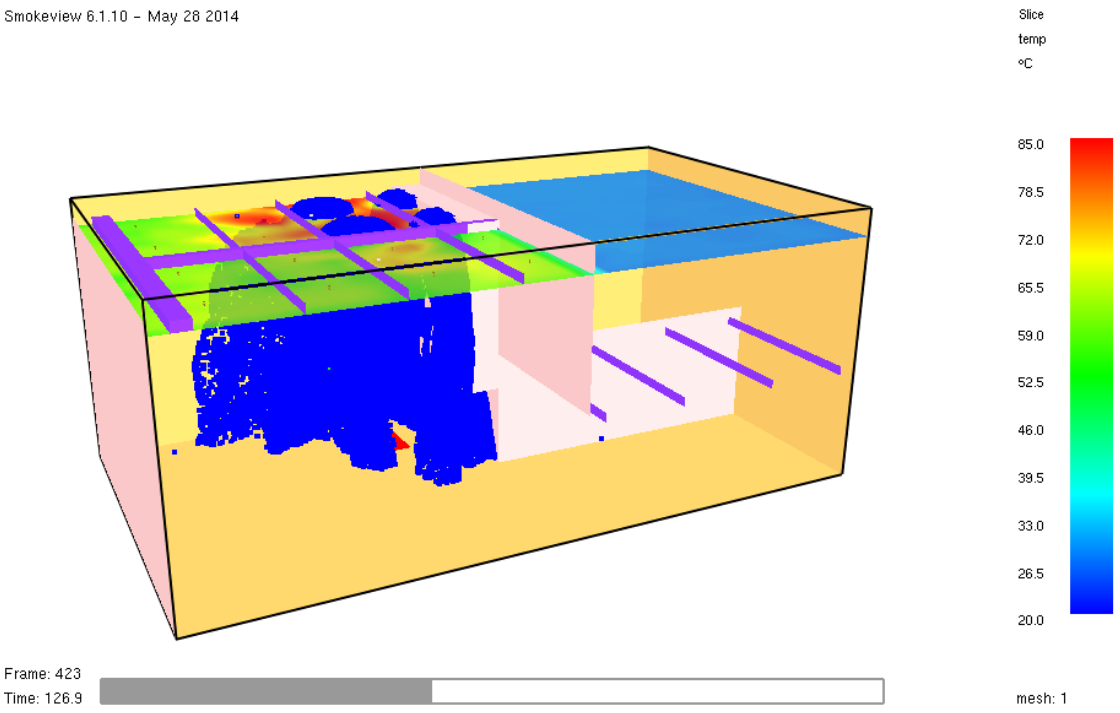
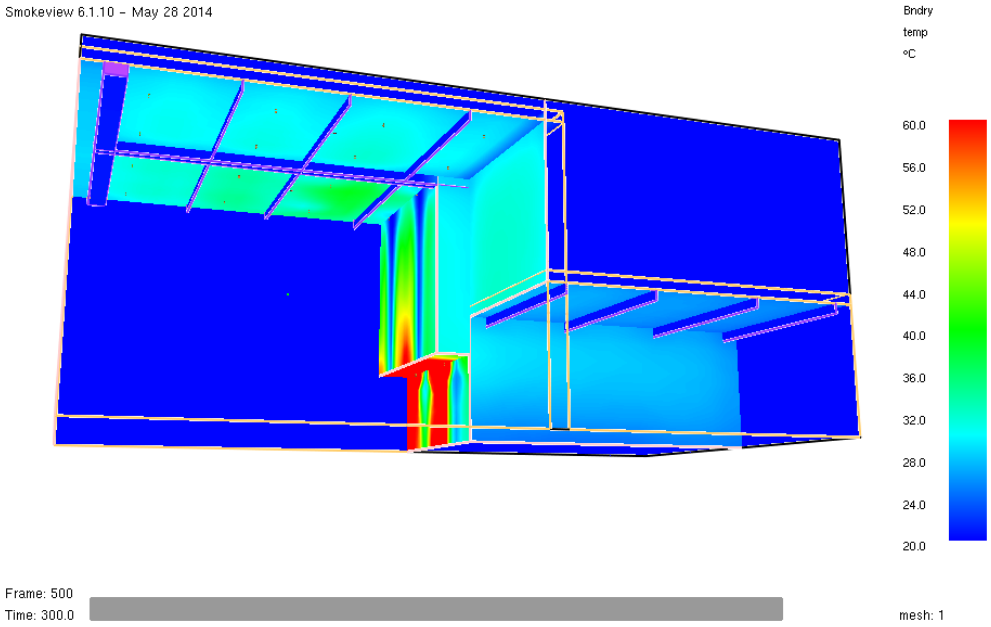


Figure 54.2 Boundary Temperatures - Projects Integration



With a total of six sprinklers activating, this is the largest response to a design fire so far and characterizes the potential high fuel loads that are stored in this area on a regular basis. An interesting point to note for this model is that the overhead sprinklers at the high ceiling area, which are 200 Degree F uprights, activated before the two pendent sprinklers rated at 155 Degrees F, which were installed under the low soffit directly adjacent to the fire. This shows how little heat is initially trapped by a small soffit. Interestingly, however, as the test progresses one can see from the boundary temperature graphic above (Figure 54.2) that the close proximity of the soffit to the fire has a large impact on the amount of radiation incident to it, and the surface temperatures of the soffit grow much higher than that of the ceiling.

8.4.3.3 Pathfinder Results and ASET vs RSET

Movement time to evacuate all the occupants from the project integration space to the exterior of the building or through the smoke barrier to the main longitudinal corridor takes 29s. Again, ASET and RSET will be compared for this contiguous space only due to the presence of the smoke barriers.

RSET

Detection Time: 12s

Notification Time: 1 s

Pre-Movement Time: 10 s

Movement Time: 29 s

RSET = 52 s

ASET = 56 s

RSET < ASET Performance Success

This design fire scenario barely passes the performance criteria. However, with almost zero safety factor, the AHJ would deem this a performance failure.

9 PERFORMANCE BASED DESIGN REVIEW

The following is a summary of the performance based design scenarios evaluated.

- One of the fire scenarios failed ASET vs RSET Performance Tests.
- Steel temperature remained below 538 ◦C.
- Upper layer gas temperature never exceeded 500 ◦C.
- Flashover would not have occurred for any of these spaces.
- Sprinkler system adequately controlled fire once activated (room temperatures remained constant or fell).
- Sprinkler system activation came just after tenability reached dangerous levels for the project integration and second floor Atrium design fire scenarios.

10 PRESCRIPTIVE DESIGN REVIEW

A breakdown of the prescriptive design analysis is shown below. The facility seems to be, for the most part, pursuant to the codes and standards under which it was built and still meets many of today's standards with some exceptions noted.

- Second exit in assembly occupancy should swing in the direction of egress travel.
- Fire sprinkler system seismic branchline restraints are missing on most lines.
- Sprinkler deflector obstructions exist.
- Sprinkler deflector distance is too from deck.
- Fire Alarm audible signals in machine and wood shop may not be loud enough for those occupancies.
- Other aspects of prescriptive design appear to meet code.

11 CONCLUSIONS AND RECOMMENDATIONS

From a structural fire protection standpoint, (BEPC) meets the code requirements set by the IBC for ratings of walls and partitions, as well as the separations of occupancies. In addition, its interior partitions, floor and ceiling systems and exterior walls all follow the requirements for II-B occupancies in the IBC. The performance-based analysis of (BEPC) found that even in a severe fire, the rooms modeled did not approach flashover conditions, nor was the structural steel ever in danger of failing. It is recommended that the exception precluding the need for window sprinklers because of the use of 1-hr rated glazing between the entry lobby and the atrium be verified.

(BEPC) predominantly meets or exceeds the requirements for egress as defined by both NFPA 101 and the California Building Code. All of the egress components are generously sized in comparison to the occupant load they are serving. However, there are several non-compliant features. The conference room on the first floor, (Room 104), was originally classified as business occupancy in the original design drawings. However, it is currently being used as an assembly space for meetings, presentations and student project expositions. As such, it violates several provisions of NFPA 101. The first is the fact that the 36" door to the space opens in the opposite direction as egress travel. Also, both door systems lack panic hardware required by such a space by code. It is recommended that all doors serving Room 104 be equipped with panic hardware, and that the 36" door be re-hung to swing in the direction of egress travel.

The automatic wet-pipe fire sprinkler system installed in BEPC was determined to provide proper coverage per the hazard of each space. Hydraulic calculations were performed which calculated the demand back the hydrant of test. These calculations indicated that the water supply met the demands of the remote areas calculated, including their respective hose stream allowances. The hydraulic design and layout of the sprinkler system meet the requirements of NFPA 13; however, the installation of the fire sprinkler system does not meet code. The branchlines in all areas with the exception of the branchlines under the exterior canopies are missing end of line restraints, which is in violation of NFPA 13 requirements for seismic restraint. In addition, upright sprinklers in the first floor corridor have obstructions to sprinkler spray development and most of the upright sprinklers in BEPC are installed too low according to NFPA 13 installation requirements. It is recommended these deficiencies be remediated as they are in violation of the code under which the building was built. These deficiencies should have been cited for immediate remediation by the owner during the 5-year inspections the building is required to have.

Smoke detection and alarm systems in (BEPC) are all installed in accordance with NFPA 72 and provide good coverage and audiovisual notification throughout. However, it is recommended that the exception for the horns in the Machine Shop and Wood Shop to be less than 15dBA over ambient conditions be verified with the AHJ.

All of the design fire scenarios modeled yielded results indicating that the fire sprinkler system would adequately control the fire and maintain temperature conditions in the room that would prevent both flashover (500 Degrees Celsius) and failure of structural steel (538 Degrees Celsius).

While flashover and structural failure was shown to be unlikely, from a life-safety standpoint, only one scenario (the machine shop trash container fire) resulted in an ASET that was greater than the RSET with a significant factor of safety. It is worth noting that the two other scenarios failed the ASET vs RSET performance test even with the (BEPC)'s robust egress capacities. The common element involved with both of the scenarios that failed was the storage and transport of potentially hazardous fire loads. (Projects Integration, and Lobby / Atrium fire scenarios respectively.) A well-defined and executed fire safety management plan, which is continually enforced, as well as student training, are recommended to reduce the probability and impact of these potential fire scenarios. A proposed fire safety management plan is included in appendix A.

If the prescriptive design elements in violation of code are remedied and a stringent fire safety management plan involving student training is implemented, the (BEPC) could maintain a higher standard of life safety for its students.

12 WORKS CITED

- NFPA 101-2012
- NFPA 101-2003
- NFPA 13-2013
- NFPA 13-1999
- NFPA 72-2002
- NFPA 72-2012
- IBC 2012
- CBC 2001
- CFC 2001
- UBC 1997
- SFPE Handbook, Fourth Edition, National Fire Protection Association
- NFPA Fire Protection Handbook, 20th Edition, National Fire Protection Association
- D.W. Stroup and D. Madrzykowski: *Heat Release Rate Tests of Plastic Trash Containers,* NIST Gaithersburg, MD 20899 Report of Test FR 4018 April 24, 2003
- NIJ Report 604-00: *Flammable and Combustible Liquid Spill / Burn Patterns*
- Guy Marlair, Claude Cwiklinski, Fabrice Marliere, Herv´e Breulet, Christian Costa. *A review of large-scale fire testing foxusing on the fire behaviour of chemicals,*. Interflam 96, Mar 1996, Cambridge, United Kingdom. pp.371-382. <ineris-00971959>

13 APPENDIX A - FIRE SAFETY MANAGEMENT PLAN

13.1 ACCEPTANCE AND AHJ PLAN APPROVAL

This plan shall be reviewed and accepted by the authority having jurisdiction. Because this is a state college, the AHJ is the Office of the State Fire Marshal. Local Requirements and authorities shall have access to and be able to provide additional input for the safety plan.

13.2 WHEN THE PLAN SHALL BE IMPLEMENTED

This plan shall be implemented in the event an unwanted fire is detected in a building or a fire alarm activates. It may also be activated for other emergencies where an evacuation of the building and emergency services are required. This plan also contains information on non-emergency related fire safety, and should be reviewed and updated regularly, especially if construction or building modifications are to commence.

Fire Evacuation Plan

1. An unwanted fire is detected by personnel, or a fire alarm activates
2. Other emergencies that would require evacuation and notification to authorities.

Fire Safety Plan

1. Reviewed regularly and implemented at all times
2. Reviewed and updated when construction or building modification is planned.

13.3 Emergency Responder Notification

This section of the safety management plan is pursuant to section 401.3 of the International Fire Code.

13.4 Fire Events

In accordance with section 401.3 of the 2012 International Fire Code, the owner or occupant shall immediately report such a condition to the fire department. Prompt notification to the fire department is essential. Personnel may notice a fire before it activates alarms, so any fire events shall be reported immediately.

13.5 Alarm Activations

Once fire alarm activates, staff or students shall immediately notify the fire department. The building is equipped throughout with both a fully monitored fire alarm system and a fire sprinkler system. However, to expedite a response and for greater redundancy, personnel shall immediately notify the fire department.

13.6 Fire Safety & Evacuation Plan

This Fire Safety Management Plan includes Fire evacuation plans and Fire Safety Plans as shown below, and in conformance with the International Fire Code 2012.

13.6.1 Fire Evacuation Plans

For group B occupancies a fire safety evacuation plan is required if the occupant load is greater than 500. From the Occupancy load factors and the occupancy types of the various rooms in this structure the total occupant load is 559. An evacuation plan is required.

The building evacuation plan shall include the following in accordance with section 404.3 of IFC 2012:

1.) Emergency egress or escape routes:

    Building emergency escape routes are shown on posted signage and are included in the Fire Safety Plans in the next section of this Fire Safety Management Plan. Emergency egress is for all occupants of the building and there is no shelter-in-place or areas of refuge in this building.

2.) Procedures for Employees who must remain to operate critical equipment before evacuating:

    Due to the presence of a machine shop where there may be CNC machining, cutting, welding etc. taking place when a fire occurs, the shop manager shall ensure all the students have evacuated and for all equipment is shutdown, gas turned off before evacuating.

3.) Procedures for Assisted rescue for persons unable to use the general means of egress unassisted.

    A rescue chair is provided in a cabinet on the second floor for the egress of disabled occupants in the event there is a fire, as the elevators will not be used. Other building occupants will assist the disabled occupant. Regular staff training on the use of the evacuation chairs is recommended.

4.) Procedures for accounting for Occupants after evacuation has been completed

    Instructors shall conduct a roll call once the occupants have evacuated the building and rendezvoused at the pre-determined area. A buddy system might also be implemented to ensure that if a student was absent from class their buddy would know and not count the individual as being still in the building. If conditions permit a designated “fire officer” may to a sweep of the building to ensure that all occupants have egressed.

5.) Identification and assignment of personnel responsible for rescue or emergency medical aid.

    Rescue workers will be clearly identifiable as such. The instructors, or designated safety officers shall be well versed in their rolls and responsibilities and have regular review of said duties and responsibilities in an emergency.

6.) The preferred method of notifying occupants of a fire is the fire alarm system. It is equipped with manual pull stations for the occupants to activate and will activate the horns and strobes throughout the interior and exterior of the structure to notify all of the incident.

7.) The preferred method of notifying emergency services is also via the fire alarm system as well as a land-line phone call to the fire service to expedite response and provide them any details of the fire. (Where, how big what is burning etc.) so they can plan their response in-route.

8.) Identification or assignment of people to contact with questions about duties and responsibilities.

    Contact information for the campus FLSO should be provided on the evacuation plan maps. And shall be readily accessible information for all, regular correspondence and awareness from FLSO to designated "Fire Safety Officers" or other competent responsible individuals should be exercised.

9.) Description of the alert tone shall be included

    The fire alarm alert tone is a series of three high-pitched pulses of sound with a slight pause in between sequences. If the fire sprinkler system has activated, a continuous, fast ringing sound will be heard from the exterior mounted water flow alarm bell.

13.6.2 Fire Evacuation Drill Frequency

IFC Table 405.2 establishes minimum frequency of fire drills depending on occupancy group.

Table 27 Fire & Evacuation Drill Frequency

TABLE 405.2 FIRE AND EVACUATION DRILL FREQUENCY AND PARTICIPATION

GROUP OR OCCUPANCY	FREQUENCY	PARTICIPATION
Group A	Quarterly	Employees
Group B[c]	Annually	Employees
Group E	Monthly[a]	All occupants
Group F	Annually	Employees
Group I	Quarterly on each shift	Employees[b]
Group R-1	Quarterly on each shift	Employees
Group R-2[d]	Four annually	All occupants
Group R-4	Quarterly on each shift	Employees[b]
High-rise buildings	Annually	Employees

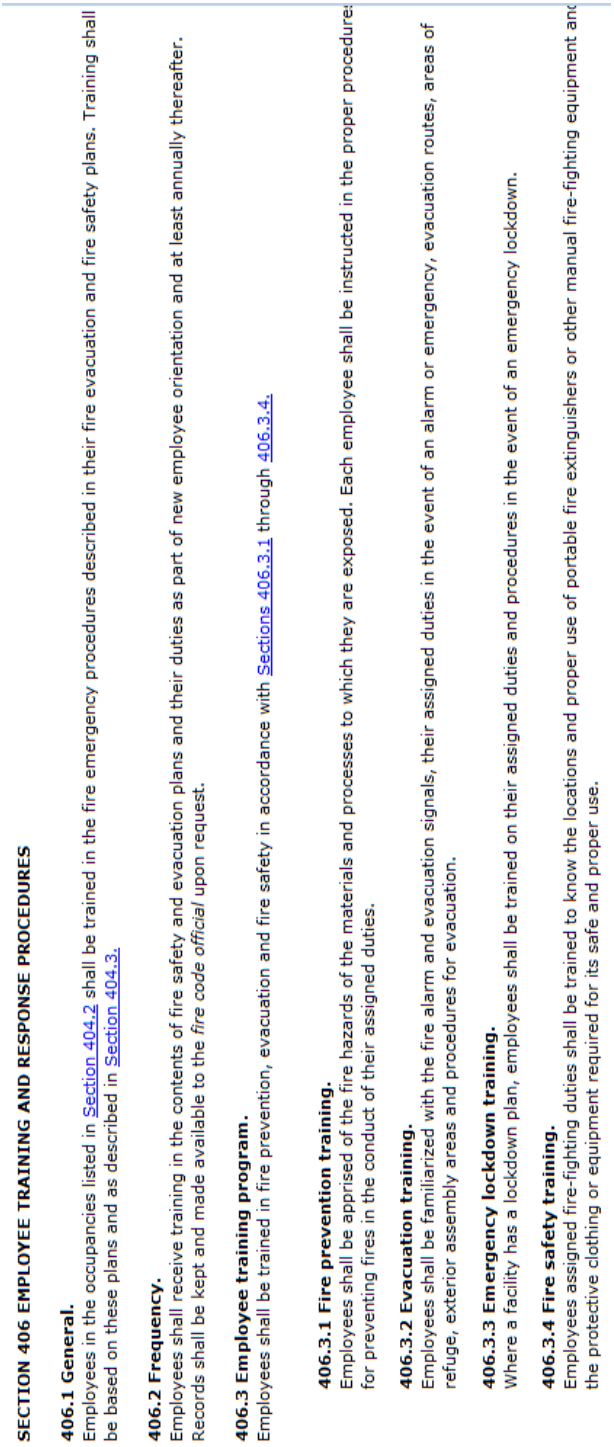
Because this is a B occupancy the frequency of fire drills shall be at a minimum once a year. Because there are no "employees" as such in this facility, it is up to the AHJ to determine whether Employee covers just the instructors as employees of the institution or students as well. It would be my recommendation to include all occupants, as additional training can only be beneficial.

In addition, the Cal Poly Campus Emergency Management system shall be notified of any emergencies through dialing 911 from a campus phone-which goes through the university police station. They then have the ability to activate a Cal Poly Emergency Notification-which sends out emails and text messages to students with information and instructions on what to do.

13.6.3 Employee Training

Employee Training Requirements shall be as set forth in section 406 of the international fire code:

Figure 55 Employee Training Requirements



SECTION 406 EMPLOYEE TRAINING AND RESPONSE PROCEDURES

406.1 General.
Employees in the occupancies listed in Section 404.2 shall be trained in the fire emergency procedures described in their fire evacuation and fire safety plans. Training shall be based on these plans and as described in Section 404.3.

406.2 Frequency.
Employees shall receive training in the contents of fire safety and evacuation plans and their duties as part of new employee orientation and at least annually thereafter. Records shall be kept and made available to the *fire code official* upon request.

406.3 Employee training program.
Employees shall be trained in fire prevention, evacuation and fire safety in accordance with Sections 406.3.1 through 406.3.4.

406.3.1 Fire prevention training.
Employees shall be apprised of the fire hazards of the materials and processes to which they are exposed. Each employee shall be instructed in the proper procedures for preventing fires in the conduct of their assigned duties.

406.3.2 Evacuation training.
Employees shall be familiarized with the fire alarm and evacuation signals, their assigned duties in the event of an alarm or emergency, evacuation routes, areas of refuge, exterior assembly areas and procedures for evacuation.

406.3.3 Emergency lockdown training.
Where a facility has a lockdown plan, employees shall be trained on their assigned duties and procedures in the event of an emergency lockdown.

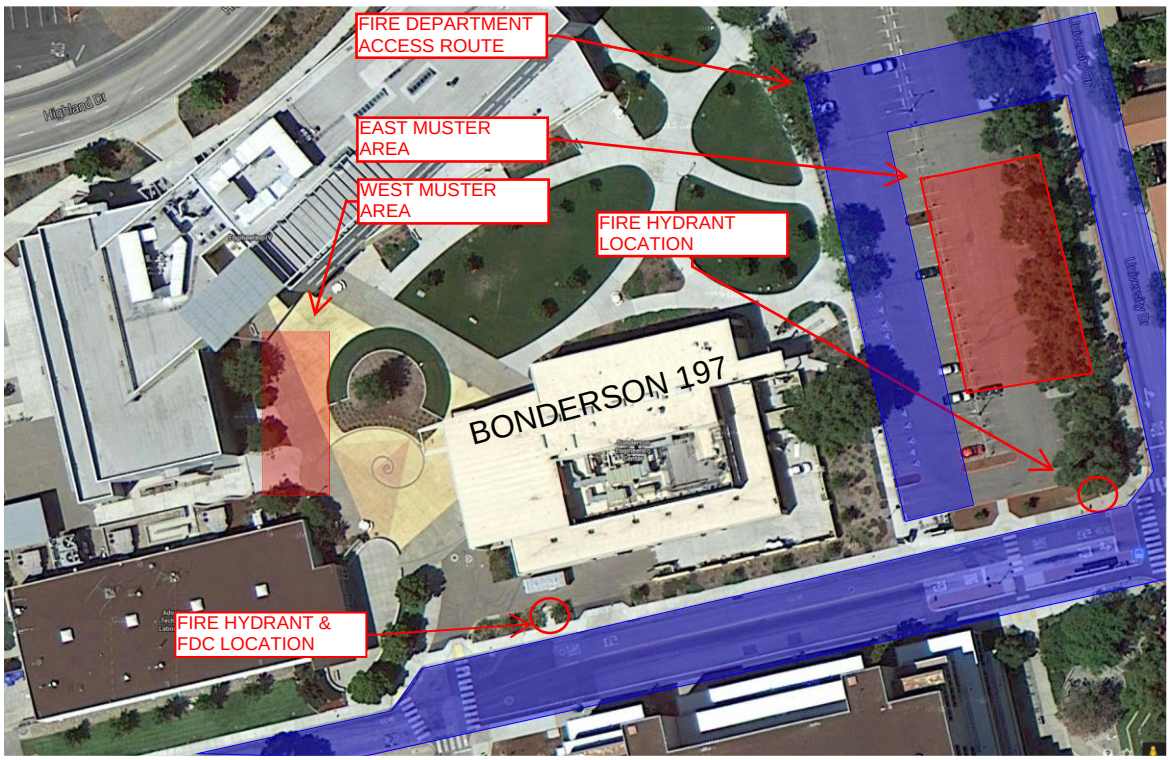
406.3.4 Fire safety training.
Employees assigned fire-fighting duties shall be trained to know the locations and proper use of portable fire extinguishers or other manual fire-fighting equipment and the protective clothing or equipment required for its safe and proper use.

13.7 Fire Safety Plans

Fire safety Egress plans shall be posted in the building.

13.7.1 Site Plans

Figure 48 Site Plan

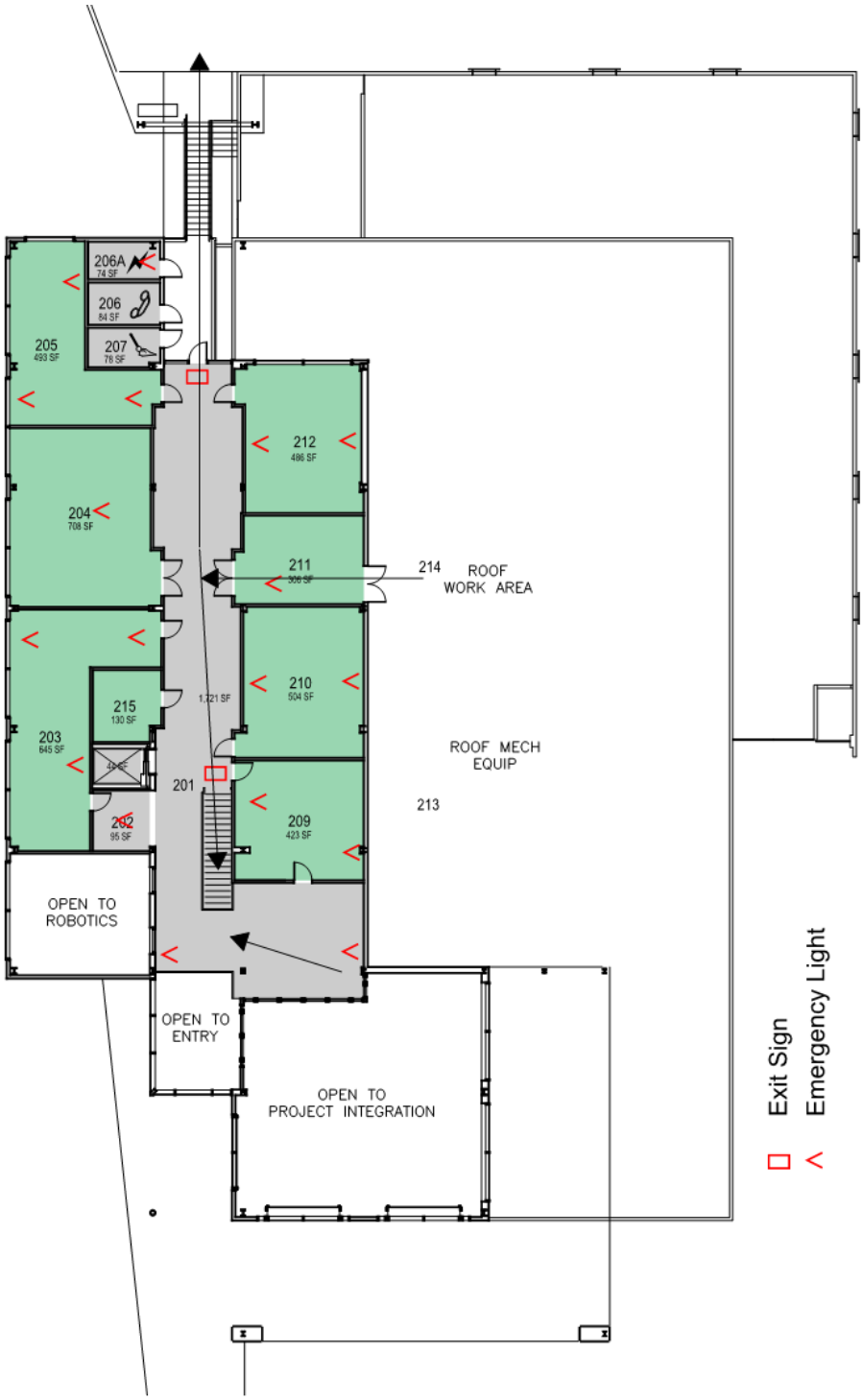


13.7.2 Exit and Egress Route Plan First Floor

Figure 49 Exit Plan First Floor

13.7.3 Exit and Egress Route Plan Second Floor

Figure 50 Exit Plan Second Floor



Because of the presence of the machine shop a list of the hazardous gases or flammables is shown below for the reference of all and to maintain proper housekeeping procedures.

13.7.4 Flammable Gas Housekeeping

Oxygen, and Acetylene tanks shall be turned off at the regulator at the end of each day and whenever the shop is not occupied.

Inert Gas tanks shall also be turned off at the regulator at the end of the day or whenever the shop is unoccupied.

Empty tanks shall be stored in the designated area with proper separation and precautions.

13.8 Fire Prevention Planning & Active Prevention

13.8.1 Fire Protection Planning

One of the best ways to reduce the risk of fire is to have fire prevention planning a part of any changes in use of the building and its rooms. This structure is unique in that there is a constant switching in and out of the students senior projects in the project labs meaning the contents and relative hazard level in each of the rooms is constantly changing. One room may be an all steel project, and the next may have stacks of large capacitors for a rail-gun project stored in it. Review of the fire hazards and ways to mitigate those hazards on a quarterly basis with the students is advised, come up with a list of how they can mitigate hazards by storing items differently, or in some cases separately etc.

13.8.2 Active Prevention

A regular walk through of the building by a building engineer, shop manager etc. on a weekly basis is advised to stay current on the contents of the building and discover and mitigate any new fire hazards that may have turned up in the process of the students working on their projects. Any pressing fire hazards should be brought to the attention of the fire department for further review and or direction.

Through the use of active prevention and including fire safety and prevention in the planning process of the ongoing projects in the space, many hazards may be identified and remedied that would have otherwise persisted and elevated the fire risk of the facility.

13.8.3 Fire Protection Features

The building is equipped with a fire sprinkler system throughout, utilizing quick response sprinklers. The building also hosts a fully monitored fire alarm system with remote annunciators and battery backup. Operation and Maintenance data for these systems will have been submitted by the trade contractors at the commissioning of the building. Any work done during the life of the building should be included in the O&M library and kept up to date.

13.9 Operation and Maintenance of Fire Protection Systems

13.9.1 Fire Sprinkler Systems

Correct operation and maintenance of the fire sprinkler systems is required for reliability of the system during fire. Inspections shall be scheduled as required by NFPA 25 with California amendments.

Inspections required by a licensed C-16 Contractor

- Quarterly Sprinkler inspections
    - Alarm devices (Flow Switches, Tamper Switches)
    - Hydraulic Nameplate Check
    - Fire department connections
    - Inspectors test flow test (alarm with 90 seconds)
    - Spare sprinkler heads and wrench present
    - Check that control valves are open
- Annual sprinkler system inspections
    - Sprinkler head inspection
    - Pipe an fitting inspection
    - Seismic bracing inspection
    - Main drain flow test
- 5 Year sprinkler inspections
    - Gauges replaced or calibrated
    - Check Valves for proper actuation
    - Check for new obstructions to sprinkler discharge
    - Check alarm valves.
    - Pressure reducing valve inspection

Any additional inspections and maintenance as require by the city of San Luis Obispo, the State Fire Marshal, or CSU requirements.

Control valves shall be clearly labeled

It is advised that a placard be placed in the riser closet with a diagram of the sprinkler system zoning / coverage areas.

A copy of the as-built drawings shall be stored in the riser room along with a sprinkler head box and spare stock of sprinkler heads.

13.10 FIRE ALARM SYSTEMS

Fire alarm systems shall be maintained in accordance with NFPA 72 and California Requirements.

- Semiannual inspection
    - Test that sprinkler water-flow switches report appropriately
    - Test of sprinkler valve tamper switches
    - Visual inspection of lead-acid fire alarm battery
    - Test Batteries – load voltage
- Annual Inspection
    - Test and visual inspection of panel functions, display, check fuses, etc.
    - Test panel battery charger
    - Battery discharge test
    - Test & Visual inspection of horns, strobes, bells, etc.
    - Test & Visual inspection of smoke detectors
    - Test & Visual inspection of heat detectors
    - Test & Visual Inspection of duct smoke detectors
    - Test & Visual Inspection of automated door closers Electromagnetic releases.
- 5 Year
    - Replace backup batteries
    - Clean smoke detectors

13.11 OPERATION AND MAINTENANCE MANUALS

Upon completion of the buildings construction operation and maintenance manuals should have been submitted by the trade contractors to the GC and the building owner. These manuals cover fire alarm, HVAC, Fire Sprinkler, etc. and include product cut sheets on all the devices and components installed, the required maintenance for each of the components and any warranties, guarantees that are associated with the trade contractor's work. These manuals shall be maintained by the building engineer for reference when repairs, and maintenance is required. An example of the contents of a fire sprinkler O&M manual is shown in the appendix below:

13.12 Fire Sprinkler – Sample O&M

Sample partial Fire Sprinkler O&M manual showing the table of contents of the manual and the first few pages of the manual is attached below. A Similar O&M for the fire sprinkler system at Bonderson Project Center should have been submitted by the installing contractor, I have requested a copy from the Cal Poly Facilities department to include in this report and am waiting to hear back on if they have one or not.

13.13 Fire Safety During Construction

13.13.1 Temporary Protection / Standpipes

Temporary manual dry standpipes for fire department use in fighting fires in the partially completed building shall be installed as required by NFPA 14 once the building structure has been erected. Additionally, temporary sprinkler protection and heat or smoke detection may be required for portions of the facility under construction. Consult local authorities before the start of work to confirm temporary protection requirements for the construction being conducted and level of occupancy of the space during construction activities.

13.13.2 Temporary construction fire extinguishers

Additional fire extinguishers in portable, clearly marked fire extinguisher cabinets shall be placed throughout the construction site in conspicuous locations and not be obstructed from easy access to extinguisher. An example of a temporary free standing fire extinguisher cabinet is shown below:

Figure 51 Temporary Construction Fire Extinguishers

13.13.3 Fire Watch

Whenever the sprinkler system is shut down for an occupied space is shutdown the AHJ may require a fire watch for the duration of the shutdown. Typically the sprinkler system will be shut-down at the beginning of the day so that construction modifications can be made and then brought back online at the end of the day's work for overnight protection, most AHJ's allow the GC to be their own fire watch during this time since it is assumed that the space is continually being worked on and is in effect being "fire watched" If the system is left off overnight, fire watch is almost always required. Depending on the situation fire watch may be avoided through the use of temporary heat detection in the area of work / renovation. Consult with local fire officials before the start of work to confirm the required level of protection and if fire watch is necessary for the construction that is taking place.

13.14 HOT WORK REQUIREMENTS

Whenever Cutting, welding, brazing and other sparking or flaming work is to be conducted the sprinkler system must remain online for the duration of the activities. If the Hot work is conducted in a portion of the facility that has not received an installation of fire sprinklers yet a second person shall accompany the worker performing the hot work with a fire extinguisher and watch for any fires created by the hot work. Additionally welding blankets / shields shall be used to protect any exposed combustible surfaces from sparks.

13.15 END-OF-LIFE FACILITY FIRE SAFETY PLAN

13.15.1 Selective and Sequenced Demolition

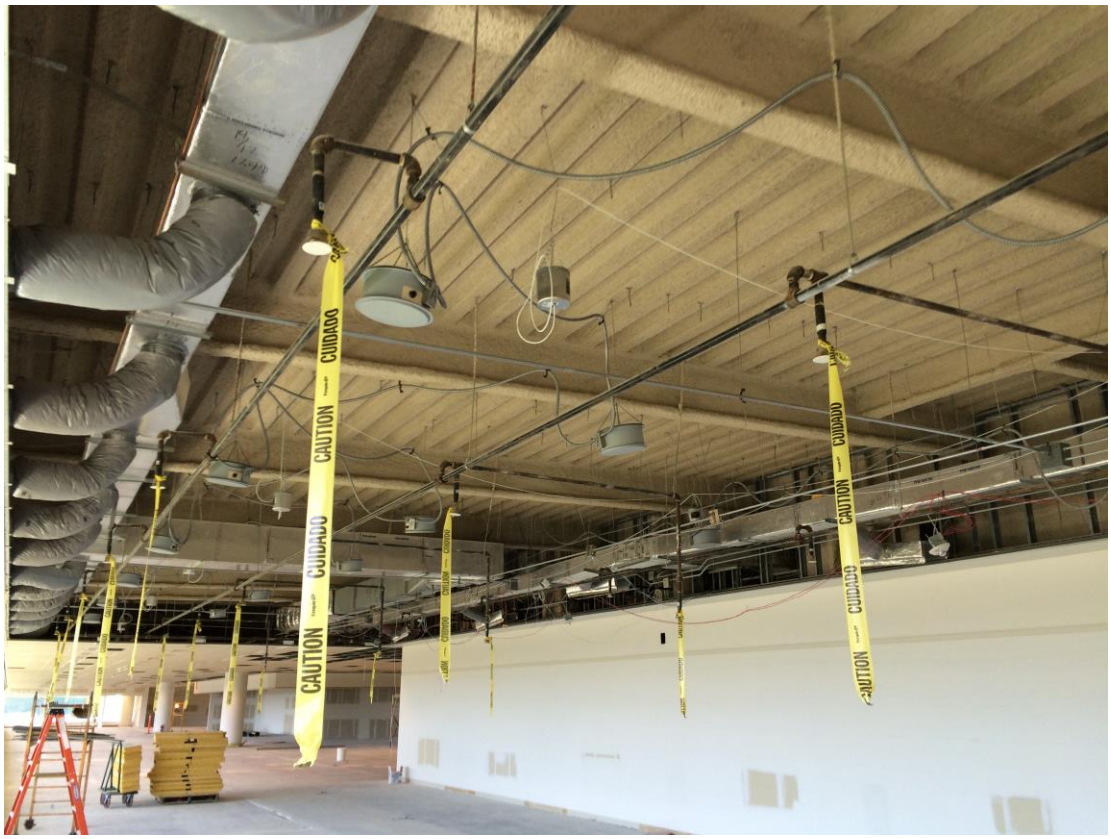
The demolition of parts or the entire building at the end of its service life shall be sequenced and demolished in the following order to minimize the possibility of a conflagration during the demolition process.

1. Demolition of interior finishes and furniture
2. Demolition of walls and interior partitions
3. Demolition of ceilings, HVAC mechanical, electrical and plumbing systems
4. Demolition of fire alarm system.
5. Demolition of the fire sprinkler system
6. Demolition of the building structure itself.

The sequencing of the demolition leaves the fire sprinkler system in service until nothing but the structure itself is left standing reducing the time that the structure is unprotected, and providing coverage throughout most of the demo process. If a drop T-Bar ceiling is utilized in the structure, demolish the ceiling tiles with smoke/heat detectors last.

An example of demolished business occupancy building tenant space where the system was kept live throughout the duration of the demolition process is shown below:

Figure 52 Sprinkler System Left In Service During Construction



The demolition contractor demolished the walls and ceiling while leaving the sprinkler system active the entire time, caution tape was applied to the sprinklers to make them visible to prevent damage. Because there were no above ceiling sprinklers in this case the sprinklers are very low in comparison to the "ceiling" which would greatly reduce the activation time for small fires, but still provides a greater level of protection than shutting down the system all together.

13.16 Fire Watch During Cutting Processes

Fire watch during cutting and other "hot work" demolition processes shall be conducted throughout the demolition process. Again consult the local AHJ for the requirements for the specific demolition plan and submit demolition plans for review by the city.

13.17 Fire Department Vehicle Access Plan

Develop and submit for review a fire department vehicle access plan for any demolition that would alter the current site access to fire department vehicles. Specify the locations of fire hydrants, FDC's and any changes to the site fire water system during demolition so the fire department is aware of any modifications and can modify their response accordingly.

13.18 Distribution of Plan

This Plan shall be distributed to the owner of the building (CSU) and the building engineering and maintenance team. The CSU shall distribute to their employees any applicable parts of this plan affecting employee actions in the event of a fire or other emergency, as required by section 404.5 of the IFC. This plan shall also be made available to all tenants in the space for reference and review of the occupants and updated annually or as necessary by changes in the building or occupancy.

14 APPENDIX B – SAMPLE O&M MANUAL

OPERATION AND MAINTENANCE MANUAL

TABLE OF CONTENTS:

FIRE SPRINKLER SYSTEM

System Description

The Fire Sprinkler system at **CSU Maritime PE Building** is composed of two fire sprinkler systems, one per level, with risers located in the fire sprinkler riser closet Room 120C, Located in the South East corner of the building.

The Fire Sprinkler system is designed to aid in the event of a fire. Unlike Hollywood movies, all sprinklers do not activate in the event of the fire. Only sprinkler heads affected by the heat from the fire's flame will activate, suppressing the fire and smoke so individuals may reach a safe destination.

The fire Sprinkler Risers are located in the riser closet 120C. They should be clearly marked by a sign stating "Fire Sprinkler Risers" similar to the following illustrations.

or

or

During routine inspection and testing, it is advised that the valves be checked periodically per Maintenance schedules and guidelines. Refer to *Section 1- Maintenance* for more information.

FIRE SPRINKLER SYSTEM

Operations

A. START-UP PROCEDURES:

1. *The system will initially be put into service by the Fire Sprinkler Contractor.*
2. Make sure the main drain is closed.
3. Slowly turn the butterfly (control) valve to the open position.
4. Allow the system to fill with water.
5. Check pressure gauges, until they reach the system pressure, indicated on the hydraulic calculation sticker, located on the riser.

B. SHUT-DOWN PROCEDURES:

1. If the system needs to be shut down, close the butterfly (control) valve slowly and completely, located on the system riser.
2. Make sure the system drain is either tied into the plumbing system, or has somewhere to drain to.
3. Open the main drain valve slowly.
4. Allow the system to drain.

C. Normal Operations:

1. Sprinkler system control valves must always be in the fully open position. Inspect weekly to verify that they are in the "open" position.
2. A reliable water supply must be maintained at all times. The gauges at the sprinkler riser should be checked monthly to ensure that normal water supply pressure is being maintained. The pressure should be as indicated on the hydraulic calculations sticker, located on the system riser.
3. Avoid blocking the proper water distribution of the sprinklers with inventory, storage or partitions, etc.

FIRE SPRINKLER SYSTEM

Emergency Instructions

In the case of any emergency it is imperative to allow the fire sprinkler system to remain active. If the following events should occur, please do the following:

A. EARTHQUAKE:

Once the building has been deemed safe to return to – a facilities maintenance manager should inspect the fire sprinkler system to ensure the system is still functional and not in need of any repairs, as a result of any structural or system damage from the earthquake. A licensed C-16 Fire Sprinkler Contractor should be consulted for any repairs required.

B. FIRE:

1. Get to a safe location and call the fire department immediately.
2. It is vital that the sprinkler control valve remain in the "open" position until the fire department determines the fire has been fully extinguished.
3. Refer to the *Section 1 - Operations* of the Fire Sprinkler System, to put system back in proper working order, or contact a licensed C-16 Fire Sprinkler Contractor.

C. PIPE BREAKAGE OR SPRINKLER LEAKAGE:

1. Close the control valve completely (turn clockwise).
2. Open the main drain valve completely.
3. Phone Transbay Fire Protection, Inc. at **800-877-8377**, or a licensed C-16 Fire Sprinkler Contractor, to make repairs and/or replace sprinklers. Once repairs have been made, proceed to step #4.
4. Close the main drain valve completely.
5. Slowly turn the control valve counter-clockwise to a partially open position. As the system is being filled, open the test and drain valve to vent any trapped air. Close the test and drain valve when a steady stream of water appears.
6. Open the control valve completely and check the gauges for the proper pressure.

FIRE SPRINKLER SYSTEM

Maintenance & Repairs

Refer to the AFSA checklist for preventative maintenance schedules and guidelines. All repairs required for the Automatic Fire Sprinkler system should be performed by a licensed Fire Sprinkler Contractor.

A. ***In the event of a broken pipe or sprinkler leak, please do the following*:**

7. Close the control valve completely (turn clockwise).
8. Open the main drain valve completely.
9. Phone a license fire sprinkler contractor to make repairs and/or replace sprinklers. Once repairs have been made then proceed to step #4.
10. Close the main drain valve completely.
11. Slowly turn the control valve counter-clockwise to a partially open position. As the system is being filled, open the inspectors test valve to vent any trapped air. Close the inspectors test valve when a steady stream of water appears.
12. Open the control valve completely and check the gauges.
13. Also refer to *Section 1 - Operations* for more information.
14. If components on the fire sprinkler system appear broken or need repair – please contact a licensed C-16 Fire Sprinkler Contractor

15 APPENDIX C – FIRE ALARM TESTING, DRAWINGS & CUT SHEETS

Life Safety Alarms
Inspection and Testing Form
Annual

Bonderson

Date: _____ **Time:** _____ **Building** **197** **Tester:**_____

SPECIAL INSTRUCTIONS:

*Smoke 1-10, 1-58, and 1-59 and heat 1-11 will recall elevator
*Test heat 1-11 last-Shunt Trip
*Unplug six signal plugs at panel 4 on left-2 on bottom-right

ELEVATOR RESET INFO
*Shunt trip reset located inside "MS" main switchboard-outdoor switch gear area-Contact electric shop for EHV1 key
*Reset detectors prior to shunt reset
*Use red fire recall key located in elevator machine room
*Turn to 'BYPASS' - Back to 'OFF' for elevator reset

*Ducts use magnet-comes to FACP as pre-alarm/supervisory
*Roll Up Door Bypass
Enter
1-Programming
Password 1-1-1-1-1 then Enter
1=Disable
Module=#
1 014 - Enter
Next Selection '+' Enter
Press Esc until you get back to main menu
To Reset Door-
*Reset FACP-Reset Door
Push Blade into red box
Push button on top of box to set Blade

*Solo stick with all extensions will reach high ceiling smokes-1D 37,38,39
*Need Ladder for 1D-36
*Problem reseting 1D36 - LIGHT SMOKE

Battery:

Test battery charge with 'SOCTESTER' battery tester.

Audio and Visual Alarms:

Activate alarm notification appliances and confirm proper operation of all audible and visual alarms. Verify audible alarms are at least 15db above ambient sound levels. (Table 7-2.2,14.a) Verify reporting at panel.
Test operation of speakers and verify correct reporting to panel.

Pulls and Detectors:

Functionally test smoke detectors (Table 7-2.2, 13.g.2). and each Pull Station and verify correct reporting at panel.
Test duct detectors (Table 7-2.2, 13.g.4).

Automatic Sprinkler Systems:

Operate water flow and alarm switches.

DESCRIPTION/LOCATION	DEVICE TYPE SERIAL NUMBER	PASS	FAIL	N/T

PANEL #: 1971

ROOM	POINT !BATT				
			Inside room 205		
	- 1	Room 105		12V 12AH 197-FP-1	( ) ( ) ( )
	- 2	Room 105		12V 12AH 197-FP-2	( ) ( ) ( )
	- 3	Room 105		12V 7AH 197-PS-1	( ) ( ) ( )
	- 4	Room 105		12V 7AH 197-PS-2	( ) ( ) ( )
ROOM	**POINT 1d001**		**Inside room 105**		
	- 1			SMOKE	( ) ( ) ( )
ROOM	**POINT 1d002**		**Inside room 119**		
	- 1			SMOKE	( ) ( ) ( )
ROOM	**POINT 1d003**		**Inside room 104-east**		
	- 1			SMOKE	( ) ( ) ( )
ROOM	**POINT 1d004**		**Inside room 104-center**		
	- 1			SMOKE	( ) ( ) ( )
ROOM	**POINT 1d005**		**Inside room 104-west**		
	- 1			SMOKE	( ) ( ) ( )
ROOM	**POINT 1d006**		**Hall outside room 104-east**		
	- 1			SMOKE	( ) ( ) ( )
ROOM	**POINT 1d007**		**Hall outside room 104-west**		
	- 1			SMOKE	( ) ( ) ( )
ROOM	**POINT 1d008**		**Hall outside room 102**		

A U D I B L E / V I S I B L E N O T I F I C A T I O N

SPECTRAlert®

Selectable Output Strobe and Horn/Strobes

SYSTEM SENSOR®

Models Available

Strobes

Red	White
S1224MC	S1224MCW
S1224MCP	S1224MCPW
S1224MCK	
S1224MCSP	

Horn/Strobes

Red	White
P1224MC	P1224MCW
P1224MCP	P1224MCPW
P1224MCK	
P1224MCSP	

Horns

Red	White
H12/24	H12/24W
H12/24K	

P1224MC Horn/Strobe

S1224MC Strobe

Product Overview

Operates on either 12V or 24V

Widest range of candela options:
12V: 15 and 15/75 candela
24V: 15, 15/75, 30, 75, 110 candela

Easy candela selection

Lower current draw

Easy DIP switch selection for horn options

Easy mounting with QuickClick™

Synchronizable with MDL Sync•Circuit™ module

Meets UL1971, NFPA72, and ADA signaling requirements

All strobe and horn/strobe models incorporate a new patented voltage booster design that has a more consistent flash bulb voltage over the range of candela selections. The benefit to the customer is a high quality strobe device.

7125-1209:222
7135-1209:223

LISTED
S5512
S4011

FM APPROVED
3014150

MEA approved
122-02-E
126-02-E

SpectrAlert® Selectable Output Horns, Strobes, and Horn/Strobes offer enhanced features that include the widest range of candela options available and the capability to recognize and self-adjust for either 12 or 24 volt operation. With an overall feature set that combines performance, installation ease, flexibility, and a consistent, aesthetically pleasing appearance, the SpectrAlert Selectable Output devices provide both the innovation and efficiency synonymous with the SpectrAlert name.

Performance. SpectrAlert selectable output wall-mount horns, strobes, and horn/strobes offer key performance features long associated with the SpectrAlert name. The selectable candela strobes and horn/strobes offer average current draws that are not only lower than conventional fixed-candela SpectrAlert products, but also lower than similar selectable candela products. By consuming less current, the ability to connect even more devices per loop is possible, resulting in a lower installed cost.

Installation. SpectrAlert selectable output horns, strobes, and horn/strobes offer the same installation-friendly features synonymous with the SpectrAlert name, such as the option of 2- and 4-wire operation; the ability to use standard size backboxes with no encroachment into the box; and universal mounting incorporating the labor-saving QuickClick™ feature. Such labor-savings features make wire connections simple and fast, further reducing installed cost.

Flexibility. SpectrAlert selectable output strobes and horn/strobes offer the broadest range of candela options. In addition, the selectable output strobes and horn/strobes can operate on either 12V or 24V, with no setting required; the device recognizes and self-adjusts to the correct current automatically. Temporal 3 or Continuous tone options continue to be available, in either an Electromechanical or 3kHz pattern.

Aesthetics. SpectrAlert selectable output horns, strobes, and horn/strobes incorporate the same stylish, low profile design of the conventional SpectrAlert products, for a consistent and aesthetically pleasing appearance across the entire product line.

Engineering Specifications

General

SpectrAlert horns, strobes and horn/strobes shall be capable of mounting to a standard 4″ × 4″ × 1 1/2″ back box or a single gang 2″ × 4″ × 1 7/8″ back box using the universal mounting plate included with each SpectrAlert product. Also, SpectrAlert products, when used in conjunction with the accessory Sync•Circuit Module, shall be powered from a non-coded power supply and shall operate on 12 or 24 volts. 12 volt rated devices shall have an operating voltage range of 9–17.5 volts. 24-volt rated devices shall have an operating voltage range or 17–33 volts. SpectrAlert products shall have an operating temperature of 32° to 120°F and operate from a regulated DC or full wave rectified, unfiltered power supply.

Strobe

Strobe shall be a System Sensor SpectrAlert Model _____ listed to UL 1971 and be approved for fire protective service. The strobe shall be wired as a primary signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system.

Horn/Strobe Combination

Horn/Strobe shall be a System Sensor SpectrAlert Model _____ listed to UL 1971 and UL 464 and shall be approved for fire protective service. Horn/strobe shall be wired as a primary signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. The horn shall have two tone options, two audibility options (at 24 volts) and the option to switch between a temporal 3 pattern and a non-temporal continuous pattern. Strobes shall be powered independently of the sounder with the removal of factory installed jumper wires. The horn on horn/strobe models shall operate on a coded or non-coded power supply (the strobe must be powered continuously).

Synchronization Module

Module shall be a System Sensor Sync•Circuit _____ listed to UL 464 and shall be approved for fire protective service. The module shall synchronize SpectrAlert strobes at 1Hz and horns at temporal 3. Also, the module shall silence the horns on horn/strobe models, while operating the strobes, over a single pair of wires. The module shall be capable of mounting to a 4 11/16″ × 4 11/16″ × 2 1/8″ back box and shall control two Style Y (class B) or one Style Z (class A) circuit. Module shall be capable of multiple zone synchronization by daisy chaining multiple modules together and re-synchronizing each other along the chain. The module shall not operate on a coded power supply.

Specifications

Walk Test
SpectrAlert horn/strobe and horn only work on "walk tests" with time durations of 4 seconds or greater

Input Terminals
12 to 18 AWG

Dimensions
Strobe and horn/strobe with universal plate
5″ × 5 5/8″ × 2 15/16″

Strobe and horn/strobe with small footprint plate
3 3/8″ × 5 5/8″ × 2 5/16″

Horn with universal mounting plate
5″ × 5 5/8″ × 1 5/16″

Horn without mounting plate
2 15/16″ × 5 5/16″ × 1 5/16″

Weight, horn only
7.2 oz.

Weight, strobe and horn/strobe
8.8 oz.

Mounting
4″ × 4″ × 1 1/2″ or 2″ × 4″ × 1 7/8″ standard boxes

Operating Temperature (Indoor)
32°F to 120°F (0°C to 49°C)

Maximum humidity (Indoor)
95% as tested per UL464

Outdoor (K Series) Operating Temperature
–40°F to 151°F
(–40°C to 66°C)

Outdoor rating
NEMA 3R (per UL 50)

Voltages
12 or 24VDC and FWR[1] unfiltered

Operating voltage range
12V: 8–17.5V; 24V: 16–33V

Operating voltage range (with Sync•Circuit module, MDL)[2]
12V: 9–17.5V; 24V: 17–33V

U.S. Patent Numbers
5,593,569
5,914,665
6,049,446

Notes:
1. Full Wave Rectified (FWR) voltage is a non-regulated, time-varying power source that is used on some power supply and panel outputs.
2. The MDL causes a one-volt voltage drop in the notification appliance circuit.

Table 1-A: SpectrAlert Strobe UL Max. Current Draw

Candela Setting	FWR Operating Current–Strobe (mA RMS)		DC Operating Current–Strobe (mA RMS)	
	8-17.5V	16-33V	8-17.5V	16-33V
15	112	64	127	59
15/75	135	74	127	69
30		93		90
75		158		160
110		208		209

Table 1-B: Horn UL Max. Current Draw Measurements (mA RMS)

Selectable Horn Tones			DC		FWR	
			8-17.5V	16-33V	8-17.5V	16-33V
Temporal	Low Volume	Electromechanical	15	23	13	23
		3000 Hz Interrupted	15	33	13	23
	High Volume	Electromechanical	36	53	20	44
		3000 Hz Interrupted	43	57	21	40
Non-Temporal	Low Volume	Electromechanical	16	37	19	29
		3000 Hz Interrupted	16	32	18	33
	High Volume	Electromechanical	38	49	46	49
		3000 Hz Interrupted	44	56	42	58

Table 1-C: 12VDC Horn/Strobe UL Max. Current Draw Measurements (mA RMS)

	Temporal			
	Low Volume		High Volume	
Candela Setting	Electromechanical	3000 Hz	Electromechanical	3000 Hz
15	111	111	112	112
15/75	127	127	126	129
	Non-Temporal			
15	113	112	114	115
15/75	128	128	130	134

Table 1-D: 24VDC Horn/Strobe UL Max. Current Draw Measurements (mA RMS)

	Temporal			
	Low Volume		High Volume	
Candela Setting	Electromechanical	3000 Hz	Electromechanical	3000 Hz
15	71	70	73	75
15/75	86	85	87	88
30	99	98	100	100
75	166	166	167	170
110	209	209	210	213
	Non-Temporal			
15	74	74	79	82
15/75	86	88	93	96
30	101	101	107	110
75	167	167	173	176
110	213	213	218	222

Explanation of Published Voltage, Current, and SPL Specifications

In May 2004 Underwriters Laboratories changed standard UL 1971 to require that operating current measuremments are made using RMS (root mean square) instead of peak or average values. RMS measurements more accurately predict the power consumption of a device since they take into account the entire current draw profile including surge, repetitive surge, and peak values. The published RMS current is the maximum operating current of that device within its operating voltage range. This current maximum may or may not occur at the endpoints of the voltage range.

Similarly, UL tests the audibility of devices in accordance with UL 464 by measuring them across the operating voltage range to determine the minimum sound pressure level produced at any particular setting.

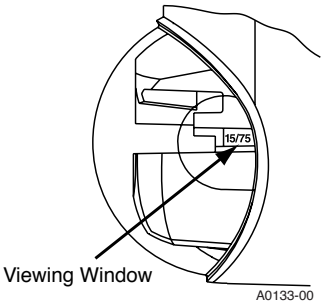
During May 2004, UL also changed the way they list the voltage range of a device. All 12V products will be listed between 8 – 17.5V and all 24V products will be listed between 16 – 33V. Those devices are considered “regulated”. Any product that does not operate within these ranges will be listed as a “special application” with its operating voltage specified on the device.

Notes

1. Current draw for strobe-only products is shown in Table 1-A.
2. Current draw for horn-only products is shown in Table 1-B.
3. 12VDC 2-wire horn/strobe current is shown in Table 1-C.
4. 24VDC 2-wire horn/strobe current draw is shown in Table 1-D.
5. Current draw for other horn/strobe power supplies can be calculated by adding the strobe current in Table 1-A to the horn current in Table 1-B from the chosen settings.

SpectrAlert Strobe Candela Selections

For strobe candela selection, adjust slide switch located on the rear of the product while watching the viewing window on the side of the reflector.



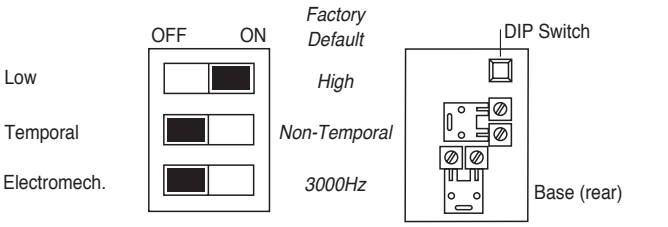
Permissible Candela Settings

Candela Setting	Operating Voltage	
	12V	24V
15	OK	OK
15/75	OK	OK
30		OK
75		OK
110		OK

SpectrAlert Horn Sound Measurements (dBA)

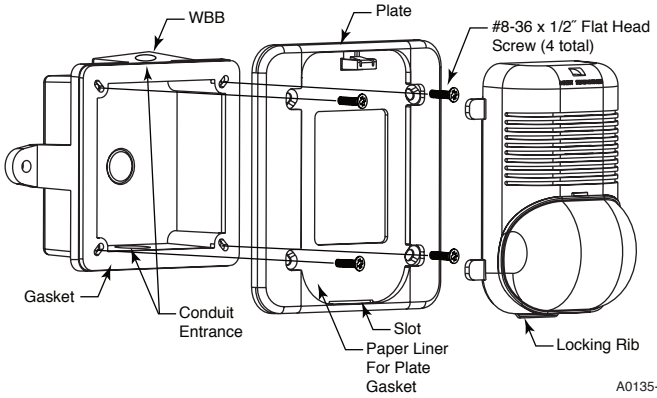
Selectable Horn Tones			8-17.5V	16-33V
Temporal	Low Volume	Electromechanical	67	75
		3000 Hz Interrupted	68	75
	High Volume	Electromechanical	71	80
		3000 Hz Interrupted	72	81
Non-Temporal	Low Volume	Electromechanical	71	79
		3000 Hz Interrupted	72	79
	High Volume	Electromechanical	76	84
		3000 Hz Interrupted	77	86

DIP Switch Operation on P1224MC



A0110-00

Typical weatherproof mounting with universal plate



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SpectrAlert Ordering Information

Model	Description
P1224MC	Selectable Output Horn/Strobe, 12/24 volt, red
P1224MCW	Selectable Output Horn/Strobe, 12/24 volt, white
P1224MCP	Selectable Output Horn/Strobe, 12/24 volt, red, plain housing
P1224MCPW	Selectable Output Horn/Strobe, 12/24 volt, white, plain housing
P1224MCK	Selectable Output Horn/Strobe, 12/24 volt, red, outdoor
P1224MCSP	Selectable Output Horn/Strobe, 12/24 volt, red, "FUEGO" housing
S1224MC	Selectable Output Strobe, 12/24 volt, red
S1224MCW	Selectable Output Strobe, 12/24 volt, white
S1224MCP	Selectable Output Strobe, 12/24 volt, red, plain housing
S1224MCPW	Selectable Output Strobe, 12/24 volt, white, plain housing
S1224MCK	Selectable Output Strobe, 12/24 volt, red, outdoor
S1224MCSP	Selectable Output Strobe, 12/24 volt, red, "FUEGO" housing

Model	Description
H12/24	Horn, 12/24 volt, red
H12/24W	Horn, 12/24 volt, white
H12/24K	Horn, 12/24 volt, red, outdoor
Accessories	
MDL	Sync•Circuit Module, red
MDLW	Sync•Circuit Module, white
MDLWA	Sync•Circuit Module, white, Canadian model
S-MP	Small Footprint Mounting Plate, red, for single-gang back box
S-MPW	Small Footprint Mounting Plate, white, for single-gang back box
BBS	Surface Mount Back Box Skirt, red
BBSW	Surface Mount Back Box Skirt, white
D-MP	Universal Mounting Plate (replacement), red
D-MPW	Universal Mounting Plate (replacement), white
WBB	Weatherproof Back Box

Notes

All of these SpectrAlert products are designed for wall mount only. All outdoor models must use weatherproof back box model WBB. Installation of less than 75 candela strobes may be permissible under the equivalent facilitation clause of the ADAAG (Sec. 2.2). However, it is the responsibility of the person or entity designing the fire alarm system to determine the acceptability of less than 75 candela strobes. All 15/75 candela strobes or horn/strobes are recommended for 20′ × 20′ rooms or less.

System Sensor Sales and Service

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System Sensor Canada
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Fx: 905.812.0771

System Sensor Europe
Ph: 44.1403.276500
Fx: 44.1403.276501

System Sensor in China
Ph: 86.29.8832.0119
Fx: 86.29.8832.5119

System Sensor in Singapore
Ph: 65.6273.2230
Fx: 65.6273.2610

System Sensor – Far East
Ph: 85.22.191.9003
Fx: 85.22.736.6580

System Sensor – Australia
Ph: 613.54.281.142
Fx: 613.54.281.172

System Sensor – India
Ph: 91.124.237.1770 x.2700
Fx: 91.124.237.3118

System Sensor – Russia
Ph: 70.95.937.7982
Fx: 70.95.937.7983

A05-0325-006•9/05•#1526

FireWarden-100-2(E)

Intelligent Addressable FACP with Built-In Communciator

NOTIFIER® by Honeywell

Addressable

General

The Notifier FireWarden-100-2 (NFW2-100) is a combination FACP (Fire Alarm Control Panel) and DACT (Digital Alarm Communicator/Transmitter) all on one circuit board. This compact intelligent addressable control panel has an extensive list of powerful features.

The SLC (Signaling Line Circuit) of the FireWarden-100-2 operates using a Rapid Group Polling communication protocol technology that polls multiple devices simultaneously for a quicker device response time.This patented technology allows a fully-loaded panel with up to 198 devices to report an incident and activate the notification circuits in under 10 seconds. With this improved polling, devices can be wired on standard twisted, unshielded wire up to a distance of 10,000 feet. (Consult the wire table on page 3 for specific installation instructions.)

The FireWarden-100-2's quick-remove chassis protects the electronics during construction. The backbox can be installed allowing field wiring to be pulled. When construction is completed, the electronics can be quickly installed with just two bolts.

Available accessories include LED, graphic and LCD annunciators, and reverse polarity/city box transmitter.

The panel is programmed through the FACP's keypad or via a standard PS-2 computer keyboard, which can be plugged directly into the printed circuit board. This permits easy typing of address labels and other programming information.

NOTE: *Unless otherwise specified, the terms FireWarden-100-2 is used in this document to refer to both the FireWarden-100-2 and the FireWarden-100-2E FACPs (Fire Alarm Control Panels).*

Features

- Listed to UL standard 864, 9th edition.
- On-board DACT.
- Four Style Y (Class B) or two Class A (Style Z) NAC circuits.
- Selectable strobe synchronization for System Sensor, Wheelock, and Gentex devices.
- Remote Acknowledge, Silence, Reset and Drill via addressable monitor modules.
- Up to 32 annunciators or remote annunciators via EIA-485.
- EIA-232 printer/PC interface (variable baud rate) on main circuit board.
- Integral 80-character LCD display with backlighting.
- Real-time clock/calendar with automatic daylight savings control.
- Detector sensitivity test capability (NFPA 72 compliant).
- History file with 1,000-event capacity.
- Maintenance alert warns when smoke detector dust accumulation is excessive.
- Automatic device type-code verification.
- One person audible or silent walk test with walk-test log and printout.
- Point trouble identification.
- Waterflow (nonsilenceable) selection per monitor point.

7101cov.jpg

- System alarm verification selection per detector point.
- PAS (Positive Alarm Sequence) and presignal delay per point (NFPA 72 compliant).

NOTE: *Only detectors may participate in PAS.*

SLC LOOP:

- SLC can be configured for NFPA Style 4, 6, or 7 operation.
- SLC supports up to 198 addressable devices per loop (99 detectors and 99 monitor, control, or relay modules).
- SLC loop maximum length 10,000 ft. (3,000 m.). *See wire table on* page 3.

NOTIFICATION APPLIANCE CIRCUITS (NACS):

- Four onboard NACs with additional NAC capability using output control modules (NC-100).
- Silence Inhibit and Auto Silence timer options.
- Continuous, March Time, Temporal or California code for main circuit board NACs with two-stage capability.
- Selectable strobe synchronization per NAC.
- 2.5 amps maximum per each NAC circuit.

NOTE: *Maximum or total 24VDC system power shared between all NAC circuits and auxiliary power outputs is 3.6 amps. (System power increases to 6.6 amps with optional XRM-24 transformer.)*

PROGRAMMING AND SOFTWARE:

- Autoprogram (learn mode) reduces installation time.
- Custom English labels (per point) may be manually entered or selected from an internal library file.
- Two programmable Form-C relay outputs.
- 99 software zones.
- Continuous fire protection during online programming at the front panel.

- Program Check automatically catches common errors not linked to any zone or input point.

User interface

LED INDICATORS

- AC POWER (green)
- FIRE ALARM (red)
- SUPERVISORY (yellow)
- ALARM SILENCED (yellow)
- SYSTEM TROUBLE (yellow)
- MAINTENANCE/PRESIGNAL (yellow)
- DISABLED (yellow)
- BATTERY FAULT (yellow)
- GROUND FAULT (yellow)

KEYPAD CONTROLS

- ACKNOWLEDGE/STEP
- ALARM SILENCE
- DRILL
- SYSTEM RESET (lamp test)
- 16-key alpha-numeric pad (similar to telephone keypad)
- 4 cursor keys
- ENTER

Ordering Options

NFW2-100(E): 198-point addressable Fire Alarm Control Panel, one SLC loop. Includes 80-character LCD display, single printed circuit board mounted on chassis, and cabinet.

NFW2-100R: Same as NFW2-100, exept in a red backbox.

4XTM Reverse Polarity Transmitter Module: Provides supervised output for local energy municipal box transmitter, alarm, and trouble.

DP-9692B: Optional dress panel for FireWarden-100-2.

TR-CE-B: Trim Ring for semi-flush mounting.

BB-26: Battery backbox, holds up to two 26 AH batteries and CHG-75.

NFS-LBB: Battery box, houses two 55 AH batteries.

CHG-75: Battery charger for lead-acid batteries with a rating of 25 to 75 AH.

CHG-120: Remote battery charging system for lead-acid batteries with a rating of 55 to 120 AH. Requires additional NFS-LBB for mounting.

NOTE: *CHG-120 or CHG-75 required for batteries larger than 18AH.*

BAT Series: Batteries, see data sheet DN-6933.

XRM-24(E): Optional transformer. Increases system power to 6.6 amps. Use XRM-24E with FireWarden-100-2E.

PRT/PK-CABLE: Cable printer/personal computer interface cable.

PRN-6: UL listed compatible event printer. Uses tractor-fed paper.

COMPATIBLE ANNUNCIATORS

ACM-8R: Relay module provides 8 Form-C 5.0 amp relays.

ACM Annunciator Series: LED-type fire annunciators capable of providing up to 99 software zones of annunciation. Available in increments of 16 or 32 points to meet a variety of applications.

LDM Graphic Series: Lamp Driver Module series for use with custom graphic annunciators.

FDU-80 (Liquid Crystal Display) point annunciator: 80-character, backlit LCD-type fire annunciators capable of displaying English-language text.

NOTE: *For more information on Compatible Annunciators for use with the FireWarden-100-2, see the following data sheets (document numbers) ACM-8R (DN-3558), ACS/ACM Series (DN-0524), LDM Series (DN-0551), FDU-80 (DN-6820).*

COMPATIBLE ADDRESSABLE DEVICES

All feature a polling LED and rotary switches for addressing.

NI-100: Addressable low-profile ionization smoke detector.

NP-100: Addressable low-profile photoelectric smoke detector.

NP-100T: Addressable low-profile photoelectric smoke detector with thermal sensor.

NH-100: Fast-response, low-profile heat detector.

NH-100R: Fast-response, low-profile heat detector with rate-of-rise option.

ND-100: Photoelectric low-flow duct smoke detector.

ND-100R: Photoelectric low-flow duct smoke detector with relay option.

NMM-100: Addressable Monitor Module for one zone of normally-open dry-contact initiating devices. Mounts in standard 4.0" (10.16 cm.) box. Includes plastic cover plate and end-of-line resistor. Module may be configured for either a Style B (Class B) or Style D (Class A) IDC.

NDM-100: Dual Monitor Module. Same as NMM-100 except it provides two Style B (Class B) only IDCs.

NMM-100P: Miniature version of NMM-100. Excludes LED and Style D option. Connects with wire pigtails. May mount in device backbox.

NZM-100: Similar to NMM-100, but may monitor up to 20 conventional two-wire detectors. Requires resettable 24 VDC power. Consult factory for compatible smoke detectors.

NC-100: Addressable Control Module for one Style Y/Z (Class B/A) zone of supervised polarized Notification Appliances. Mounts directly to a 4.0" (10.16 cm.) electrical box. Notification Appliance Circuit option requires external 24 VDC to power notification appliances.

NC-100R: Addressable relay module containing two isolated sets of Form-C contacts, which operate as a DPDT switch. Mounts directly to a 4.0" (10.16 cm.) box, surface mount using the SMB500.

NOT-BG12LX: Addressable manual pull station with interface module mounted inside.

N100-ISO: Fault Isolator Module.

SMB500: Used to mount all modules except the NMM-100P.

NZM-100-6 Six-zone interface module. Mount one or two modules in a BB-2F cabinet (optional). Mount up to six modules on a CHS-6 chassis in a BB-6F.

NOTE: *For more information on Compatible Addressable Devices for use with the FireWarden-100-2, see the following data sheets (document numbers): N100-ISO (DN-6994), NP-100/NP-100T (DN-6995), NI-100 (DN-6996), NH-100/NH-100R (DN-6997), ND-100/ND-100R (DN-7006), NMM-100/NMM-100P/NDM-100/NZM-100 (DN-6999), NC-100/NC-100R (DN-7000), NOT-BG12LX (DN-7001), and NZM-100-6 (DN-60150).*

Wiring Requirements

While shielded wire is not required, it is recommended that all SLC wiring be twisted-pair to minimize the effects of electrical interference. Wire size should be no smaller than 18 AWG (0.78 mm^2) and no larger than 12 AWG (3.1 mm^2). The wire size depends on the length of the SLC circuit. Use the table below to determine the specific wiring requirements for the SLC.

SLC Wire Requirements	Distance in Feet (m)	Wire Size	Wire Type
Twisted-pair, unshielded	10,000 feet (3,048 m)	12 AWG (3.31 mm^2)	*Non-Plenum (FPLR):* Genesis 4315, Belden 5020UL
			Plenum (FPLP): Genesis 4515, Belden 6020UL
Twisted-pair, unshielded	8,000 feet (2,438 m)	14 AWG (2.08 mm^2)	*Non-Plenum (FPLR):* Genesis 4313, Belden 5120UL
			Plenum (FPLP): Genesis 4513, Belden 6120UL
Twisted-pair, unshielded	4,875 feet (1,486 m)	16 AWG (1.31 mm^2)	*Non-Plenum (FPLR):* Genesis 4311, Belden 5220UL
			Plenum (FPLP): Genesis 4511, Belden 6220UL
Twisted-pair, unshielded	3,225 feet (983 m)	18 AWG (0.821 mm^2)	*Non-Plenum (FPLR):* Genesis 4306, Belden 5320UL
			Plenum (FPLP): Genesis 4506, Belden 6320UL

FireWarden-100-2 Wire Requirements

SYSTEM SPECIFICATIONS

System Capacity

- Intelligent Signalling Line Circuits 1
- Addressable device capacity 198
- Programmable software zones 99
- Annunciators 32

Electrical Specifications

AC Power: FireWarden-100-2: 120 VAC, 60 Hz, 3.0 amps. FireWarden-100-2(E): 240 VAC, 50 Hz, 1.5 amps. Wire size: minimum 14 AWG (2.00 mm^2) with 600 V insulation.

Battery: Two 12 V 18AH lead-acid batteries. Battery charger capacity: 7 – 18 AH. FireWarden-100-2 cabinet holds maximum of two 18 AH batteries.

Communication Loop: Supervised and power-limited.

Notification Appliance Circuits: Each terminal block provides connections for two Style Y (Class B) or one Style Z (Class A) for a total of four Style Y (Class B) or two Style Z (Class A) NACs. Maximum signaling current per circuit: 2.5 amps. End-of-Line Resistor: 4.7K ohm, 1/2 watt (P/N 71252 UL listed) for Style Y (Class B) NAC. Refer to panel documentation and *Notifier Device Compatibility Document* for listed compatible devices.

Two Programmable Relays and One Fixed Trouble Relay: Contact rating: 2.0 amps @ 30 VDC (resistive), 0.5 amps @ 30 VAC (resistive). Form-C relays.

Special Application Power (24 VDC Nominal): Jumper selectable (JP4) for conversion to resettable power output. Up to 0.5 amps total DC current available from each output. Power-limited.

Four-Wire Resettable Special Application Smoke Detector Power (24 VDC nominal): Up to 0.5 amps for powering four-wire smoke detectors. Power-limited. Refer to *Notifier Device Compatibility Document* for listed compatible devices.

Remote Sync Output: Remote power supply synchronization output. Nominal special application power: 24 VDC. Maximum current: 40 mA. End-of-Line Resistor: 4.7K ohm. Output linked to NAC 1 control. Supervised and power-limited.

Telephone Interface: Requires dedicated business telephone number with a minimum of 7 volts DC. Obtain dedicated phone line directly from your local phone company. Do not use shared phone lines or PBX (digital) type phone line extensions.

Cabinet Specifications

Door: 19.26" (48.92 cm.) high x 16.82" (42.73 cm.) wide x 0.12" (.30 cm.) deep. **Backbox:** 19.00" (48.26 cm.) high x 16.65" (42.29 cm.) wide x 5.20" (13.34 cm.) deep. **Trim Ring (TR-CE-B):** 22.00" (55.88 cm.) high x 19.65" (49.91 cm.) wide.

Shipping Specifications

Weight: 26.9 lbs. (12.20 kg.) **Dimensions:** 20.00" (50.80 cm.) high x 22.5" (57.15 cm.) wide x 8.5" (21.59 cm.) deep.

Temperature and Humidity Ranges

This system meets NFPA requirements for operation at 0 – 49°C/32 – 120°F and at a relative humidity 93% ± 2% RH (noncondensing) at 32°C ± 2°C (90°F ± 3°F). However, the useful life of the system's standby batteries and the electronic components may be adversely affected by extreme temperature ranges and humidity. Therefore, it is recommended that this system and its peripherals be installed in an environment with a normal room temperature of 15 – 27°C/60 – 80°F.

NFPA Standards

The FireWarden-100-2 complies with the following NFPA 72 Fire Alarm Systems requirements:

- **LOCAL** (Automatic, Manual, Waterflow and Sprinkler Supervisory).
- **AUXILIARY** (Automatic, Manual and Waterflow) (requires 4XTM).
- **REMOTE STATION** (Automatic, Manual and Waterflow) (Where a DACT is not accepted, the alarm, trouble and supervisory relays may be connected to UL 864 listed transmitters. For reverse polarity signaling of alarm and trouble, 4XTM is required.)
- **PROPRIETARY** (Automatic, Manual and Waterflow).
- **CENTRAL STATION** (Automatic, Manual and Waterflow, and Sprinkler Supervised).
- **AUTO DETECTOR SELF TEST**

Agency Listings and Approvals

The listings and approvals below apply to the basic FireWarden-100-2 control panel. In some cases, certain modules may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

- **UL:** S635
- **FM approved**
- **CSFM:** 7165-0028:235
- **MEA:** 120-06-E, Volume 2

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NOTIFIER®

October 9, 2001 DN-6346 • H-116

HPX-751

HARSH™ Hostile-Area Smoke Head Analog Addressable Detector

Section: Intelligent/Addressable Devices

GENERAL

NOTIFIER's HARSH™ (Hostile-Area Smoke Head) HPX-751 smoke detector provides early warning smoke detection in hostile environments where traditional smoke detectors are not practical. Using a small air intake fan and a high-performance replaceable filter, air and smoke are drawn into a photoelectric sensing chamber, while unwanted airborne particulate and water mist are removed. This feature allows HARSH to operate in difficult applications, such as textile or paper mills, which due to environmental conditions tend to cause nuisance alarms with standard smoke detectors.

HARSH™ is a trademark of NOTIFIER.

UL LISTED S1115

ULC CS308 Vol. 19 *(HPX-751A)*

California State Fire Marshal 7272-0028:206

MEA 212-00-E

FM Approved

6346cov.jpg

FEATURES

- Analog intelligent communications.
- High-performance filter removes particulates down to 25 microns.
- Air delivery system is separately powered and fully supervised.
- Filter is easily field replaceable.
- Tolerant of external air velocity.
- Resistant to water vapor in applications where occasional hose-down cleaning is performed.
- Optional remote LED annunciator.
- Rotary DECADE address switches.
- Compatible with the AM2020, AFP1010, AFC-600, AFP-400, AFP-300, AFP-200, and AFP-100 (all software releases).
- Requires auxiliary 24 VDC from system or remote power supply.

SPECIFICATIONS

Size: 2.875" (73.025 mm) high, 3.375" (85.725 mm) high in base; diameter 4.0" (101.6 mm), 6.125" (155.575 mm) diameter in base.

Weight: 7.3 oz. (207 g).

Current draw, SLC: ***DETECTOR:*** 230 µA @ 24 VDC (without communication); 285 µA @ 24 VDC (one communication every 5 sec. with LED enabled).

Current draw, auxiliary 24 VDC (15 to 30 VDC filtered; ripple voltage may not drop below 15 volts): 6 mA standby; 60 mA when checking for smoke; 80 mA when checking for proper airflow. ***For battery calculation purposes,*** average standby current is 27 mA.

Operating voltage range: 15 – 32 volts DC peak.

Operating temperature range: 0°C to 49°C (32°F to 120°F).

Relative humidity: 10% – 93%, non-condensing.

Air velocity: 4,000 ft/1219.2 meters per minute maximum.

PRODUCT LINE INFORMATION

Model	*Description*
HPX-751	Hostile-environment smoke detector head.
HPX-751A	Canadian model.
B710HD	Flanged adapter base, 6.125" (155.575 mm) diameter.
RF-FTX	Replacement filter cover assembly, box of 6.
RA400Z	Remote LED annunciator, 3 – 32 VDC, fits U.S. single-gang electrical box.
M02-04-01	Test magnet.
M02-09-00	Test magnet with telescope stick.

NOTIFIER® 12 Clintonville Road, Northford, Connecticut 06472

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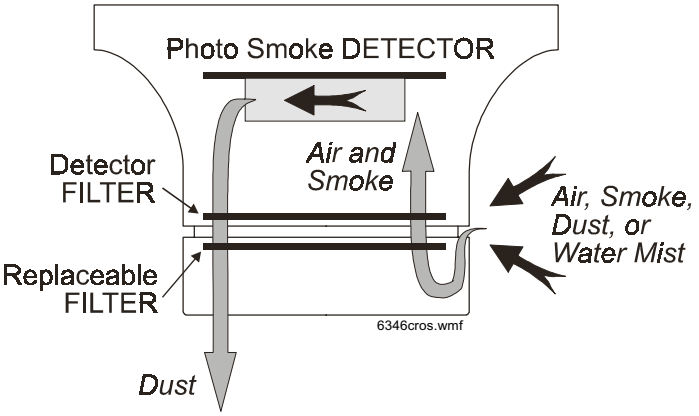
Operation overview diagram:

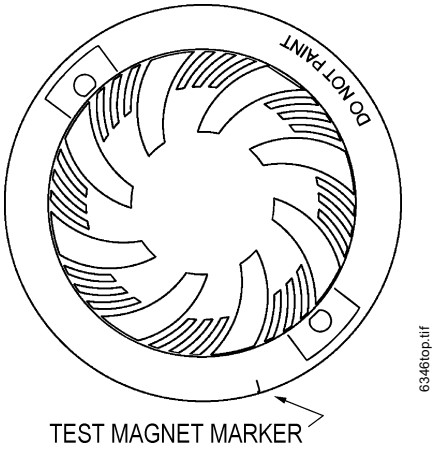


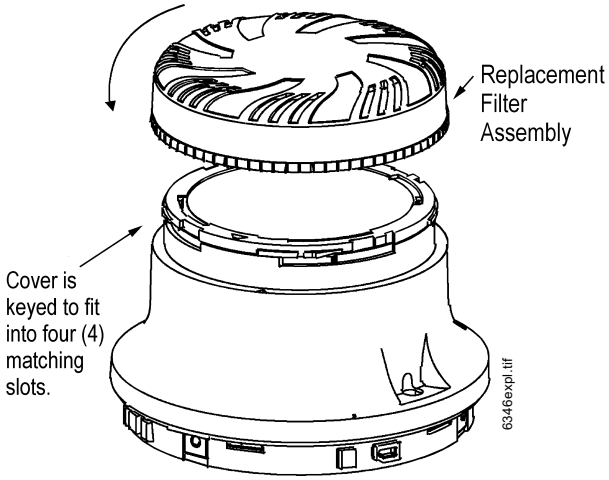
HARSH OPERATION OVERVIEW

Normal Operation — A miniature fan is pulsed on and off under microprocessor control to conserve power, yet provide good smoke response. The system uses two filters (one replaceable) that remove particulates while allowing smoke to pass.

Filter Supervision — Periodically, the filter system is tested for blockage using a special thermal airflow sensor. In reasonably clean environments, the filter is expected to last at least as long as the smoke-entry test period required by NFPA 72. In very dirty environments, the filter may need replacement more frequently.

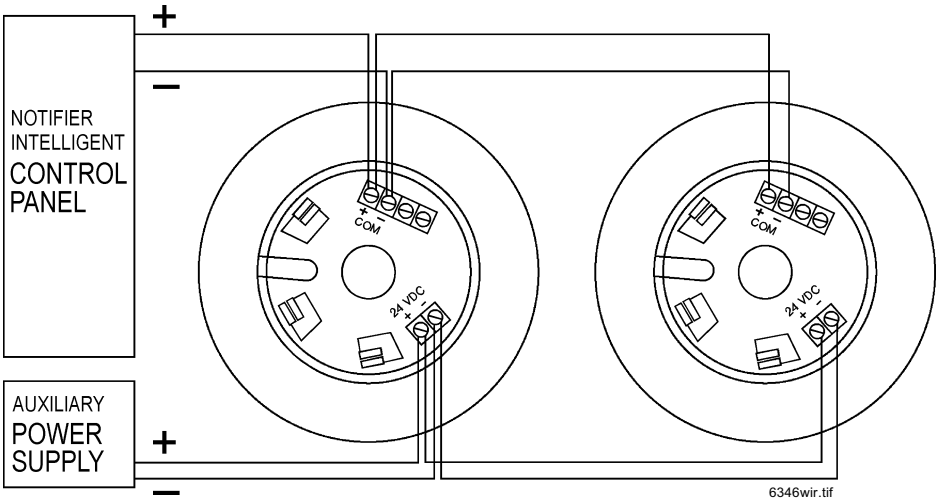
Filter Trouble Reporting — If HARSH determines that filter blockage is imminent, a warning trouble is indicated to the panel, followed by a return to normal. 72 hours after this warning, the detector will disconnect, giving a continuous trouble signal.





The HARSH detector contains both a permanent filter and a replaceable filter, a fan, and a photoelectric detector; to fit into a flanged adapter base.

WIRING DIAGRAM



FSP-851(A) Series

Intelligent Plug-In Photoelectric Smoke Detectors with FlashScan®

NOTIFIER® by Honeywell

Intelligent/Addressable Devices

General

Notifier FSP-851(A) Series intelligent plug-in smoke detectors with integral communication provide features that surpass conventional detectors. Detector sensitivity can be programmed in the control panel software. Sensitivity is continuously monitored and reported to the panel. Point ID capability allows each detector's address to be set with rotary, decimal address switches, providing exact detector location for selective maintenance when chamber contamination reaches an unacceptable level. The FSP-851(A) photoelectric detector's unique optical sensing chamber is engineered to sense smoke produced by a wide range of combustion sources. Dual electronic thermistors add 135°F (57°C) fixed-temperature thermal sensing on the FSP-851T(A). The FSP-851R(A) is a remote test capable detector for use with DNR(A)/DNRW duct detector housings. FSP-851(A) series detectors are compatible with Notifier Onyx and CLIP series Fire Alarm Control Panels (FACPs).

FlashScan® (U.S. Patent 5,539,389) is a communication protocol developed by Notifier that greatly increases the speed of communication between analog intelligent devices. Intelligent devices communicate in a grouped fashion. If one of the devices in the group has new information, the panel's CPU stops the group poll and concentrates on single points. The net effect is response speed greater than five times that of earlier designs.

Features

- Sleek, low-profile design.
- Addressable-analog communication.
- Stable communication technique with noise immunity.
- Low standby current.
- Two-wire SLC connection.
- Compatible with FlashScan® and CLIP protocol systems.
- Rotary, decimal addressing (1-99 on CLIP systems, 1-159 on FlashScan systems).
- Optional remote, single-gang LED accessory.
- Dual LED design provides 360° viewing angle.
- Visible bi-color LEDs blink green every time the detector is addressed, and illuminate steady red on alarm *(FlashScan systems only)*.
- Remote test feature from the panel.
- Walk test with address display (an address on 121 will blink the detector LED: 12-[pause]-1*(FlashScan systems only)*.
- Built-in functional test switch activated by external magnet.
- Built-in tamper-resistant feature.
- Sealed against back pressure.
- Constructed of off-white fire-resistant plastic, designed to commercial standards, and offers an attractive appearance.
- 94-5V plastic flammability rating.
- SEMS screws for wiring of the separate base.
- Optional relay, isolator, and sounder bases.

Specifications

Sensitivity: 0.5% to 2.35% per foot obscuration

Size: 2.1" (5.3 cm) high; base determines diameter.

- **B210LP(A):** 6.1" (15.5 cm) diameter.
- **B501(A):** 4.1" (10.4 cm) diameter.
- **B200S(A):** 6.875" (17.46 cm) diameter.
- **B200SR(A):** 6.875" (17.46 cm) diameter.
- **B224RB(A):** 6.2" (15.748 cm) diameter.
- **B224BI(A):** 6.2" (15.748 cm) diameter.

B210-2951.jpg

FSP-851(A) in B210LP(A) Base

Shipping Weight: 5.2oz. (147g).

Operating Temperature range: FSP-851(A), 0°C to 49°C (32°F to 120°F). FSP-851T(A), 0°C to 38°C (32°F to 100°F). Low temperature signal for FSP-851T(A) at 45°F +/- 10°F (7.22°C +/- 5.54°C). FSP-851R(A) installed in a DNR(A)/DNRW, -20°C to 70°C (-4°F to 158°F).

UL/ULC Listed Velocity Range: 0-4000 ft/min. (1219.2 m/min.), suitable for installation in ducts.

Relative Humidity: 10%-93% noncondensing.

Thermal Ratings: Fixed-temperature setpoint 135°F (57°C).

DETECTOR SPACING AND APPLICATIONS

Notifier recommends spacing detectors in compliance with NFPA 72. In low airflow applications with smooth ceiling, space detectors 30 feet (9.144m) for ceiling heights 10 feet (3.148m) and higher. For specific information regarding detector spacing, placement, and special applications refer to NFPA 72. *System Smoke Detector Application Guide*, document A05-1003, is available at systemsensor.com

ELECTRICAL SPECIFICATIONS

Voltage Range: 15-32 volts DC peak.

Standby Current (max. avg.): 300µA @ 24VDC (one communication every five seconds with LED enabled).

LED Current (max.): 6.5mA @ 24 VDC ("ON").

Installation

FSP-851(A) plug-in detectors use a separate base to simplify installation, service, and maintenance. A special tool allows maintenance personnel to plug in and remove detectors without using a ladder.

Mount base (all base types) on an electrical backbox which is at least 1.5" (3.81 cm) deep. For a chart of compatible junction boxes, see *DN-60054.*

NOTE: *1) Because of inherent supervision provided by the SLC loop, end-of-line resistors are not required. Wiring "T-taps" or branches are permitted for Style 4 (Class "B") wiring. 2) When using relay or sounder bases, consult the ISO-X(A) installation*

sheet I56-1380 for device limitations between isolator modules and isolator bases.

Agency Listings and Approvals

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. *Consult factory for latest listing status.*

- **UL Listed:** S1115.
- **ULC Listed:** S1115 (FSP-851A, FSP-851RA, FSP-851TA).
- **MEA Listed:** 225-02-E .
- **FM Approved.**
- **CSFM:** 7272-0028:0206 .
- **Maryland State Fire Marshal:** Permit # 2122 **.**
- **BSMI:** CI313066760036.
- **CCCF:** Certif. # 2004081801000017 (FSP-851T)
  Certif. # 2004081801000016 (FSP-851).
- **U.S. Coast Guard:** 161.002/42/1 (NFS-640); 161.002/50/0 (NFS2-640/NFS-320/NFS-320C, excluding B210LP(A)).
- **Lloyd's Register:** 11/600013 (NFS2-640/NFS-320/NFS-320C, excluding B210LP(A)).

Product Line Information

***NOTE:** "A" suffix indicates ULC Listed model.*

FSP-851: Low-profile intelligent photoelectric sensor. Must be mounted to one of the bases listed below.

FSP-851A: Same as FSP-851 but with ULC listing.

FSP-851T: Same as FSP-851 but includes a built-in 135°F (57°C) fixed-temperature thermal device.

FSP-851TA: Same as FSP-851T but with ULC listing.

FSP-851R: Low-profile intelligent photoelectric sensor, remote test capable. For use with DNRA/DNRW.

FSP-851RA: Same as FSP-851R but with ULC listing. For use with DNRA.

INTELLIGENT BASES

***NOTE:** "A" suffix indicates ULC Listed model.*

***NOTE:** For details on intelligent bases, see DN-60054.*

B210LP(A): Standard U.S. flanged low-profile mounting base.

B210LPBP: Bulk pack of B210LP; package contains 10.

B501(A): Standard European flangeless mounting base.

B501BP: Bulk pack of B501; package contains 10.

B200S(A): Intelligent, programmable sounder base capable of producing sound output in high or low volume with ANSI Temporal 3, ANSI Temporal 4, continuous tone, marching tone, and custom tone.

B200SR(A): Intelligent sounder base capable of producing sound output with ANSI Temporal 3 or continuous tone. Replaces B501BH series bases in retrofit applications.

B224RB(A): Plug-in System Sensor **relay** base. Screw terminals: up to 14 AWG (2.0 mm²). Relay type: Form-C. Rating: 2.0 A @ 30 VDC resistive; 0.3 A @ 110 VDC inductive; 1.0 A @ 30 VDC inductive.

B224BI(A): Plug-in System Sensor ***isolator*** detector base. Maximum 25 devices between isolator bases .

ACCESSORIES

F110: Retrofit flange to convert B210LP(A) to match the B710LP(A) profile, or to convert older high-profile bases to low-profile.

F110BP: Bulk pack of F110; package contains 15.

F210: Replacement flange for B210LP(A) base.

RA100Z(A): Remote LED annunciator. 3 – 32 VDC. Mounts to a U.S. single-gang electrical box. For use with B501(A) and B210LP(A) bases only.

SMB600: Surface mounting kit

M02-04-00: Test magnet.

M02-09-00: Test magnet with telescoping handle.

XR2B: Detector removal tool. Allows installation and/or removal of detector heads from bases in high ceiling applications.

XP-4: Extension pole for XR2B. Comes in three 5-foot (1.524 m) sections.

T55-127-010: Detector removal tool without pole.

BCK-200B: Black detector covers for use with FSP-851(A) only; box of 10.

WCK-200B: White detector covers for use with FSP-851(A) only; box of 10.

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www.notifier.com

NOT-BG12LX

Addressable Manual Pull Station

NOTIFIER® by Honeywell

Intelligent/Addressable Devices

General

The Notifier NOT-BG12LX is a state-of-the-art, dual-action (i.e., requires two motions to activate the station) pull station that includes an addressable interface for FireWarden series intelligent control panels, and the NSP-25 panel. Because the NOT-BG12LX is addressable, the control panel can display the exact location of the activated manual station. This leads fire personnel quickly to the location of the alarm.

Features

- Maintenance personnel can open station for inspection and address setting without causing an alarm condition.
- Built-in bicolor LED, which is visible through the handle of the station, flashes in normal operation and latches steady red when in alarm.
- Handle latches in down position and the word “ACTIVATED” appears to clearly indicate the station has been operated.
- Captive screw terminals wire-ready for easy connection to SLC loop (accepts up to 12 AWG/3.25 mm² wire).
- Can be surface mounted (with SB-10 or SB-I/O) or semi-flush mounted. Semi-flush mount to a standard single-gang, double-gang, or 4" (10.16 cm) square electrical box.
- Smooth dual-action design.
- Meets ADAAG controls and operating mechanisms guidelines (Section 4.1.3[13]); meets ADA requirement for 5 lb. maximum activation force.
- Highly visible.
- Attractive shape and textured finish.
- Key reset.
- Includes Braille text on station handle.
- Optional trim ring (BG12TR).
- Meets UL 38, Standard for Manually Actuated Signaling Boxes.

Construction

Shell, door, and handle are molded of durable polycarbonate material with a textured finish.

Specifications

- **Shipping Weight:** 9.6 oz. (272.15 g)
- **Normal operating voltage:** 24 VDC.
- **Maximum SLC loop voltage:** 28.0 VDC.
- **Maximum SLC standby current:** 375 µA.
- **Maximum SLC alarm current:** 5 mA.
- **Temperature Range:** 32°F to 120°F (0°C to 49°C)
- **Relative Humidity:** 10% to 93% (noncondensing)
- **For use indoors in a dry location**

Installation

The NOT-BG12LX will mount semi-flush into a single-gang, double-gang, or standard 4" (10.16 cm) square electrical outlet box, or will surface mount to the model SB-10 or SB-I/O surface backbox. If the NOT-BG12LX is being semi-flush mounted, then the optional trim ring (BG12TR) may be used.

The NOT-BG12LX
Addressable Manual Pull Station

The BG12TR is usually needed for semi-flush mounting with 4" (10.16 cm) or double-gang boxes (not with single-gang boxes).

Operation

Pushing in, then pulling down on the handle causes it to latch in the down/activated position. Once latched, the word “ACTIVATED” (in bright yellow) appears at the top of the handle, while a portion of the handle protrudes from the bottom of the station. To reset the station, simply unlock the station with the key and pull the door open. This action resets the handle; closing the door automatically resets the switch.

Each manual station, on command from the control panel, sends data to the panel representing the state of the manual switch. Two rotary decimal switches allow address settings (1 – 99 on NFW2-100/NFW2-100C, 1 – 50 for NFW-50/NFW-50C).

Architectural/Engineering Specifications

Manual Fire Alarm Stations shall be non-coded, with a key-operated reset lock in order that they may be tested, and so designed that after actual Emergency Operation, they cannot be restored to normal except by use of a key. An operated station shall automatically condition itself so as to be visually detected as activated. Manual stations shall be constructed of red-colored polycarbonate material with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in white letters, 1.00 inches (2.54 cm) or larger. Stations shall be suitable for surface mounting on matching backbox SB-10 or SB-I/O; or semi-flush mounting on a standard single-gang, double-gang, or 4" (10.16 cm) square electrical box, and shall be installed

within the limits defined by the Americans with Disabilities Act (ADA) or per national/local requirements. Manual Stations shall be Underwriters Laboratories listed.

Manual stations shall connect with two wires to one of the control panel SLC loops. The manual station shall, on command from the control panel, send data to the panel representing the state of the manual switch. Manual stations shall provide address setting by use of rotary decimal switches.

Product Line Information

NOT-BG12LX: Dual-action addressable pull station. Includes key locking feature. (Listed for Canadian and non-Canadian applications.)

SB-10: Surface backbox; metal.

SB-I/O: Surface backbox; plastic.

BG12TR: Optional trim ring.

17021: Keys, set of two.

Agency Listings and Approvals

In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

- **UL/ULC Listed:** S692 (listed for Canadian and non-Canadian applications).
- **MEA:** 67-02-E Vol. IV.
- **CSFM: 7150-0028:0199.**
- **FM Approved.**

Patented: U.S. Patent No. D428,351; 6,380,846; 6,314,772; 6,632,108.

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FDU-80

80 Character Liquid Crystal Display

NOTIFIER® by Honeywell

Annunciators

General

The FDU-80 is a compact, cost-effective, 80-character, backlit LCD remote Fire Annunciator for use with the NOTIFIER Fire-Warden-100-2, NFS2-640, and NFS-320 Fire Alarm Control Panels (FACPs). The FDU-80 mimics the display of the control panel and displays complete system point status information.

Up to 32 FDU-80s may be connected onto the EIA-485 terminal port of each FACP. The FDU-80 requires no programming, which saves time during system commissioning.

Features

- 80-character Liquid Crystal Display.
- Mimics all display information from the host panel.
- Control switches for System Acknowledge, Signal Silence, Drill and Reset with enable key.
- System status LEDs for Power, Alarm, Trouble, Supervisory and Alarm Silenced.
- No programming necessary — FDU-80 connects to the terminal porton the FACP.
- Displays device type identifiers, individual point alarm, trouble or supervisory, zone and custom alpha labels.
- Time-and-date display field.
- Aesthetically pleasing design.
- May be powered from the host FACP or by remote power supply (requires 24 VDC).
- Up to 32 FDU-80 annunciators per FACP.
- Plug-in terminal blocks for ease of installation and service.
- Can be remotely located up to 6,000 feet (1828.8 m) from the FACP.
- Local piezo sounder with alarm and trouble resound.
- Semi-flush mounts to 2.188" (5.556 cm) minimum deep, three-gang electrical box (NOTIFIER PN **10103**) or three-gangable electrical switchbox.
- Surface-mounts to NOTIFIER PN **SBB-3** surface backbox.

Operation

The FDU-80 annunciator provides the FACP with point annunciation with full display text on an 80-character LCD display. The FDU-80 also provides an array of LEDs to indicate system status, and includes control switches for remote control of critical system functions.

The FDU-80 provides the FACP with up to 32 remote serially connected annunciators. All field-wiring terminations on the FDU-80 use removable, compression-type terminal blocks for ease of wiring and circuit testing.

Communication between the FACP and the annunciators is accomplished over an EIA-485 serial interface, which greatly reduces wire and installation cost over traditional systems.

Installation

The FDU-80 can be semi-flush mounted to a 2.188" (5.556 cm) minimum deep, three-gang electrical box or three-gangable electrical switchboxes. Alternately, an SBB-3 surface backbox is available for surface-mount applications.

6820fdu8.jpg

Ordering Information

FDU-80: 80 character, backlit, LCD Fire Annunciator with control switches for remote control of system functions, and key-switch lock.

FDU-80C: ULC-listed version; see DN-60573 for details.

10103: Three-gang electrical box, minimum 2.188" (5.556 cm) deep, for semi-flush mount applications.

SBB-3: Three-gang surface backbox for surface-mount applications.

Agency Listings And Approvals

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

- **UL Listed:** S635
- **MEA Listed:** 245-00-E
- **FDNY:** COA#6038
- **CSFM: 7120-0028:209**
- **FM Approved**

NOTE: For ULC-listed version, see DN-60573.

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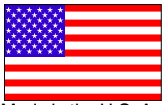

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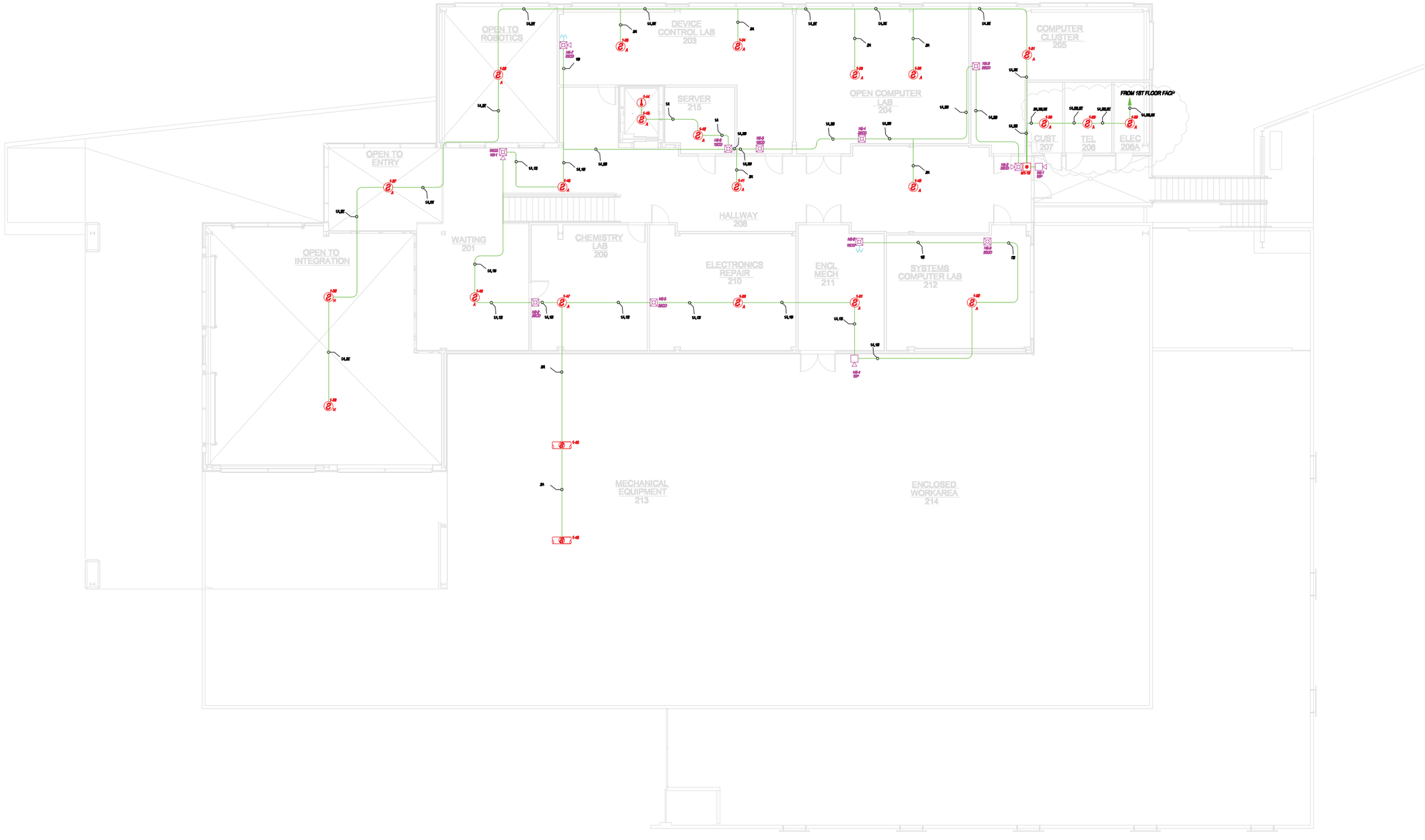
ELEV. EQUIP 103
ROBTOTICS 102
CART STOR 118
GROUP WORK/ SOCIETY 104
MDF 119
ELEC 115
LOBBY 101
HALLWAY 106
ANN
DF
CUST 113
WOMEN'S 112
MEN'S 111
METAL FAB/ MACHINE SHOP 114
TRANSFORMER
PROJECT INTERGRATION 107
TECH SUPPORT 117
WOODWORKING SHOP 115
DEDICATED PROJECT #1 108
DEDICATED PROJECT #2 109
DEDICATED PROJECT #3 110
TOOL STORAGE 116
COVERED WORK AREA
OUTDOOR WORK AREA
IN SLAB CONDUIT FROM RISER
TO SECOND FLOOR
FACP | FCPS
UNDERGROUND TO OSBY PROVIDED BY OTHERS

A.H.J. APPROVAL
03/06/2020

FIRE ALARM FLOOR PLAN FIRST FLOOR
1/8" = 1'

FA-2



03/06/2006 A.H.J. APPROVAL

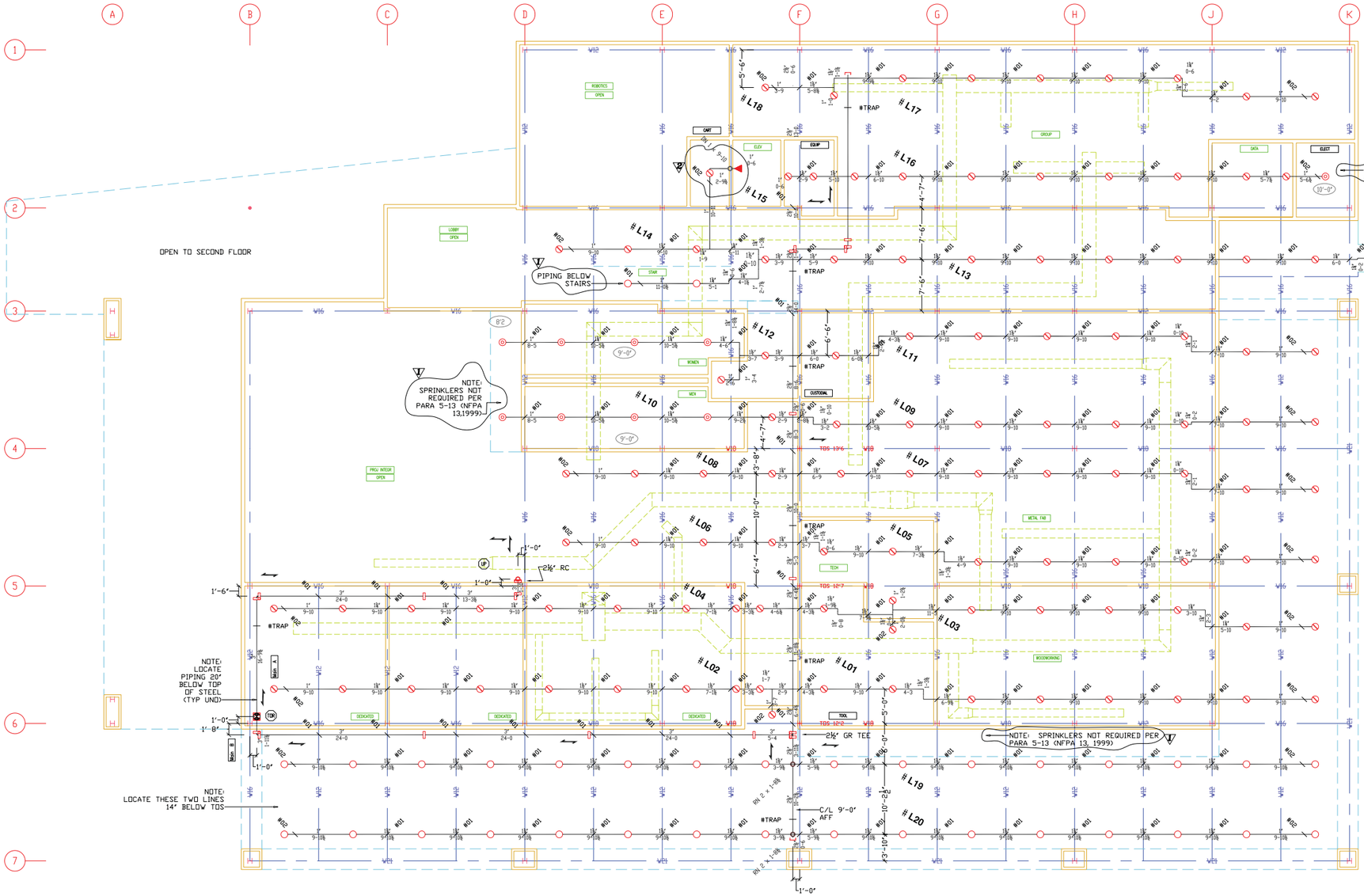
FIRE ALARM FLOOR PLAN SECOND FLOOR

1/8" = 1'

FA-3

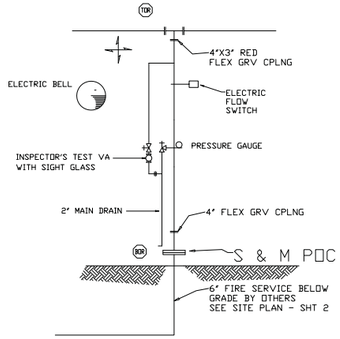
16 APPENDIX D – FIRE SPRINKLER SYSTEM DRAWINGS

Architectural Drawings



GROUND LEVEL FLOOR PLAN FF = 0'-0"

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



4" RISER ASSY

NO SCALE

DESIGN

PUBLIC AREAS, CLASSROOMS — STORAGE, EQUIPMENT,MAINTAINANCE

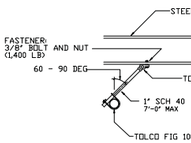
OCCUPANACY: LIGHT HAZARD — ORD HAZARD GP 1

DENSITY: .10 GPM/SF — .15 GPM/SF

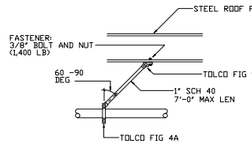
MAX HEAD SPACING: 225 SF — 130 GPM/SF

REMOTE AREA: SEE FLOOR PLAN (PARA 7-2.3.2.4)

PIPING: 2 1/2"-4" - SCHED 10 WITH GRVD FITTINGS
1"-2" - SCHED 30 WITH C I THREADED FITTINGS



LATERAL BRACE
MAX SPACING 40 FT



LONGITUDINAL BRACE
MAX SPACING 80 FT

SWAY BRACING

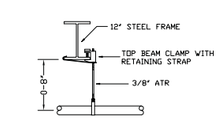
NO SCALE

"FIG C" - TABLE 4-14.4.3.5.6

SPRINKLER PIPING LOADS

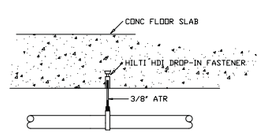
DIA	TYPE	LENGTH	1/2 WT/FT	1/2 TOTAL WT
1 "	SCH 30	50 FT	1.03 LB	51.5 LB
1¼ "	SCH 30	50 FT	1.47 LB	73.5 LB
1½ "	SCH 30	100 FT	1.81 LB	181 LB
2½ "	SCH 10	60 FT	2.95 LB	177 LB

TOTAL 1/2 WT OF PIPING 483 LB
FITTINGS ALLOW 15% 73 LB
TOTAL 556 LB



HANGER 01

NO SCALE



HANGER 02

NO SCALE

GENERAL NOTES

1. THE SPACING AND DETAILS OF THE SUPPORT AND BRACING OF THE FIRE SPRINKLER PIPING SHALL COMPLY WITH THE 1999 EDITION OF NFPA 13.
2. INSTALLATION OF THE SPRINKLER SYSTEM SHALL NOT BE STARTED UNTIL COMPLETE PLANS AND SPECIFICATIONS (INCLUDING WATER SUPPLY INFORMATION) HAVE BEEN APPROVED BY THE STATE FIRE MARSHAL. DRAWINGS AND CALCULATIONS SHALL BE STAMPED AND SIGNED BY A LICENSED C-16 FIRE PROTECTION CONTRACTOR.
3. AT VARIOUS STAGES AND UPON COMPLETION, THE SYSTEM MUST BE TESTED IN THE PRESENCE OF THE ENFORCING AGENCY.
4. PENETRATIONS OF RATED ASSEMBLIES SHALL BE FIRE-STOPPED. FIRE STOPPING SHALL BE AN APPROVED MATERIAL AS PRESCRIBED IN CALIFORNIA BUILDING CODE, SECTION 714.
5. ALL FIRE SPRINKLER DESIGN AND INSTALLATION SHALL COMPLY WITH THE 1999 EDITION OF NFPA 13
6. HEADS LOCATED ON PLAN ARE FOR VISUAL REFERENCE ONLY AND ARE NOT NECESSARILY CENTER LINE OF TILE.
7. THE LENGTH OF AN UNSUPPORTED ARMOVER TO A SPRINKLER SHALL NOT EXCEED 24 IN.
8. ALL PIPING SHALL BE HYDROSTATICALLY TESTED AT 200 PSI FOR 2 HRS PER NFPA 13 (1999) PARA 10-2.2.1
9. A SUPPLY OF SPARE SPRINKLERS SHALL BE PROVIDED PER NFPA 13 (1999) PARA 3-2.9

CSFM NO. 18-40-03-0001-000-370-0

HANGERS

HANGER - SEE DETAIL

NOTE: THESE DRAWINGS ARE THE PROPERTY OF S & M FIRE PROTECTION, INC. ALL DESIGN, HYDRAULIC CALCULATIONS AND OTHER INFORMATION ON THE DRAWINGS ARE FOR USE ON THE SPECIFIED PROJECT BY S & M FIRE PROTECTION ONLY, AND SHALL NOT BE USED OTHERWISE.

REVISIONS

NO.	DATE	BY	REVISION
1	6 Oct,2005	TPL	Per South Coast Engr Plan Review
2	15 Mar,2006	TPL	Per 1/10/06 Plan Review
3			
4			
5			

SYMBOLS

- UPRIGHT ON LINE
- PENDANT ON LINE
- UPRIGHT ON 1' SPRIG
- PENDANT ON 1' DROP
- UPRIGHT OVER PENDANT
- OTHER
- SIDEWALL ON 1/2" OUTLET
- 1/2" DRY PENDANT

SYMBOLS

- SWAY BRACING

SYMBOLS

- PIPE UP/DOWN
- GRVD COUPLING (FLEX)
- GRVD COUPLING (RIGID)
- SPRINKLER RISER
- HYDRAULIC CALC NODE PT
- LINE NO
- MAIN PIECE NO

SPRINKLERS

MFG / MODEL	SIN	FINISH	K	SYMB	DEGREE	QTY
1/2" TYCO TY-FRB UPRIGHT	TY3131	BRASS	5.6	○	200	36
1/2" TYCO TY-FRB PENDANT ON 1" DROP	TY3231	CHROME	5.6	◎	155	9
1/2" TYCO TY-FRB UPRIGHT ON 26" SPRIG	TY3131	BRASS	5.6	⊘	200	111
1/2" TYCO TY-FRB HORIZ SIDEWALL	TY3331	BRASS	5.6	◁	155	1
TOTAL SPRINKLERS THIS SHEET:						157

BONDERSON PROJECTS CENTER
COLLEGE OF ENGINEERING
SAN LUIS OBISPO, CA

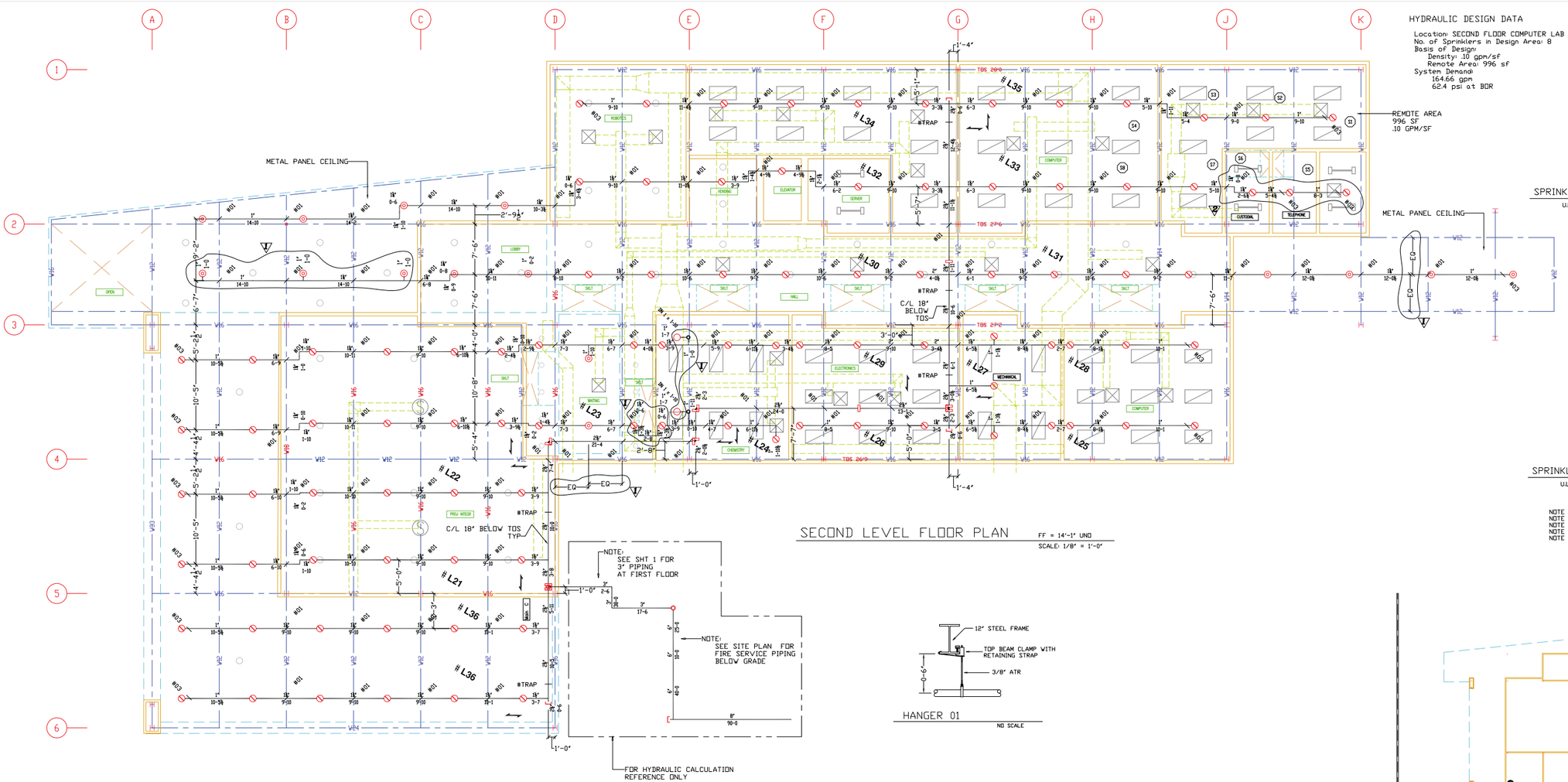
JTA JOB NO: 0309
PROJECT NO: PR 04-600

S & M FIRE PROTECTION, INC.
3523 S. Higuera St. Unit D
San Luis Obispo, CA 93401
C-16 713250
PHONE: (805) 541-4566

DRAWN BY: LOVERIN | SCALE: NOTED | DATE: 8 July 2005

JOB: 05C- 728

1 OF 2

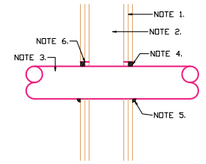


SECOND LEVEL FLOOR PLAN

FF = 14'-1" UNO
SCALE: 1/8" = 1'-0"

HYDRAULIC DESIGN DATA

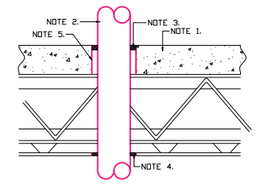
Location: SECOND FLOOR COMPUTER LAB
No. of Sprinklers in Design Area: 8
Basis of Design:
Density: .10 gpm/sf
Remote Area: 996 sf
System Demand:
164.66 gpm
62.4 psi at BDR



SPRINKLER PIPE THROUGH 1 HR OR 2 HR GYPSUM WALL ASSY

U.L. SYSTEM NO. W-L-1290 — NO SCALE

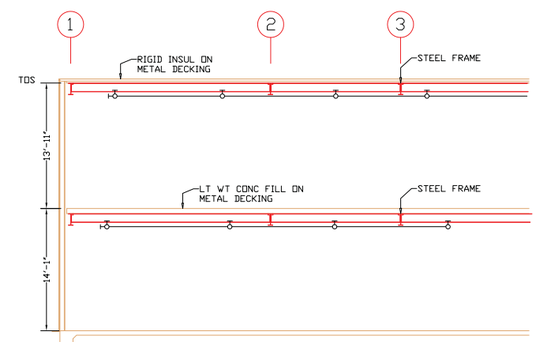
NOTE 1. GYPSUM WALL ASSY (1 HR OR 2 HR FIRE RATING)
NOTE 2. WOOD OR STEEL WALL STUDS
NOTE 3. MAX 4" NOM DIA STEEL PIPE (SCHED 10 OR HEAVIER)
NOTE 4. MINIMUM 5/8" DEPTH HILTI CP 606 FIRESTOP SEALANT
NOTE 5. MINIMUM 1/2" BEAD HILTI CP 606 FIRESTOP SEALANT
NOTE 6. MAX DIA OF OPENING 5" - MAX ANNULAR SPACE 1/2"



SPRINKLER PIPE THROUGH 1 HR CONC FLOOR/CEILING ASSY

U.L. SYSTEM NO. F-E-1004 — NO SCALE

NOTE 1. CONCRETE AND STEEL FLOOR/CEILING ASSY (1 HR FIRE RATING)
NOTE 2. MAX 6" NOM DIA STEEL PIPE (SCHED 40)
NOTE 3. MINIMUM 1/2" DEPTH HILTI FS-ONE FIRESTOP SEALANT
NOTE 4. MINIMUM 5/8" DEPTH HILTI FS-ONE FIRESTOP SEALANT
NOTE 5. DIAMETER OF OPENING TO BE MAX 1" LARGER THAT OD OF STEEL PIPE
ANNULAR SPACE = MIN 1/4", MAX 3/4"

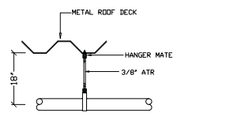


SECTION

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

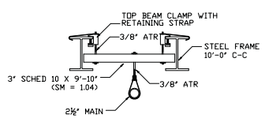
HANGER 01

NO SCALE



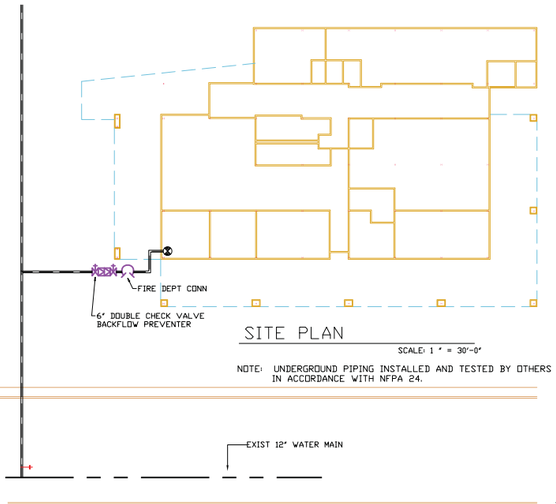
HANGER 03

NO SCALE



TRAPEZE ASSY

NO SCALE



SITE PLAN

SCALE: 1 " = 30'-0"

NOTE: UNDERGROUND PIPING INSTALLED AND TESTED BY OTHERS IN ACCORDANCE WITH NFPA 24.

FIRE HYDRANT TEST DATA

Location: 26
Hydrant No.: I-05-06
Static Pressure: 80 psi
Residual Pressure: 60 psi
Observed Flow: 1,210 gpm
Calculated Flow at 20 psi: 2,190 gpm
Test Date: 9/3/02
Data Provided By: F.P.C.P. - Cal Poly

BUILDING CODE ANALYSIS

BUILDING	OCCUPANCY GROUP	CONST TYPE	HEIGHT	AREA
FIRST FLOOR	B/F	II-N SPRINK	14'-1"	12,240 SF
SECOND FLOOR	B/F	II-N SPRINK	29'	6,335 SF

CSFM NO. 18-40-03-0001-000-370-0

HANGERS

- HANGER - SEE DETAIL

REVISIONS

NO.	DATE	BY	REVISION
1	6 Oct, 2005	TPL	Per South Coast Engr Plan Review
2	15 Mar, 2006	TPL	Per 1/10/06 Plan Review
3			
4			
5			

SYMBOLS

- UPRIGHT ON LINE
- PENDANT ON LINE
- UPRIGHT ON 1' SPRIG
- PENDANT ON 1' DROP
- UPRIGHT OVER PENDANT
- OTHER
- SIDEWALL ON 1/2" OUTLET
- 1/2" DRY PENDANT

SYMBOLS

- SWAY BRACING

SYMBOLS

- PIPE UP/DOWN
- GRVD COUPLING (FLEX)
- GRVD COUPLING (RIGID)
- SPRINKLER RISER
- HYDRAULIC CALC NODE PT
- LINE NO
- MAIN PIECE NO

SPRINKLERS

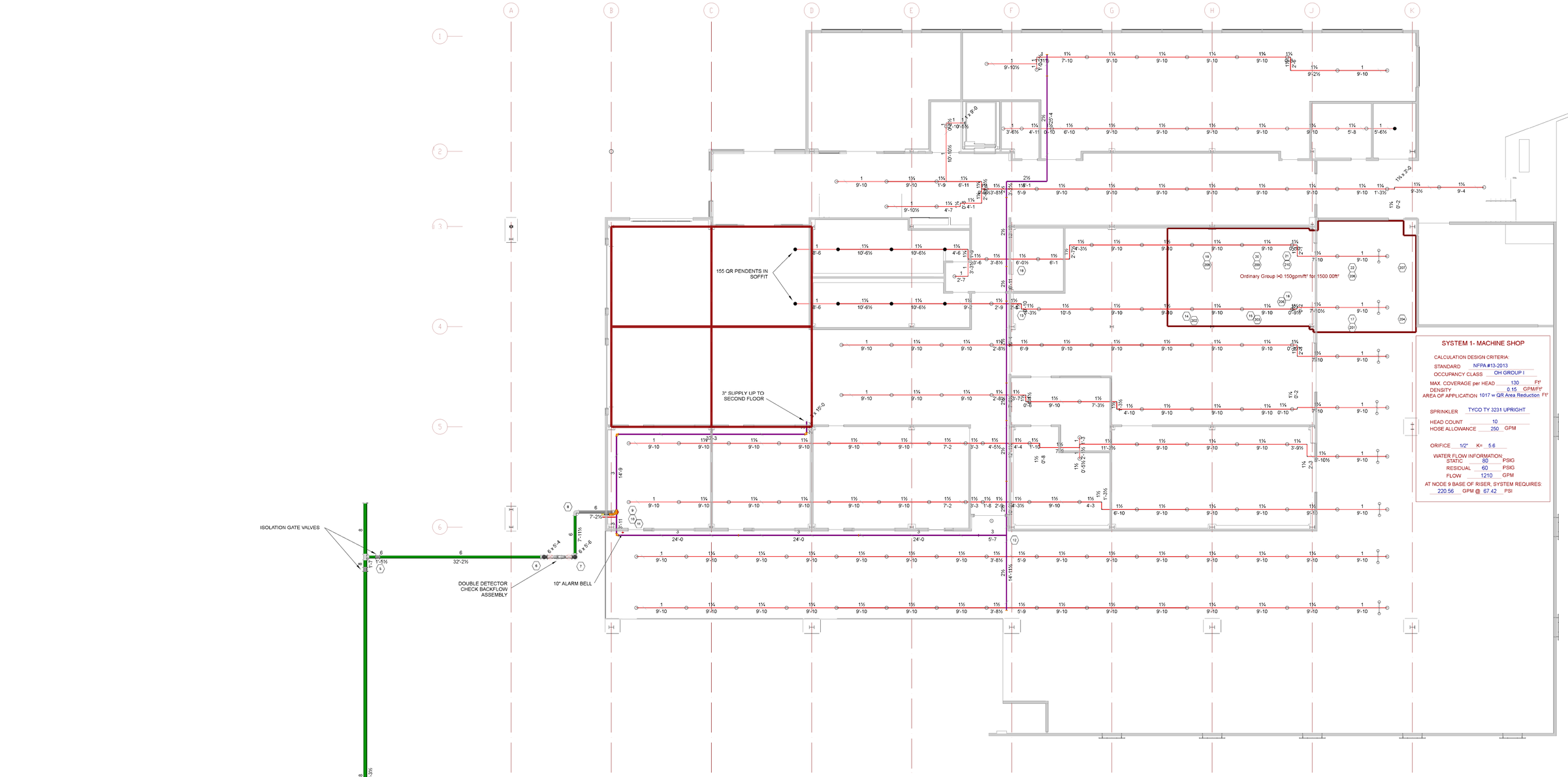
MFG / MODEL	SIN	FINISH	K	SYMB	DEGREE	QTY
1/2" TYCO TY-FRB PENDANT ON 1" DROP	TY3231	CHR	5.6	◎	155	15
1/2" TYCO TY-FRB UPRIGHT ON 8" SPRIG	TY3131	BRASS	5.6	⊘	200	97
1/2" TYCO TY-FRB UPRIGHT	TY3131	BRASS	5.6	○	200	2
TOTAL SPRINKLERS THIS SHEET:						114

BONDERSON PROJECTS CENTER
COLLEGE OF ENGINEERING
SAN LUIS OBISPO, CA

JTA JOB NO: 0309
PROJECT NO: PR 04-600

S & M FIRE PROTECTION, INC.
3523 S. Higuera St. Unit D
San Luis Obispo, CA 93401
C-16 713250
PHONE: (805) 541-4566

JOB: 05C- 728
DRAWN BY: LOVERIN
SCALE: NOTED
DATE: 8 July 2005



SYSTEM 1- MACHINE SHOP

CALCULATION DESIGN CRITERIA:

STANDARD	NFPA #13-2013	
OCCUPANCY CLASS	OH GROUP I	
MAX. COVERAGE per HEAD	130	Ft²
DENSITY	0.15	GPM/Ft²
AREA OF APPLICATION	1017 w QR Area Reduction	Ft²
SPRINKLER	TYCO TY 3231 UPRIGHT	
HEAD COUNT	10	
HOSE ALLOWANCE	250	GPM
ORIFICE	1/2"	K= 5.6

WATER FLOW INFORMATION:

STATIC	80	PSIG
RESIDUAL	60	PSIG
FLOW	1210	GPM

AT NODE 9 BASE OF RISER, SYSTEM REQUIRES:
220.56 GPM @ 67.42 PSI

Coordination Sign-off

Contractor	Signature	Date
Mechanical		
Electrical		
Plumbing		

North

Sprinkler Head Information

	Brand / SIN #	Model	Symbol	Type	Size	Temperature	K	Finish	Escutcheon	Quantity
(E) UPRIGHT	TYCO TY3231	TY-FRB	⊠	QR SSU	1/2"	200º	5.6	BRASS	N/A	147
(E) PENDENT	TYCO TY3232	TY-FRB	●	QR SSP	1/2"	155º	5.6	CHROME	CHROME	9
(E) HORIZONTAL SIDEWALL	TYCO TY3331	TY-FRB	⊬	QR SSP	1/2"	155º	5.6	BRASS	CHROME	1
									Total Heads This Sheet	157

Sprinkler Head Symbols

- (E) SIDEWALL SPRINKLER
- (E) QR PENDENT
- (E) QR UPRIGHT

Standard Symbols

- Hanger Location
- End of Line Restraint
- Existing Piping

0 4' 8' 16'
SCALE: 1/4" = 1'-0"

REVISIONS

	DATE
0 FPE PROJECT BUILDING ANALYSIS	1/19/2015

CAL POLY
TELEPHONE : (650) 594-1588
FAX : (650) 594-1613
Email: Garrett@walschon.com

Job No.	197
Date	1-19-15
Designer	GB
Checked	CN
Scale	1/8" = 1'-0

Bonderson Projects Center
Building 197
San Luis Obispo CA, 93401
First Floor Piping Plan

FP-1.0

1 of 2

SCOPE OF WORK

BONDERSON ENGINEERING PROJECTS CENTER (BEPC) IS A PROPOSED 2-STORY, APPROX 20,000 SQ FT, STL-FRAMED BLDG DEDICATED TO COLLEGE OF ENGINEERING STUDENTS' DEVELOPING THEIR SENIOR PROJECTS. VOCATIONAL-SHOP-TYPE, COMPUTER, OFFICE AND SUPPORT SPACES ARE INCLUDED, ALONG WITH PAVED OUTDOOR WORK AREA ENCLOSED BY CONC WALLS AND STL FENCING. SITEWORK EXTENDS BEYOND BUILDING FOOTPRINT TO INTEGRATE BLDG WITH ITS SURROUNDINGS, PROVIDE A SETTING FOR INFORMAL GATHERING & TO PROVIDE ACCESSIBILITY.

ACCESSIBILITY STRATEGY

TO PROVIDE ACCESSIBILITY TO BEPC FROM SURROUNDINGS & THROUGHOUT BEPC, STRATEGY IS AS FOLLOWS:

(E) GENTLY-INCLINED SIDEWALK POT AT S EDGE OF SITE (ALONG N PERIMETER ROAD) IS KEY TO BEPC ACCESSIBILITY:

– CROSSWALKS & CURB DEPRESSIONS AT N PERIMETER ROAD INTERSECTIONS IMMEDIATELY SOUTHWEST & SOUTHEAST OF SITE LINK SIDEWALK POT TO OTHER COLLEGE OF ENGINEERING FACILITIES, ACCESSIBLE PARKING & GREATER CAMPUS

– SIDEWALK POT IN TURN SHALL PROVIDE ACCESS TO BEPC'S W & E ENTRANCES VIA POT THAT EXTEND NORTHWARD TO ENGINEERING IV FLANK SITE ON W AND E, RESPECTIVELY

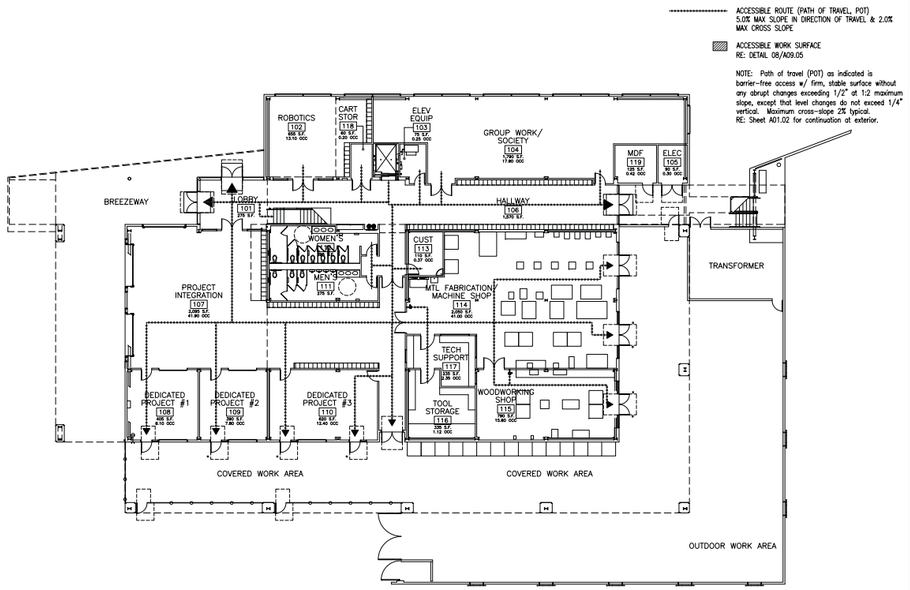
– ACCESS TO BEPC SECONDARY ENTRANCES FRONTING OUTDOOR WORK AREA SHALL BE FROM SIDEWALK POT

ACCESSIBLE PARKING FOR BEPC SHALL BE PROVIDED IMMEDIATELY E OF SITE AS PART OF ENGINEERING IV PROJECT. POT PROVIDING ACCESS TO E ENTRY OF BEPC SHALL SERVE ACCESSIBLE PARKING. POT TO BEPC E ENTRANCE SHALL DESCEND GRADUALLY (2% MAX SLOPE) ABOUT 3 FT, FROM NATURAL GRADE AT PARKING TO BEPC GROUND LEVEL FFE.

INTERMEDIATE LANDING AT E ENTRANCE, ABOUT 4 FT ABOVE GROUND FFE SHALL BE ACCESSIBLE, WITH AN EMERG "BLUE" PHONE. ANOTHER, EXISTING EMERG "BLUE" PHONE, ALSO ACCESSIBLE, SHALL BE MAINTAINED AT SOUTHWEST OF SITE.

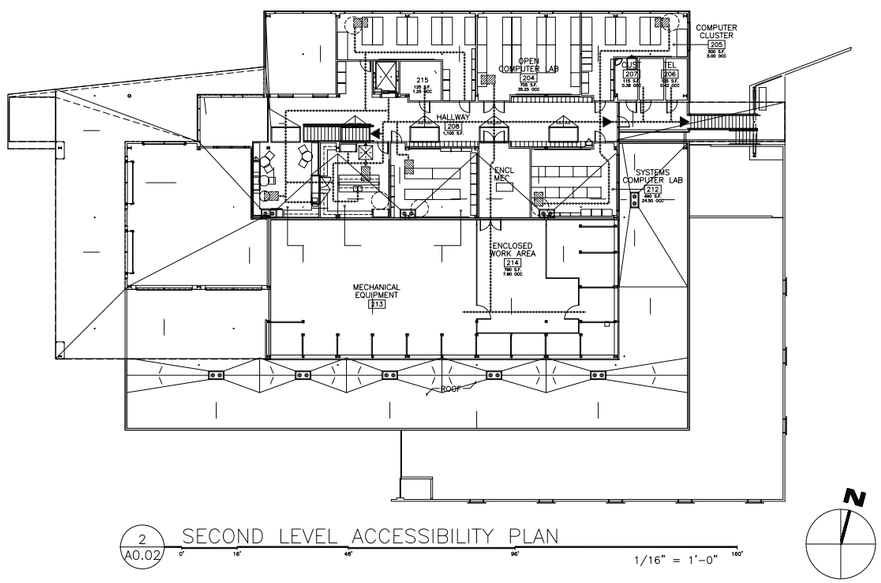
ACCESS TO W PART OF SITE SHALL BE VIA A N–S POT THAT SHALL LINK SIDEWALK POT TO FORMAL W ENTRANCE OF BEPC & BEYOND, ENGINEERING IV. A POT CONNECTS ACCESSIBLE GATES INTO OUTDOOR WORK AREA & DOORS INTO INDIVIDUAL SHOP SPACES ALONG BEPC'S S & E SIDES (& ULTIMATELY, VIA ANOTHER GATE, E BEPC ENTRANCE).

ACCESS TO BEPC GROUND LEVEL, THEREFORE, SHALL BE VIA W, E & SECONDARY ENTRANCES. GROUND LEVEL, SECOND LEVEL SHALL BE ACCESSIBLE THROUGHOUT, EXCEPT NON-PUBLIC ROOF AREAS. ENCLOSED WORK AREA "ROOM" 214, OPEN TO SKY, SHALL BE ACCESSIBLE. ACCESS FROM GROUND TO SECOND LEVELS IS VIA AN ACCESSIBLE, HYDRAULIC ELEV. RMS WHERE AN INFORMAL LECTURE SITUATION IS ANTICIPATED SHALL BE EQUIPPED W/ ASSISTED LISTENING DEVICES.



1 A0.02 GROUND LEVEL ACCESSIBILITY PLAN

1/16" = 1'–0"



2 A0.02 SECOND LEVEL ACCESSIBILITY PLAN

1/16" = 1'–0"

AREA TABULATION – GROUND LEVEL

NUMBER	NAME / ACTIVITY	AREA (SQ FT) ROOM AREA	LESS THRU CIRCULATION	NET AREA	OCCUPANCY PER UBC TABLE 3–A	USE CLASSIFICATION PER UBC TABLE 10–A	OCCUPANT LOAD FACTOR PER UBC TABLE 10–A	OCCUPANT LOAD
101	ENTRY	275	275	–	B	–	–	–
102	ROBOTICS	655	–	655	B	VOCATIONAL ROOM	50	13.10
103	ELEVATOR EQUIPMENT	75	–	75	B	MECHANICAL EQUIPMENT	300	0.25
104	GROUP WORK / SOCIETY	1,790	–	1,790	B	OFFICE	100	17.90
105	ELECTRICAL	90	–	90	B	MECHANICAL EQUIPMENT	300	0.30
106	HALLWAY	1,570	1,570	–	B	–	–	–
107	PROJECT INTEGRATION	2,095	–	2,095	B	VOCATIONAL ROOM	50	41.90
108	DEDICATED PROJECT #1	405	–	405	B	VOCATIONAL ROOM	50	8.10
109	DEDICATED PROJECT #2	390	–	390	B	VOCATIONAL ROOM	50	7.80
110	DEDICATED PROJECT #3	620	–	620	B	VOCATIONAL ROOM	50	12.40
111	MEN'S	295	295	–	B	–	–	–
112	WOMEN'S	275	275	–	B	–	–	–
113	CUSTODIAL	110	–	110	B	STORAGE & STOCK	300	0.37
114	METAL FABRICATION/MACHINE SHOP	2,050	–	2,050	B	SCHOOL SHOP	50	41.00
115	WOODWORKING SHOP	790	–	790	B	SCHOOL SHOP	50	15.80
116	TOOL STORAGE	335	–	335	B	STORAGE & STOCK	300	1.12
117	TECH SUPPORT	235	–	235	B	OFFICES	100	2.35
118	CART STORAGE	60	–	60	B	STORAGE & STOCK	300	0.20
119	MAIN DATA FRAME	125	–	125	B	STORAGE & STOCK	300	0.42
	GROUND LEVEL TOTALS	12,240	2,415	9,825				163.01

AREA TABULATION – SECOND LEVEL

NUMBER	NAME / ACTIVITY	AREA (SQ FT) ROOM AREA	LESS THRU CIRCULATION	NET AREA	OCCUPANCY PER UBC TABLE 3–A	USE CLASSIFICATION PER UBC TABLE 10–A	OCCUPANT LOAD FACTOR PER UBC TABLE 10–A	OCCUPANT LOAD
201	WAITING	410	–	410	B	(ACCESSORY TO HALLWAY)	–	–
202	VENDING	95	–	95	B	(ACCESSORY TO HALLWAY)	–	–
203	DEVICE CONTROL LAB	650	–	650	B	VOCATIONAL ROOM	50	13.00
204	OPEN COMPUTER LAB	705	–	705	B	CLASSROOM	20	35.25
205	COMPUTER CLUSTER	500	–	500	B	OFFICE	100	5.00
206	TELECOMMUNICATION	125	–	125	B	MECHANICAL EQUIPMENT	300	0.42
207	CUSTODIAL	110	–	110	B	STORAGE & STOCK	300	0.37
208	HALLWAY	1,100	1,100	–	B	–	–	–
209	CHEMISTRY LAB	425	–	425	B	VOCATIONAL SHOP	50	8.50
210	ELECTRONICS REPAIR	490	–	490	B	VOCATIONAL SHOP	50	9.80
211	ENCLOSED MECHANICAL	310	–	310	B	MECHANICAL EQUIPMENT	300	1.10
212	SYSTEMS COMPUTER LAB	490	–	490	B	CLASSROOM	20	24.50
213	MECHANICAL BAY	–	–	–	B	–	–	–
214	ENCLOSED WORK AREA	790	–	790	B	ALL OTHERS	100	7.90
215	SERVER	125	–	125	B	OFFICE	100	1.25
	SECOND LEVEL TOTALS	6,335	1,100	5,235				107.09
	1ST LEVEL TOTALS	12,240	2,415	9,825				163.01
	GRAND TOTALS	18,575	3,515	15,060				270.1

CODE ANALYSIS

APPLICABLE CODES:
1. CALIFORNIA CODE OF REGULATIONS (CCR), INCLUDING TITLES 19 & 24
2. AMERICANS WITH DISABILITIES ACT (ADA)
3. CALIFORNIA BUILDING CODE, 2001 (AS AMENDED & INCLUDED IN CCR TITLE 24)

OCCUPANCY CLASSIFICATION:
B /F – "BUSINESS" W/ WOODSHOP AS ACCESSORY USE (<10% OF TOTAL AREA)

CONSTRUCTION TYPE:
II–N; SPRINKLED

ALLOWABLE FLOOR AREA:

ALLOWABLE AREA (TABLE 5B)	12,000 SQ FT
MULTISTORY INCREASE (504.2)	12,000 SQ FT
BASIC ALLOWABLE FLOOR AREA:	24,000 SQ FT

ALLOWABLE AREA INCREASES:

> 20' SEPARATION ON ALL SIDES @ 100% (505.1.3)	24,000 SQ FT
ADJUSTED ALLOWABLE FLOOR AREA	48,000 SQ FT

ACTUAL FLOOR AREAS:

FIRST FLOOR AREA:	12,240 SQ FT
ALLOWABLE FLOOR AREA:	24,000 SQ FT
THEREFORE THE FIRST FLOOR AREA IS IN COMPLIANCE	
SECOND FLOOR AREA:	6,335 SQ FT
ALLOWABLE FLOOR AREA:	24,000 SQ FT
THEREFORE THE SECOND FLOOR AREA IS IN COMPLIANCE	
TOTAL BUILDING FLOOR AREA:	18,575 SQ FT
ALLOWABLE FLOOR AREA:	48,000 SQ FT
THEREFORE THE BUILDING FLOOR AREA IS IN COMPLIANCE	

ALLOWABLE HEIGHT:

ACTUAL HEIGHT:	29'–0"
ALLOWABLE HEIGHT (TABLE–5B)	55'–0"
THEREFORE, BUILDING HEIGHT IS IN COMPLIANCE	

FIRE RESISTIVE REQUIREMENTS:

EXTERIOR NON–BEARING & BEARING WALL:	ONE–HOUR < 20 FT NON RATED ELSEWHERE
EXTERIOR OPENINGS:	NOT PERMITTED < 5 FT PROTECTED < 10 FT
STRUCTURAL FRAME:	NON–RATED
PERMANENT PARTITIONS:	NON–RATED
SHAFT ENCLOSURES:	NON–RATED < 2 STORIES
STAIRWAY:	NON–COMBUSTABLE
FLOOR–CEILING & ROOF–CEILING	NON–RATED

INTERNAL OCCUPANCY SEPARATION:
I. FIRE–RATED SEPARATION BETWEEN USES WITHIN THE MAIN BUILDING:
A. "LABORATORIES AND VOCATIONAL SHOPS IN BUILDINGS USED FOR EDUCATIONAL PURPOSES, AND SIMILAR AREAS CONTAINING HAZARDOUS MATERIALS, SHALL BE SEPARATED FROM EACH OTHER AND FROM OTHER PORTIONS OF THE BUILDING BY NOT LESS THAN ONE–HOUR FIRE–RESISTIVE OCCUPANCY SEPARATION: (CBC 304.2.2.1).
1. HAZARDOUS MATERIALS TO BE USED IN CHEMISTRY LABORATORY, ROOM 209 AS PROVIDED BY COLLEGE OF ENGINEERING AND PER CBC TABLE 3–D AND 3–E, ARE WITHIN EXEMPT QUANTITIES FOR USE AND STORAGE.
2. THEREFORE, OCCUPANCY IS "B" NOT "H" AND THE REQUIREMENTS OF CBC SECTIONS 307.5 AND 307.8 SHALL APPLY.

EXITING REQUIREMENTS:
B–OCCUPANCY CORRIDORS SHALL BE OF ONE–HOUR CONSTRUCTION W/ 20–MIN DOOR OPENINGS & 45–MIN WINDOW OPENINGS (1007.4.3).

OCCUPANTS IN LABORATORIES HAVING AN AREA IN EXCESS OF 200 SQ FT SHALL HAVE ACCESS TO AT LEAST TWO EXITS OR EXIT ACCESS DOORS FROM THE ROOM AND ALL PORTIIONS OF THE ROOM SHALL BE WITHIN 75 FEET OF AN EXIT OR EXIT–ACCESS DOOR. (CBC SECTION 304.2.2.1)

FOR PLUMBING FIXTURE OCCUPANT LOAD
RE: MEMORANDUM #03 FROM CAL POLY, DATED 08/13/2004

	WATER CLOSETS	URINALS	LAVATORIES
MEN'S	1 PER 40	1 PER 35	1 PER 40
WOMEN'S	1 PER 30	–	1 PER 40
REQ'D MEN'S	(½0)120=3	(½5)120=4	(½0)120=3
REQ'D WOMEN'S	7	–	(½0)120=3

GROUND LEVEL
I. OFFICES
A. ALLOWED SQ FT PER OCCUPANT (CBC TABLE 10–A): 100
B. OFFICES (NET USABLE): 2,025 SQ FT
C. TOTAL OCCUPANTS: 20.25
D. TOTAL EXITS REQUIRED: 1
E. TOTAL EXIT WIDTH REQUIRED (CBC 1003.2): (20.25)(.2)= 4.1"
II. MECHANICAL EQUIPMENT
A. ALLOWED SQ FT PER OCCUPANT (CBC TABLE 10–A): 300
B. MECHANICAL EQUIPMENT (NET USABLE): 165 SQ FT
C. TOTAL OCCUPANTS: .55
D. TOTAL EXITS REQUIRED: 1
E. TOTAL EXIT WIDTH REQUIRED (CBC 1003.2): (.55)(.2) = 0.1"
III. SCHOOL SHOP & VOCATIONAL ROOMS
A. ALLOWED SQ FT PER OCCUPANT (CBC TABLE 10A): 50
B. SCHOOL SHOP & VOCATIONAL ROOMS (NET USABLE): 7,190 SQ FT
C. TOTAL OCCUPANTS: 28.40
D. TOTAL EXITS REQUIRED: 1
E. TOTAL EXIT WIDTH REQUIRED (CBC 1003.2): (28.40)(.2)=5.6"
IV. STORAGE & STOCK
A. ALLOWED SQ FT PER OCCUPANT (CBC TABLE 10–A): 300
B. STORAGE & STOCK (NET USABLE): 630 SQ FT
C. TOTAL OCCUPANTS: 2.1
D. TOTAL EXITS REQUIRED:1
E. TOTAL EXIT WIDTH REQUIRED (CBC 1003.2): (2.1)(.2) = 0.4"

TOTAL OCCUPANTS GROUND LEVEL: 163.01; TOTAL EXITS REQUIRED: 2; TOTAL EXIT WIDTH REQUIRED: (163.01)(.2)=32.6"

2ND LEVEL
I. CLASSROOM
A. ALLOWED SQ FT PER OCCUPANT (CBC TABLE 10–A): 20
B. CLASSROOM (NET USABLE): 1195 SQ FT
C. TOTAL OCCUPANTS, CLASSROOM: 59.75
D. TOTAL EXITS REQUIRED: 2
E. TOTAL EXIT WIDTH REQUIRED (CBC 1003.2): (59.75)(.2) = 11.95"
II. OFFICES
A. ALLOWED SQ FT PER OCCUPANT (CBC TABLE 10–A): 100
B. OFFICES (NET USABLE): 625 SQ FT
C. TOTAL OCCUPANTS, OFFICES: 6.25
D. TOTAL EXITS REQUIRED: 1
E. TOTAL EXIT WIDTH REQUIRED (CBC 1003.2): (6.25)(.2) = 1.3"
III. MECHANICAL EQUIPMENT
A. ALLOWED SQ FT PER OCCUPANT (CBC TABLE 10–A): 300
B. MECHANICAL EQUIPMENT (NET USABLE): 435 SQ FT
C. TOTAL OCCUPANTS, MECHANICAL EQUIPMENT: 1.45
D. TOTAL EXITS REQUIRED: 1
E. TOTAL EXIT WIDTH REQUIRED (CBC 1003.2): (1.45)(.2) = 0.3"
IV. STORAGE AND STOCK ROOMS
A. ALLOWED SQ FT PER OCCUPANT (CBC TABLE 10–A): 300
B. STORAGE AND STOCK ROOMS (NET USABLE): 110 SQ FT
C. TOTAL OCCUPANTS, STORAGE & STOCK: 0.42
D. TOTAL EXITS REQUIRED: 1
E. TOTAL EXIT WIDTH REQUIRED (CBC 1003.2): (0.42)(.2)(1) = .1"
V. VOCATIONAL ROOMS
A. ALLOWED SQ FT PER OCCUPANT (CBC TABLE 10–A): 50
B. VOCATIONAL ROOMS (NET USABLE): 1,565 SQ FT
C. TOTAL OCCUPANTS, VOCATIONAL ROOMS: 31.3
D. TOTAL EXITS REQUIRED: 1
E. TOTAL EXIT WIDTH REQUIRED (CBC 1003.2): (31.3)(.2)(1) = 6.3"
VI. ALL OTHERS
A. ALLOWED SQ FT PER OCCUPANT (CBC TABLE 10–A): 100
B. ALL OTHERS (NET USABLE): 790 SQ FT
C. TOTAL OCCUPANTS: 7.9
D. TOTAL EXITS REQUIRED:1
E. TOTAL EXIT WIDTH REQUIRED (CBC 1003.2): (7.9)(.2) = 1.6"

TOTAL OCCUPANTS, 2ND LEVEL: 107.09; TOTAL EXITS REQUIRED: 2; TOTAL EXIT WIDTH REQUIRED: (107.09)(.2) = 21.4"

GROUND LEVEL EXT ENCLOSED WORK AREA
I. ALL OTHERS
A. ALLOWED SQ FT PER OCCUPANT (CBC TABLE 10–A): 100
B. ALL OTHERS (NET USABLE): 8110 SQ FT
C. TOTAL OCCUPANTS, ALL OTHERS: 81.10
D. TOTAL EXITS REQUIRED: 2
E. TOTAL EXIT WIDTH REQUIRED (CBC 1003.2): (81.1)(.2) = 16.2"

REQ'D # OF BATHROOM PLUMBING FIXTURES
OCCUPANT LOAD EQ 239 PEERSONS (SEE ABOVE)
120 MEN & 120 WOMEN

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JTA JOB NO: 0309 FOUNDATION PROJECT NO: PR 04–600

CAL POLY

BONDERSON ENGINEERING PROJECTS CENTER
ENGINEERING / ARCHITECTURE RENOVATION & REPLACEMENT
PHASE II–A

COLLEGE OF ENGINEERING
SAN LUIS OBISPO, CA 93407

DWG TITLE
CODE ANALYSIS, SCOPE OF WORK & ACCESSIBILITY STRATEGY & PLANS

SCALE: AS NOTED DRAWN BY: MCL

DWG NO.
A00.02

DATE: 08 NOV '04

TENTATIVE EQUIPMENT LIST (NIC)

METAL FABRICATION/MACHINE SHOP

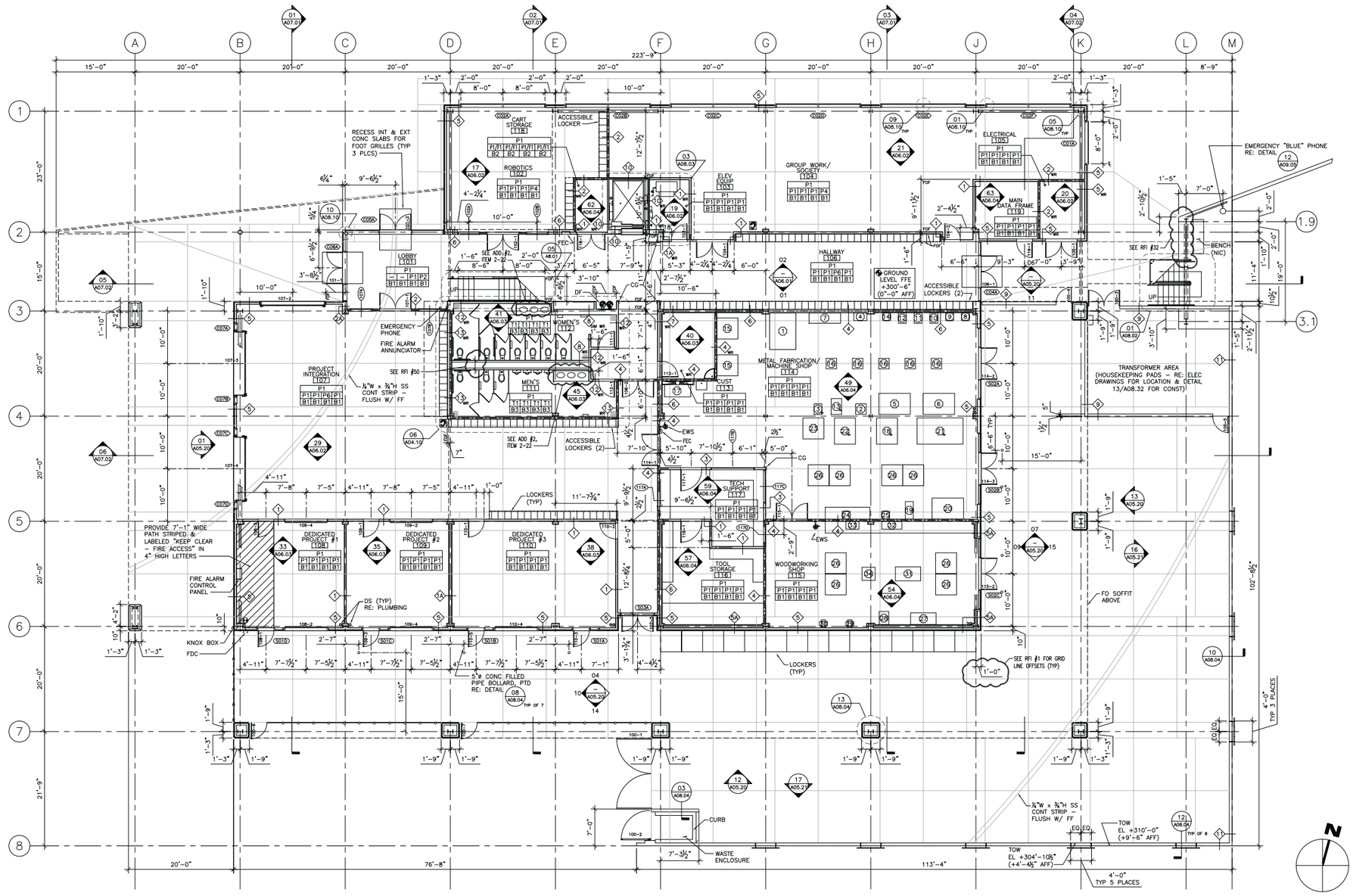
1. TILT FRAME VERTICAL BAND SAW (60x84x84)
2. ABRASIVE CUT OFF SAW (24x24x60)
3. PORTABLE PLASMA CUTTING OUTFIT (18x24x18)
4. PORTABLE OXY/ACET CUTTING OUTFIT (30x18x72)
5. BOX & PAN BRAKE 4 ft x 16 ga. (72x48x48)
6. POWER SQUARING SHEAR, 4 ft x 16 ga. (72x48x48)
7. SHEETMETAL ROLL, 4 ft, x 16 ga. (72x24x48)
8. SHEETMETAL NOTCHER, 6" x 16 ga. (18x18x36)
9. TURRET PUNCH, 16 ga. (18x18x36)
10. GTAW-WELDER (18x24x36)
11. MIG (SHORT ARC) WELDER (18x24x18)
12. MIG (SPRAY TRANSFER) WELDER (18x24x18)
13. RESISTANCE WELDER (24x36x72)
14. BELT SANDER (18x18x36)
15. 4ft x 4ft FABRICATION TABLE (48x48x36)
16. 2ft x 2ft FABRICATION TABLE (24x24x36)
17. WELDING TABLE & FUME HOOD (70x48x32)
18. MANUAL/CNC MILL (48x60x84)
19. DRILL PRESS (18x40x72)
20. MANUAL LATHE (12") (72x48x72)
21. MANUAL/CNC LATHE (16") (105x60x60)
22. 24" VERTICAL BAND SAW
23. SMALL HORIZONTAL CUT OFF BAND SAW
24. ARBOR PRESS
25. PEDESTAL TOOL GRINDER
26. WORK TABLE (48x48x36)

WOODWORKING SHOP

27. WOOD LATHE (58x27x54)
28. WOODWORKING BANDSAW (22x30-3/4)
29. DRILL PRESS (8.5x12)
30. HEAVY DUTY DRILL PRESS (8.5x12)
31. TABLESAW (32x57-5/8x34)
32. EDGE HORIZONTAL / VERTICAL SANDER (46x18x38)
33. 6"x48" BELT / 12" DISC SANDER (30x18)
34. PLANER / MOLDER MACHINE (30x30)

LEGEND

- 1-HR FIRE RATED WALL
- ASSISTIVE LISTENING SYSTEM SIGNAGE RE: DETAIL 06/A09.05
- P7 P1|P1|P1|P1 B1|B1|B1|B1 — ROOM FINISHES KEY RE: SHT A10.01
- 5 — WALL TYPES KEY RE: SHTS A07.10 & A07.11 (WR INDICATES WR GYP BD WET SIDE)
- TILE FLOOR



01 A02.10 GROUND LEVEL FLOOR PLAN

0" 8" 16" 32" 64" 128" 256"

LOCKER TABULATION

TOTAL LOCKERS GROUND LEVEL	310
ACCESSIBLE LOCKERS REQ'D (1%) (.01)310=3.1	4
ACCESSIBLE LOCKERS PROVIDED	5

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ADDENDUM #2 08 FEB '05

JTA JOB NO: 0309 FOUNDATION PROJECT NO: PR 04-600

CAL POLY

BONDERSON ENGINEERING PROJECTS CENTER
ENGINEERING / ARCHITECTURE RENOVATION & REPLACEMENT
PHASE II-A

COLLEGE OF ENGINEERING
SAN LUIS OBISPO, CA 93407

DWG TITLE

GROUND LEVEL FLOOR PLAN

SCALE: 1/8" = 1'-0" DRAWN BY: MCL

DWG NO.

A02.10

DATE: 08 NOV '04

TENTATIVE EQUIPMENT LIST (NIC)

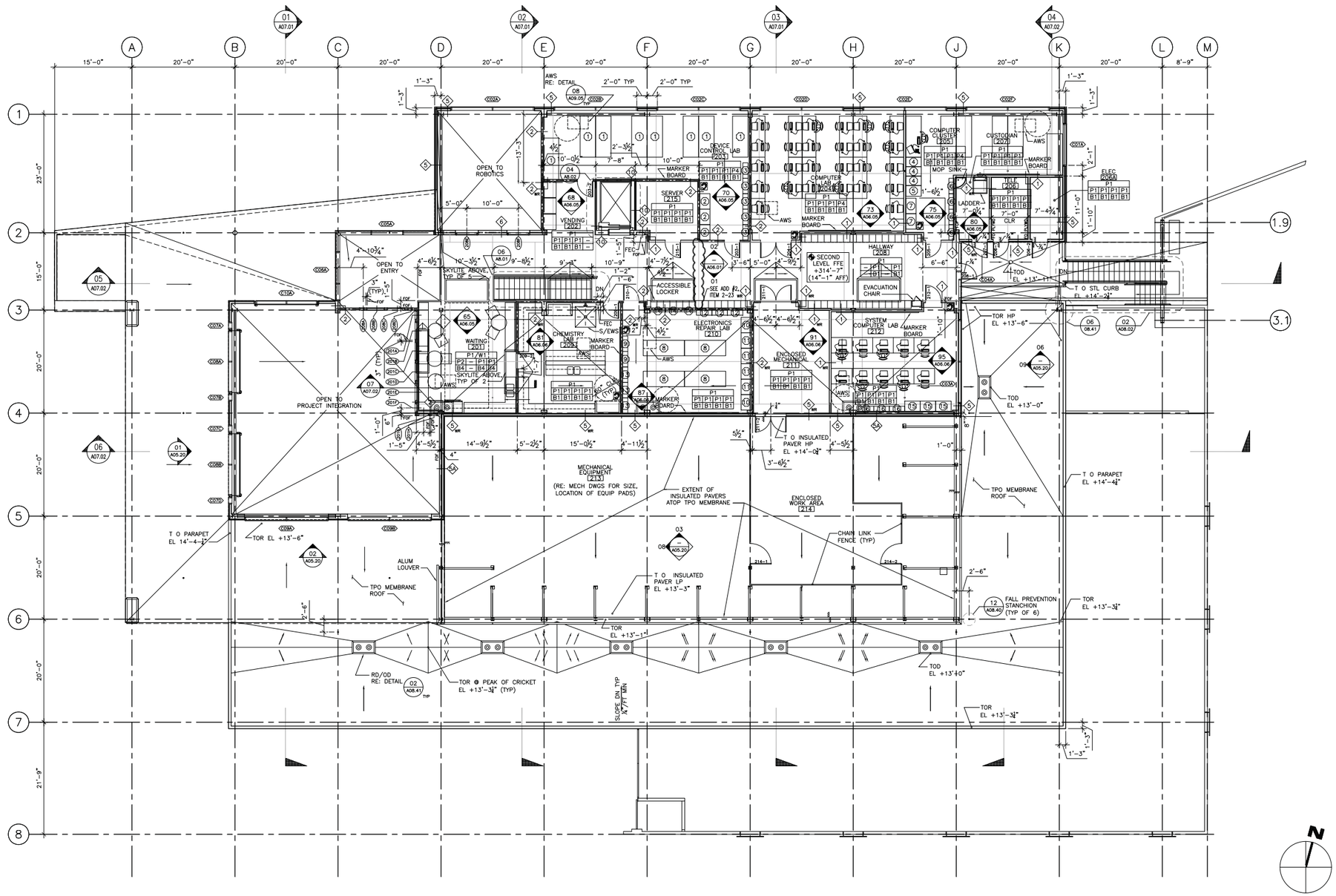
DEVICE CONTROL LAB
- ① ELECTRONIC TEST BENCH (8'x3')
- ② CABINET W/ DOORS (36x24x72)
- ③ BOOK CASES (36x12x72)

COMPUTER CLUSTER LAB
- ④ 19" RACK (22x36x72)
- ⑤ 23" RACK (25x36x72)
- ⑥ BOOK CASE (36x12x72)
- ⑦ CABINET (36x24x72)

ELECTRONICS REPAIR LAB
- ⑧ ELECTRONIC TEST BENCH (8'x3')
- ⑨ BOOK CASES (36x12x72)
- ⑩ CABINET W/ DOORS (36x24x72)
- ⑪ HEAVY DUTY SHELVES (36x24x72)
- ⑫ SHELVES (36x12x72)
- ⑬ PARTS DRAWERS (36x12x72)
- ⑭ LEED RACKS (36x4x72)

SYST COMP LAB
- ⑮ CABINETS W/ DOORS (36x24x72)
- ⑯ BOOK CASE (36x12x72)

LEGEND
- 1-HR FIRE RATED WALL
- ASSISTIVE LISTENING SYSTEM SIGNAGE RE: DETAIL 06/A09.05
- ROOM FINISHES KEY RE: SHT A10.01
- WALL TYPES KEY RE: SHTS A07.10 & A07.11 (WR INDICATES WR GYP BD WET SIDE)



01 A02.20 SECOND LEVEL FLOOR PLAN / LOW ROOF PLAN

0" 8" 16" 32" 64" 128" 256"

LOCKER TABULATION

TOTAL LOCKERS SECOND LEVEL	100
ACCESSIBLE LOCKERS REQ'D (1%) (.01)100=1.0	1
ACCESSIBLE LOCKERS PROVIDED	1

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JTA JOB NO: 0309 FOUNDATION PROJECT NO: PR 04-600

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SAN LUIS OBISPO, CA 93407

DWG TITLE

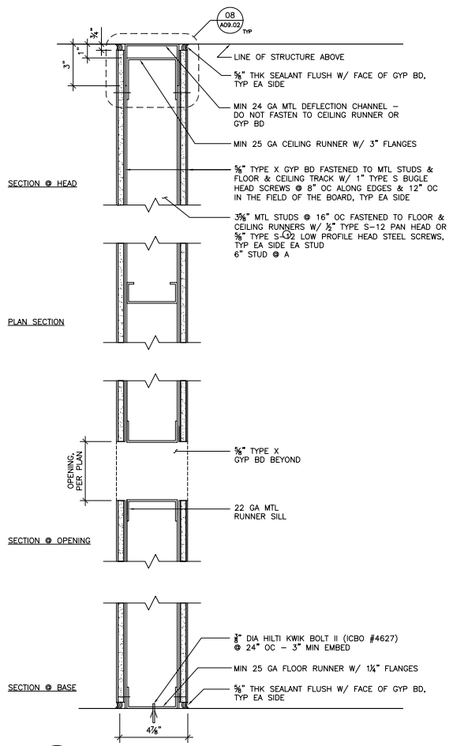
SECOND LEVEL FLOOR PLAN / LOW ROOF PLAN

SCALE: 1/8" = 1'-0" DRAWN BY: MCL

DWG NO.

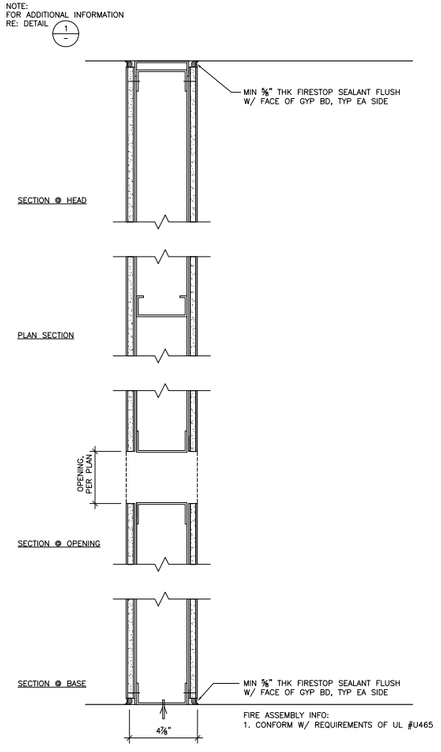
A02.20

DATE: 08 NOV '04



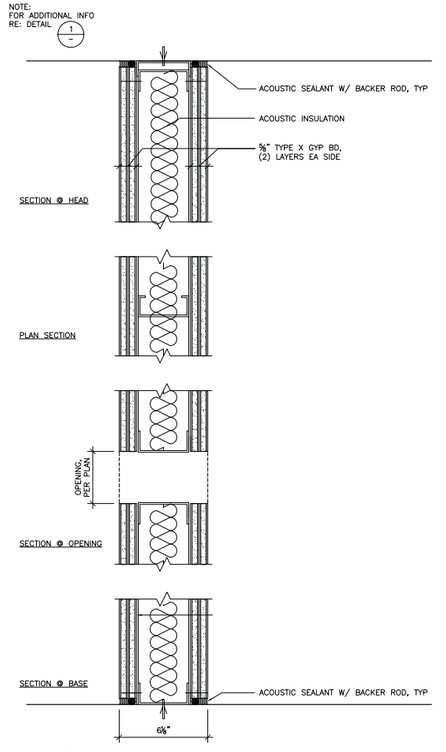
1 A07.10 NON–RATED – 1

3" = 1'–0"



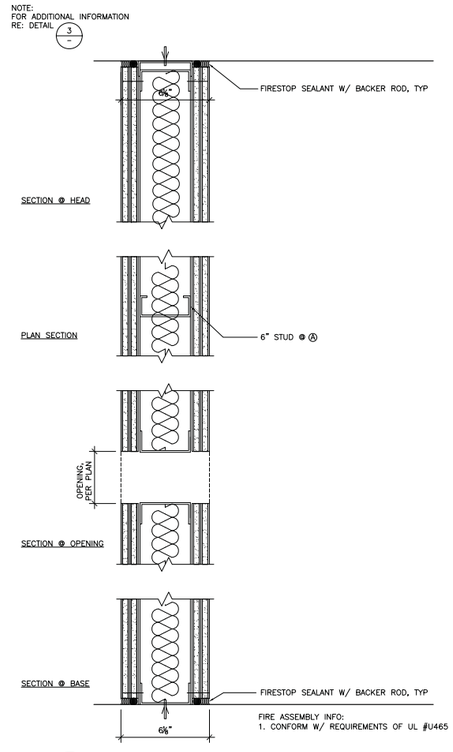
2 A07.10 1–HOUR – 2

3" = 1'–0"



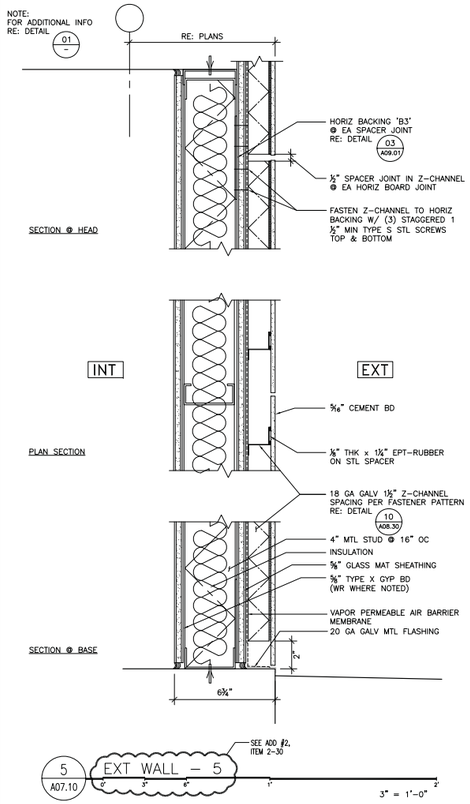
3 A07.10 NON–RATED ACOUSTIC – 3

3" = 1'–0"



4 A07.10 1–HOUR RATED ACOUSTIC – 4

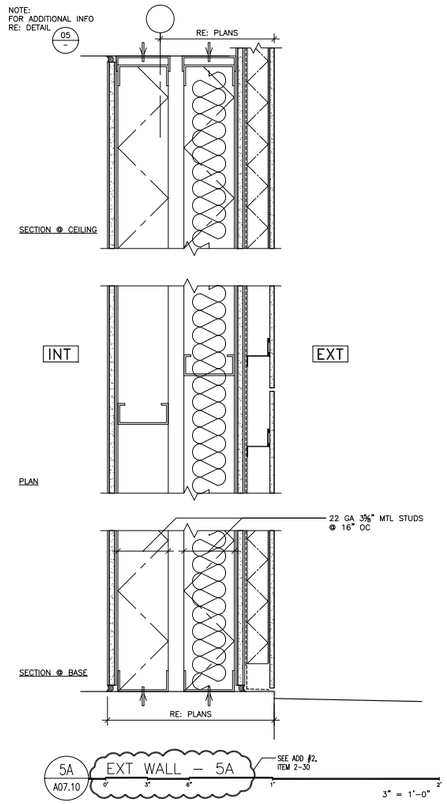
3" = 1'–0"



5 A07.10 EXT WALL – 5

SEE ADD #2, ITEM 2–30

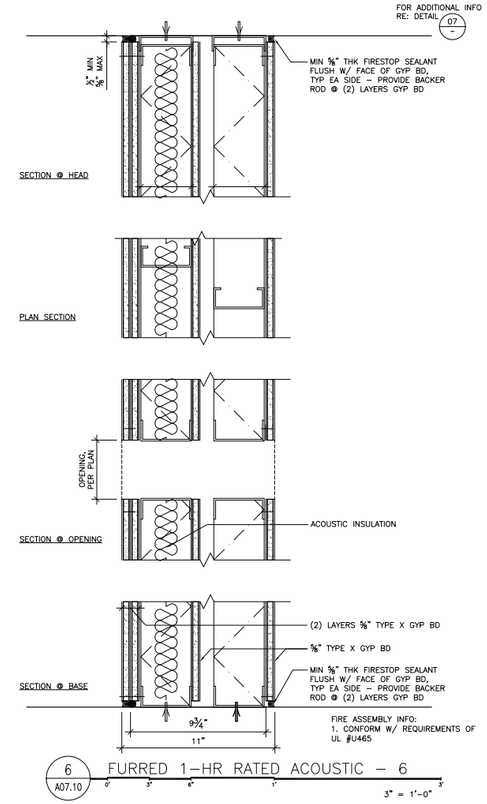
3" = 1'–0"



5A A07.10 EXT WALL – 5A

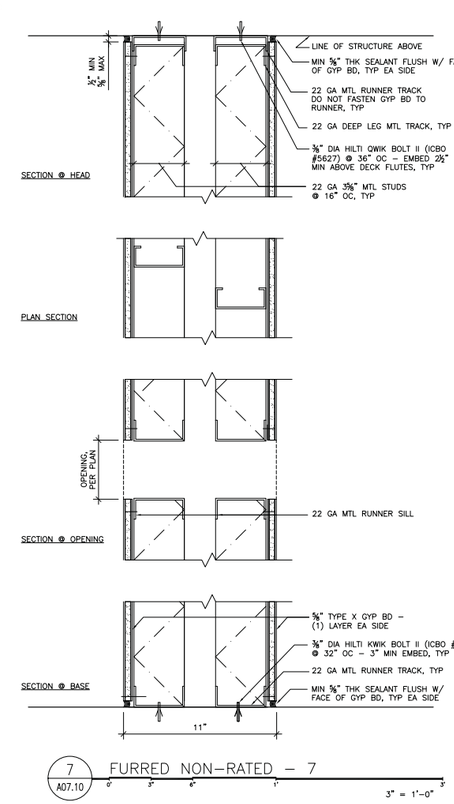
SEE ADD #2, ITEM 2–30

3" = 1'–0"



6 A07.10 FURRED 1–HR RATED ACOUSTIC – 6

3" = 1'–0"



7 A07.10 FURRED NON–RATED – 7

3" = 1'–0"

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DSA – CSU
MOU – _____

IDENTIFICATION STAMP
DIVISION OF THE STATE ARCHITECT
OFFICE OF REGULATION SERVICE

APPL. #:

ACCESS COMPLIANCE SECTION

DATE: _____

ENGINEER'S SIGNATURE
PC ASSOCIATES

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ADDENDUM #2 — 08 FEB '05

JTA JOB NO: 0309 FOUNDATION PROJECT NO: PR 04–600

CAL POLY

BONDERSON ENGINEERING PROJECTS CENTER

ENGINEERING / ARCHITECTURE RENOVATION & REPLACEMENT
PHASE II–A

COLLEGE OF ENGINEERING
SAN LUIS OBISPO, CA 93407

DWG TITLE

WALL TYPES – PAGE 1

SCALE: 3" = 1'–0" DRAWN BY: MCL

DWG NO.

A07.10

DATE: 08 NOV '04

DOOR SCHEDULE – GROUND LEVEL

(SEE ADD #2, ITEM 2-37)

DOOR NUMBER	DOOR SIZE WIDTH	HEIGHT	THICK	TYPE	DOOR CON	DOOR FRAME	PANIC HDW	FIRE RATED	HDW SET	DETAILS HEAD	JAMB	THRES	NOTE
100–1	12'–6"	8'–0"	1 3/4"	L	D5	F5	–	–	14	–	–	–	
100–2	5'–6"	6'–0"	1 3/4"	M	D5	F5	–	–	11	–	07/A08.04	–	
100–3	6'–0"	7'–9"	1 3/4"	O	D5	F5	YES	–	09	–	12/A08.32	–	1
100–4	3'–0"	7'–9"	1 3/4"	P	D5	F5	YES	–	10	–	12/A08.32	–	
100–5	3'–0"	7'–9"	1 3/4"	P	D5	F5	YES	–	11	–	12/A08.32	–	1
100–6	3'–0"	7'–9"	1 3/4"	P	D5	F5	YES	–	10	–	12/A08.32	–	1
100–7	3'–0"	7'–9"	1 3/4"	P	D5	F5	YES	–	10	–	12/A08.32	–	1
101–1	6'–0"	8'–0"	1 3/4"	H	D4	F4	YES	–	1	12/A08.10	13/A08.10	14/A08.32	
101–2	6'–0"	8'–0"	1 3/4"	H	D4	F4	YES	–	1	12/A08.10	13/A08.10	14/A08.32	
102–1	6'–0"	7'–0"	1 3/4"	N	D1	F1	–	60MIN	12	05/A08.31	05/A08.31	–	
103–1	3'–0"	7'–0"	1 3/4"	C	D1	F1	–	–	17	05/A08.31	05/A08.31	–	
104–1	6'–0"	7'–0"	1 3/4"	F	D1	F1	–	–	15	05/A08.31	05/A08.31	–	
104–2	3'–0"	7'–0"	1 3/4"	D	D1	F1	–	–	16	05/A08.31	05/A08.31	–	
105–1	6'–0"	7'–0"	1 3/4"	G	D1	F1	–	–	4	12/A08.31	13/A08.31	06/A08.31	
106–1	6'–0"	7'–0"	1 3/4"	F	D4	F4	YES	–	1	12/A08.10	13/A08.10	14/A08.32	
106–2	6'–0"	7'–0"	1 3/4"	N	D1	F3	–	60MIN	12	05/A08.31	05/A08.31	–	
107–1	6'–0"	8'–0"	1 3/4"	H	D1	F1	–	60MIN	13	05/A08.31	05/A08.31	–	
107–2	12'–0"	14'–1"	1 3/4"	I	D3	F3	–	–	22	09/A08.32	05/A08.32	–	
107–3	12'–0"	14'–1"	1 3/4"	I	D3	F3	–	–	22	10/A08.32	03/A08.32	–	
107–4	12'–0"	14'–1"	1 3/4"	I	D3	F3	–	–	22	10/A08.32	03/A08.32	–	
107–5	6'–0"	7'–0"	1 3/4"	N	D1	F1	–	–	2	16/A08.31	13/A08.31	06/A08.31	
108–1	3'–0"	7'–0"	1 3/4"	A	D1	F1	–	–	3	16/A08.31	08/A08.31	06/A08.31	
108–2	8'–0"	8'–1"	1 3/4"	K	D3	F3	–	–	22	10/A08.31	08/A08.31	–	
108–3	3'–0"	7'–0"	1 3/4"	A	D1	F1	–	–	16	05/A08.31	05/A08.31	–	
108–4	8'–0"	8'–1"	1 3/4"	K	D3	F3	–	–	22	11/A08.31	09/A08.31	–	
109–1	3'–0"	7'–0"	1 3/4"	A	D1	F1	–	–	16	05/A08.31	05/A08.31	–	
109–2	8'–0"	8'–1"	1 3/4"	K	D3	F3	–	–	22	11/A08.31	09/A08.31	–	
109–3	3'–0"	7'–0"	1 3/4"	A	D1	F1	–	–	3	16/A08.31	08/A08.31	06/A08.31	
109–4	8'–0"	8'–1"	1 3/4"	K	D3	F3	–	–	22	10/A08.31	08/A08.31	–	
110–1	3'–0"	7'–0"	1 3/4"	A	D1	F1	–	–	16	05/A08.31	05/A08.31	–	
110–2	3'–0"	7'–0"	1 3/4"	A	D1	F1	–	–	16	05/A08.31	05/A08.31	–	
110–3	3'–0"	7'–0"	1 3/4"	A	D1	F1	–	–	3	16/A08.31	08/A08.31	06/A08.31	
110–4	8'–0"	8'–1"	1 3/4"	K	D3	F3	–	–	22	10/A08.31	08/A08.31	–	
110–5	3'–0"	7'–0"	1 3/4"	A	D1	F1	–	–	3	16/A08.31	08/A08.31	06/A08.31	
111–1	3'–0"	7'–0"	1 3/4"	C	D1	F1	–	–	23	05/A08.31	05/A08.31	07/A08.31	
112–1	3'–0"	7'–0"	1 3/4"	C	D1	F1	–	–	23	05/A08.31	05/A08.31	07/A08.31	
113–1	3'–0"	7'–0"	1 3/4"	C	D1	F1	–	–	18	05/A08.31	05/A08.31	–	
114–1	6'–0"	7'–0"	1 3/4"	N	D1	F1	–	60MIN	12	05/A08.31	05/A08.31	–	
114–2	6'–0"	7'–0"	1 3/4"	Q	D1	F1	–	–	2	16/A08.31	14/A08.31	06/A08.31	
114–3	6'–0"	7'–0"	1 3/4"	Q	D1	F1	–	–	2	16/A08.31	14/A08.31	06/A08.31	
115–1	6'–0"	7'–0"	1 3/4"	N	D1	F1	–	60MIN	12	05/A08.31	05/A08.31	–	
115–2	6'–0"	7'–0"	1 3/4"	Q	D1	F1	–	–	2	16/A08.31	14/A08.31	06/A08.31	
116–1	4'–0"	7'–0"	1 3/4"	B	D1	F1	–	–	21	05/A08.31	05/A08.31	–	
117–1	4'–0"	7'–0"	1 3/4"	B	D1	F1	–	–	20	05/A08.31	05/A08.31	–	
118–1	5'–4"	7'–0"	1 3/4"	R	D1	F1	–	–	19	05/A08.31	05/A08.31	–	
119–1	3'–0"	7'–0"	1 3/4"	C	D1	F1	–	–	5	12/A08.31	13/A08.31	06/A08.31	

SIGNAGE SCHEDULE

DOOR NUMBER	SIGN TYPE	ROOM ID
–	–	–
–	–	–
–	–	–
–	–	–
101–1	ISA, EXIT A	–
101–2	ISA, EXIT A	–
102–1	ID, EXIT B	102
–	–	–
104–1	ID, EXIT B	104
104–2	ID, EXIT B	104
105–1	ID	105
106–1	ISA, EXIT A	–
106–2	ISA, EXIT B	106
107–1	ID, EXIT B	107
–	–	–
–	–	–
107–5	ID, ISA, EXIT A	107
108–1	ID, ISA, EXIT A	108
–	–	–
108–3	ID, EXIT B	108
–	–	–
109–1	ID, EXIT B	109
–	–	–
109–3	ID, ISA, EXIT A	109
–	–	–
110–1	ID, EXIT B	110
110–2	ID, EXIT B	110
110–3	ISA, ID, EXIT A	110
–	–	–
110–5	ID, ISA, EXIT A	110
111–1	R1A, R2A	112
112–1	R1B, R2B	111
113–1	ID	113
114–1	ID, EXIT B	114
114–2	ID, ISA, EXIT A	114
114–3	ID, ISA, EXIT A	114
115–1	ID, EXIT B	115
115–2	ID, ISA, EXIT A	115
116–1	ID	116
117–1	ID	117
118–1	ID	118
119–1	ID	119

DOOR SCHEDULE – SECOND LEVEL

(SEE ADD #2, ITEM 2-37)

DOOR NUMBER	DOOR SIZE WIDTH	HEIGHT	THICK	TYPE	DOOR CON	DOOR FRAME	PANIC HDW	FIRE RATED	HDW SET	DETAILS HEAD	JAMB	THRES	NOTE
203–1	3'–0"	7'–0"	1 3/4"	A	D1	F1	–	60MIN	24	05/A08.31	05/A08.31	–	
203–2	3'–0"	7'–0"	1 3/4"	A	D1	F1	–	60MIN	24	05/A08.31	05/A08.31	–	
204–1	6'–0"	7'–0"	1 3/4"	F	D1	F1	–	–	15	05/A08.31	05/A08.31	–	
205–1	3'–0"	7'–0"	1 3/4"	C	D1	F1	–	–	16	05/A08.31	05/A08.31	–	
206–1	3'–0"	7'–0"	1 3/4"	C	D1	F1	–	–	7	12/A08.31	13/A08.31	06/A08.31	
207–1	3'–0"	7'–0"	1 3/4"	C	D1	F3	–	–	8	12/A08.31	13/A08.31	06/A08.31	
208–1	3'–0"	7'–0"	1 3/4"	D	D4	F4	YES	–	6	12/A08.10	13/A08.10	06/A08.31	
209–1	3'–0"	7'–0"	1 3/4"	A	D1	F1	–	60MIN	24	05/A08.31	05/A08.31	–	
209–2	3'–0"	7'–0"	1 3/4"	A	D1	F1	–	60MIN	24	05/A08.31	05/A08.31	–	
210–1	3'–0"	7'–0"	1 3/4"	A	D1	F1	–	60MIN	24	05/A08.31	05/A08.31	–	
211–1	6'–0"	7'–0"	1 3/4"	N	D1	F1	–	–	15	12/A08.31	13/A08.31	06/A08.31	
211–2	6'–0"	7'–0"	1 3/4"	N	D1	F1	–	–	15	12/A08.31	13/A08.31	06/A08.31	
212–1	3'–0"	7'–0"	1 3/4"	D	D1	F1	–	–	16	05/A08.31	05/A08.31	–	
214–1	3'–0"	7'–0"	1 3/4"	–	D1	–	–	–	14	–	–	–	CHAIN LINK
214–2	3'–0"	7'–0"	1 3/4"	–	D1	–	–	–	14	–	–	–	CHAIN LINK
215–1	3'–0"	7'–0"	1 3/4"	C	D1	F1	–	–	16	05/A08.31	05/A08.31	–	

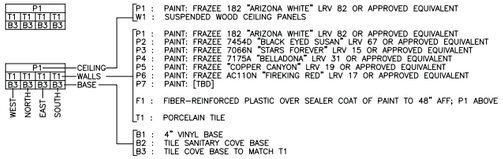
SIGNAGE SCHEDULE

DOOR NUMBER	SIGN TYPE	ROOM ID
203–1	ID	203
203–2	ID, EXIT B	203
204–1	ID, EXIT B	204
205–1	ID, EXIT B	205
206–1	ID	206
207–1	ID, EXIT B	207
208–1	EXIT C	–
209–1	ID, EXIT B	209
209–2	ID, EXIT B	209
210–1	ID, EXIT B	210
211–1	ID	211
–	–	214
212–1	ID, EXIT B	212
–	–	–
–	–	–
215–1	ID	215

DOOR SCHEDULE NOTES:

1. FOR EXT STL DR CONST RE: DETAIL 11/A08.32
2. FOR ACCESSIBLE DOOR NOTES RE: 2001 CBC SEC 1133B.2

ROOM FINISHES KEY



ROOM FINISH NOTES:
1. ALL FLOORS SLIP–RESISTANT SEALED CONC UNLESS NOTED ON PLANS AS TILE
2. PAINT STRUCTURE, EQUIPMENT & SUPPORTS SAME AS CEILING

DOOR CON (CONSTRUCTION)

D1 = STL
D2 = (NOT USED)
D3 = OVERHEAD DOOR
D4 = ALUM
D5 = STL GATE

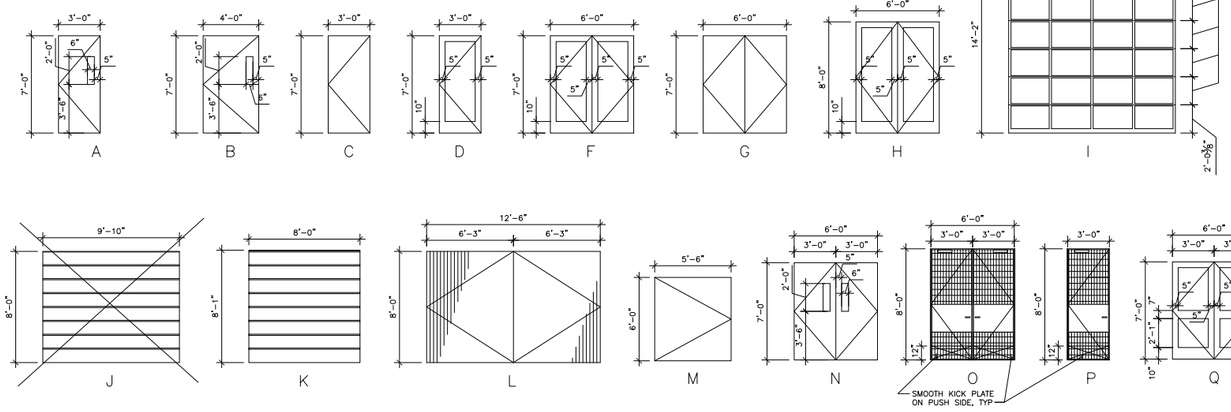
DOOR FRAME

F1 = HM
F2 = (NOT USED)
F3 = OVERHEAD DOOR GUIDES
F4 = ALUM
F5 = STL GATE

SIGN TYPE

ISA = INTERNATIONAL SYMBOL OF ACCESSIBILITY – RE: 03/A09.05
EXIT A = TACTILE EXIT SIGN – RE: 05A/A09.05
EXIT B = INTERIOR (ROOM SIDE) MOUNT TACTILE EXIT SIGN – RE: 05B/A09.05
EXIT C = TACTILE EXIT SIGN – RE: 05C/A09.05
ID = ROOM SIGNAGE – RE: 04/A09.05
R1A = WOMEN'S ROOM IDENTIFICATION – RE: 15/A04.10
R1B = MEN'S ROOM IDENTIFICATION – RE: 16/A04.10
R2A = WOMEN'S DOOR SIGNAGE – RE: 03B/A04.10
R2B = MEN'S DOOR SIGNAGE – RE: 03A/A04.10

DOOR TYPE



WINDOW SCHEDULE – GROUND LEVEL

WINDOW NUMBER	WINDOW SIZE WIDTH	HEIGHT	SILL HT	CLASS TYPE	DETAILS HEAD	JAMB	SILL	NOTES
102A	4'–0"	4'–0"	3'–0"	5	03/A08.31	03/A08.31	03/A08.31	1–HR
102B	4'–0"	4'–0"	3'–0"	5				1–HR
107A	4'–0"	5'–0"	3'–0"	5				1–HR
107B	4'–0"	5'–0"	3'–0"	5				1–HR
117A	3'–6"	3'–6"	3'–6"	5				1–HR
117B	8'–0"	3'–6"	3'–6"	1				
117C	6'–0"	3'–6"	3'–6"	1				
117D	3'–0"	3'–6"	3'–6"	5				1–HR

WINDOW SCHEDULE – SECOND LEVEL

WINDOW NUMBER	WINDOW SIZE WIDTH	HEIGHT	SILL HT	CLASS TYPE	DETAILS HEAD	JAMB	SILL	NOTES
201A	1'–7½"	4'–11"	4'–11"	5	03/A08.31	03/A08.31	03/A08.31	1–HR
201B	3'–5½"	5'–7½"	4'–5½"	5				
201C	3'–5"	5'–7½"	4'–5½"	5				
201D	3'–5"	5'–7½"	4'–5½"	5				
201E	3'–5½"	5'–7½"	4'–5½"	5				
201F	1'–7½"	5'–7½"	4'–5½"	5				
201G	1'–11"	5'–7½"	4'–5½"	5				
201H	8'–10"	4'–11"	4'–11"	5				
208A	8'–8½"	8'–11"	8'–11"	5				
208B	3'–5"	8'–11"	8'–11"	5				
208C	3'–5"	8'–11"	8'–11"	5				
208D	0'–8½"	8'–11"	8'–11"	5				
208E	4'–0"	8'–8"	8'–6"	5				
208F	4'–0"	3'–8"	3'–6"	5				

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DSA – CSU
MOU – _____

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OFFICE OF REGULATION SERVICE
APPL. #:
ACCESS COMPLIANCE SECTION
DATE: _____

[CONSULTANT'S SIGNATURE]
PC ASSOCIATES

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ADDENDUM #2 08 FEB '05

JTA JOB NO: 0309 FOUNDATION PROJECT NO: PR 04–600

CAL POLY

BONDERSON ENGINEERING PROJECTS CENTER
ENGINEERING / ARCHITECTURE RENOVATION & REPLACEMENT
PHASE II–A

COLLEGE OF ENGINEERING
SAN LUIS OBISPO, CA 93407

DWG TITLE

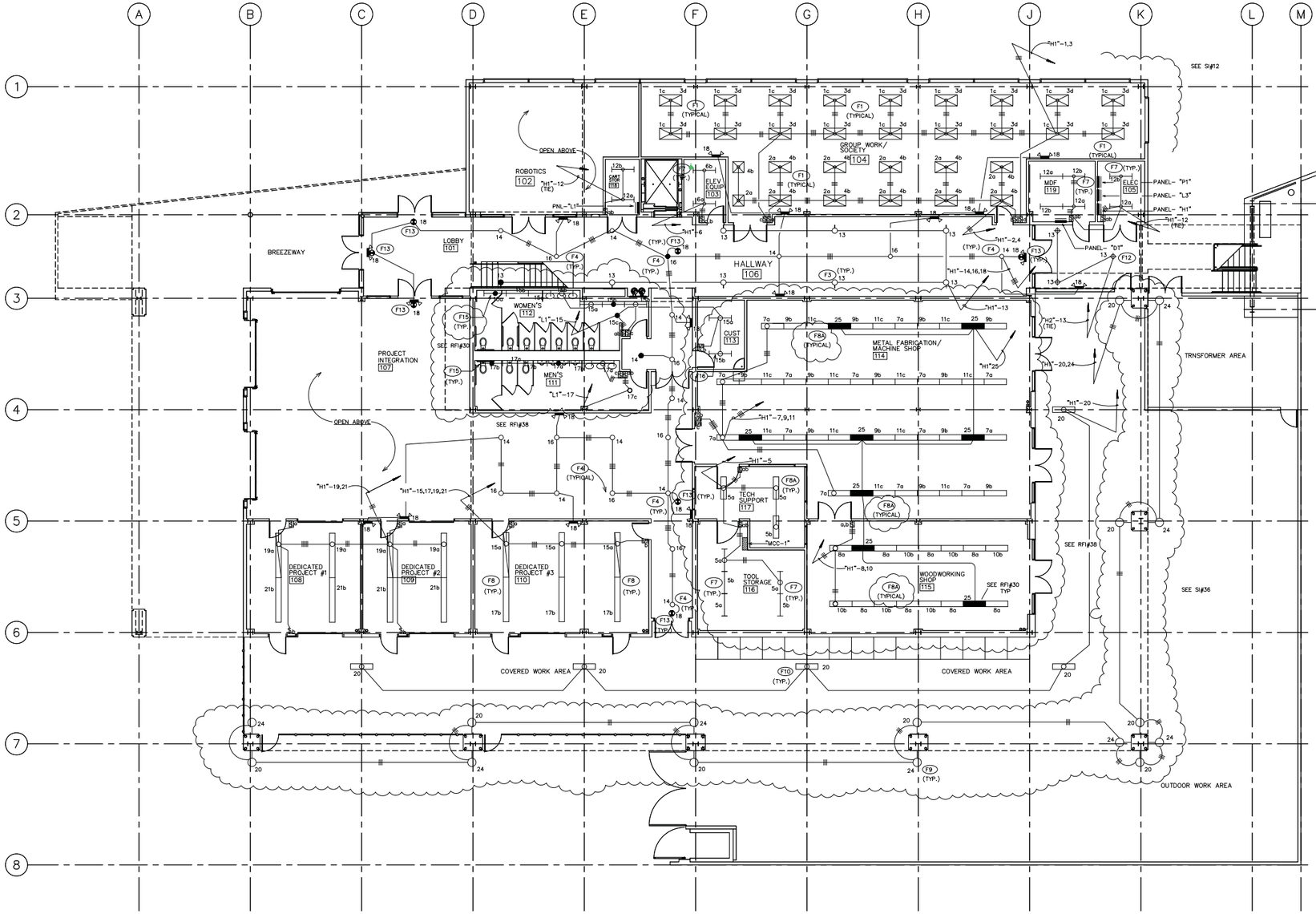
SCHEDULES

SCALE: NO SCALE DRAWN BY: MCL

DWG NO.

A10.01

DATE: 08 NOV '04



PLAN NOTES:

1- ELECTRICAL CONTRACTOR TO PROVIDE 120 VOLT BALLAST FOR LIGHTING FIXTURE INSTALLED IN ROOM #113, 112 AND ROOM # 111.

GROUND LEVEL LIGHTING PLAN

0' 8' 16' 32' 64' 128' 256'

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JTA JOB NO: 0309 FOUNDATION PROJECT NO: PR 04-600

CAL POLY

BONDERSON ENGINEERING PROJECTS CENTER

ENGINEERING / ARCHITECTURE RENOVATION & REPLACEMENT PHASE II-A

COLLEGE OF ENGINEERING
SAN LUIS OBISPO, CA 93407

DWG TITLE

GROUND LEVEL LIGHTING PLAN

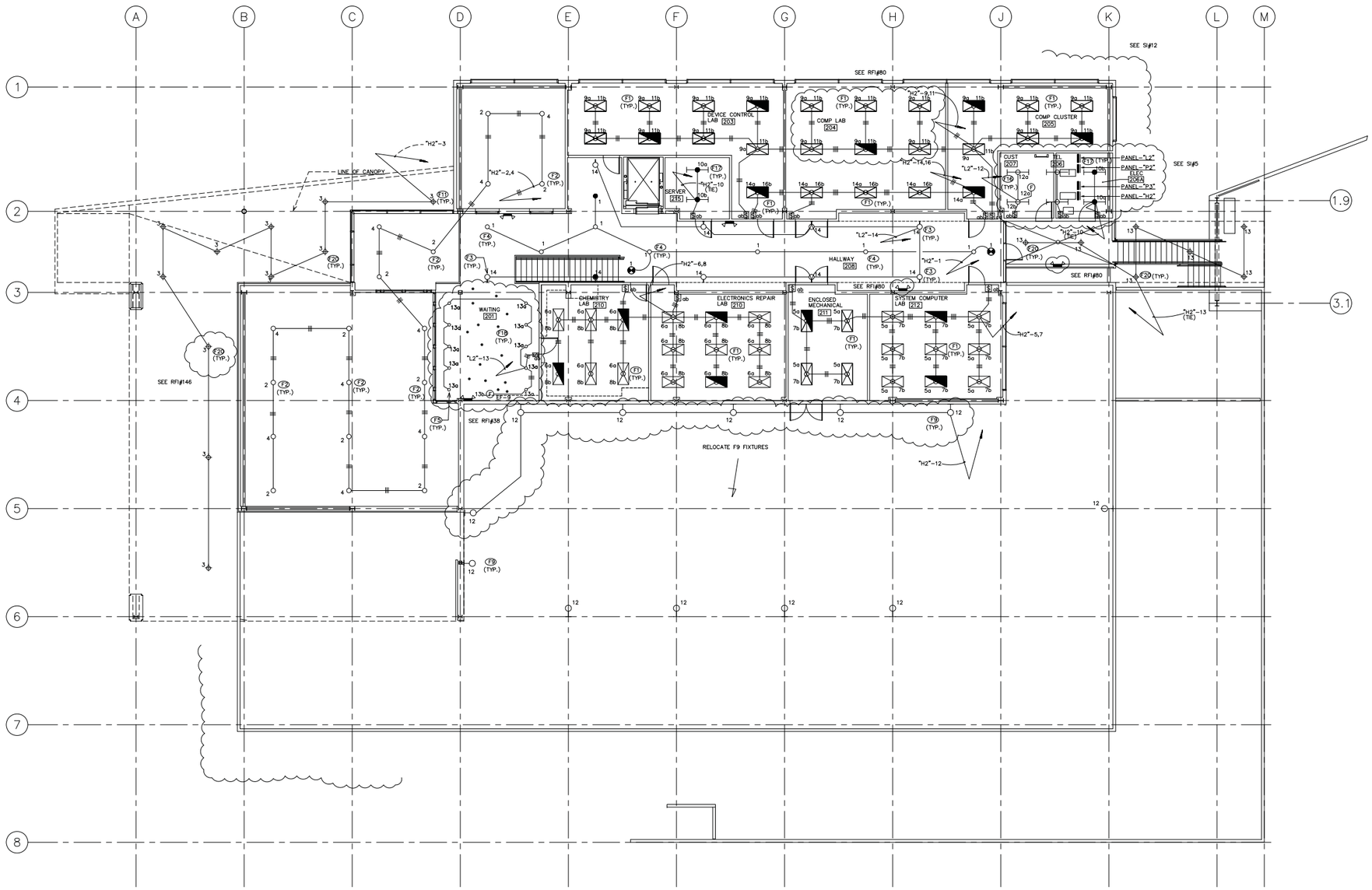
SCALE: 1/8" = 1'-0" DRAWN BY: FE

DWG NO.

E-4 ASI #27

OF - 14

DATE: 08 NOV '04



1 A2.21 SECOND LEVEL EQUIPMENT PLAN

0' 8' 16' 32' 64' 128' 256'

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OFFICE OF THE STATE FIRE MARSHAL
APPROVED FIRE AND PANIC ONLY

Reviewed by: _____
Code Enforcement South

Approval of this plan does not authorize or approve any omission or deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

DSA - CSU
MOU - _____

IDENTIFICATION STAMP
DIVISION OF THE STATE ARCHITECT
OFFICE OF REGULATION SERVICE

APPL. #:

ACCESS COMPLIANCE SECTION

DATE: _____

(CONSULTANT'S SIGNATURE)
PC ASSOCIATES

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JTA JOB NO: 0309 FOUNDATION PROJECT NO: PR 04-600

CAL POLY

BONDERSON ENGINEERING PROJECTS CENTER
ENGINEERING / ARCHITECTURE RENOVATION & REPLACEMENT
PHASE II-A

COLLEGE OF ENGINEERING
SAN LUIS OBISPO, CA 93407

DWG TITLE

SECOND LEVEL
LIGHTING PLAN

SCALE: 1/8" = 1'-0" DRAWN BY: FE

DWG NO. E-5 ASI #27
OF - 14

DATE: 08 NOV '04

ELECTRICAL LEGEND

ELECTRICAL ABBREVIATIONS

A
- A — AMPERE
- AC — ALTERNATING CURRENT
- A\C — AIR CONDITIONER
- AF — AMPERE FRAME
- AHU — AIR HANDLING UNIT
- AIC — AMPERE INTERRUPTING CAPACITY
- ALT — ALTERNATE
- AT — AMPERE TRIP
- ATS — AUTOMATIC TRANSFER SWITCH
- AUX — AUXILIARY
- AWG — AMERICAN WIRE GAUGE
- AFF — ABOVE FINISHED FLOOR

B
- BATT — BATTERY
- BC — BARE COPPER
- BKBD — BACKBOARD
- BKR — BEAKER
- BOT — BOTTOM OF TRAY

C
- C — CONDUIT
- CB — CIRCUIT BREAKER
- CKT — CIRCUIT
- C.O. — CONDUIT ONLY
- CPT — CONTROL POWER TRANSFORMER
- CU — COPPER

D
- DIA — DIAMETER
- DISC — DISCONNECT
- DIST — DISTRIBUTION
- DWG — DRAWING

E
- EF — EXHAUST FAN
- ELEC — ELECTRIC
- EMERG — EMERGENCY
- EQUIP — EQUIPMENT
- EWC — ELECTRIC WATER COOLER

F
- FA — FIRE ALARM PANEL
- FDR — FEEDER
- FLA — FULL LOAD AMPERES
- F/O — FIBER OPTIC
- FT — FEET
- FVNR — FULL VOLTAGE NON-REVERSING

G
- GFI — GROUND FAULT INTERRUPTER
- GND — GROUND

J
- JB — JUNCTION BOX

K
- KA — KILOAMPERES
- KCMIL — THOUSAND CIRCULAR MILLS
- KV — KILOVOLT
- KVA — KILOVOLT AMPERES
- KVAR — KILOVOLT AMPERES-REACTIVE
- KW — KILOWATT
- KWH — KILOWATTHOUR

L
- LOC — LOCATION
- LTG — LIGHTING

M
- MCB — MAIN CIRCUIT BREAKER
- MCC — MOTOR CONTROL CENTER
- MCP — MOTOR PROTECTION CIRCUIT
- MCS — MOLDED CASE SWITCH
- MH — MOUNTING HEIGHT
- MIN — MINIMUM
- MLO — MAIN LUGS ONLY
- MTD — MOUNTED
- MTG — MOUNTING

N
- N — NEUTRAL
- NEC — NATIONAL ELECTRIC CODE
- N.C. — NORMALLY CLOSED
- NIC — NOT IN CONTRACT
- N.O. — NORMALLY OPEN

O
- O.C. — ON CENTER

P
- PF — POWER FACTOR
- PH — PHASE
- PNL — PANEL
- PR — PAIR
- PWR — POWER

R
- RCPT — RECEPTACLE

S
- SA — SURGE ARRESTER
- SECT — SECTION
- SW — SWITCH
- SWBD — SWITCHBOARD
- SWGR — SWITCHGEAR

T
- T — TRANSFORMER
- TEL — TELEPHONE
- THWN — MOISTURE AND HEAT RESISTANT THERMOPLASTIC INSULATION
- TRANSF — TRANSFORMER
- T/S — TWISTED SHIELDED
- TYP — TYPICAL

U
- UPS — UNINTERRUPTABLE POWER SUPPLY
- UON — UNLESS OTHERWISE NOTED
- U/G — UNDERGROUND

V
- V — VOLT, VOLTAGE, VOICE
- VA — VOLT AMPERE

W
- W — WATT, WIRE, WEST
- WP — WEATHERPROOF
- WTR HTR — WATER HEATER

X
- XFMR — TRANSFORMER

MISCELLANEOUS
- Z — IMPEDANCE
- ø — PHASE, DIAMETER
- & — AND
- # — NUMBER
- 3P — THREE POLE

LIGHTING FIXTURES

- FLUORESCENT FIXTURE (1a, "F1" (7))
  1a = DENOTES CKT #1. CONTROLLED BY SWITCH "a"
  F1 = DENOTES TYPE "F1" FIXTURE, PER FIXTURE SCHEDULE
  (7) = DENOTES 7 FIXTURES
- FLUORESCENT FIXTURE WITH BUILT-IN EMERGENCY BATTERY PACK — SEE FRI#38
- RECESSED INCANDESCENT, HID OR COMPACT FLUORESCENT FIXTURE. TYPE AS SHOW ON PLANS
- LIGHTING FIXTURE ON EMERGENCY OR NIGHT LIGHT CIRCUIT TYPE AS SHOWN ON PLANS
- WALL WASHER FIXTURE, SHADED SIDE INDICATESDIRECTION OF AIM
- WALL MOUNTED LIGHTING FIXTURE
- WALL MOUNTED LIGHTING FIXTURE
- WALL MOUNTED EXIT SIGN
- SHADING INDICATES ILLUMINATED FACE OF EXIT SIGN
- ARROW INDICATES EXIT SIGN DIRECTIONAL ARROW
- WALL MTD EMERGENCY BATTERY PACK WITH LTG HEADS (TWO SHOWN)
- RECESSED FIXTURE WITH ADJUSTABLE DIRECTINOAL LIGHT
- PARKING LOT TYPE. POLE MTD LIGHTING FIXTURE
- SURFACE MTD DIRECTIONAL AIMING LIGHT
- FLOOD LIGHT FIXTURE WITH DIRECTIONAL AIMING LIGHT
- TRACK LIGHT

SWITCHES AND CONTROLS

- PUSH BUTTON OR CONTROL STATION
- PHOTO ELECTRIC CELL
- CONTACTOR
- MOTOR STARTER: 0 = STARTER SIZE
- COMBINATION MOTOR STARTER DISCONNECT SWITCH
  30 = AMPERE RATING
  (12) = FUSE SIZE
  0 = STARTER SIZE
- FUSED DISCONNECT SWITCH
  30 = AMPERE RATING
  (15) = FUSE SIZE
- NON-FUSED DISCONNECT SWITCH
  30 = AMPERE RATING
- TOGGLE SWITCH, SWITCH DESIGNATION
  SUBSCRIPT:
  3 = THREE WAY
  4 = FOUR WAY
  D = DIMMER
  K = KEY SWITCH
  P = PILOT LIGHT
  T = TIME DELAY SWITCH
  WP = WEATHERPROOF
  XP = EXPLOSION PROOF
- S_N — MANUAL MOTOR STARTER SWITCH, 20A, 125V
- DUAL-RELAY WALL SWITCH INFRARED OCCUPANCY SENSOR +48" A.F.F.
- DRAWING REFERENCE NOTE: (SEE NOTE ON DRAWING)
- CONCEALED CONDUIT (3/4", UON)
- UNDERGROUND CONDUIT
- WIRING HATCH MARKS DENOTES NUMBER OF #12 AWG CONDUCTORS, LONG HATCH MARK DENOTES NEUTRAL CONDUCTOR, LONG HATCH WITH DOT DENOTES GROUND WIRE.
- CONDUIT OR CABLE TURNING UP
- CONDUIT OR CABLE TURNING DOWN
- CONDUIT CAPPED
- LPA-1/3/5, 2,4 — DENOTES HOMERUN TO PANEL "LPA" WITH CIRCUITS 1,3 & 5 WITH COMMON NEUTRAL, AND CIRCUITS 2,4, EACH WITH ITS OWN NEUTRAL

SINGLE LINE DIAGRAM LEGEND

- DRAW-OUT POWER BREAKER 3 POLES. SIZE AS INDICATED
- PLUG-IN MOLDED CASE BREAKER 3 POLES. SIZE AS INDICATED
- MOLDED CASE CIRCUIT BREAKER 3 POLES. SIZE AS INDICATED
- AUTOMATIC TRANSFER SWITCH
- POWER TRANSFORMER
- LIMIT OF EQUIPMENT
- N.O. — CONTACTOR, NORMALLY OPEN
- N.C. — CONTACTOR, NORMALLY CLOSED
- MOTOR STARTER, SINGLE SPEED
  0 = STARTER SIZE
- 3 PHASE MOTOR
  2 = HORSEPOWER
- GROUNDING/DOWNLEAD CONDUCTOR
- SATS — STATIC AUTOMATIC TRANSFER SWITCH
- DC BATTERY
- SA OR TVSS "A" — SURGE ARRESTER OR TRANSIENT VOLTAGE SURGE SUPPRESSORS
  A = LETTER INDICATES SUPPRESSORS CATEGORY
- BUS DUCT
- DBLA — FEEDER IDENTIFICATION, SEE SINGLE LINE DIAGRAM
- LOAD INTERRUPTER SWITCH WITH FUSE
- DELTA CONNECTION
- WYE CONNECTION WITH GROUND
- DISCONNECT
- POWER SHIELDED TRANSFORMER
- SINGLE PHASE MOTOR

FIXTURE SCHEDULE

FIXTURE TYPE	WATTS TOTAL	MANUFACTURER AND CATALOG NO.	DESCRIPTION	LAMP NO.	LAMP WATTS	LAMP TYPE	FURNISHED AND INSTALLED BY ELECTRICAL CONTRACTOR	MOUNTING (S: SURFACE, R: RECEESED, W: WALL, G: GROUND, C: COVE)	REMARKS
F1	104	PEERLITE # 10CRMS-332-70/30-R4-277-GEB	INDIRECT BAFFLE	3	32	T8	✓	S	SEE FRI#30 47,38
F2	70	DEL RAY LTG. 2542-S-0-70-120-E	HIGH BAY LOBBY	1	70	MH		S	SEE RFI#30
F3	42	DEL RAY LTG. 2363-S42	WALL MTD. HALLWAY	1	42	CFL		W	
F4	32	DEL RAY LTG. 7601-1-32-277	PENDANT HALLWAY	1	32	CFL		S	
F5	26	DEL RAY LTG. 6010-26-2-120V.	PENDANT WAITING ROOM	1	26	CFL		S	
F6	68	LITHONIA RP-2-RS-S-PBL-277	RECESSED PERIMETER	2	32	T8		R	
F7	68	LITHONIA C-2-25-277-GEB-AL	4' STRIP	2	32	T8		S	
F8	104	SPEC LIGHT # FTS8-332-NI-X12-11-277-1/4	8' UNIBODY HIGH BAY	3	32	T8		S	SEE RFI#30 47
F8A	104	SPEC LIGHT # FTS8-332-NI-X12-11-277-1/4	4' UNIBODY HIGH BAY	3	32	T8		S	SEE RFI#30 47
F9	70	LITHONIA WFL2-70M-RW-277	COLUMN MTD.	1	70	MH		W	
F10	68	LITHONIA DMW-232-AR-277-1/3 EB	WORK AREA	2	32	T8		S	
F11	50	GOTHAM LGH-50M-9-FW-FFL-277	HIGH CEILING CANOPY	1	50	MH		R	SEE RFI#32
F12	32	GOTHAM LGF-218DTT-9-FW-FFL-277	CANOPY	2	18	CFL		R	
F13	5	LITHONIA EDG(1AND/OR2)G-277-ELN	EXIT	1	5	LED		S	
F14	175	LUMINIS# W740	POLE	1	150	HPS		–	(1)
F15	68	SAME AS F6 EXCEPT W/120VOLT BALLAST	RECESSED PERIMETER	2	32	T8		R	
F16	68	SAME AS F7 EXCEPT W/120 VOLT BALLAST	4' STRIP	2	32	T8		S	
F17	68	SAME AS F7 EXCEPT W/EMERGENCY BACK UP.	4' STRIP	2	32	T8		S	
F18	525	KURT VERSEN 1-1/4" APERTURE ON 277 V PRIMARY TRANSFORMER.	DROPPED CEILING CANOPY	15	35	MR16	↓	R	

(1) FURNISH AND INSTALL A 12'-0" POLE WITH CONCRETE BASE.

FIRE ALARM CODE

- FACP — FIRE ALARM CONTROL PANEL + 72" TO TOP
- FAAP — FIRE ALARM ANNUNCIATOR PANEL + 5'-6" TO TOP
- ASSD — AIR SAMPLING SMOKE DETECTION CONTROL PANEL
- FIRE ALARM MANUAL PULL STATION (ADDRESSABLE) + 48" AFF
- FIRE ALARM AUDIO/VISUAL SIGNAL (SPEAKER/STROBE) + 80" AFF
- CEILING MTD IONIZATION TYPE SMOKE DETECTOR
- CEILING MTD PHOTOELECTRIC TYPE SMOKE DETECTOR
- CEILING MTD RATE OF RISE HEAT DETECTOR
- IONIZATION TYPE DUCT DETECTOR
- ADDRESSABLE INTERFACE DEVICE
- ADDRESSABLE CONTROL DEVICE
- FA — CONDUIT DEDICATED TO THE FIRE ALARM SYSTEM
- STROBE DEVICE
- NOTIFIER HARSH SMOKE DETECTOR
- NOTIFIER ACCLIMATE SMOKE DETECTOR
- GENTEX HORN STROBE

RECEPTACLES

- DUPLEX RECEPTACLE, 20A, 125V, 2P, 3W, 18" AFF UON
- SINGLE RECEPTACLE, 20A, 125V, 2P, 3W, 18" AFF UON
- 480V POWER RECEPTACLE, TYPE AS NOTED
- SPECIAL RECEPTACLE, 18" AFF UON, VOLTAGE, NUMBER OF POLES AND AMPS AS INDICATED
- DOUBLE RECEPTACLE, 15A, 125V, 2P, 3W, 18" AFF UON
- FLUSH FLOOR MOUNTED POWER AND COMMUNICATION OUTLET BOX WITH DOUBLE DUPLEX CONVENIENCE RECEPTACLES AND TWO ETHERNET FIBER OPTIC OUTLET JACKS, PER PLAN DWGS AND SPECIFICATIONS.
- PLUGMOLD RECEPTACLE, 6" ABOVE COUNTER UON
- WALL MOUNTED TELEPHONE OUTLET
- JUNCTION BOX WALL MOUNTED, 10" AFF UON
- JUNCTION BOX INSTALLED IN CEILING
- FLUSH FLOOR MOUNTED JUNCTION BOX
- PULL BOX
- FLOOR MOUNTED OUTLET. DOUBLE DUPLEX PEDESTAL TYPE.
- WALL MOUNTED. DOUBLE DUPLEX OUTLET
- DATA OUTLET
- PULL BOX

DISTRIBUTION EQUIPMENT

- PANEL BOARD
- POWER PANEL OR DISTRIBUTION BOARD
- ELECTRICAL CABLE TRAY
- BUS DUCT# 3 480V 3ø-3W
- BUS DUCT #1 208V 3ø-3W
- BUS DUCT#2 240V 3ø-3W

COMMUNICATIONS LEGEND

- MICROPHONE OUTLET
- PUBLIC ADDRESS SPEAKER – CEILING MOUNTED
- PUBLIC ADDRESS SPEAKER SPEAKER/INTERCOM

GENERAL NOTES:

1- FIRE ALARM SYSTEM WILL BE DESIGN BUILT AND UNDER SEPARATE PLAN CHECK AND PERMIT.

2- WHERE EVER CABLE TRAY PENETRATE AND PASS THROUGH FIRE RATED WALL, CONTRACTOR TO MAKE, PROVIDE AND USE CONDUIT TRANSITION FROM CABLE TRAY TO CONDUIT TO CABLE TRAY.

3- CONTRACTOR TO FURNISH AND INSTALL SOLID BUTTOM CABLE TRAY IN EXPOSED AREAS AND WIRE BASKET TRAY ONLY IN ACCESSIBLE CEILING AREAS.

4- ELECTRICAL CONTRACTOR TO PROVIDE 1#6 GROUND WIRE AT MDF AND "IGF". BOND TO MAIN ELECTRICAL GROUND.

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COLLEGE OF ENGINEERING
SAN LUIS OBISPO, CA 93407

DWG TITLE
ELECTRICAL SYMBOLS, LEGEND AND FIXTURE SCHEDULE

SCALE: NONE DRAWN BY: FE

DWG NO.
E-1 ASI #27
OF – 14

DATE: 08 NOV '04

GENERAL NOTES

1. ALL MATERIALS AND WORKMANSHIP SHALL CONFORM TO SPECIFICATIONS, PLANS AND ALL GOVERNING ORDINANCES.
2. ALL WORK SHALL COMPLY WITH CALIFORNIA BUILDING CODE 2001, AND ALL OTHER LOCAL OR STATE AGENCIES HAVING JURISDICTION OVER THIS PROJECT.
3. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS OF THE JOB PRIOR TO STARTING CONSTRUCTION AND THE OWNER, ARCHITECT OR ENGINEER SHALL BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES OR INCONSISTENCIES. DO NOT SCALE DIMENSIONS, WHERE NO DIMENSIONS ARE PROVIDED, CONSULT WITH OWNER, ARCHITECT OR ENGINEER FOR CLARIFICATION BEFORE PROCEEDING WITH THE WORK.
4. ANY WORK PERFORMED IN CONFLICT WITH THE CONTRACT DOCUMENTS OR ANY CODE REQUIREMENTS SHALL BE CORRECTED BY THE CONTRACTOR AT HIS OWN EXPENSE AND AT NO EXPENSE TO THE OWNER, ARCHITECT OR ENGINEER.
5. ALL SYMBOLS AND ABBREVIATIONS USED ON THE DRAWINGS ARE CONSIDERED TO BE CONSTRUCTION STANDARDS. IF CLARIFICATION IS REQUIRED, THE CONTRACTOR SHALL NOTIFY THE ARCHITECT OR ENGINEER PRIOR TO PROCEEDING WITH THE WORK.
6. NO OPENINGS, POCKETS, NOTCHES, BLOCKOUTS, ETC., ARE ALLOWED IN STRUCTURAL ELEMENTS UNLESS DETAILED ON THE STRUCTURAL DRAWINGS. NOTIFY THE ARCHITECT OR ENGINEER OF ANY OPENINGS, POCKETS, ETC., SHOWN BY OTHER DRAWINGS BUT NOT SHOWN ON STRUCTURAL DRAWINGS.
7. THE CONTRACTOR SHALL PROVIDE ALL MEASURES NECESSARY TO PROTECT THE STRUCTURE DURING CONSTRUCTION. SUCH MEASURES SHALL INCLUDE BUT NOT LIMITED TO BRACING, SHORING, ETC. OBSERVATION VISITS OF THE SITE BY OWNER, ARCHITECT OR ENGINEER SHALL NOT INCLUDE THE INSPECTION OF BRACING, SHORING, ETC.
8. CONSTRUCTION MATERIAL SHALL BE SPREAD OUT IF PLACED ON FRAMED FLOORS, ROOFS, ETC. THE LOAD SHALL NOT EXCEED THE DESIGN LIVE LOAD.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL EXCAVATION PROCEDURES INCLUDING LAGGING, SHORING AND PROTECTION OF ADJACENT PROPERTY, STRUCTURES, STREETS AND UTILITIES IN ACCORDANCE WITH ALL NATIONAL, STATE AND LOCAL SAFETY ORDINANCES.
10. SEE MECHANICAL, ELECTRICAL AND/OR ARCHITECTURAL DRAWINGS FOR LOCATION AND SIZE OF PIPE, VENT, DUCT AND OTHER SIMILAR OPENINGS, AND EMBEDDED OR ATTACHED ITEMS.
11. NOTES AND DETAILS ON DRAWINGS SHALL TAKE PRECEDENCE OVER GENERAL NOTES AND TYPICAL DETAILS.
12. DO NOT SCALE DRAWINGS.
13. DURING COURSE OF CONSTRUCTION, THE ENGINEER, ARCHITECT SHALL VISUALLY REVIEW STRUCTURAL SYSTEM FOR GENERAL CONFORMANCE WITH THE APPROVED PLANS. ANY OBSERVED DEFICIENCIES SHALL BE REPORTED IN WRITING TO THE OWNER'S REPRESENTATIVE, TO THE CONTRACTOR AND TO THE DEPARTMENT.
14. STRUCTURAL OBSERVATION SHALL BE PROVIDED BY ENGINEER OF RECORD IN ACCORDANCE WITH SECTION 1702 A, CALIFORNIA BUILDING CODE 1998.

SOIL DATA

1. SOIL BEARING PRESSURE FOR COLUMN PADS = 750 psf FOR MAT MODULUS OF SUBGRADE = 45 pci
2. THE DESIGN IS BASED ON THE RECOMMENDATIONS GIVEN ON THE GEOTECHNICAL ENGINEERING INVESTIGATION REPORT FILE NO. PROJECT 2-1281 BY GSI SOILS INC. GEOTECHNOLOGIES INC. DATED JULY 01, 2003. ALL RECOMMENDATIONS RELATED TO SOIL PREPARATION AND CONSTRUCTION SHALL BE FOLLOWED THROUGH.

METAL DECK

1. ALL ROOF AND FLOOR METAL DECK AND ACCESSORIES SHALL BE FORMED FROM STEEL SHEETS CONFORMING TO ASTM A653 PER SECTION 05300 OR HIGHER SPECIFICATIONS.
2. DECK SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A525 COMMERCIAL COATING CLASS G-60 OR G-90.
3. CUTTING AND FRAMING OF OPENINGS FOR OTHER TRADES LARGER THAN 6 INCHES AND NOT SHOWN ON THE DRAWINGS WILL REQUIRE APPROVAL FROM THE ENGINEER.
4. ALL DECK SHALL BE ASC PACIFIC (I.C.B.O. 2757), VERCO (I.C.B.O. 2078) OR APPROVED EQUAL, AND THE TYPES AND GAUGES SHALL BE AS INDICATED ON THE DRAWINGS.
5. DECKS SHALL HAVE MINIMUM 2" BEARING AT SUPPORTS.
6. WELDING OF DECK AT ROOF DECKING SHALL BE CONTINUOUSLY INSPECTED BY THE DISTRICT INSPECTOR OR HIS REPRESENTATIVE.

CONCRETE

1. CONCRETE SHALL BE AS FOLLOWS:

LOCATION	AGGREGATES	STRENGTH @ 28 DAYS	DRY WEIGHT
A. CONTINUOUS FOOTING	HARDROCK	3000 PSI	145 PCF
B. FOOTING PADS	HARDROCK	3000 PSI	145 PCF
C. GRADE SLABS/MAT	HARDROCK	3500 PSI	145 PCF
	DESIGNED FOR	2000 PSI	
D. GRADE BEAMS	HARDROCK	3000 PSI	145 PCF
E. STRUCTURAL SLAB AND BEAMS	HARDROCK	4000 PSI	145 PCF
F. COLUMNS	HARDROCK	4000 PSI	145 PCF
G. CONCRETE OVER METAL DECK	LIGHTWEIGHT	3500 PSI	110 PCF

NOTE: A HIGHER GRADE OF CONCRETE MAY BE SUBSTITUTED FOR THOSE SHOWN ABOVE, BUT WILL BE SUBJECT TO THE CODE REQUIREMENTS OF THE HIGHER GRADE.

2. CEMENT SHALL CONFORM TO ASTM C150 TYPE I OR II.
3. HARDROCK AGGREGATES SHALL CONFORM TO ASTM C33. THEIR MAX. SIZE SHALL BE 1-1/2 INCHES FOR FOOTINGS GRADE BEAMS AND 1 INCH FOR ALL OTHER WORK.
4. LIGHTWEIGHT AGGREGATES (CONFORMING TO ASTM C330) SHALL BE APPROVED BY THE ENGINEER, AND THEIR MAXIMUM SIZE SHALL BE ONE INCH.
5. A STATEMENT OF MIX DESIGN SHALL BE MADE FOR CONCRETE WITH DESIGN STRENGTHS OVER 2500 PSI. COPIES OF THE MIX DESIGN SHALL BE SUBMITTED TO THE OWNER, ARCHITECT, ENGINEER, AND BUILDING DEPARTMENT FOR APPROVAL BEFORE USE.
6. ONLY ONE GRADE OF CONCRETE SHALL BE POURED ON THE JOB AT ONE TIME.
7. CONTINUOUS INSPECTION IS REQUIRED FOR ALL CONCRETE WITH DESIGN STRENGTHS OVER 2000 PSI.
8. CONCRETE COVER OVER REINFORCING SHALL BE AS FOLLOWS:
   a) CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH 3"
   b) EXPOSED TO EARTH OR WEATHER
      1) CAST-IN-PLACE - NON-STRESSED 2"
   c) NOT EXPOSED TO EARTH OR WEATHER
      1) MAIN BARS IN BEAMS AND COLUMNS 2"
      2) TIES AND STIRRUPS 1-1/2"
9. ALL REINFORCING SHOWN CONTINUOUS SHALL BE LAPPED PER ACI 318 CLASS B SPLICE AND A MIN. OF 40 DIAM. (GRADE 60) AT SPLICES, AND SHALL BE MADE AWAY FROM POINTS OF MAXIMUM STRESS. MINIMUM LAP SHALL BE 2'-0" LONG.
10. BEFORE CONCRETE IS POURED, CHECK WITH ALL TRADES TO INSURE PROPER PLACEMENT OF ALL OPENINGS, SLEEVES, CURBS, CONDUITS, BOLTS, INSERTS, ETC., RELATING TO WORK.
11. ALL SLEEVES NOT SPECIFICALLY SHOWN ON THE DRAWINGS SHALL BE LOCATED BY THE TRADES INVOLVED AND SHALL BE APPROVED BY THE ENGINEER.

    DRY PACK CONCRETE SHALL BE ONE PART PORTLAND CEMENT AND ONE PART SAND WITH SUFFICIENT WATER TO ALLOW A SMALL AMOUNT OF PASTE TO COME TO THE SURFACE.
12. CONCRETE GROUT SHALL BE NON-SHRINKING WITH SUFFICIENT WATER TO ALLOW POURING. ULTIMATE COMPRESSIVE STRENGTH (F'C) AT 28 DAYS SHALL BE EQUAL TO 5000 PSI MINIMUM.
13. A MIX THAT PRODUCES LOWEST SLUMP COMPATIBLE WITH PROPER PLACEMENT SHALL BE USED. (4-1/2" MAXIMUM SLUMP UNLESS OTHERWISE APPROVED BY THE STRUCTURAL ENGINEER.)
14. ALL CONCRETE IS DESIGNED BY ULTIMATE STRENGTH DESIGN METHOD.
15. FORMS FOR CONCRETE STRUCTURAL MEMBERS (SLABS, BEAMS) SHALL NOT BE STRIPPED UNTIL THE CONCRETE HAS REACHED ITS DESIGN STRENGTH.
16.

REINFORCING

1. ALL REINFORCING SHALL CONFORM TO ASTM A-615 SPECIFICATIONS, 2-2628(B) GRADE 60 EXCEPT #3 BARS MAY BE GRADE 40. WELDED BARS SHALL BE ASTM A-706.
2. REINFORCING BARS SHALL BE SPLICED AND BENT IN STRICT ACCORDANCE WITH THE DRAWINGS AND DETAILS AND C.R.S.I. PUBLICATIONS. NO KINKS ALLOWED. ALL BARS SHALL BE CLEAN PRIOR TO CONCRETE PLACEMENT.
3. PROVIDE DOWELS OF SAME SIZE AND NUMBER FROM ADJACENT POUR, BOTH VERTICALLY AND HORIZONTALLY TO MATCH TYPICAL REINFORCING SHOWN. LAPS TO BE IN ACCORDANCE WITH THE DRAWINGS AND DETAILS. DOWELS SHALL BE CLEANED AFTER POUR.
4. USE LOW HYDROGEN ELECTRODES, GRADE E-70 OR E-90, FOR WELDING OF REINFORCING BARS.
5. SHOP DRAWINGS FOR REINFORCING STEEL SHALL BE SUBMITTED TO THE STRUCTURAL ENGINEER FOR APPROVAL PRIOR TO FABRICATION.
6. FIELD WELDING OR BENDING OF REINFORCING IS NOT PERMITTED EXCEPT AS INDICATED ON THE DRAWINGS OR AS APPROVED BY THE STRUCTURAL ENGINEER.

STRUCTURAL STEEL

1. STRUCTURAL STEEL SHALL CONFORM TO ASTM A-36 UNO, AND TO THE AISC SPECIFICATIONS FOR FABRICATION AND ERECTION.
2. TUBES SHALL CONFORM TO ASTM A-500 STANDARD SPECIFICATIONS, GRADE B.
3. ALL STEEL EXPOSED TO WEATHER SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
4. BOLTS SHALL CONFORM TO ASTM A-307 SPECIFICATIONS TYPICALLY UNLESS NOTED OTHERWISE AS H.S.B. HIGH STRENGTH BOLTS (H.S.B.) TO CONFORM TO ASTM A-325SC.
5. ALL STRUCTURAL STEEL SHALL BE FABRICATED IN THE SHOP OF A FABRICATOR LICENSED BY THE CITY OF LOS ANGELES AND SHOP DRAWINGS SHALL BE SUBMITTED TO THE ARCHITECT FOR APROVAL PRIOR TO FABRICATION.
6. ALL WELDING, EXCEPT MINOR OR TACK WELDING, SHALL BE CONTINUOUSLY INSPECTED BY THE DISTRICT INSPECTOR.
7. PROVIDE ONE SHOP COAT OF PAINT ON ALL STRUCTURAL STEEL NOT COVERED WITH CONCRETE, FIREPROOFING, MASONRY OR AT CONTACT SURFACES AT HIGH STRENGTH BOLTS.
8. CONTRACTOR SHALL SUBMIT METHOD OF CONSTRUCTION AND TEMPORARY BRACING OF STRUCTURAL STEEL FRAMING TO THE STRUCTURAL ENGINEER AND BUILDING DEPARTMENT FOR APPROVAL.
9. STUDS AND SHEAR ANCHORS TO CONFORM TO ASTM A-108 OR A-496 SPECIFICATIONS. ALL STUDS SHALL BE AUTOMATIC END WELDED PER MANUFACTURER'S RECOMMENDATION TO PROVIDE FUSION BETWEEN THE END OF STUD AND STEEL SURFACE OF BEAM/COLUMN.
10. HIGH STRENGTH BOLTING SHALL BE CONTINUOUSLY INSPECTED BY THE DISTRICT INSPECTOR.

BLOCK MASONRY NOTES

1. UNITS SHALL BE CONCRETE BLOCK CONFORMING TO ASTM C90 WITH AN ULTIMATE COMPRESSIVE STRENGTH OF MASONRY F'm=2000 PSI AT 28 DAYS.
2. GROUT SHALL BE OF FLUID CONSISTENCY AND SHALL BE ONE PART CEMENT, THREE PARTS SAND, AND MAY CONTAIN AN ADDITIONAL TWO PARTS PEA GRAVEL IF GROUT SPACES ARE 4" OR MORE IN EVERY DIRECTION. F'c = 2000 PSI MINIMUM AT 28 DAYS.
3. MORTAR MIX SHALL BE 1:3 PORTLAND CEMENT TO SAND WITH NOT MORE THAN ONE-HALF NOR LESS THAN ONE-QUARTER PART LIME PUTTY WITH RED LABEL ADDED, TYPE S, 2000 PSI.
4. ALL BLOCK REINFORCING SHALL HAVE A MINIMUM LAP OF 50 BAR DIAMETER OR 2'-0" MINIMUM.
5. GROUT FILL ALL CELLS UNLESS NOTED OR SHOWN OTHERWISE.
6. ALL CONCRETE BLOCK WALLS SHALL BE CONSTRUCTED UTILIZING COMMON RUNNING BOND UNLESS NOTED OR SHOWN OTHERWISE.
7. CONTINUOUS SPECIAL INSPECTION IS REQUIRED FOR CMU, MORTAR AND GROUT WORK BY AN APPROVED INSPECTOR.
8. CONCRETE BLOCK SHALL BE OF SIZES SHOWN ON THE DRAWINGS, TYPE AND COLORS AS SELECTED BY THE ARCHITECT AND CONFORM TO ASTM C-90, GRADE N-1. BLOCK SHALL BE NORMAL WEIGHT UNIT.

EXCAVATION

1. THE PREPARATION OF BUILDING PAD SHALL BE PER RECOMMENDATIONS IN THE GEOTECHNICAL REPORT. 4 FEET DEEP OVEREXCAVATION AND COMPACTED FILL OF MIN. 90% OF MAX. DRY DENSITY IS REQUIRED.

SPECIAL INSPECTION

SPECIAL INSPECTION SHALL BE PERFORMED PER SECTION 1701 OF CBC FOR THE FOLLOWING:

CONCRETE:
a) DURING TAKING OF TEST SPECIMENS AND PLACING OF REINFORCED CONCRETE.
b) PRIOR TO AND DURING PLACEMENT OF CONCRETE AROUND BOLTS.

STRUCTURAL WELDING:
a) FLOOR DECK WELDING.
b) WELDED STUDS ON STEEL BEAMS.
c) WELDING OF REINFORCING STEEL.
d) MOMENT FRAME FIELD WELDING.

HIGH STRENGTH BOLTING:
HIGH STRENGTH A325 BOLT INSTALLATION.

EARTHWORK:
DURING EARTHWORK EXCAVATION, GRADING AND FILLING OPERATIONS.

STRUCTURAL DESIGN CRITERIA

CODE: CALIFORNIA BUILDING CODE 2001 ED.

LOADING: DEAD LOADS

ROOF	12 PSF
2ND FLOOR	80 PSF AND

LIVE LOADS

ROOF	20 PSF
2ND FLOOR	80 PSF FOR CLASSROOM
	80 PSF FOR CORRIDORS
	80 PSF FOR RESTROOMS

SOIL BEARING: 3000 PSF FOR WALL FOUNDATION

SEISMIC LOADS/PARAMETERS:

SOURCE TYPE B	N_a = 1.0
SOIL PROFILE TYPE B	N_v = 1.2
	R = 7.0
SEISMIC IMPORTANCE FACTOR	1.0

STRUCTURAL OBSERVATION

1. STRUCTURAL OBSERVATION IS REQUIRED FOR THE STRUCTURAL SYSTEM IN ACCORDANCE WITH UBC SECTION 1702. STRUCTURAL OBSERVATION IS THE VISUAL OBSERVATION OF THE ELEMENTS AND CONNECTIONS OF THE STRUCTURAL SYSTEM AT SIGNIFICANT CONSTRUCTION STAGES AND THE COMPLETED FOR GENERAL CONFORMANCE TO THE APPROVED PLANS AND SPECIFICATIONS. STRUCTURAL OBSERVATION DOES NOT WAIVE THE RESPONSIBILITY FOR THE INSPECTIONS REQUIRED OF THE INSPECTOR OR THE DEPUTY INSPECTOR.
2. THE OWNER SHALL EMPLOY A CIVIL OR STRUCTURAL ENGINEER OR ARCHITECT TO PERFORM THE STRUCTURAL OBSERVATION. THE ENGINEER OR ARCHITECT SHALL BE REGISTERED OR LICENSED IN THE STATE OF CALIFORNIA. THE DEPARTMENT OF BUILDING AND SAFTEY RECOMENDS THE USE OF THE ENGINEER OR ARCHITECT RESPONSIBLE FOR THE STRUCTURAL DESIGN WHEN THEY ARE INDEPENDENT OF THE CONTRACTOR.
3. THE STRUCTURAL OBSERVER SHALL PROVIDE EVIDENCE OF EMPLOYMENT BY THE OWNER A LETTER FROM THE OWNER OR A COPY OF THE AGREEMENT FOR SERVICES SHALL BE SENT TO THE BUILDING INSPECTOR. BEFORE THE FIRST SITE VISIT. THE STRUCTURAL OBSERVER SHALL ALSO INFORM THE OWNER OF THE REQUIREMENTS FOR A PRECONSTRUCTION MEETING AND SHALL PRESIDE OVER THIS MEETING.
4. THE OWNER OR THE OWNER'S REPRESENTATIVE SHALL COORDINATE AND CALL FOR A MEETING BETWEEN THE ENGINEER OR ARCHITECT RESPONSIBLE FOR THE STRUCTURAL DESIGN, STRUCTURAL OBSERVER, CONTRACTOR, AFFECTED SUBCONTRACTORS AND DEPUTY INSPECTORS. THE PURPOSE OF THE MEETING SHALL BE TO IDENTIFY THE MAJOR STRUCTURAL ELEMENTS AND CONNECTIONS THAT AFFECT THE VERTICAL AND LATERAL LOAD SYSTEMS OF THE STRUCTURE AND TO REVIEW SCHEDULING OF THE REQUIRED OBSERVATIONS. A RECORD OF THE MEETING SHALL BE INCLUDED IN THE FIRST OBSERVATION REPORT SUBMITTED TO THE BUILDING INSPECTOR.
5. THE STRUCTURAL OBSERVER SHALL PERFOM SITE VISITS AT THOSE STEPS IN THE PROGRESS OF THE WORK THAT ALLOW FOR CORRECTION OF DEFICIENCIES WITHOUT SUBSTANTIAL EFFORT OR UNCOVERING OF THE WORK INVOLVED. AT A MINIMUM, THE FOLLOWING SIGNIFICANT CONSTRUCTION STAGES REQUIRED A SITE VISIT AND AN OBSERVATION REPORT FROM THE STRUCTURAL OBSERVER.

CONSTRUCTION STAGES	ELEMENTS/CONNECTIONS TO BE OBSERVED
a) _____	/ REINFORCEMENT
b) STRUCTURAL FRAMES	/ STRUCTURAL MEMBERS AND CONNECTIONS
c) SECOND FLOOR	/ FLOOR
d) ROOF	/ FRAMING, SHEATHING

6. THE STRUCTURAL OBSERVER SHALL PREPARE A REPORT ON THE DEPARTMENT FORM FOR EACH SIGNIFICANT STAGE OF CONSTRUCTION OBSERVED. THE ORIGINAL OF THE OBSERVATION REPORT SHALL BE SENT TO THE BUILDING INSPECTOR'S OFFICE AND SHALL BE SIGNED AND SEALED (WET STAMP) BY THE RESPONSIBLE STRUCTURAL OBSERVER. ONE COPY OF THE OBSERVATION REPORT SHALL BE ATTACHED TO THE APPROVED PLANS. THE COPY ATTACHED TO THE PLANS NEED NOT BE SEALED BUT SHALL BE SIGNED BY THE RESPONSIBLE STRUCTURAL OBSERVER OR THEIR DESIGNEE. COPIES OF THE REPORT SHALL ALSO BE GIVEN TO THE OWNER, CONTRACTOR AND DEPUTY INSPECTOR.
7. A FINAL OBSERVATION REPORT MUST BE SUBMITTED WHICH SHOWS THAT ALL OBSERVED DEFICIENCIES WERE RESOLVED AND THE STRUCTURAL SYSTEM GENERALLY CONFORMS WITH THE APPROVED PLANS AND SPECIFICATIONS. THE DEPARTMENT OF BUILDING AND SAFTEY WILL NOT ACCEPT THE STRUCTURAL WORK WITHOUT THIS FINAL OBSERVATION REPORT AND THE CORRECTION OF SPECIFIC DEFICIENCIES NOTES DURING NORMAL BUILDING AND DEPUTY INSPECTION.
8. WHEN THE OWNER ELECTS TO CHANGE THE STRUCTURAL OBSERVER OF RECORD, THE OWNER SHALL:
   a) NOTIFY THE BUILDING INSPECTOR IN WRITING BEFORE THE NEXT INSPECTION.
   b) CALL AN ADDITIONAL PRECONSTRUCTION MEET, AND
   c) FURNISH THE REPLACEMENT OBSERVER WITH A COPY OF ALL PREVIOUS OBSERVATION REPORTS.

   THE REPLACEMENT STRUCTURAL OBSERVER SHALL APPROVE THE CORRECTION OF THE ORIGINAL OBSERVED DEFICIENCIES UNLESS OTHERWISE APPROVED BY PLAN CHECK SUPERVISION. THE POLICY OF THE DEPARTMENT SHALL BE TO CORRECT ANY PROPERLY NOTED DEFICIENCIES WITHOUT CONSIDERATION OF THEIR SOURCE.

STRUCTURAL STEEL

1. STRUCTURAL STEEL SHALL CONFORM TO ASTM A-36 UNO, AND TO THE AISC SPECIFICATIONS FOR FABRICATION AND ERECTION.
2. TUBES SHALL CONFORM TO ASTM A-500 STANDARD SPECIFICATIONS, GRADE B.
3. ALL STEEL EXPOSED TO WEATHER SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.

SEE RFI #74

4. BOLTS SHALL CONFORM TO ASTM A-307 SPECIFICATIONS TYPICALLY UNLESS NOTED OTHERWISE AS H.S.B. HIGH STRENGTH BOLTS (H.S.B.) TO CONFORM TO ASTM A-325N (STD.).
5. (NOT USED)
6. ALL WELDING, EXCEPT MINOR OR TACK WELDING, SHALL BE CONTINUOUSLY INSPECTED BY AN APPROVED WELDING INSPECTOR.
7. PROVIDE ONE SHOP COAT OF PAINT ON ALL STRUCTURAL STEEL NOT COVERED WITH CONCRETE, FIREPROOFING, MASONRY OR AT CONTACT SURFACES AT HIGH STRENGTH BOLTS.
8. CONTRACTOR SHALL SUBMIT METHOD OF CONSTRUCTION AND TEMPORARY BRACING OF STRUCTURAL STEEL FRAMING TO THE STRUCTURAL ENGINEER AND BUILDING DEPARTMENT FOR APPROVAL.
9. HIGH STRENGTH BOLTING SHALL BE CONTINUOUSLY INSPECTED BY AN APPROVED INSPECTOR.

John Trautmann Architects

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OFFICE OF THE STATE FIRE MARSHAL
APPROVED FIRE AND PANIC ONLY

Reviewed by: _____
Code Enforcement South

Approval of this plan does not authorize or approve any omission or deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

DSA - CSU
MOU - _____

IDENTIFICATION STAMP
DIVISION OF THE STATE ARCHITECT
OFFICE OF REGULATION SERVICE

APPL. #:

ACCESS COMPLIANCE SECTION
DATE: _____

[CONSULTANT'S SIGNATURE]
PC ASSOCIATES

RECORD DRAWINGS
WARNING

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JTA JOB NO: 0309 FOUNDATION PROJECT NO: PR 04-600

CAL POLY

BONDERSON ENGINEERING PROJECTS CENTER
ENGINEERING / ARCHITECTURE RENOVATION & REPLACEMENT PHASE II-A

COLLEGE OF ENGINEERING
SAN LUIS OBISPO, CA 93407

DWG TITLE

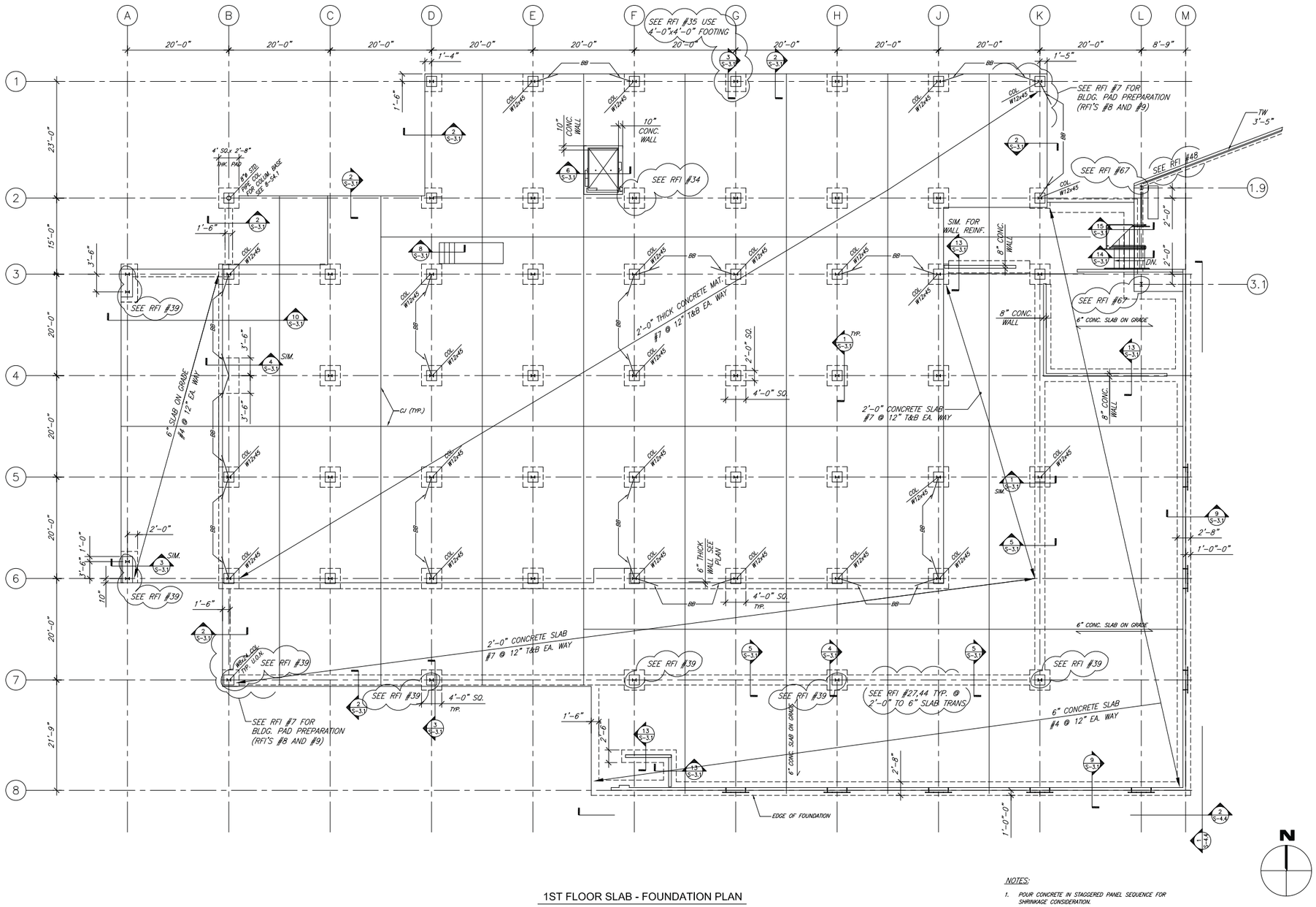
GENERAL NOTES

SCALE: DRAWN BY: SC

DWG NO.

S1.0

DATE: 08 NOV '04



1ST FLOOR SLAB - FOUNDATION PLAN

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

NOTES:

1. *POUR CONCRETE IN STAGGERED PANEL SEQUENCE FOR SHRINKAGE CONSIDERATION.*

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CAL POLY

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COLLEGE OF ENGINEERING
SAN LUIS OBISPO, CA 93407

DWG TITLE

1ST FLOOR SLAB/ FOUNDATION PLAN

SCALE: 1/8" = 1'-0" DRAWN BY: APSG

DWG NO.

S2.1

DATE: 08 NOV '04

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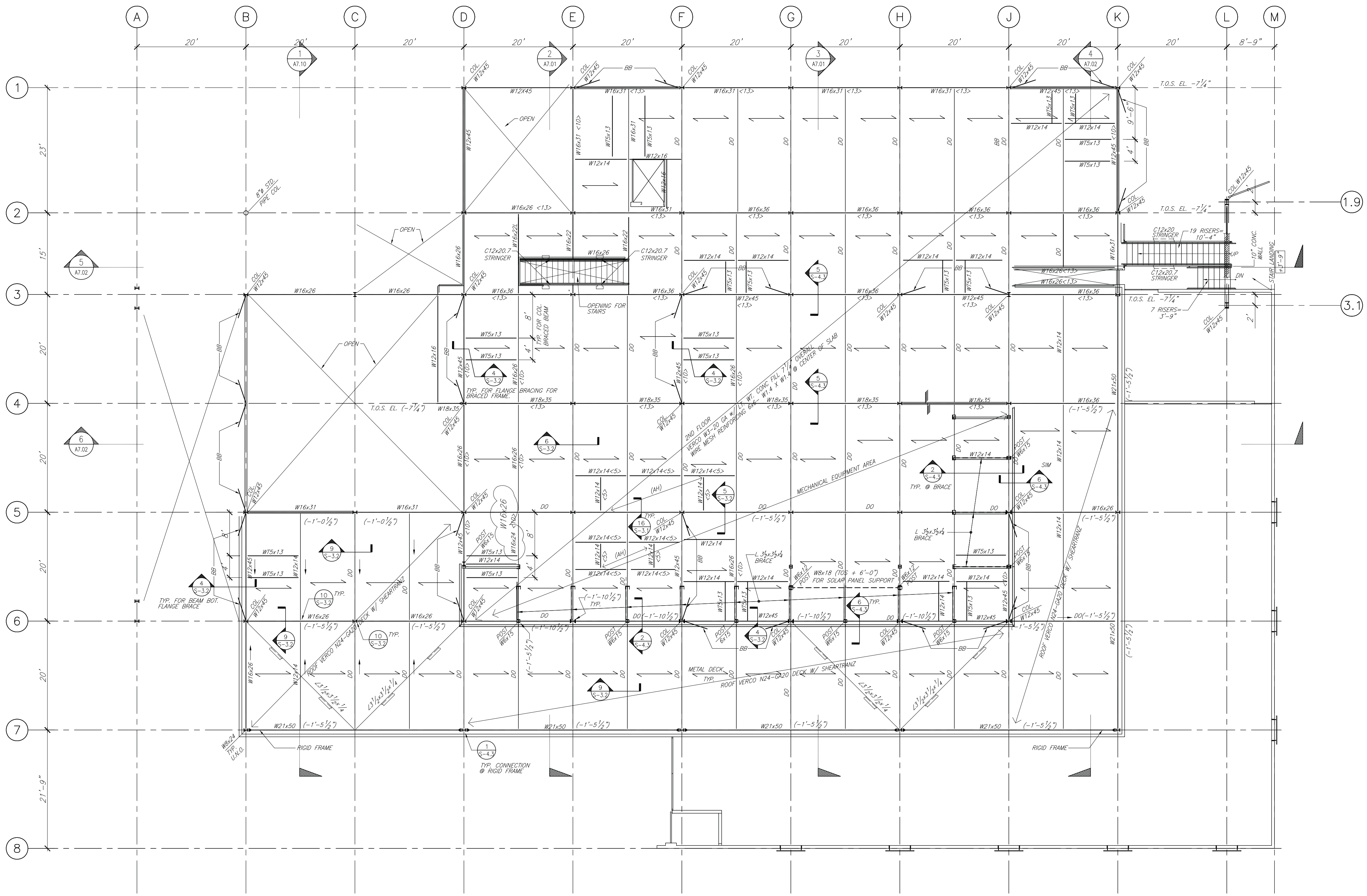

ROOF: DL = 12 PSF
LL = 20 PSF

FLOOR & MECH. EQUIPMENT AREA: DL = 80 PSF
LL = 80 PSF

NOTES:

1. ⟵⟶ INDICATE DIRECTIONS OF FLOOR/ROOF DECK SPAN.
2. ( ) INDICATES TOP OF STEEL ELEV. TOS ELEVATION AS SHOWM ARE BASED ON DATUM (0'–0") TO TOP OF CONCRETE ELEVATION FOR THE MAIN FLOOR CONCRETE DECK.
3. BB INDICATES BRACED BAYS.
4. < > INDICATED NO. OF EQUALLY SPACED 3/4" øx 5" WELDED STUDS.

SECOND FLOOR - FRAMING PLAN

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

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Code Enforcement South

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PC ASSOCIATES

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JTA JOB NO: 0309 FOUNDATION PROJECT NO: PR 04–600

BONDERSON ENGINEERING PROJECTS CENTER
ENGINEERING / ARCHITECTURE RENOVATION & REPLACEMENT
PHASE II–A

COLLEGE OF ENGINEERING
SAN LUIS OBISPO, CA 93407

DWG TITLE

SECOND FLOOR FRAMING PLAN

SCALE: 1/8" = 1'–0" DRAWN BY: APSG

DWG NO.

S2.2

DATE: 08 NOV '04

17 APPENDIX E FIRE SPRINKLER SYSTEM HYDRAULIC CALCULATIONS

Hydraulic Overview

Job

Job Number: 596	Design Engineer: Garrett Brown
Job Name: Bonderson Projects Center	Phone: 925-846-9484 / FAX: 925-846-9710
Address 1: Building 197	State Certification/License Number:
Address 2: Cal Poly, San Luis Obispo 93401	AHJ:
Address 3:	Job Site/Building:

System

Density: 0.150gpm/ft²	Area of Application: 1500.00ft² (Actual 1017.89ft²)
Most Demanding Sprinkler Data: 5.6 K-Factor 19.25 at 11.816	Hose Streams: 250.00
Coverage Per Sprinkler: 128.33ft²	Number Of Sprinklers Calculated: 10
System Pressure Demand: 67.425	System Flow Demand: 220.56
Total Demand: 470.56 @ 67.425	Pressure Result: +9.090 (11.9%)

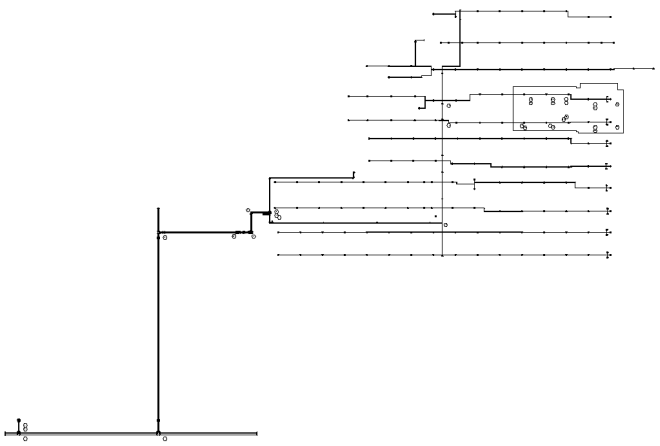
Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1210.00	250.00	80.000	60.000

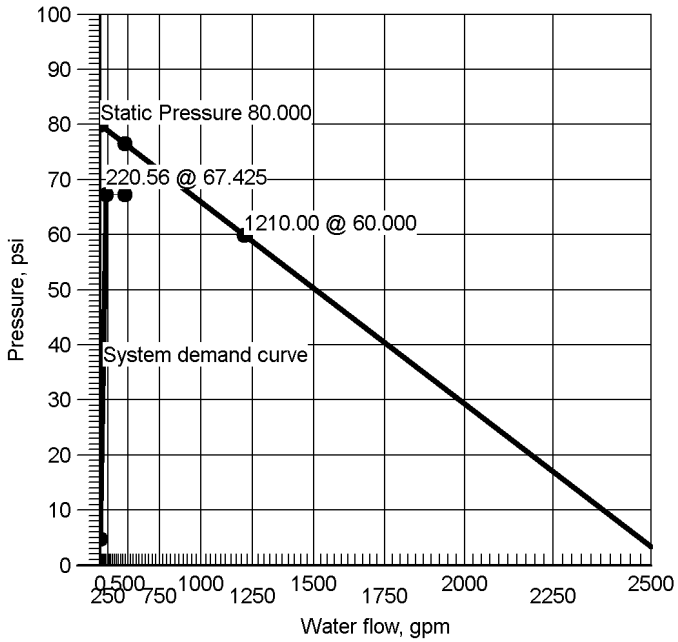
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
B.O.R.	61.947	28.02	220.56
T.O.R	57.832	29	220.56

Fire Sprinklers from CAD convert level 1.cad



Water Supply at Node 1 (1210.00, 250.00, 80.000, 60.000)



Hydraulic Summary

Job

Job Number: 596	Design Engineer: Garrett Brown
Job Name: Bonderson Projects Center	State Certification/License Number:
Address 1: Building 197	AHJ:
Address 2: Cal Poly, San Luis Obispo 93401	Job Site/Building:
Address 3:	Drawing Name: Fire Sprinklers from CAD convert level 1.cad

System

Most Demanding Sprinkler Data: 5.6 K-Factor 19.25 at 11.816

Hose Allowance At Source: 250.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 250.00

System Flow Demand	Total Water Required (Including Hose Allowance)
220.56	470.56

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 18.17 between nodes 14 and 15

Maximum Velocity Under Ground	
2.43 between nodes 7 and 8	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
1418.43gal	

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group I	

Density	Area of Application
0.150gpm/ft²	1500.00ft² (Actual 1017.89ft²)

Number Of Sprinklers Calculated	Coverage Per Sprinkler
10	128.33ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area: Right: 57.624

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply	250.00	80.000	60.000		1210.00	76.515		470.56	67.425	9.090

Contractor

	Contractor Number	Contact Name	Contact Title

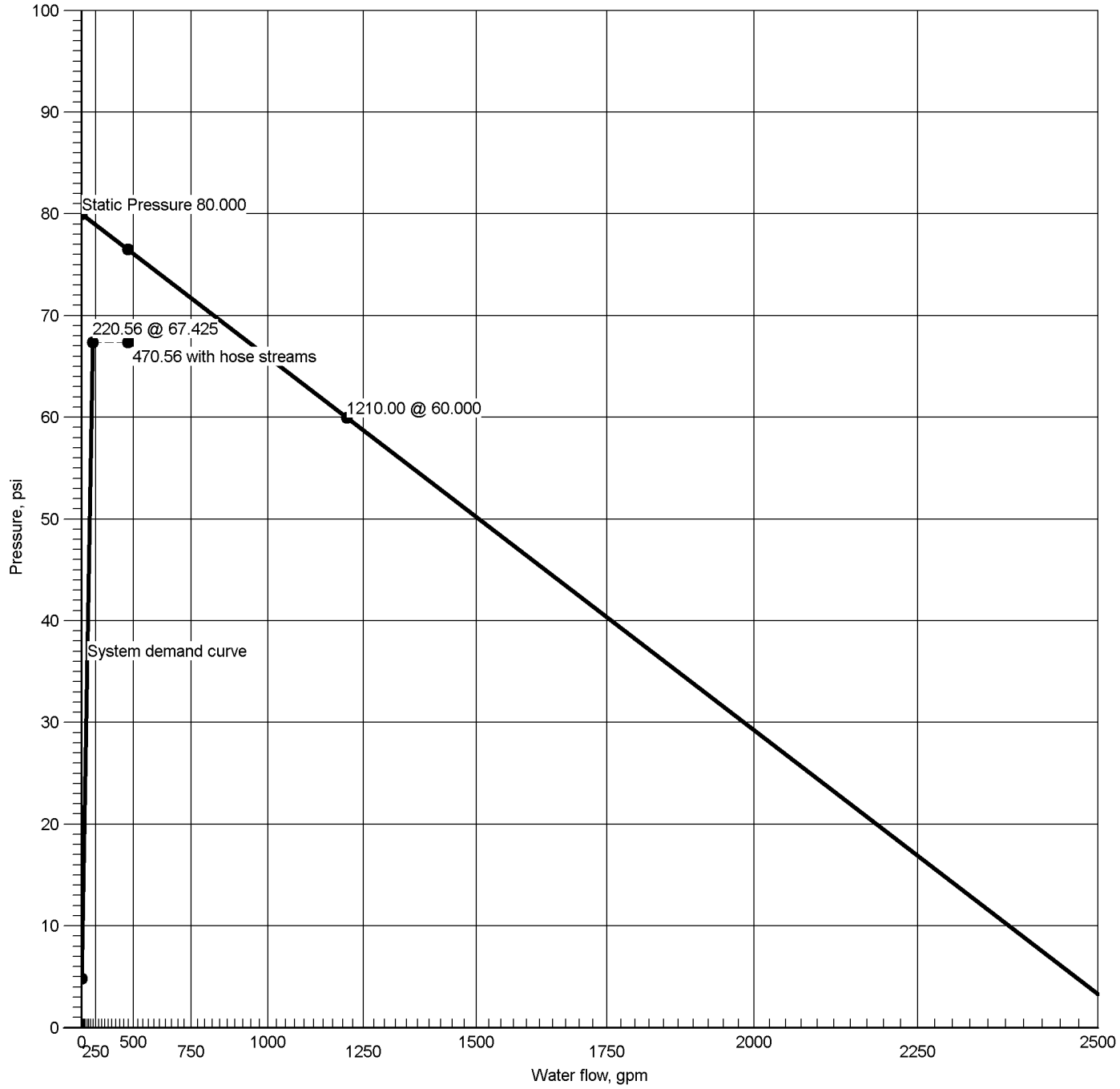
Name of Contractor:	Phone	Extension

Address 1	FAX

Address 2	E-mail

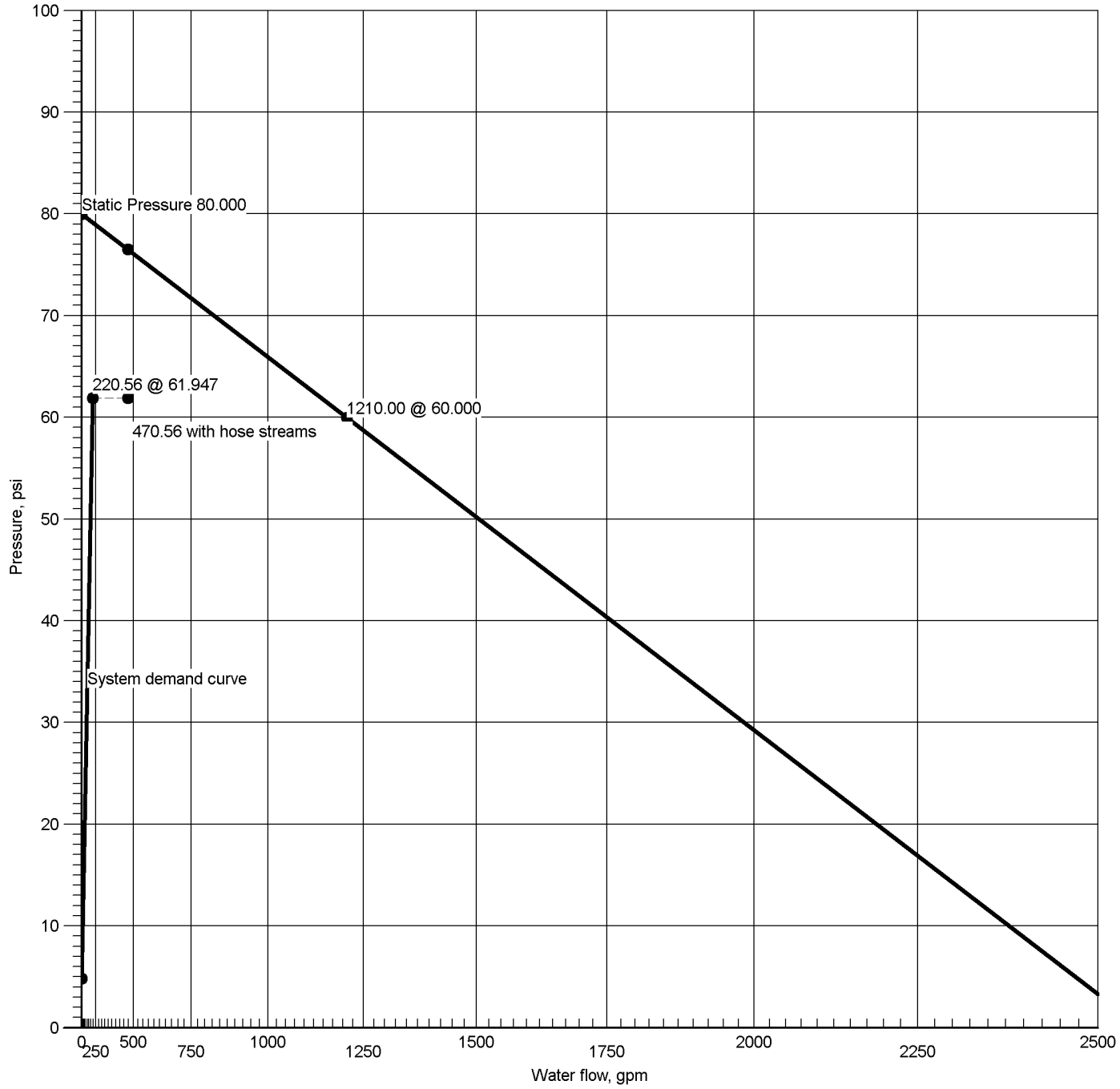
Address 3	Web-Site

Water Supply at Node 1



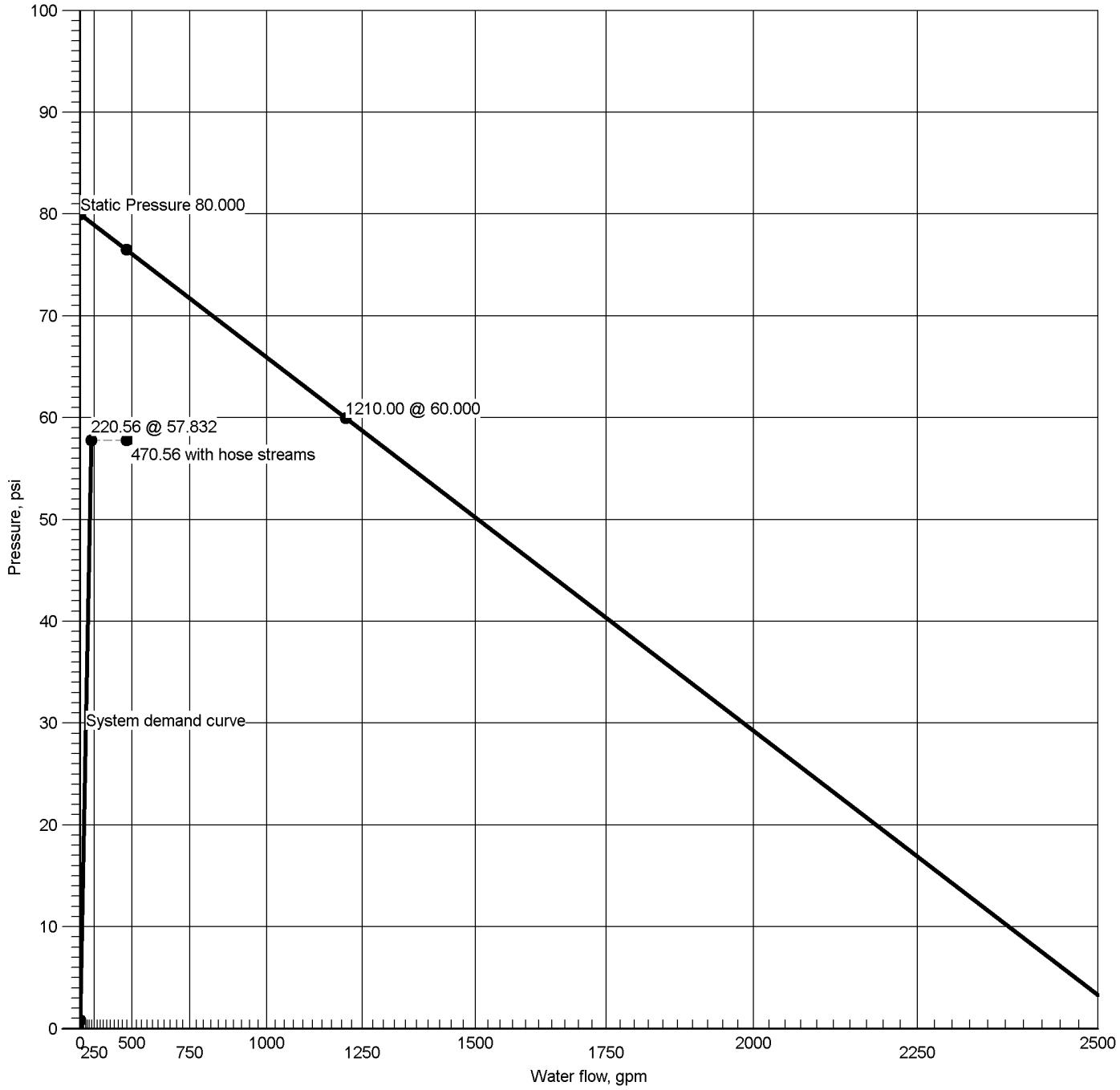
Hydraulic Graph	Water Supply at Node 1
Static: Pressure	80.000
Residual: Pressure	60.000 @ 1210.00
Available Pressure at Time of Test	76.515 @ 470.56
System Demand	67.425 @ 220.56
System Demand (Including Hose Allowance at Source)	67.425 @ 470.56

B.O.R.



Hydraulic Graph	B.O.R.
Static: Pressure	N/A
Residual: Pressure	N/A
Available Pressure at Time of Test	N/A
System Demand	61.947 @ 220.56
System Demand (Including Hose Allowance at Source)	61.947 @ N/A

T.O.R



Hydraulic Graph	T.O.R
Static: Pressure	N/A
Residual: Pressure	N/A
Available Pressure at Time of Test	N/A
System Demand	57.832 @ 220.56
System Demand (Including Hose Allowance at Source)	57.832 @ N/A

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
SP	1.0490	19.25	7.15	120		0.121248	12'-0	Pf 1.697
207	12'-2	19.25	5.6	11.816		Sprinkler	2'-0	Pe 0.867
22	10'-2			14.381		E(2'-0)	14'-0	Pv
BL	1.3800	39.14	8.40	120		0.118507	11'-3	Pf 2.044
22	10'-2	19.89		14.381		Flow (q) from Route 3	6'-0	Pe
21	10'-2			16.425		2E(3'-0)	17'-3	Pv
BL	1.3800	60.48	12.97	120		0.265144	10'-0	Pf 2.651
21	10'-2	21.35		16.425		Flow (q) from Route 5		Pe
20	10'-2			19.077			10'-0	Pv
BL	1.3800	83.59	17.93	120		0.482394	10'-0	Pf 4.824
20	10'-2	23.10		19.077		Flow (q) from Route 7		Pe
19	10'-2			23.901			10'-0	Pv
BL	1.6100	109.59	17.27	120		0.375800	39'-10½	Pf 20.991
19	10'-2	26.00		23.901		Flow (q) from Route 9	16'-0	Pe
18	10'-2			44.891		2E(4'-0), PO(8'-0)	55'-10½	Pv
CM	2.6350	109.59	6.45	120		0.034119	8'-11½	Pf 0.305
18	10'-2			44.891				Pe
13	10'-2			45.197			8'-11½	Pv
CM	2.6350	220.56	12.98	120		0.124444	46'-3	Pf 7.804
13	10'-2	110.97		45.197		Flow (q) from Route 2	16'-5½	Pe
12	10'-2			53.001		T(16'-5½)	62'-8½	Pv
CM	3.2600	220.56	8.48	120		0.044137	82'-7	Pf 4.832
12	10'-2			53.001			26'-10½	Pe 0.000
11	10'-2			57.832		LtE(6'-8½), T(20'-2), T.O.R	109'-5½	Pv
FR	4.2600	220.56	4.96	120		0.011994	7'-5	Pf 0.089
11	10'-2			57.832				Pe 3.577
10	1'-11			61.498		f(-0.000)	7'-5	Pv
FR	4.0260	220.56	5.56	120		0.015792	1'-0	Pf 0.016
10	1'-11			61.498				Pe 0.434
9	0'-11			61.947		B.O.R.	1'-0	Pv
FR	6.2800	220.56	2.28	140		0.001362	13'-3	Pf 0.057
9	0'-11			61.947			28'-4½	Pe 2.168
8	-4'-1			64.172		2LtE(14'-2)	41'-7½	Pv
UG	6.0900	220.56	2.43	150		0.001393	9'-0	Pf 0.032
8	-4'-1			64.172			13'-10½	Pe -0.000
7	-4'-1			64.203		LtE(13'-10½)	22'-10½	Pv
FR	6.2800	220.56	2.28	140		0.001362	12'-0	Pf 5.166
7	-4'-1			64.203			42'-6½	Pe -0.000
6	-4'-1			69.369		3LtE(14'-2), BFP(-5.091)	54'-6½	Pv
UG	6.0900	220.56	2.43	150		0.001393	35'-8	Pf 0.120
6	-4'-1			69.369			50'-10	Pe
5	-4'-1			69.490		GV(4'-7½), T(46'-2½)	86'-6	Pv
UG	7.9800	220.56	1.41	150		0.000373	90'-9	Pf 0.058
5	-4'-1			69.490			64'-10½	Pe
4	-4'-1			69.548		2GV(6'-0½), T(52'-10)	155'-7½	Pv
UG	11.6500	220.56	0.66	150		0.000059	90'-0	Pf 0.010
4	-4'-1			69.548			80'-5½	Pe
3	-4'-1			69.558		T(80'-5½)	170'-5½	Pv
UG	6.0900	220.56	2.43	150		0.001393	6'-0	Pf 0.028
3	-4'-1			69.558			13'-10½	Pe
2	-4'-1			69.585		LtE(13'-10½)	19'-10½	Pv
FR	6.2800	220.56	2.28	140		0.001362	5'-0	Pf 0.007
2	-4'-1			69.585				Pe -2.168
1	0'-11			67.425		Water Supply	5'-0	Pv
		250.00				Hose Allowance At Source		
1		470.56						
• • • • • Route 2 • • • • •								
SP	1.0490	19.58	7.27	120		0.125155	12'-0	Pf 1.752
204	12'-2	19.58	5.6	12.229		Sprinkler	2'-0	Pe 0.867
17	10'-2			14.848		E(2'-0)	14'-0	Pv
BL	1.3800	39.81	8.54	120		0.122317	9'-4	Pf 1.874
17	10'-2	20.23		14.848		Flow (q) from Route 4	6'-0	Pe
16	10'-2			16.722		2E(3'-0)	15'-4	Pv
BL	1.3800	61.36	13.16	120		0.272315	10'-0	Pf 2.723
16	10'-2	21.55		16.722		Flow (q) from Route 6		Pe
15	10'-2			19.445			10'-0	Pv
BL	1.3800	84.70	18.17	120		0.494340	10'-0	Pf 4.943
15	10'-2	23.34		19.445		Flow (q) from Route 8		Pe
14	10'-2			24.388			10'-0	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	1.6100	110.97	17.49	120	0.384652	38'-1	Pf 20.808
14	10'-2	26.27		24.388	Flow (q) from Route 10	16'-0	Pe
13	10'-2			45.197	2E(4'-0), PO(8'-0)	54'-1	Pv
• • • • • Route 3 • • • • •							
SP	1.0490	19.89	7.38	120	0.128784	2'-0	Pf 0.901
206	12'-2	19.89	5.6	12.612	Sprinkler	5'-0	Pe 0.867
22	10'-2			14.381	T(5'-0)	7'-0	Pv
• • • • • Route 4 • • • • •							
SP	1.0490	20.23	7.51	120	0.132915	2'-0	Pf 0.930
201	12'-2	20.23	5.6	13.050	Sprinkler	5'-0	Pe 0.867
17	10'-2			14.848	T(5'-0)	7'-0	Pv
• • • • • Route 5 • • • • •							
SP	1.0490	21.35	7.92	120	0.146802	2'-0	Pf 1.028
210	12'-2	21.35	5.6	14.530	Sprinkler	5'-0	Pe 0.867
21	10'-2			16.425	T(5'-0)	7'-0	Pv
• • • • • Route 6 • • • • •							
SP	1.0490	21.55	8.00	120	0.149404	2'-0	Pf 1.046
205	12'-2	21.55	5.6	14.809	Sprinkler	5'-0	Pe 0.867
16	10'-2			16.722	T(5'-0)	7'-0	Pv
• • • • • Route 7 • • • • •							
SP	1.0490	23.10	8.58	120	0.169927	2'-0	Pf 1.189
209	12'-2	23.10	5.6	17.020	Sprinkler	5'-0	Pe 0.867
20	10'-2			19.077	T(5'-0)	7'-0	Pv
• • • • • Route 8 • • • • •							
SP	1.0490	23.34	8.66	120	0.173121	2'-0	Pf 1.212
203	12'-2	23.34	5.6	17.366	Sprinkler	5'-0	Pe 0.867
15	10'-2			19.445	T(5'-0)	7'-0	Pv
• • • • • Route 9 • • • • •							
SP	1.0490	26.00	9.65	120	0.211412	2'-0	Pf 1.480
208	12'-2	26.00	5.6	21.554	Sprinkler	5'-0	Pe 0.867
19	10'-2			23.901	T(5'-0)	7'-0	Pv
• • • • • Route 10 • • • • •							
SP	1.0490	26.27	9.75	120	0.215572	2'-0	Pf 1.509
202	12'-2	26.27	5.6	22.012	Sprinkler	5'-0	Pe 0.867
14	10'-2			24.388	T(5'-0)	7'-0	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

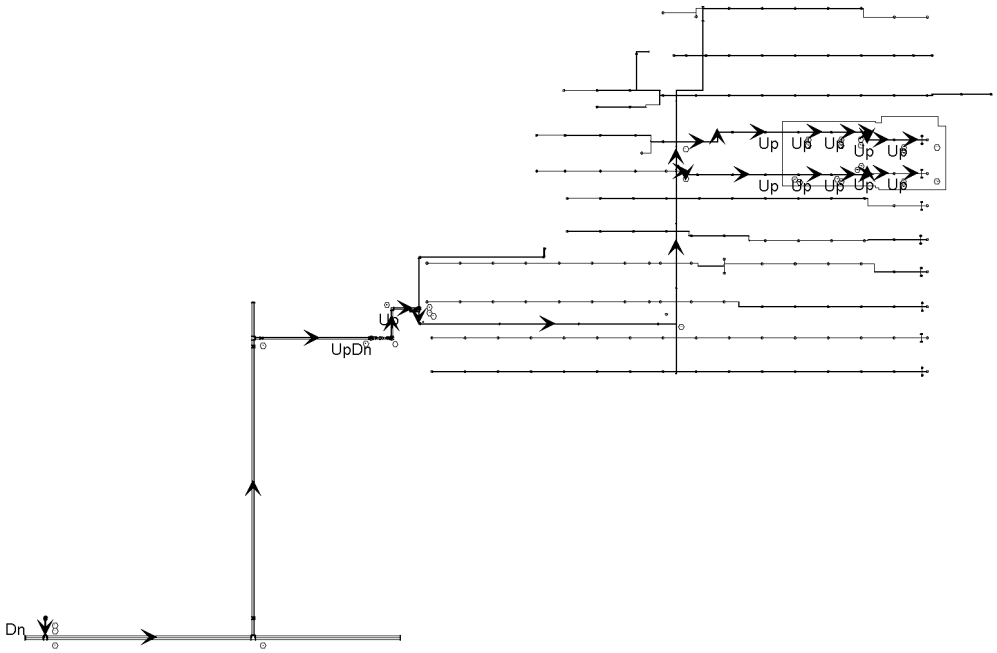
AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap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18 APPENDIX F – FDS CODE

18.1 SCENARIO 1 ENTRANCE LOBBY

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Mar 17, 2015 6:45:36 AM

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CONDUCTIVITY=0.78,

DENSITY=2700.0/

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&OBST XB=0.0,0.133198,0.0,4.69697,8.2802,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=3.048,3.1812,0.0,4.69697,8.2802,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=6.096,6.2292,0.0,4.69697,8.2802,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=9.144,9.2772,0.0,4.69697,8.2802,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=12.192,12.3252,0.0,4.69697,8.2802,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=15.24,15.3732,0.0,4.69697,8.2802,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=18.288,18.4212,0.0,4.69697,8.2802,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=21.336,21.4692,0.0,4.69697,8.2802,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=24.384,24.5172,0.0,4.69697,8.2802,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=27.432,27.5652,0.0,4.69697,8.2802,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=30.48,30.6132,0.0,4.69697,8.2802,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=33.528,33.6612,0.0,4.69697,8.2802,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=36.576,36.7092,0.0,4.69697,8.2802,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=5.73066,36.8808,0.145999,4.67968,4.1148,4.2672, SURF_ID='Steel Roof Deck'/ Obstruction

&OBST XB=19.3834,21.2312,0.0,0.48829,4.1148,4.2672, SURF_ID='Steel Roof Deck'/ Obstruction

&OBST XB=6.096,12.192,-6.2484,0.145999,4.1148,4.2672, SURF_ID='Steel Roof Deck'/ Obstruction

&OBST XB=0.0,36.8808,0.0,4.718,8.6868,8.8392, COLOR='INVISIBLE', SURF_ID='Steel Roof Deck'/ Obstruction

&OBST XB=6.096,12.192,-6.2484,0.145999,8.6868,8.8392, COLOR='INVISIBLE', SURF_ID='Steel Roof Deck'/ Obstruction

&HOLE XB=9.2964,15.24,0.507797,2.0827,4.08432,4.29768/ Hole

&VENT SURF_ID='Fire', XB=1.0,1.65192,2.0,2.65192,0.0,0.0/ Fire

&BNDF QUANTITY='WALL TEMPERATURE'/

&ISOF QUANTITY='TEMPERATURE', VALUE=10.0,37.7778,65.5556,93.3333,121.111/

```
&SLCF QUANTITY='TEMPERATURE', PBZ=3.81/
&SLCF QUANTITY='TEMPERATURE', PBZ=2.4384/
&SLCF QUANTITY='VISIBILITY', PBZ=6.096/
&SLCF QUANTITY='TEMPERATURE', PBY=6.096/
&SLCF QUANTITY='V-VELOCITY', VECTOR=.TRUE., PBX=3.048/
&SLCF QUANTITY='VISIBILITY', PBY=1.524/
&SLCF QUANTITY='OPTICAL DENSITY', PBY=1.524/
&SLCF QUANTITY='TEMPERATURE', PBZ=6.096/
&SLCF QUANTITY='TEMPERATURE', PBX=1.524/
&SLCF QUANTITY='TEMPERATURE', PBZ=8.5344/


&TAIL /
```

18.2 Scenario 2 Machine Shop

Machine_Shop_Fire_Size_Revisio.fds

Generated by PyroSim - Version 2014.4.1208

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```
&HEAD CHID='Machine_Shop_Fire_Size_Revisio'/
&TIME T_END=930.0/
&DUMP RENDER_FILE='Machine_Shop_Fire_Size_Revisio.ge1', DT_RESTART=300.0/
&RADI RADTMP=900.0/

&MESH ID='Room 107', FYI='Room 107', IJK=120,80,30, XB=0.0,18.3642,0.0,11.9634,0.0,4.29768/

&SPEC ID='WATER VAPOR'/

&PART ID='Water',
    SPEC_ID='WATER VAPOR',
    DIAMETER=500.0,
    MONODISPERSE=.TRUE.,
    AGE=60.0,
    SAMPLING_FACTOR=1/

&REAC ID='Trash Container Fire',
    FUEL='REAC_FUEL',
    FORMULA='C2H4',
    HRRPUA_SHEET=1755.0,
    CO_YIELD=0.077,
    SOOT_YIELD=0.027,
    HEAT_OF_COMBUSTION=4.36E4/

&PROP ID='Tyco FRB 200_Water Spray',
```

```
    QUANTITY='SPRINKLER LINK TEMPERATURE',
    ACTIVATION_TEMPERATURE=74.0,
    RTI=50.0,
    PART_ID='Water',
    FLOW_RATE=56.08,
    PARTICLE_VELOCITY=5.0,
    SPRAY_ANGLE=60.0,75.0/
&PROP ID='Cleary Photoelectric P1',
    QUANTITY='CHAMBER OBSCURATION',
    ACTIVATION_OBSCURATION=1.64042,
    ALPHA_E=1.8,
    BETA_E=-1.0,
    ALPHA_C=1.0,
    BETA_C=-0.8/
&DEVC ID='SPRK', PROP_ID='Tyco FRB 200_Water Spray', XYZ=7.8486,0.9144,3.81,
ORIENTATION=0.0,0.0,1.0/
&DEVC ID='SPRK01', PROP_ID='Tyco FRB 200_Water Spray', XYZ=10.8966,0.9144,3.81,
ORIENTATION=0.0,0.0,1.0/
&DEVC ID='SPRK02', PROP_ID='Tyco FRB 200_Water Spray', XYZ=13.9446,0.9144,3.81,
ORIENTATION=0.0,0.0,1.0/
&DEVC ID='SPRK03', PROP_ID='Tyco FRB 200_Water Spray', XYZ=16.9926,0.9144,3.81,
ORIENTATION=0.0,0.0,1.0/
&DEVC ID='SPRK04', PROP_ID='Tyco FRB 200_Water Spray', XYZ=7.8486,4.8259,3.81,
ORIENTATION=0.0,0.0,1.0/
&DEVC ID='SPRK05', PROP_ID='Tyco FRB 200_Water Spray', XYZ=10.8966,4.8259,3.81,
ORIENTATION=0.0,0.0,1.0/
&DEVC ID='SPRK06', PROP_ID='Tyco FRB 200_Water Spray', XYZ=13.9446,4.8259,3.81,
ORIENTATION=0.0,0.0,1.0/
&DEVC ID='SPRK07', PROP_ID='Tyco FRB 200_Water Spray', XYZ=16.9926,4.8259,3.81,
ORIENTATION=0.0,0.0,1.0/
&DEVC ID='SPRK08', PROP_ID='Tyco FRB 200_Water Spray', XYZ=7.8486,7.01028,3.81,
ORIENTATION=0.0,0.0,1.0/
```

```
&DEVC ID='SPRK09', PROP_ID='Tyco FRB 200_Water Spray', XYZ=10.8966,7.01028,3.81,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK10', PROP_ID='Tyco FRB 200_Water Spray', XYZ=13.9446,7.01028,3.81,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK11', PROP_ID='Tyco FRB 200_Water Spray', XYZ=16.9926,7.01028,3.81,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK12', PROP_ID='Tyco FRB 200_Water Spray', XYZ=7.8486,10.9219,3.81,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK13', PROP_ID='Tyco FRB 200_Water Spray', XYZ=10.8966,10.9219,3.81,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK14', PROP_ID='Tyco FRB 200_Water Spray', XYZ=13.9446,10.9219,3.81,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK15', PROP_ID='Tyco FRB 200_Water Spray', XYZ=16.9926,10.9219,3.81,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK16', PROP_ID='Tyco FRB 200_Water Spray', XYZ=4.8006,4.8259,3.81,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK17', PROP_ID='Tyco FRB 200_Water Spray', XYZ=4.8006,7.01028,3.81,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK18', PROP_ID='Tyco FRB 200_Water Spray', XYZ=1.55143,7.01028,3.81,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK19', PROP_ID='Tyco FRB 200_Water Spray', XYZ=1.55143,4.8259,3.81,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK20', PROP_ID='Tyco FRB 200_Water Spray', XYZ=4.8006,10.9219,3.81,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SD', PROP_ID='Cleary Photoelectric P1', XYZ=5.08102,9.13364,3.9624/

&DEVC ID='SD01', PROP_ID='Cleary Photoelectric P1', XYZ=14.2738,9.13364,3.9624/

&DEVC ID='SD02', PROP_ID='Cleary Photoelectric P1', XYZ=14.2738,3.11384,3.9624/

&DEVC ID='SD03', PROP_ID='Cleary Photoelectric P1', XYZ=7.56818,3.72344,3.9624/

&DEVC ID='LAYER MID', QUANTITY='LAYER HEIGHT', XB=10.668,10.668,6.096,6.096,0.0,4.1148/

&DEVC ID='LAYER DOOR', QUANTITY='LAYER HEIGHT', XB=0.3048,0.3048,3.6576,3.6576,0.0,3.9624/


&MATL ID='GYPSUM',
    FYI='NBSIR 88-3752 - ATF NIST Multi-Floor Validation',
```

```
    SPECIFIC_HEAT=1.09,
    CONDUCTIVITY=0.17,
    DENSITY=930.0/
&MATL ID='INSULATION',
    FYI='Isolatek BLAZE-SHIELD DC/F - WTC FDS5 Validation',
    SPECIFIC_HEAT_RAMP='INSULATION_SPECIFIC_HEAT_RAMP',
    CONDUCTIVITY_RAMP='INSULATION_CONDUCTIVITY_RAMP',
    DENSITY=208.0/
&RAMP ID='INSULATION_CONDUCTIVITY_RAMP', T=20.0, F=0.05/
&RAMP ID='INSULATION_CONDUCTIVITY_RAMP', T=377.0, F=0.1/
&RAMP ID='INSULATION_CONDUCTIVITY_RAMP', T=677.0, F=0.2/
&RAMP ID='INSULATION_SPECIFIC_HEAT_RAMP', T=20.0, F=0.8/
&RAMP ID='INSULATION_SPECIFIC_HEAT_RAMP', T=677.0, F=2.0/
&MATL ID='STEEL',
    FYI='Drysdale, Intro to Fire Dynamics - ATF NIST Multi-Floor Validation',
    SPECIFIC_HEAT=0.46,
    CONDUCTIVITY=45.8,
    DENSITY=7850.0,
    EMISSIVITY=0.95/

&SURF ID='Gyp Wall',
    RGB=255,204,204,
    BACKING='VOID',
    MATL_ID(1,1)='GYPSUM',
    MATL_ID(2,1)='INSULATION',
    MATL_ID(3,1)='GYPSUM',
    MATL_MASS_FRACTION(1,1)=1.0,
    MATL_MASS_FRACTION(2,1)=1.0,
    MATL_MASS_FRACTION(3,1)=1.0,
```

```
    THICKNESS(1:3)=0.015874,0.0920496,0.015874/
&SURF ID='W-Beam',
    RGB=146,53,255,
    BACKING='VOID',
    MATL_ID(1,1)='STEEL',
    MATL_MASS_FRACTION(1,1)=1.0,
    THICKNESS(1)=0.42672/
&SURF ID='Steel Roof Deck',
    RGB=146,202,166,
    BACKING='VOID',
    MATL_ID(1,1)='STEEL',
    MATL_ID(2,1)='INSULATION',
    MATL_MASS_FRACTION(1,1)=1.0,
    MATL_MASS_FRACTION(2,1)=1.0,
    THICKNESS(1:2)=0.0025399,0.0762,
    LAYER_DIVIDE=0.01/
&SURF ID='Fire',
    COLOR='RED',
    HRRPUA=1755.0,
    RAMP_Q='Fire_RAMP_Q'/
&RAMP ID='Fire_RAMP_Q', T=0.0, F=0.0/
&RAMP ID='Fire_RAMP_Q', T=100.0, F=0.0116/
&RAMP ID='Fire_RAMP_Q', T=200.0, F=0.081/
&RAMP ID='Fire_RAMP_Q', T=300.0, F=0.302/
&RAMP ID='Fire_RAMP_Q', T=400.0, F=0.348/
&RAMP ID='Fire_RAMP_Q', T=500.0, F=0.4488/
&RAMP ID='Fire_RAMP_Q', T=600.0, F=0.4883/
&RAMP ID='Fire_RAMP_Q', T=636.0, F=0.527/
&RAMP ID='Fire_RAMP_Q', T=800.0, F=0.527/
```

&RAMP ID='Fire_RAMP_Q', T=850.0, F=0.527/

&RAMP ID='Fire_RAMP_Q', T=900.0, F=0.527/

&OBST XB=0.0,5.99237,2.77178,2.8956,0.0,4.1148, SURF_ID='Gyp Wall'/ South Wall 1

&OBST XB=5.99237,18.3642,0.0,0.123825,0.0,4.1148, SURF_ID='Gyp Wall'/ South Wall 2

&OBST XB=5.87057,5.99237,0.0,2.8956,0.0,4.1148, SURF_ID='Gyp Wall'/ South Wall 1.5

&OBST XB=0.0,0.123825,2.8956,8.02538,0.0,4.1148, SURF_ID='Gyp Wall'/ West Wall 1

&OBST XB=0.0,3.2004,8.02538,8.14921,0.0,4.1148, SURF_ID='Gyp Wall'/ West Wall 1.5

&OBST XB=3.07658,3.2004,8.02538,11.9634,0.0,4.1148, SURF_ID='Gyp Wall'/ Obstruction

&OBST XB=3.07658,18.3642,11.9634,12.0871,0.0,4.1148, COLOR='INVISIBLE', SURF_ID='Gyp Wall'/ Obstruction

&OBST XB=18.3642,18.4879,0.0,12.0871,0.0,4.1148, SURF_ID='Gyp Wall'/ East Wall

&OBST XB=18.1356,18.288,0.0,11.9634,3.7082,4.1148, SURF_ID='W-Beam'/ W16x31

&OBST XB=15.0876,15.24,0.0,11.9634,3.7082,4.1148, SURF_ID='W-Beam'/ W16x31

&OBST XB=12.0396,12.192,0.0,11.9634,3.7082,4.1148, SURF_ID='W-Beam'/ W16x31

&OBST XB=8.9916,9.144,0.0,11.9634,3.7082,4.1148, SURF_ID='W-Beam'/ W16x31

&OBST XB=5.9436,6.096,0.0,11.9634,3.7082,4.1148, SURF_ID='W-Beam'/ W16x31

&OBST XB=2.8956,3.048,0.0,11.9634,3.7082,4.1148, SURF_ID='W-Beam'/ W16x31

&OBST XB=5.86831,18.3642,0.0,11.9634,4.1148,4.2672, COLOR='INVISIBLE', SURF_ID='Steel Roof Deck'/ Obstruction

&OBST XB=3.2004,5.99237,2.82255,12.0871,4.1148,4.2672, COLOR='INVISIBLE', SURF_ID='Steel Roof Deck'/ Obstruction

&OBST XB=0.0,3.2004,2.82255,8.14913,4.1148,4.2672, COLOR='INVISIBLE', SURF_ID='Steel Roof Deck'/ Obstruction

&HOLE XB=-0.0153035,0.1524,3.048,4.8768,-0.0143256,2.1336/ Hole

&HOLE XB=6.7818,8.585,-0.0149543,0.1524,-0.0143256,2.1336/ Door to Woodshop

&VENT SURF_ID='Fire', XB=6.4008,6.8958,2.7432,3.23818,0.0,0.0/ Vent01

```
&BNDF QUANTITY='WALL TEMPERATURE'/


&SLCF QUANTITY='TEMPERATURE', PBX=5.0292/
&SLCF QUANTITY='TEMPERATURE', PBY=3.6576/
&SLCF QUANTITY='VISIBILITY', PBY=3.6576/
&SLCF QUANTITY='OPTICAL DENSITY', PBY=3.6576/
&SLCF QUANTITY='TEMPERATURE', PBZ=1.8288/
&SLCF QUANTITY='VISIBILITY', PBZ=1.8288/


&TAIL /
```

18.3 SCENARIO 3 PROJECTS INTEGRATION

Project_Intergrationlong.fds

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```
&HEAD CHID='Project_Intergrationlong'/
&TIME T_END=1000.0/
&DUMP RENDER_FILE='Project_Intergrationlong.ge1', DT_RESTART=300.0/

&MESH ID='Room 107', FYI='Room 107', IJK=40,40,30, XB=-0.3048,21.9456,0.0,12.445,0.0,9.144/

&SPEC ID='WATER VAPOR'/

&PART ID='Water',
    SPEC_ID='WATER VAPOR',
    DIAMETER=500.0,
    MONODISPERSE=.TRUE.,
    AGE=60.0,
    SAMPLING_FACTOR=1/

&REAC ID='Pallet Fire Misc Items',
    FUEL='REAC_FUEL',
    FORMULA='C3H6',
    HRRPUA_SHEET=1100.0,
    CO_YIELD=0.025,
    SOOT_YIELD=0.072,
    HEAT_OF_COMBUSTION=4.34E4/

&PROP ID='Cleary Photoelectric P1',
    QUANTITY='CHAMBER OBSCURATION',
```

```
    ACTIVATION_OBSCURATION=4.6752,
    ALPHA_E=1.8,
    BETA_E=-1.0,
    ALPHA_C=1.0,
    BETA_C=-0.8/
&PROP ID='Tyco FRB 200_Water Spray',
    QUANTITY='SPRINKLER LINK TEMPERATURE',
    ACTIVATION_TEMPERATURE=74.0,
    RTI=50.0,
    PART_ID='Water',
    FLOW_RATE=56.08,
    PARTICLE_VELOCITY=5.0,
    SPRAY_ANGLE=60.0,75.0/
&PROP ID='Tyco FRB 155_Water Spray',
    QUANTITY='SPRINKLER LINK TEMPERATURE',
    ACTIVATION_TEMPERATURE=68.3333,
    RTI=50.0,
    PART_ID='Water',
    FLOW_RATE=56.08,
    PARTICLE_VELOCITY=5.0,
    SPRAY_ANGLE=60.0,75.0/
&DEVC ID='Smoke Layer Height', QUANTITY='LAYER HEIGHT', XB=6.096,6.096,6.096,6.096,0.0,8.6868/
&DEVC ID='S 1-38', PROP_ID='Cleary Photoelectric P1', XYZ=6.7056,9.144,8.5344/
&DEVC ID='S 1-39', PROP_ID='Cleary Photoelectric P1', XYZ=6.7056,3.048,8.5344/
&DEVC ID='SPRK 1', PROP_ID='Tyco FRB 200_Water Spray', XYZ=1.42037,1.524,8.382,
ORIENTATION=0.0,0.0,1.0/
&DEVC ID='SPRK 01', PROP_ID='Tyco FRB 200_Water Spray', XYZ=4.72135,1.524,8.382,
ORIENTATION=0.0,0.0,1.0/
&DEVC ID='SPRK 02', PROP_ID='Tyco FRB 200_Water Spray', XYZ=7.71754,1.524,8.382,
ORIENTATION=0.0,0.0,1.0/
```

&DEVC ID='SPRK 03', PROP_ID='Tyco FRB 200_Water Spray', XYZ=10.7137,1.524,8.382,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK 04', PROP_ID='Tyco FRB 200_Water Spray', XYZ=1.42037,4.572,8.382,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK 05', PROP_ID='Tyco FRB 200_Water Spray', XYZ=4.72135,4.572,8.382,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK 06', PROP_ID='Tyco FRB 200_Water Spray', XYZ=7.71754,4.572,8.382,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK 07', PROP_ID='Tyco FRB 200_Water Spray', XYZ=10.7137,4.572,8.382,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK 08', PROP_ID='Tyco FRB 200_Water Spray', XYZ=1.42037,7.72058,8.382,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK 09', PROP_ID='Tyco FRB 200_Water Spray', XYZ=4.72135,7.72058,8.382,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK 10', PROP_ID='Tyco FRB 200_Water Spray', XYZ=7.71754,7.72058,8.382,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK 11', PROP_ID='Tyco FRB 200_Water Spray', XYZ=10.7137,7.72058,8.382,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK 12', PROP_ID='Tyco FRB 200_Water Spray', XYZ=1.42037,10.9698,8.382,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK 13', PROP_ID='Tyco FRB 200_Water Spray', XYZ=4.72135,10.9698,8.382,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK 14', PROP_ID='Tyco FRB 200_Water Spray', XYZ=7.71754,10.9698,8.382,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK 15', PROP_ID='Tyco FRB 200_Water Spray', XYZ=10.7137,10.9698,8.382,
ORIENTATION=0.0,0.0,1.0/

&DEVC ID='SPRK 16', PROP_ID='Tyco FRB 155_Water Spray', XYZ=11.5824,7.3152,2.5908/

&DEVC ID='SPRK 17', PROP_ID='Tyco FRB 155_Water Spray', XYZ=11.5824,10.3632,2.5908/

&MATL ID='GYPSUM',

FYI='NBSIR 88-3752 - ATF NIST Multi-Floor Validation',

SPECIFIC_HEAT=1.09,

CONDUCTIVITY=0.17,

```
    DENSITY=930.0/
&MATL ID='INSULATION',
    FYI='Isolatek BLAZE-SHIELD DC/F - WTC FDS5 Validation',
    SPECIFIC_HEAT_RAMP='INSULATION_SPECIFIC_HEAT_RAMP',
    CONDUCTIVITY_RAMP='INSULATION_CONDUCTIVITY_RAMP',
    DENSITY=208.0/
&RAMP ID='INSULATION_CONDUCTIVITY_RAMP', T=20.0, F=0.05/
&RAMP ID='INSULATION_CONDUCTIVITY_RAMP', T=377.0, F=0.1/
&RAMP ID='INSULATION_CONDUCTIVITY_RAMP', T=677.0, F=0.2/
&RAMP ID='INSULATION_SPECIFIC_HEAT_RAMP', T=20.0, F=0.8/
&RAMP ID='INSULATION_SPECIFIC_HEAT_RAMP', T=677.0, F=2.0/
&MATL ID='STEEL',
    FYI='Drysdale, Intro to Fire Dynamics - ATF NIST Multi-Floor Validation',
    SPECIFIC_HEAT=0.46,
    CONDUCTIVITY=45.8,
    DENSITY=7850.0,
    EMISSIVITY=0.95/

&SURF ID='Gyp Wall',
    RGB=255,204,204,
    BACKING='VOID',
    MATL_ID(1,1)='GYPSUM',
    MATL_ID(2,1)='INSULATION',
    MATL_ID(3,1)='GYPSUM',
    MATL_MASS_FRACTION(1,1)=1.0,
    MATL_MASS_FRACTION(2,1)=1.0,
    MATL_MASS_FRACTION(3,1)=1.0,
    THICKNESS(1:3)=0.015874,0.0920496,0.015874/
&SURF ID='W-Beam',
```

```
    RGB=146,53,255,
    BACKING='VOID',
    MATL_ID(1,1)='STEEL',
    MATL_MASS_FRACTION(1,1)=1.0,
    THICKNESS(1)=0.42672/
&SURF ID='Steel Roof Deck',
    RGB=146,202,166,
    BACKING='VOID',
    MATL_ID(1,1)='STEEL',
    MATL_ID(2,1)='INSULATION',
    MATL_MASS_FRACTION(1,1)=1.0,
    MATL_MASS_FRACTION(2,1)=1.0,
    THICKNESS(1:2)=0.0025399,0.0762,
    LAYER_DIVIDE=0.01/
&SURF ID='Fire',
    COLOR='RED',
    HRRPUA=1380.0,
    RAMP_Q='Fire_RAMP_Q'/
&RAMP ID='Fire_RAMP_Q', T=0.0, F=0.0/
&RAMP ID='Fire_RAMP_Q', T=10.0, F=0.14/
&RAMP ID='Fire_RAMP_Q', T=20.0, F=0.53/
&RAMP ID='Fire_RAMP_Q', T=25.0, F=1.0/
&RAMP ID='Fire_RAMP_Q', T=30.0, F=0.69/
&RAMP ID='Fire_RAMP_Q', T=35.0, F=0.82/
&RAMP ID='Fire_RAMP_Q', T=40.0, F=1.0/
&RAMP ID='Fire_RAMP_Q', T=50.0, F=0.82/
&RAMP ID='Fire_RAMP_Q', T=55.0, F=0.792/
&RAMP ID='Fire_RAMP_Q', T=80.0, F=0.792/
&RAMP ID='Fire_RAMP_Q', T=100.0, F=0.792/
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&RAMP ID='Fire_RAMP_Q', T=110.0, F=0.792/

&RAMP ID='Fire_RAMP_Q', T=120.0, F=0.792/

&OBST XB=12.192,12.3139,0.0,12.5687,0.0,9.144, SURF_ID='Gyp Wall'/ Wall Gridline D

&OBST XB=-0.123825,12.192,12.445,12.5687,0.0,8.6868, SURF_ID='INERT'/ Wall Gridline 3

&OBST XB=-0.123825,12.3139,-0.123825,0.0,0.0,8.6868, COLOR='INVISIBLE', SURF_ID='Gyp Wall'/ Wall Gridline 5

&OBST XB=-0.123825,0.0,0.0,12.445,0.0,8.6868, SURF_ID='Gyp Wall'/ Wall Gridline B

&OBST XB=10.8204,12.192,5.7912,12.5687,2.7432,8.6868, SURF_ID='Gyp Wall'/ Soffit

&OBST XB=12.192,22.0706,-0.123825,0.0,0.0,4.38912, COLOR='INVISIBLE', SURF_ID='Gyp Wall'/ Hallway Wall GL 5

&OBST XB=12.192,22.0706,5.7912,5.91502,0.0,4.38912, SURF_ID='Gyp Wall'/ Hallway Wall GL 3

&OBST XB=12.3444,12.4968,0.0,6.096,3.7082,4.1148, SURF_ID='W-Beam'/ W16x31

&OBST XB=15.3924,15.532,0.0,6.096,3.7082,4.1148, SURF_ID='W-Beam'/ W16x31

&OBST XB=18.4404,18.58,0.0,6.096,3.7082,4.1148, SURF_ID='W-Beam'/ W16x31

&OBST XB=21.4884,21.628,0.0,6.096,3.7082,4.1148, SURF_ID='W-Beam'/ W16x31

&OBST XB=0.3048,0.54864,0.1524,12.192,8.27837,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=6.4008,6.6,0.1524,12.192,8.27837,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=0.0,12.2807,5.7912,6.19658,8.382,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=3.3528,3.6576,0.1524,12.192,8.27837,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=9.4488,9.7536,0.1524,12.192,8.27837,8.6868, SURF_ID='W-Beam'/ Obstruction

&OBST XB=-0.123825,12.445,-0.123825,12.5687,8.6868,8.8392, COLOR='INVISIBLE', SURF_ID='Steel Roof Deck'/ Roof Deck 107

&OBST XB=12.192,22.0706,-0.123825,5.91502,4.1148,4.2672, COLOR='INVISIBLE', SURF_ID='Steel Roof Deck'/ Hallway Roof Deck

&HOLE XB=12.1615,12.3444,-0.0311125,5.7912,-0.03048,3.8606/ Project Integration Hall

&VENT SURF_ID='Fire', XB=8.715,9.715,9.473,10.473,0.0,0.0/ Fire

&VENT SURF_ID='Fire', XB=8.715,9.715,8.348,9.348,0.0,0.0/ Fire01

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&BNDF QUANTITY='WALL TEMPERATURE'/

&ISOF QUANTITY='TEMPERATURE', VALUE=10.0,37.7778,65.5556,93.3333,121.111/

&SLCF QUANTITY='TEMPERATURE', PBY=3.048/
&SLCF QUANTITY='U-VELOCITY', VECTOR=.TRUE., PBY=3.048/
&SLCF QUANTITY='TEMPERATURE', PBZ=8.382/
&SLCF QUANTITY='VISIBILITY', PBY=3.048/
&SLCF QUANTITY='OPTICAL DENSITY', PBY=3.048/
&SLCF QUANTITY='TEMPERATURE', PBY=9.144/
&SLCF QUANTITY='TEMPERATURE', PBX=10.668/
&SLCF QUANTITY='TEMPERATURE', PBZ=1.8288/
&SLCF QUANTITY='VISIBILITY', PBZ=1.8288/

&TAIL /
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