Development Services

From Concept to Construction

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More Contact Info (http://www.portlandoregon.gov//bds/article/519984)

APPEAL SUMMARY

Status: Decision Rendered - Reconsideration of ID 20820

Appeal ID: 21893	**Project Address:** 2519, 2525 E Burnside St
Hearing Date: 9/18/19	**Appellant Name:** Tom Jaleski
Case No.: B-008	**Appellant Phone:** 9712385266
Appeal Type: Building	**Plans Examiner/Inspector:** Guy Altman, Corey Stanley
Project Type: commercial	**Stories:** 3 **Occupancy:** B, S-1 **Construction Type:** V-B
Building/Business Name:	**Fire Sprinklers:** Yes - Throughout
Appeal Involves: Erection of a new structure,Addition to an existing structure	**LUR or Permit Application No.:**
Plan Submitted Option: pdf [File 1] [File 2] [File 3] [File 4] [File 5] [File 6]	**Proposed use:** Office Building

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	1021.3.1 Access to Exits at Adjacent Levels
Requires	Access to exits at other levels shall be by stairways or ramps. Where access to exits occurs from adjacent building levels, the horizontal and vertical exit access travel distance to the closest exit shall not exceed that specified in Section 1016.1. Access to exits at other levels shall be from an adjacent story.
Proposed Design	The proposed design includes a three-story addition to an existing single-story office building with a partial basement. The three-story addition is served by two means of egress from each floor: an enclosed interior exit stairway and an unenclosed exit access stairway. These stairs meet the requirements of Section 1021.3.1, except that the exit access stair will serve as one of the means of egress from the third floor down to the first floor. Refer to Attachment #1 for the floor plans and section. The attached performance analysis is provided as documentation of equivalent protection to the prescriptive code requirements, which limit the use of exit access stair to just one floor when used for means of egress. Refer to Attachment #2 for the report stamped by Oregon Registered Fire Protection Engineer. The building will follow the prescriptive requirements for the provision of aerial fire apparatus access road per OFC Appendix D105.1.
Reason for alternative	The intent of Section 1021.3.1, for restricting travel to only one adjacent story before reaching an exit, is to account for longer travel time through stairs compared to horizontal travel. The concern, as explained in the IBC Commentary (see Attachment #3) on this section, is that the slower

vertical travel will result in occupants taking more time to egress the building, especially as the code permits exit access travel to be measured horizontally when travelling up or down exit access stairs. The prescriptive exit access travel limitations are a combination of longstanding tradition and time-travel studies, even though it has never been directly connected to time taken for occupants to exit a building. This concern is more of an issue in large floor plates, which expose occupants to untenable conditions when egressing through the open exit access stairs on multiple floors and taking longer to reach an exit or exit discharge.

During the review of the previous appeal #20592 by the administrative board, a primary concern was the potential that the building will not be able to provide aerial access. The project team has confirmed with PGE that the overhead power lines along the street will be buried underground. This assures that the final building design submittal will satisfy the provisions of OFC Appendix D105.1 for aerial fire apparatus access road.

Based on the clarification in the IBC commentary, our knowledge of how the current life safety codes evolved, and the confirmation that prescriptive aerial access will be provided, we performed computational egress analysis to compare the egress times of the proposed design against a prescriptive baseline. The baseline includes a means of egress system with occupants starting at the most remote location on the third floor. Occupants travel only one floor down the open stair and then horizontally until the maximum exit access travel distance of 300 ft is reached. The analysis concluded that the occupants in the proposed design reach an exit 14.5 seconds faster than the prescriptive code design. Refer to Attachment #2 for the performance analysis for a three-story unenclosed exit access stairway as a second means of egress.

Similar egress analysis was accepted under Appeal #12863 and sets the precedent for this appeal. (refer to Attachment #4). This appeal uses a more sophisticated analysis compared to the previous one.

Additionally, the proposed building has a relatively small building footprint, with only 3,343 sf on the third floor. The total travel distance from the most remote point on the third floor, down the exit access stair to the exit door on the first floor, is less than 200 ft. This is significantly lower than the 300 ft limit allowed for egress travel on a single floor.

The 71 occupants on the third floor only require two 44-inch stairs per the requirements of OSSC Section 1005.3.1. The 51-inch exit access stair and 44-inch interior exit stair provide additional egress capacity and assist with quick evacuation of the occupants. The actual occupant load capacity of the 44-inch enclosed exit stair alone is twice the occupant load of the third floor. This ensures that the occupants have ample egress capacity all the way to the building exit.

The occupants egressing down the unenclosed exit access stair will have a direct line of sight to the exit on the first floor, which provides quicker evacuation. This is also aided by the fact that most of the occupants on the upper floors are employees of the office and familiar with space layout and egress route. Refer to Attachment #5 illustrating the clear line of sight from the base of the stair to the building exit.

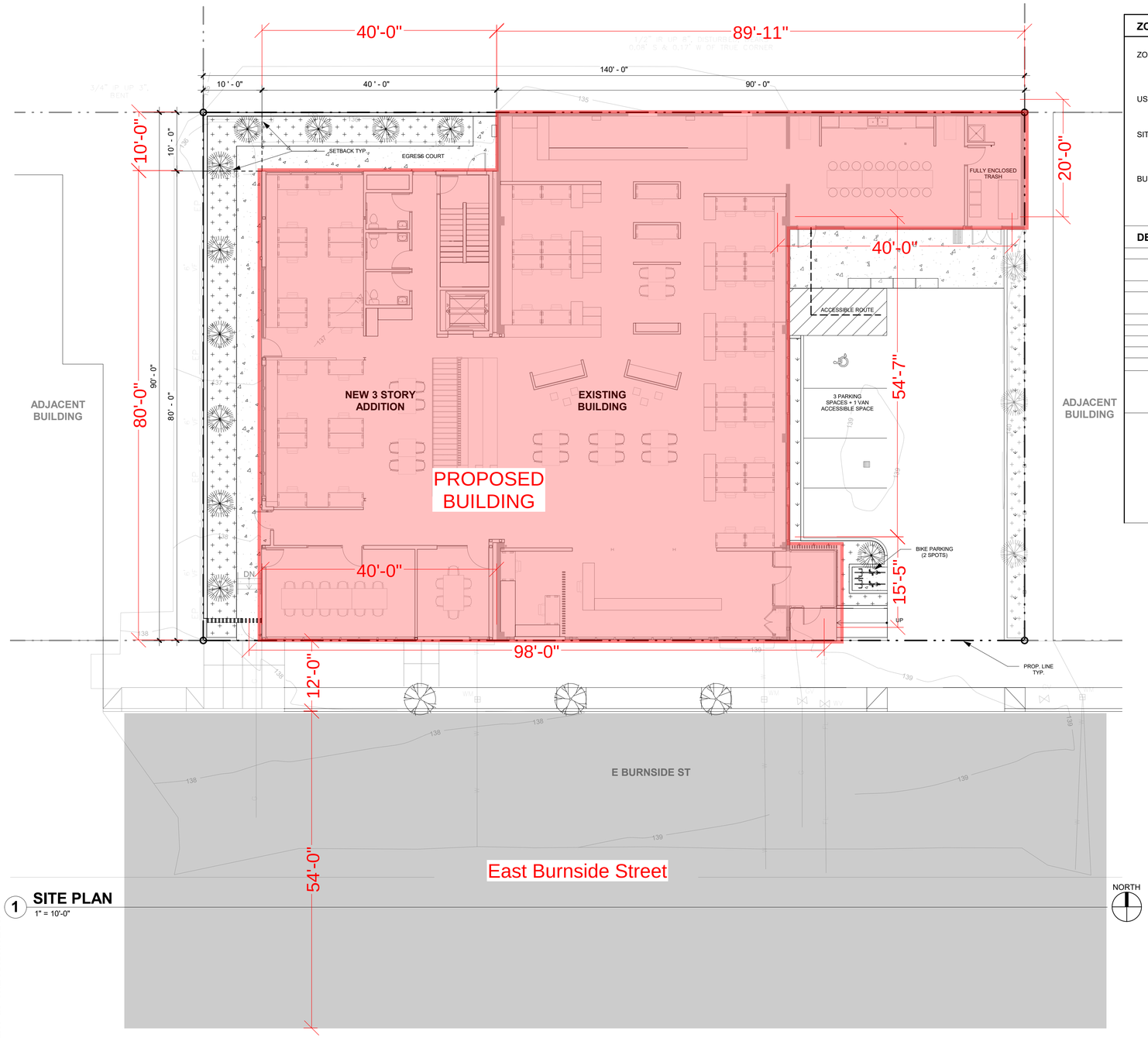
The stair opening will be protected by draft curtains and closely spaced sprinklers on the second and third floor in accordance with NFPA 13, following the requirements of OSSC Section 1009.3 Exception 3. These sprinklers prevent the migration of fire through the exit access stair opening as occupants are descending the stairs.

Based on the performance analysis of egress, plus the small footprint, short exit access travel distance, direct line of sight to the building exit, wide stairs and sprinkler protected openings, the proposed design to utilize the exit access stairs as a second means of egress from the third floor meets the intent of the code and provides equivalent protection.

APPEAL DECISION

Exit access stair with egress from 3rd floor to exit door on 1st floor: Denied. Proposal does not provide equivalent Life Safety protection.
Appellant may contact John Butler (503 823-7339) with questions.

Pursuant to City Code Chapter 24.10, you may appeal this decision to the Building Code Board of Appeal within 90 calendar days of the date this decision is published. For information on the appeals process, go to www.portlandoregon.gov/bds/appealsinfo, call (503) 823-7300 or come in to the Development Services Center.



1 **SITE PLAN**
1" = 10'-0"

ZONING CODE SUMMARY

ZONING	
BASE ZONE	CM2 - COMMERCIAL MIXED USE
OVERLAY ZONE	d - DESIGN
ADJACENT ZONING	R-1
USE	
CURRENT	OFFICE
PROPOSED	NO CHANGE
SITE AREA	12,600 SF
IMPERVIOUS AREA	9,754 SF
LANDSCAPE AREA	2,846 SF
BUILDING AREA TOTAL	14,521 SF
FIRST FLOOR	8,423 SF
SECOND FLOOR	2,755 SF
THIRD FLOOR	3,343 SF

DEVELOPMENT STANDARDS		REQUIRED	PROPOSED
33.1##.			
	MAXIMUM FAR	2.5:1	14,521 SF / 31,500 SF = 46% FAR USED
	WITH BONUS	4:1	NO BONUS PROPOSED
	MAXIMUM BUILDING HEIGHT	45'	39' , 44' TO MECHANICAL SCREEN
	MINIMUM BUILDING SETBACKS	10 FT	10 FT
	MAXIMUM BUILDING SETBACKS	10 FT	10 FT
	BUILDING COVERAGE	100% MAX	68%
	MIN. LANDSCAPE AREA	15%	23%
	GROUND FLOOR WINDOWS	#	SEE SITE PLAN
	PEDESTRIAN STANDARDS	ENTRY LOCATED WITHIN 20' OF SIDEWALK	YES
	PERIMETER LANDSCAPING	L3 STANDARD	L3 STANDARD
	SCREENING		
	GARBAGE / RECYCLING	YES	FULLY ENCLOSED
	MECHANICAL	YES	FULLY SCREENED
33.266.100	PARKING	NO	4 SPOTS PROVIDED
	CLOSE TO TRANSIT?	WITHIN 25' OF TRANSIT STREET	ON TRANSIT STREET (BURNSIDE)
33.266.200	BIKE PARKING		
	SHORT TERM	2	2
	LONG TERM	2	30
	TOTAL	4	32


View from the East Burnside Street

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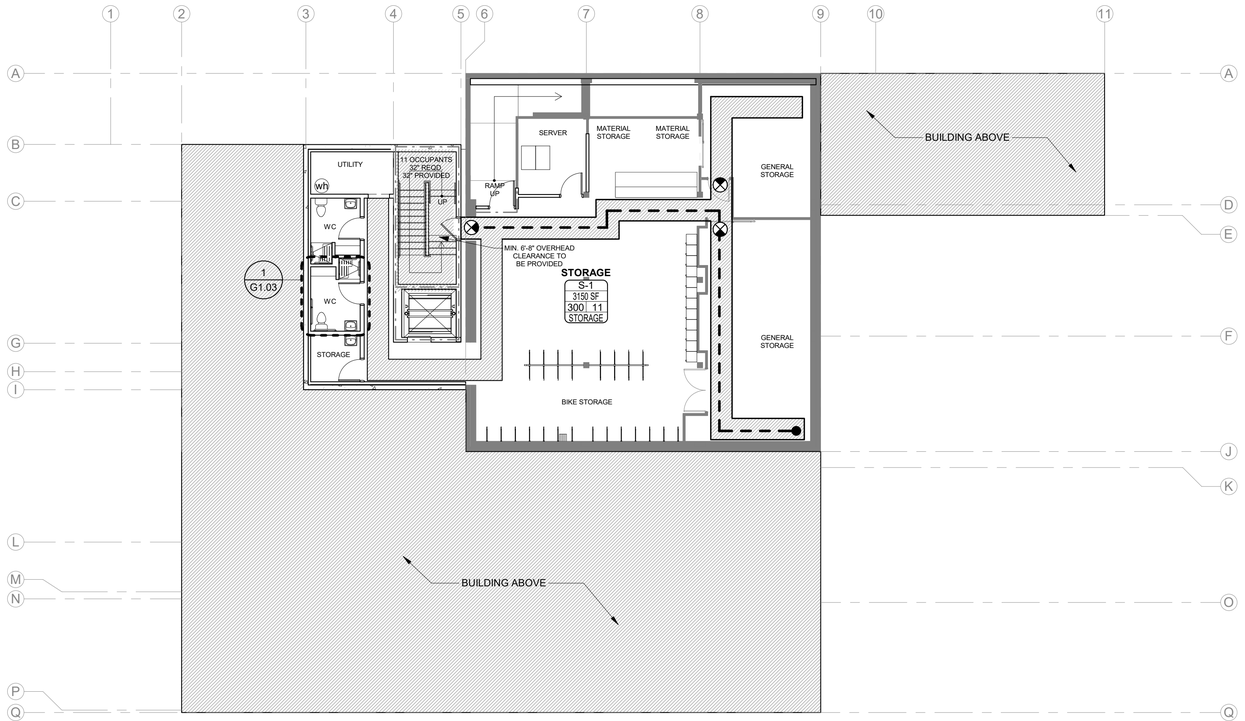
Drawing:

ZONING SUMMARY

ATTACHMENT #1

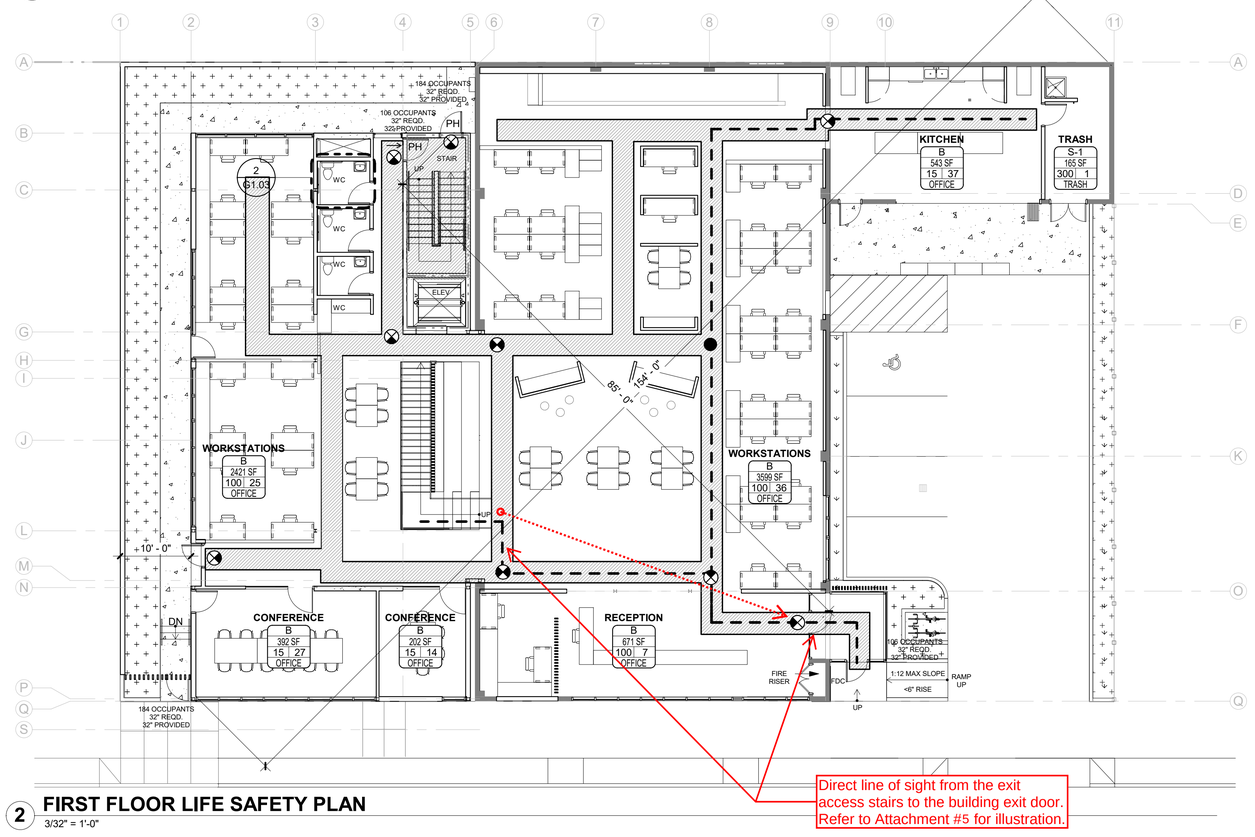
Sheet No:

G1.00



1 BASEMENT FLOOR LIFE SAFETY PLAN

3/32" = 1'-0"



2 FIRST FLOOR LIFE SAFETY PLAN

3/32" = 1'-0"

NORTH

BUILDING CODE SUMMARY

OCCUPANCY

EXISTING: B(OFFICES), S-1(STORAGE)
NEW: B(OFFICES), S-1(STORAGE) **NO CHANGE PROPOSED**

CONSTRUCTION TYPE

EXISTING: TYPE V-B (SPRINKLERED)
PROPOSED: TYPE V-B (SPRINKLERED) **NO CHANGE PROPOSED**

ALLOWABLE AREA:

CHAPTER 5

TABLE 503	BASIC ALLOWABLE AREA:	**ALLOWABLE:** B 9,000 / 2 STORIES	**ALLOWED:** B 27,000 / 3 STORIES (W/ SPRINKLER INCREASE)
SEC 506.2	BUILDING HEIGHT LIMIT:	**ALLOWABLE:** 60'	**ACTUAL:** 38'-0" ✓ O.K.
	ACTUAL BUILDING AREA:	FIRST FLOOR: 8,423 SF SECOND FLOOR: 2,755 SF THIRD FLOOR: 2,457 SF TOTAL : 13,635 SF	
SEC 506.3	INCREASE FOR SPRINKLERS:	200% INCREASE (BUILDINGS WITH MORE THAN 1 STORY) 9,000 + 200% INCREASE = 27,000 SF PER STORY 27,000 SF * 3 STORIES = **81,000 SF TOTAL** MAX BUILDING HEIGHT: **60'** MAX STORIES: **3**	✓ O.K.
TABLE 508.4	REQUIRED SEPARATION OF OCCUPANCIES:	**B,F-1,M,S-1** : **B,F-1,M,S-1**	NO SEPARATION REQUIRED ✓ O.K.

CHAPTER 6

TABLE 601	FIRE RESISTANCE RATING	TYPE V-B CONSTRUCTION	0-HRS REQD. FOR ALL BUILDING ELEMENTS
TABLE 602	FIRE SEPARATION DISTANCE	10 ≤ X ≤ 30	0-HRS REQD.

CHAPTER 7

SEC 713.4	SHAFT ENCLOSURES	2 HRS REQD. FOR MORE THAN 4 STORIES (INCLUDING BASEMENT)	2 HR SHAFT ENCLOSURE PROVIDED FOR EXIT STAIRWAY AND ELEVATOR ✓ O.K.

CHAPTER 8

TABLE 803.9	INTERIOR ENVIRONMENTS:	GROUP **B**	EXIT STAIRWAYS: **A** FINISH REQUIREMENT ROOMS: **C** FINISH REQUIREMENT

CHAPTER 9

SEC 903.2.8	FIRE PROTECTION SYSTEMS:	AN AUTOMATIC SPRINKLER SYSTEM IS INSTALLED THROUGHOUT THE BUILDING IN ACCORDANCE WITH SECTION 903.3 AND NFPA 13.	

EGRESS DESIGN:

CHAPTER 10

SEC 1003.5	ELEVATION CHANGE:	ELEVATION ≤ 6"	RAMP SHALL BE PROVIDED WITH EITHER HANDRAILS OR FLOOR FINISH MATERIALS THAT CONTRAST WITH ADJACENT FLOOR FINISH MATERIALS.
TABLE 1004.1.2	OCCUPANT LOAD:	**BASEMENT:** STORAGE: 11 OCCUPANTS SUBTOTAL: 11 OCCUPANTS **FIRST FLOOR:** RECEPTION: 07 OCCUPANTS WORKSTATIONS: 36 OCCUPANTS KITCHEN: 37 OCCUPANTS TRASH: 01 OCCUPANTS CONFERENCE: 12 OCCUPANTS CONFERENCE: 29 OCCUPANTS WORKSTATIONS: 25 OCCUPANTS SUBTOTAL: 147 OCCUPANTS **SECOND FLOOR** WORKSTATIONS: 20 OCCUPANTS CONFERENCE: 15 OCCUPANTS CONFERENCE: 26 OCCUPANTS SUBTOTAL: 61 OCCUPANTS	**THIRD FLOOR:** WORKSTATIONS: 22 OCCUPANTS ROOF DECK: 49 OCCUPANTS SUBTOTAL: 71 OCCUPANTS **OCCUPANT LOAD SUMMARY:** BASEMENT: 10 OCCUPANTS FIRST FLOOR: 147 OCCUPANTS SECOND FLOOR: 61 OCCUPANTS THIRD FLOOR: 71 OCCUPANTS **TOTAL : 290 OCCUPANTS** EXISTING LOAD: 50 OCCUPANTS (PER PERMIT 07-123362) **NET NEW LOAD: 240 OCCUPANTS**
SEC 1005.3.1	EGRESS WIDTH:		290 OCC X 0.15" = 43.50" REQUIRED 64" PROVIDED (2 EXITS) ✓ O.K.
SEC 1005.3.2	EXCEPTION	FOR OTHER THAN GROUP H AND I-2 OCCUPANCIES THE CAPACITY, IN INCHES, OF MEANS OF EGRESS COMPONENTS OTHER THAN STAIRWAYS SHALL BE CALCULATED BY MULTIPLYING THE OCCUPANT LOAD SERVED BY SUCH COMPONENT BY MEANS OF EGRESS CAPACITY FACTOR OF 0.15 INCH PER OCCUPANT IN BUILDINGS EQUIPPED THROUGHOUT WITH AN AUTOMATIC SPRINKLER SYSTEM INSTALLED IN ACCORDANCE WITH SECTION 903.3.1.1 OR 903.3.1.2 AND AN EMERGENCY VOICE/ALARM COMMUNICATION SYSTEM IN ACCORDANCE WITH SECTION 907.5.2.2.	
SEC 1008.1.9.3	LOCKS AND LATCHES:		OCCUPANT LOAD < 300 IN OFFICE PANIC HARDWARE NOT REQUIRED ON MAIN EXTERIOR DOOR PER 1008.1.9.3 EXCEPTION 2. ✓ O.K.

CODE SUMMARY LEGEND

- 1 HOUR RATED ASSEMBLY
- 2 HOUR RATED ASSEMBLY
- 3 HOUR RATED ASSEMBLY
- AREA NAME
- NAME / Occ Grp / # SF / OLF / # / Function
  - OCCUPANCY (CH. 3)
  - AREA (SF)
  - OCCUPANT LOAD FACTOR / NUMBER OF OCCUPANTS
  - FUNCTION (CH. 10)
- EXIT SIGN SHADE INDICATES ILLUMINATE FACE. ARROW INDICATES DIRECTION TO EXIT
- EXIT A 100' - 0" — EXIT PATH
- DENOTES EMERGENCY EGRESS PATH (MINIMUM 1 FT CANDLE WITH BATTERY BACKUP)
- COMMON PATH
- PH — PANIC HARDWARE

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PLAN REVIEW SET 07.31.19
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Drawing:

CODE SUMMARY

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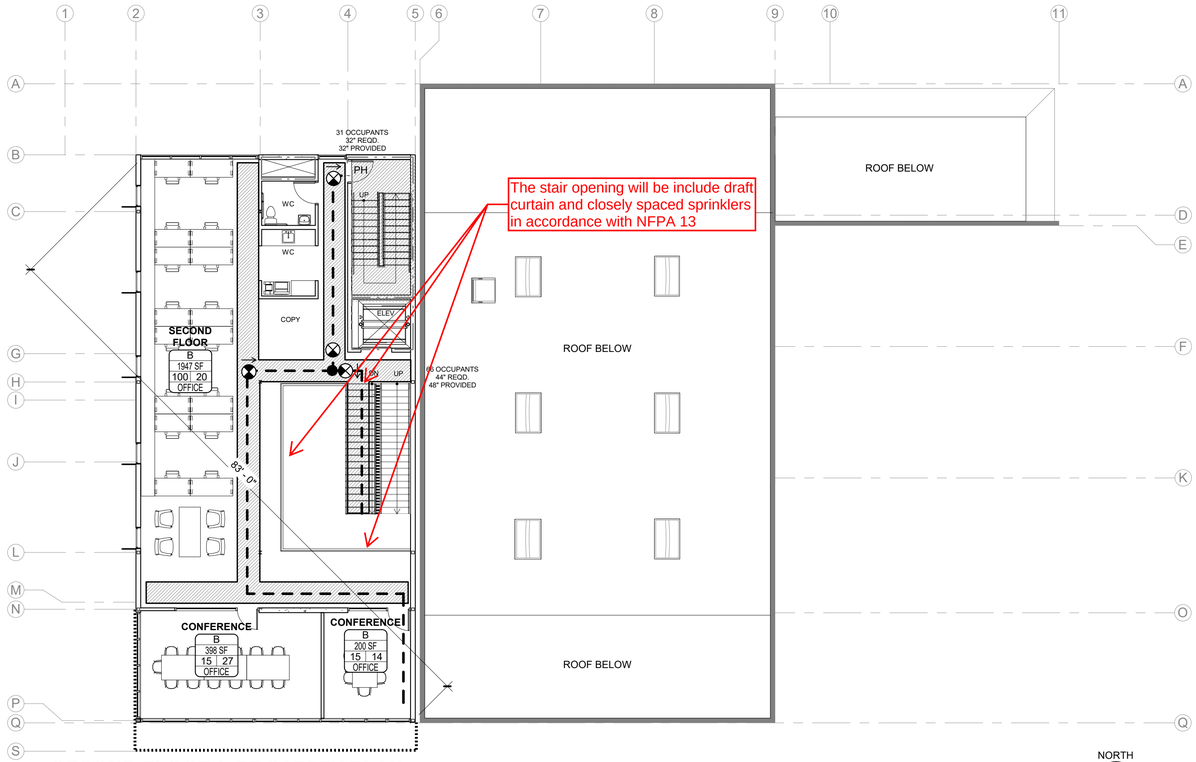
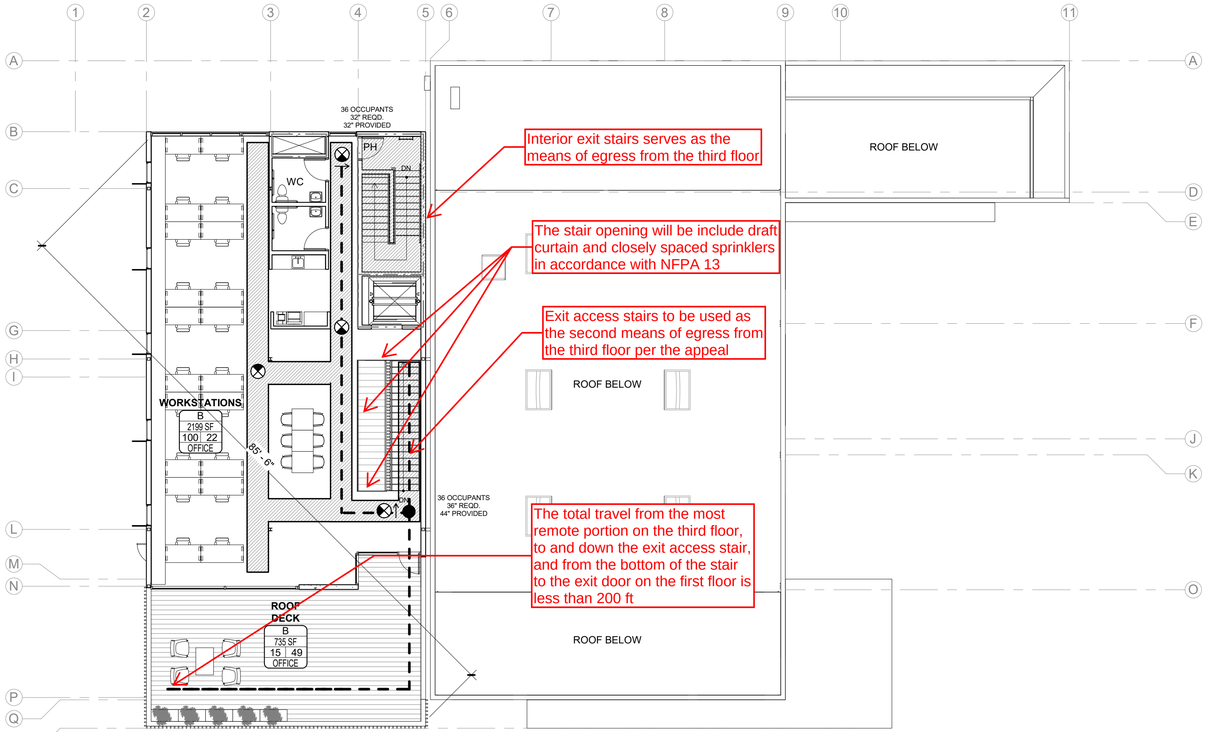
G1.01



1 SECOND FLOOR LIFE SAFETY PLAN

3/32" = 1'-0"

NORTH



2 THIRD FLOOR LIFE SAFETY PLAN

3/32" = 1'-0"

NORTH

BUILDING CODE SUMMARY

EGRESS DESIGN CONTINUED:

SEC 1009.3	EXIT ACCESS STAIRWAYS:	EXIT ACCESS STAIRWAYS SHALL BE ENCLOSED	NON ENCLOSED STAIRWAY ALLOWED PER EXCEPTION 3	
			STAIRWAY FOOTPRINT = 24'-0" LENGTH, 9'-4" WIDTH ALLOWABLE OPENING = 2 X 24'-0" X 9'-4" = 448 SF ACTUAL OPENING = 23'-6" X 19'-0" = 447 SF	O.K.
		MIN. 18" DRAFT CURTAIN AT ALL OPENINGS CLOSELY SPACED SPRINKLERS PER 1009.3	PROVIDED PROVIDED	O.K.
SEC 1014.3	COMMON PATH:	100' MAX	FIRST FLOOR: 78'-0" FROM KITCHEN SECOND FLOOR: 67'-0" FROM CONFERENCE THIRD FLOOR: 50'-0" FROM ROOF DECK	O.K.
SEC 1015.2.1	TWO EXITS:	> 1/3 THE DIST. OF DIAG.	FIRST FLOOR: DIAG. DISTANCE = 154'-0" / 3 = 51'-4" DISTANCE BETWEEN EXITS: 85'-0" SECOND FLOOR: DIAG. DISTANCE = 83'-0" / 3 = 27'-8" DISTANCE BETWEEN EXITS: 31'-10" THIRD FLOOR: DIAG. DISTANCE = 85'-6" / 3 = 28'-6" DISTANCE BETWEEN EXITS: 47'-9"	O.K.
SEC 1016	TRAVEL DISTANCE:	300' MAX W/ SPRINKLERS	FIRST FLOOR: 134'-5" FROM KITCHEN SECOND FLOOR: 108'-1" FROM CONFERENCE THIRD FLOOR: 195'-1" FROM ROOF DECK	O.K.
SEC 1021	MIN. # OF EXITS REQ'D:	2	BASEMENT: 1 EXIT PROVIDED (SEE 1021.1.2) FIRST FLOOR: 2 EXITS PROVIDED SECOND FLOOR: 2 EXITS PROVIDED ROOF DECK: 1 EXIT PROVIDED (SEE 1021.1.2)	O.K.
SEC 1021.1.2	STORIES WITH ONE EXIT:	49 OCCUPANTS MAX 100' TRAVEL DISTANCE MAX	BASEMENT: 10 OCCUPANTS 88'-0" TRAVEL DISTANCE ROOF DECK: 49 OCCUPANTS 43'-0" TRAVEL DISTANCE	O.K.
SEC 1021.2	EXITS FROM STORIES:	TWO EXITS, OR EXIT ACCESS STAIRWAYS OR RAMPS PROVIDING ACCESS TO EXITS, FROM ANY STORY OR OCCUPIED ROOF SHALL BE PROVIDED PER 1021.2.		O.K.
SEC 1021.3.1	ACCESS TO EXITS AT ADJACENT LEVELS:	ACCESS TO EXITS AT OTHER LEVELS SHALL BE BY STAIRWAYS OR RAMPS. WHERE ACCESS TO EXITS OCCURS FROM ADJACENT BUILDING LEVELS, THE HORIZONTAL AND VERTICAL EXIT ACCESS TRAVEL DISTANCE TO THE CLOEST EXIT SHALL NOT EXCEED THAT SPECIFIED IN SECTION 1016.1. ACCESS TO EXITS AT OTHER LEVELS SHALL BE FROM AN ADJACENT STORY		
SEC 1027.4.2	COURT CONSTRUCTION:	MIN. 10'-0" WIDE	EGRESS COURT = 10'-0" (NO RATING REQD.)	O.K.

PLUMBING:

TABLE 2902.1 MIXED OCCUPANCY CALCULATION FOR WHOLE BUILDING:

WATER CLOSET CALCULATION
OCC: OCC LOAD / 2(SEX) = LOAD/FIXTURE RATIO

B: 279 OCC/2 = 140/RATIO = 3.80 REQD PER SEX
S-1: 12 OCC/2 = 6/100 = 0.06 REQD PER SEX

3.80 + 0.06 = **3.86 REQD PER SEX (4 REQD)**

LAVATORY CALCULATION
OCC: OCC LOAD / 2(SEX) = LOAD/FIXTURE RATIO
B: 279 OCC/2 = 140/RATIO = 2.75 REQD PER SEX
S-1: 12 OCC/2 = 6/100 = 0.06 REQD PER SEX

2.75 + 0.08 = **2.83 REQD PER SEX (3 REQD)**

ACTUAL WATER CLOSET COUNT

MEN'S : 3 WATER CLOSETS PROVIDED
WOMEN'S : 3 WATER CLOSETS PROVIDED
UNISEX: 2 WATER CLOSET PROVIDED — O.K.

ACTUAL LAVATORY COUNT

MEN'S : 3 LAVATORIES PROVIDED
WOMEN'S : 3 LAVATORIES PROVIDED
UNISEX: 2 LAVATORY PROVIDED — O.K.

ACCESSIBILITY:

SEC 3411 PROJECT VALUATION: EXISTING IMPROVMENTS = 7960 SF * $131.05 = $1,043,158 * 0.4 = $417,264
NEW CONSTRUCTION = 11,053 SF * $131.05 = $1,448,495
TOTAL VALUATION: = $1,865,760

25% ACCESSIBILITY UPGRADE REQUIREMENT: $466,440

ALL BARRIERS HAVE BEEN REMOVED. — O.K.

THE ALTERED AREA IS FULLY COMPLIANT. THE ALTERED AREA HAS BEEN ASSESSED BY THE APPLICANT TO CHAPTER 11 OF THE OSSC AND FOUND TO BE COMPLIANT.

VALUATION DATA HAS BEEN BASED ON THE LATEST ICC VALUATION DATA (FEBRUARY 2018)

603.2.3	DOOR SWING	EXCEPTION 2	WHERE THE TOILET ROOM OR BATHING ROOM IS FOR INDIVIDUAL USE ANDA CLEAR FLOOR SPACE COMPLYING WITH 305.3 IS PROVIDED WITHIN ROOM BEYOND THE ARC OF THE DOOR SWING, DOORS SHALL BE PERMITTED TO SWING IN THE CLEAR FLOOR SPACE OR CLEARANCE FOR ANY FIXTURE.
SEC 1109.2	TOILET FACILITES	EXCEPTION 3	WHERE MULTIPLE SINGLE USER TOILET OR BATHING ROOMS ARE CLUSTERED AT A SINGLE LOCATION, AT LEAST 50 PERCENT BUT NOT LESS THAN ONE ROOM FOR EACH USE AT EACH CLUSTER MUST BE ACCESSIBLE.

TITLE 24:

SEC 24.85.040 NO CHANGE OF OCCUPANY PROPOSED

TOTAL LOAD : 290 OCCUPANTS — O.K.
EXISTING LOAD: 50 OCCUPANTS
NET NEW LOAD: 240 OCCUPANTS

NET NEW LOAD > 149 OCCUPANTS. EXISTING BUILDING MUST BE UPGRADED TO OSSC OR ASCE 13 IMPROVEMENT STANDARD PER 24.85

SEC 24.85.050 THE ADDITION OR STRUCTURAL ALTERATION SHALL COMPLY WITH THE REQUIREMENTS OF NEW BUILDINGS .

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CODE SUMMARY

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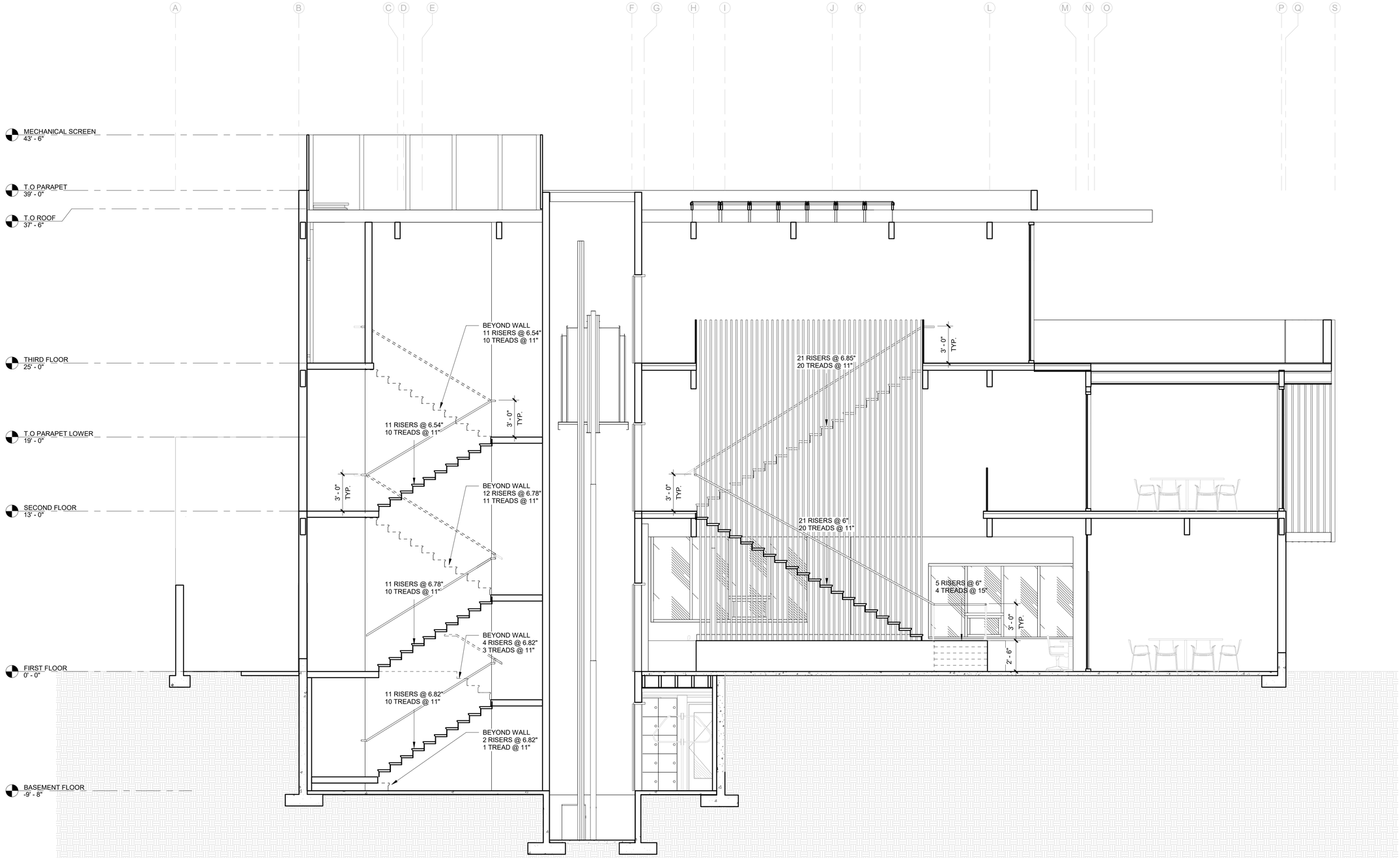

1 **N/S BUILDING SECTION**
1/4" = 1'-0"

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BUILDING SECTION @ STAIRS

Sheet No:

G1.04

BUILDING CODE | ACCESSIBILITY | FIRE EXPERTS
A Minority-Owned Business
Office Locations: OR | WA | NY | TN | CO
Main Phone Attendant: 503-488-5651

ATTACHMENT #2

Client Name:	**Scott Edwards Architecture**		
Project Number:	C00192-000A.3	Date:	8/15/2019
Distribution:	Peter Grimm, Scott Edwards Architecture Eric Wenzel, Scott Edwards Architecture		
Subject:	Attachment #2 - Performance analysis for a three-story unenclosed exit access stairway as a second means of egress		
Referenced Codes and Standards:	2014 Oregon Structural Specialty Code, including the recently adopted Appendix N (OSSC)		
Building Name:	SEA Burnside HQ		
Room Area Affected:	Whole Building		

1. OVERVIEW

Scott Edwards Architecture (SEA) is expanding their Burnside Street headquarters in SE Portland. A portion of the one-story office building will be demolished and replaced by a three-story structure. The new addition and the existing single story will be a single building for code compliance. The three-story building will be of Type V-A construction with a total area of 19,000 sf. It will include Group B (business) and S-1 (storage) occupancies.

The three-story addition will include two (2) egress stairs – one enclosed interior exit stair and one unenclosed exit access stair protected by draft curtains and closely spaced sprinklers. Appeal #20592 was submitted to permit the use of the unenclosed stair as the second means of egress from the third floor, which includes 71 occupants. The appeal was denied on the basis that the proposed design did not meet equivalent protection.

Code Unlimited has been asked to perform egress analyses of the proposed design and a code prescriptive design. A comparison of the prescriptive baseline condition with the proposed three-story stair demonstrates that the proposed design provides faster egress than the prescriptive code path. Based on the egress simulations, using the unenclosed stair as the second means of egress, all of the building occupants reach an exit 14.5 seconds faster than a representative code-compliant egress path.

2. EGRESS SIMULATION

Pathfinder, an advanced occupant-movement simulation software designed by Thunderhead Engineering, was used to determine building evacuation times. The latest release of the software, (Pathfinder 2019.1) was utilized for the modeling. This software is an agent-based egress simulator that uses steering behaviors to model occupant motion. Pathfinder is also a validated software for use in computer modeling of building evacuation as per Table 60.1 of the SFPE Handbook 5th Edition (see attached pdf).

The simulation for the behaviors of the occupant movement utilized Steering Mode. This mode models a realistic simulation of occupant behavior during egress and queuing. Occupants are modeled to avoid collisions and simulate movements of pedestrians in a traffic system (Figure 1). This is more conservative and realistic compared to the SFPE Mode where occupants can occupy a single space simultaneously. SFPE Mode sets limitation on occupant flow rate through egress components (doorways, corridors, stairways) and models occupants to travel the shortest path to egress, which leads to occupants overlapping each other (Figure 2). Occupants do not react with the changing environment during egress in SFPE Mode, such as avoiding collisions with other occupants or walls and boundaries or navigating available space.

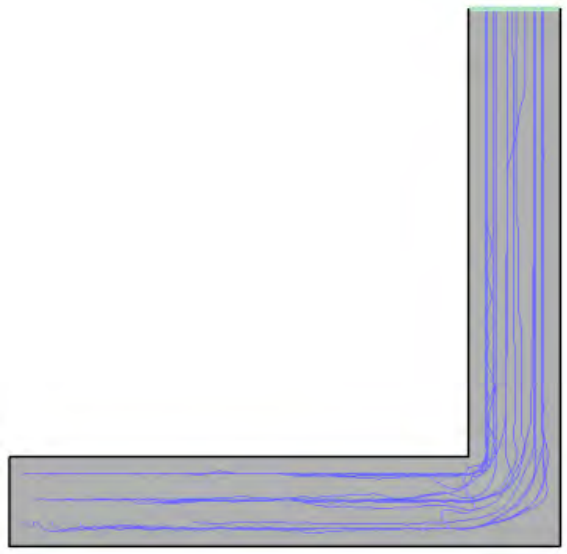


Figure 1: Occupant trails around a corridor modeled in Steering Mode.

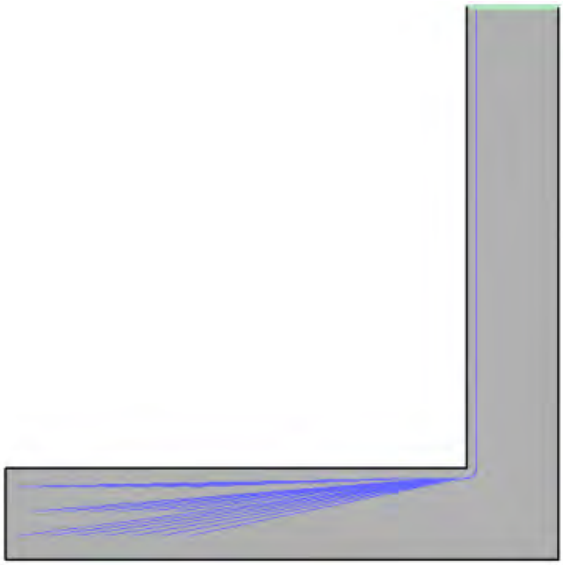


Figure 2: Occupant trails around a corridor modeled in SFPE Mode.

The SFPE Handbook Table 3-12.4 provides walking speeds on horizontal surfaces. As summarized in Table 1 below, those with full ambulatory abilities have a walking speed of 4.10 ft/s (1.25 m/s). Those with locomotor disabilities are reported to move at 2.62 ft/s (0.8 m/s). Walking speeds on stairs are computed by the software in accordance with Engineering Guide to Human Behavior in Fire (SFPE, 2003).

Table 1: Summary of walking speeds on horizontal surfaces per the SFPE Handbook.

Ambulatory Ability	Percentage of Occupants	Walking Speed
Disability	10%	2.62 ft/s

Ambulatory Ability	Percentage of Occupants	Walking Speed
No Disability	90%	4.10 ft/s

The percentage of occupants with mobility impairments does not pose a significant limitation on the total egress time in this analysis. The occupants' steering behavior allows occupant avoidance during egress, which permits faster moving occupants to move around slower moving occupants. Therefore, the limits posed by occupants with mobility impairments is based on the one occupant furthest from an exit and with a mobility impairment. The models reveal that the largest factor affecting total egress times is queueing at "pinch points" such as doorways, corridor entrances from open areas and, to a lesser extent, at the tops of stairways.

The inputs to the simulation have been adjusted to conservatively represent the occupant movement that is expected in the evacuation of the business building. As referenced in the 4th Edition of the SFPE Handbook of Fire Protection Engineering, the U.S. Census Bureau reported in 2005 that 14.9% of the U.S. population 5 years and older had some level of disability, excluding people living in institutions.

For this analysis, a comparison was performed to determine the effects of mobility impairment on total egress time. Since this is a business occupancy and majority of occupants will be adult population with standard mobility, 10% of the building occupants have been assumed to have mobility impairment. To evaluate whether an increased percentage of mobility impaired occupants would affect egress, the egress models were simulated again with 15% of the occupants being disabled.

The Prescriptive approach and the Proposed design are described in detail in Sections 3.1 and 3.2 below. The egress time model results for Prescriptive approach were identical for both 10% and 15% mobility impairment, which is consistent with the time of egress being dependent on the slowest moving person traveling from the most remote point. Faster-moving occupants are able to pass the slower moving occupants and the time at which the last slower-moving occupant exits the building determines the total evacuation time.

The Proposed design results for the 10% mobility impaired model was within 1 second of the 15% model, due to random variations in the movement times induced by the model, and is considered statistically insignificant.

3. COMPARISON ANALYSIS

Two egress simulations were performed using Pathfinder, first to establish the time required to travel the baseline prescriptive approach, and then to establish the proposed design utilizing the three-story open stair. The two simulations were compared to determine if equivalent protection is provided by the proposed design.

- The first simulation models the prescriptive approach. In this scenario, the occupants of the third floor use the open exit access stair as the second means of egress. These occupants travel down to the second story, and the remaining travel is assumed to be on a horizontal surface until the 300 ft maximum exit access travel distance is satisfied. This

complies with the code intent and the 2014 OSSC Table 1016.2 and 1021.3.1 requirements.

- The second simulation models the proposed design, where the unenclosed exit access stair provides a second means of egress from the third story, continuing down the stair to the first floor and then horizontally across the floor to a building exit based on actual distance travelled.

The success criterion is based on comparing the egress time where all occupants are either out of the building or within an enclosed exit stair. The code does not restrict the travel distance once an occupant is within a protected enclosed exit stair enclosure. Figures 3, 4, and 5 show the egress paths using the prescriptive approach and the proposed design.

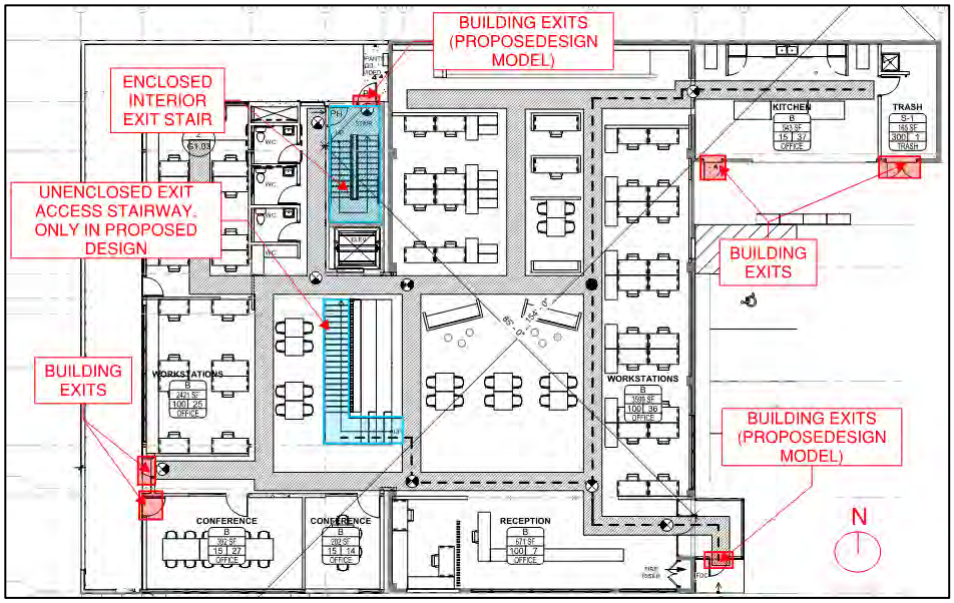


Figure 3: First floor egress plan showing the Prescriptive Approach and Proposed Design.

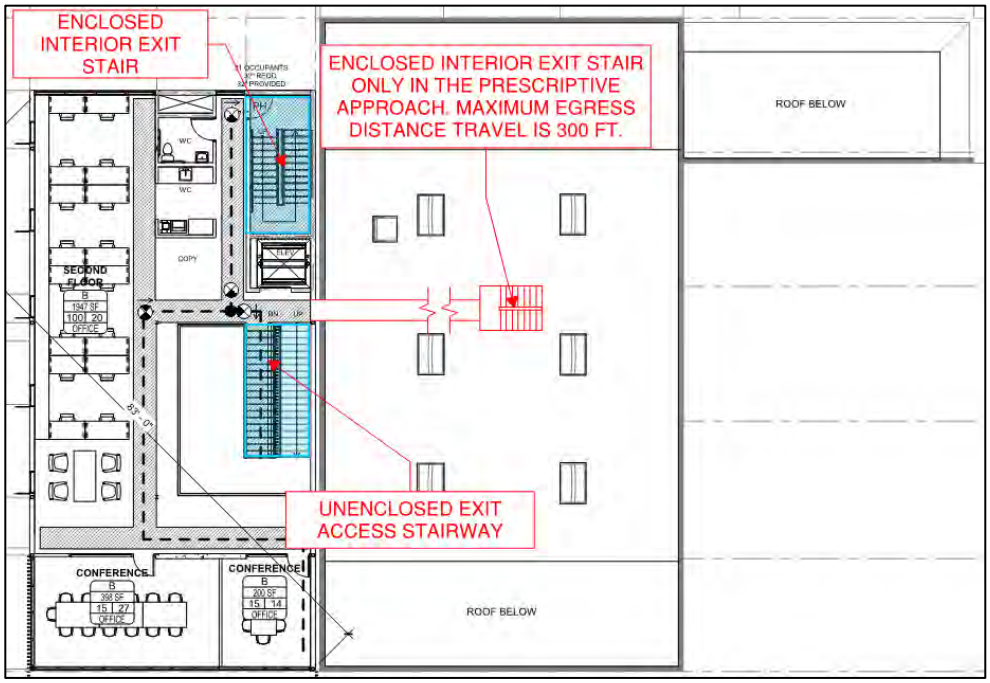


Figure 4: Second floor egress plan showing the Prescriptive Approach and Proposed Design.

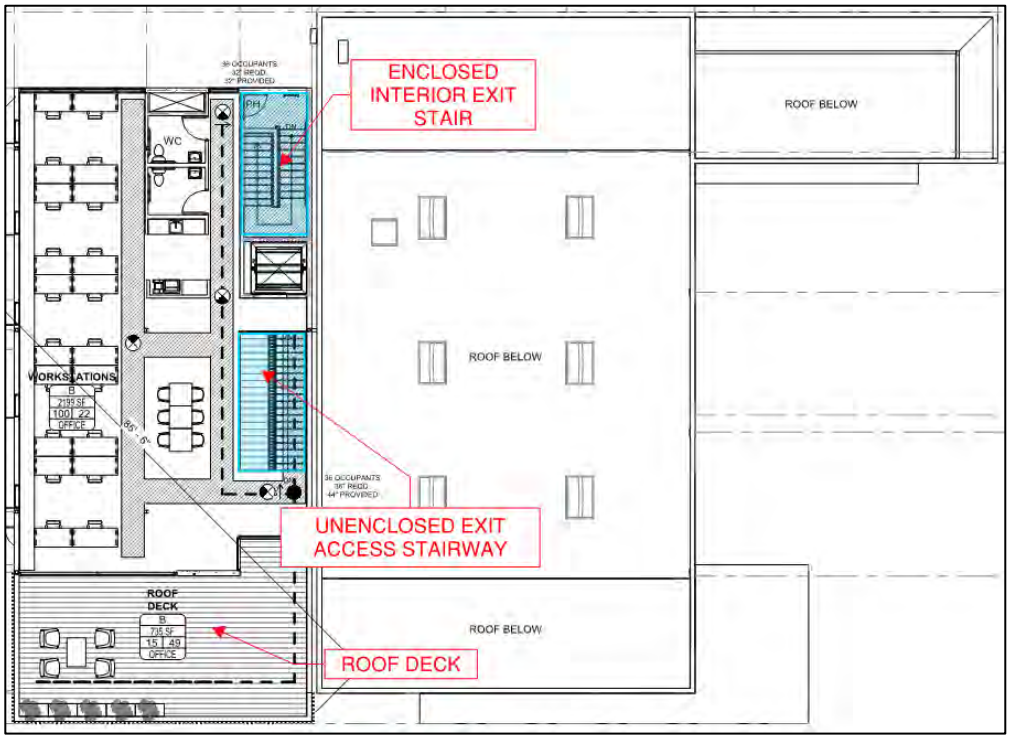


Figure 5: Third floor egress plan showing the Prescriptive Approach and Proposed Design.

3.1 Prescriptive Approach

The prescriptive approach includes a 44-inch wide unenclosed exit access stair connecting the second and third floors, and the remainder of the path is a 4-ft wide imaginary corridor on the second floor that leads straight to an exit (Figure 7). Starting the egress from the most remote point on the third floor, the total travel distance down one flight of the stair and then along a corridor to an exit on the second floor is modeled to be 300 feet since this is a B occupancy sprinklered building.

The egress time, when all occupants are either out of the building or within the enclosed stair, is found to be **191.50 seconds (3 min 11.5 sec)**.

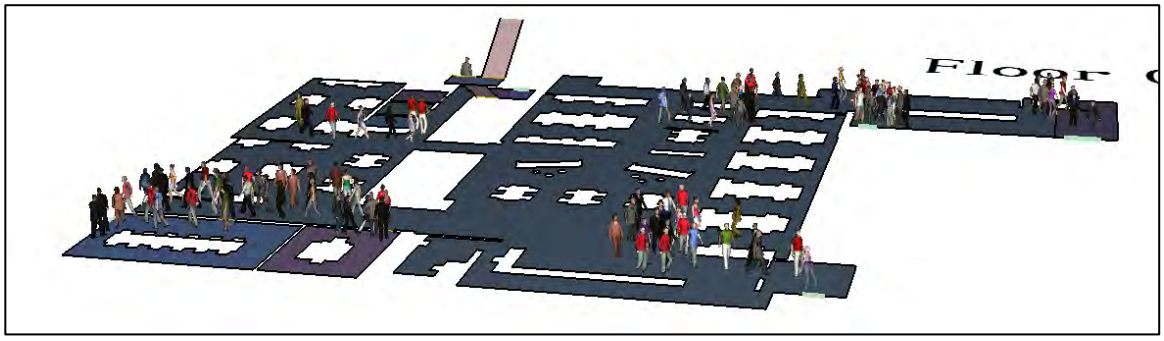


Figure 6: First Floor Plan – 12.2 seconds into egress, the occupants disperse to various exits.

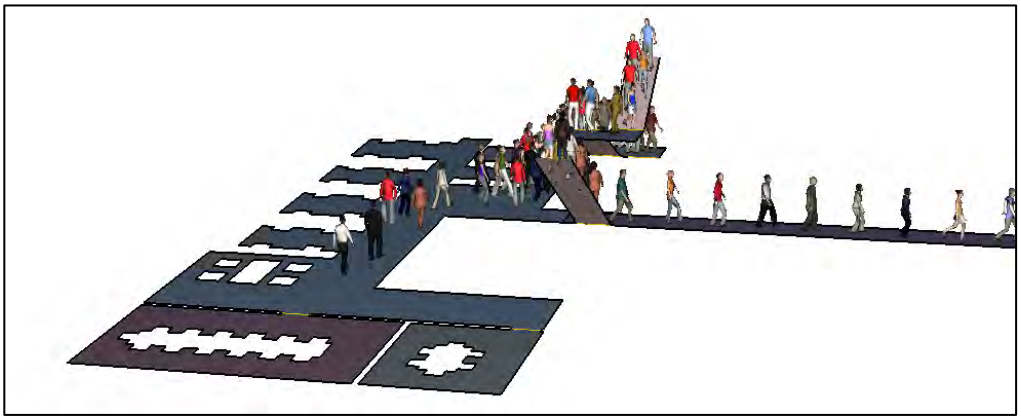


Figure 7: Second Floor Plan – 54 seconds into egress, the occupants egress through the enclosed interior exit stairway. The Third-Floor roof deck occupants use the unenclosed stair to reach an independent exit through a 4 ft wide imaginary corridor (on the right).

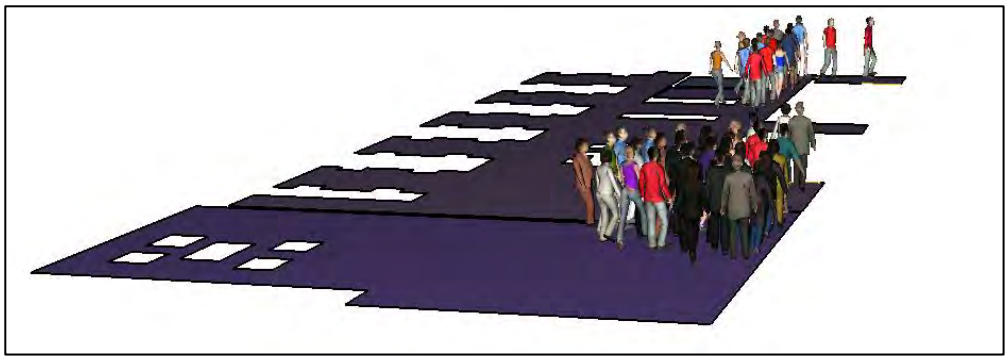


Figure 8: Third Floor Plan – 25.5 seconds into egress, the occupants' egress through the enclosed interior exit stair. The roof deck occupants use the unenclosed stair to reach an independent exit on the Second Floor.

3.2 Proposed Design

The egress simulation of the proposed design includes a 51-inch open stair as the second means of egress from the third floor down to the first floor. The number of exits on the first floor are limited to two exits instead of six as a conservative measure to demonstrate the additional protection of the proposed design. The total travel distance is as currently designed. The building exit selected at the first floor is in the direct view of the occupants coming down the stair. Another exit that is closer is closed in the simulation to establish a more conservative scenario. The total travel distance in this simulation, when measured using the code mandated method down the two flights of stairs and then horizontally across the first floor, is 200 feet.

The egress time, when all occupants are either out of the building or are within the enclosed interior exit stair, is found to be **177 seconds (2 min 57 sec)**, 14.5 seconds faster than the prescriptive approach results.

Figure 9: First Floor Plan – 9.6 seconds into egress, the occupants use either of the two exits.

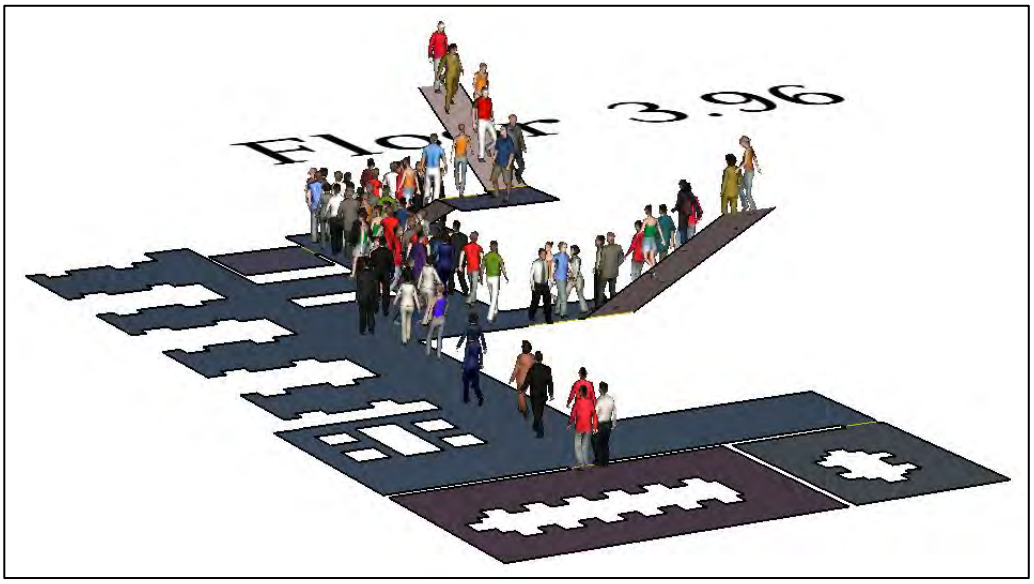


Figure 10: Second Floor Plan – 46.9 seconds into egress, the occupants use both the enclosed interior exit stair and the unenclosed exit access stair for egress.

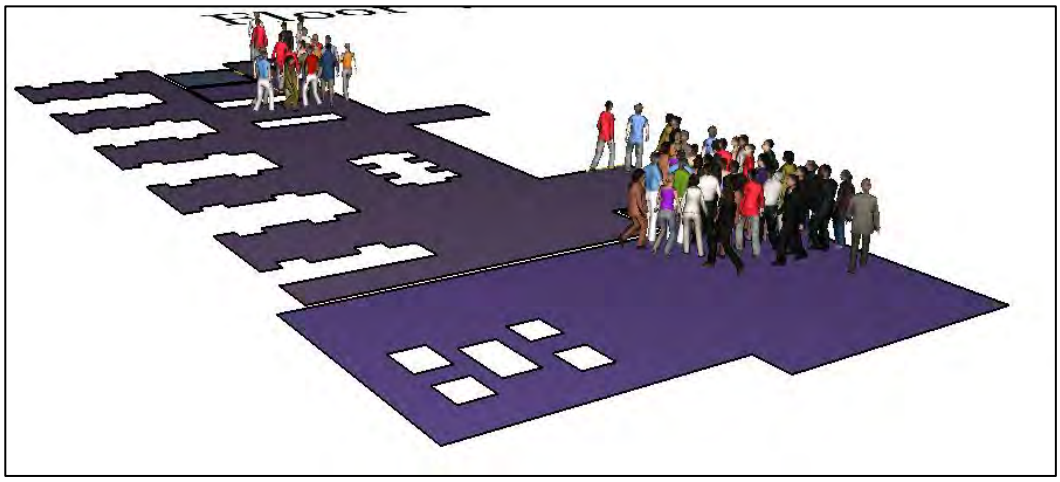


Figure 11: Third Floor Plan – 16 seconds into egress, the occupants use both the enclosed interior exit stair and the unenclosed exit access stair for egress.

4. SUMMARY

Table 2 summarizes the design parameters of the two simulated egress models.

Table 2: Design parameters of the egress models.

Parameters	Prescriptive Approach	Proposed Design
1. Enclosed exit stair width	44 in.	44 in.
2. Exit door width at enclosed exit stair	32 in.	32 in.
3. Occupant load	First Floor – 147 Second Floor – 61 Third Floor – 71	First Floor – 147 Second Floor – 61 Third Floor – 71
4. Unenclosed exit access stair width	44 in.	51 in. **(exceeds minimum width requirement)**
5. Maximum travel distance	300 ft, where the occupants travel from the most remote point on the third floor, down the unenclosed exit access stair to an exit on the second floor	200 ft, where occupants travel from the most remote point on the third floor, down the unenclosed exit access stair to an exit on the first floor **(exceeds protection by limiting distance of egress travel)**
6. Number of Exits	Six (6): one enclosed stair, one unenclosed stair, and four building exits on the first floor.	Two (2): one enclosed stair and one unenclosed stair that leads to the exit on the south side of the building (Figure 3). **(conservative measure due to reduced number of exits)**
7. Egress Time	**191.50 sec (3 min 11.5 sec)**	**177 sec (2 min 57 sec)**, exceeding the benchmark by 14.5 seconds.

5. CONCLUSION

The use of one enclosed exit stair coupled with an unenclosed exit access stairway as the second means of egress from the third floor to the first floor performs better than an arrangement that meets the prescriptive requirements of the code. The proposed design:

1. includes wider stairs (51”) than the prescriptive minimum stair requirements (44”),
2. shorter total egress travel distance from the most remote point on the third floor to an exit using the open stairs, and
3. as a conservative measure, only considers use of 2 of the available 6 exits on the first floor.

Based on the results of the egress simulations, all the occupants in the proposed building can reach an exit at least 14.5 seconds faster using the proposed design than a representative code-compliant building using the prescriptive approach. Therefore, the proposed design will exceed the protection for egressing occupants intended by the code.

Vincent L. Collins, FPE

Fire Protection Engineer/Principal

ATTACHMENT #3

1021.2.5 Additional exits. In buildings over 420 feet (128 m) in height, additional *exits* shall be provided in accordance with Section 403.5.2.

❖ Super high-rise buildings provide a unique situation for concerns about emergency evacuation and fire department access. Section 403.5.2 requires an additional stairway in these buildings. Since this is in excess of the required exit stairways, this additional stairway is not required to meet remoteness requirements from other exits. If the alternative for evacuation is provided by an occupant evacuation elevator, then the additional stairway is not required (Sections 403.6.2 and 3008.).

1021.3 Exit configuration. *Exits*, or *exit access stairways* or *ramps* providing access to *exits* at other stories, shall be arranged in accordance with the provisions of Sections 1015.2 through 1015.2.2. *Exits* shall be continuous from the point of entry into the *exit* to the *exit discharge*.

❖ The entrance to the enclosures for exit stairways or exit access stairways shall meet the same arrangement as exit and exit access doorways (see Sections 1015.2 through 1015.2.2). The need for exits to be independent of each other cannot be overstated. Each occupant of each floor must be provided with the required number of exits without having to pass through one exit to gain access to another. Each exit is required to be independent of other exits to prohibit such areas from merging downstream and becoming, in effect, one exit.

The requirement for exits to be continuous is repeated from Section 1021.1 and is consistent with the exit termination requirements in Section 1022.3 and the exit discharge termination requirements in Section 1023.4. The intent of this section is to provide safety in all portions of the exit by requiring continuity of the fire protection characteristics of the enclosure for the exit stairway or ramp. Exit passageways (see Section 1023) are a continuation of an exit enclosure. This would include, but not be limited to, the fire-resistance rating of the exit enclosure walls and the opening protection rating of the doors.

Section 1027.1, Exceptions 1 and 2, allows for an alternative for direct access to the outside via an intervening lobby or vestibule. Horizontal exits (see Section 1025), while not providing direct access to the outside of the structure, do move occupants to another "building" by moving through a fire wall (see Section 1025 and Section 1027.1, Exception 3) or into a refuge area protected by fire barriers and horizontal assemblies. Horizontal exits are commonly used in hospitals and jails for a defend-in-place type of protection.

1021.3.1 Access to exits at adjacent levels. Access to *exits* at other levels shall be by *stairways* or *ramps*. Where access to *exits* occurs from adjacent building levels, the horizontal and vertical *exit access* travel distance to the closest *exit* shall not exceed that specified in Section 1016.1. Access to *exits* at other levels shall be from an adjacent story.

Exception: Landing platforms or roof areas for *helistops* that are less than 60 feet (18 288 mm) long, or less than 2,000 square feet (186 m^2) in area, shall be permitted to access the second *exit* by a fire escape, *alternating tread device* or ladder leading to the story or level below.

❖ Emergency evacuation from a multistory building will typically involve stairways or ramps as the vertical element for the means of egress route. These stairways and ramps can be exit access (Section 1009.3) or exits (Section 1022). When exit access stairways or ramps complying with Section 1009.3 are part of that route, the measurement of the exit access travel distance will include travel from the most remote point on the floor, to and down the exit access stairway or ramp and from the bottom of the stairway or ramp to an enclosure for an exit stairway or ramp or exterior exit door (see Section 1016.3). Vertical travel is slower than horizontal travel, so the exit access stairway or ramp should not be used for more than one story before an exit is reached.

It is not the intent of this section to require stairways in open parking structures or outdoor facilities to have enclosed stairways after one story of vertical travel. Due to the open nature of these facilities and the specific exceptions for openness (Section 1009.3, Exception 6 and 7) and measurement of exit access travel to the top of the stair or ramp (Section 1016.3, Exception 1 and 3), the exit access stairway can extend the total height of the building.

The exception is to allow for the second exit from small helistops to be a fire escape, alternating tread device or ladder instead of an exit or exit access stairway or ramp.

1021.4 Vehicular ramps. Vehicular ramps shall not be considered as an *exit access ramp* unless pedestrian facilities are provided.

❖ A vehicle-only ramp may be considered as one of the required exit access ramps if pedestrian walkways are provided along the ramp. The low-slope ramps that are lined with parking spaces are not considered vehicle ramps. In open parking garages, according to Section 1009.3, Exception 6, the exit access stairways and ramps are not required to be enclosed since an open parking structure is designed to permit the ready ventilation of the products of combustion to the outside by exterior wall openings (see Section 406.5.2). Also, parking structures are characterized by open floor areas that allow the occupants to observe a fire condition and choose a travel path that would avoid the fire threat.

Development Services

From Concept to Construction

Phone: 503-823-7300 Email: bds@portlandoregon.gov 1900 SW 4th Ave, Portland, OR 97201
More Contact Info (http://www.portlandoregon.gov//bds/article/519984)

ATTACHMENT #4

APPEAL SUMMARY

Status: Decision Rendered

Appeal ID: 12863	**Project Address:** 3039 NE Rosa Parks Way
Hearing Date: 12/23/15	**Appellant Name:** Tom Jaleski
Case No.: B-011	**Appellant Phone:** 5034885651
Appeal Type: Building	**Plans Examiner/Inspector:** Jody Orrison
Project Type: commercial	**Stories:** 3 **Occupancy:** E, A-3 **Construction Type:** II-B
Building/Business Name:	**Fire Sprinklers:** Yes - throughout
Appeal Involves: Erection of a new structure	**LUR or Permit Application No.:**
Plan Submitted Option: pdf [File 1] [File 2] [File 3] [File 4] [File 5] [File 6] [File 7] [File 8] [File 9] [File 10] [File 11] [File 12]	**Proposed use:** Education below 12th grade

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	712.1.8
Requires	712.1.8 Two-story openings. In other than Groups I-2 and I-3, a floor opening that is not used as one of the applications listed in this section shall be permitted if it complies with all of the items below. Does not connect more than two stories. Does not contain a stairway or ramp required by Chapter 10. Does not penetrate a horizontal assembly that separates fire areas or smoke barriers that separate smoke compartments. Is not concealed within the construction of a wall or a floor/ceiling assembly. Is not open to a corridor in Group I and R occupancies. Is not open to a corridor on non-sprinklered floors. Is separated from floor openings and air transfer openings serving other floors by construction conforming to required shaft enclosures.
Proposed Design	Appeal 11944 approved this three story opening request previously, with a condition that Stair S3 adjacent and open to this three story space not be a required means of egress. It is essential that Stair S3 perform as the third means of egress from the third floor and the fourth means or egress from the second floor. Therefore, we are requesting reconsideration of this appeal for approval without conditions. We are submitting a separate appeal to allow the Stair S3 to be unenclosed three story exit access stair located adjacent to this opening. The key difference between what was approved and what is provided here, besides the request to remove the Stair S3 condition is,

foot, which provides smoke removal capability equivalent to a 4,800 cubic feet per minute (CFM) exhaust fan per OSSC 910.4. The design is proposing over three times that size, which will far exceed the expectations of section 712.1.8.

The area smoke detectors located throughout the building provide additional protection by giving building occupants early warning of a fire event occurring in other areas. This is not considered or required by the code, under the provisions of section 712.1.8.

Due to the small size of the floor opening, complete separation of the third story, addition of roof vents, smoke detection throughout the building including beam detection in the three-story opening, and the addition of sprinklers and draft curtains for fire/smoke separation at the second floor, equivalent or better protection is provided. Therefore we request approval of this appeal.

Appeal item 2

Code Section	1021.3.1
Requires	1021.3.1 Access to exits at adjacent levels. Access to exits at other levels shall be by stairways or ramps. Where access to exits occurs from adjacent building levels, the horizontal and vertical exit access travel distance to the closest exit shall not exceed that specified in Section 1016.1. Access to exits at other levels shall be from an adjacent story.
Proposed Design	A three-story exit access stair is part of a new three story PPS Faubion PK-8 School building of Type IIB construction, and fully sprinklered. The stair was designed as an exit access stair per the requirements of section 1009.3 exception 4. The application of section 1021.3.1 was not clear until now and it is too late to significantly alter the design. However, this appeal proposes to meet the intent of section 1021.3.1. as follows: Exit access stair S3 will be provided with the draft curtains and sprinklers as required by section 1009.3 exception 4 but will be limited to only three stories. Two enclosed exit stairs (S2 and S4) and one unenclosed stair (S1) are available at the second floor for occupants coming down stair S3 from the third floor. Required width of stair S3 is 68 inches but it is designed to be 96 inches wide. All the other three stairs are also oversized with additional egress capacity available to accommodate occupants of stair S3. One hour fire barrier is provided at the third floor level to separate stair S3 from the rest of the floor. An egress analysis by a licensed Fire Protection Engineer is attached to demonstrate that even with very conservative assumptions stair S3 will meet code expectations of a safe means of egress from second and third floors.
Reason for alternative	The requirements governing exit access stairs were revised in the 2012 International Building Codes. However, the way these revisions were done left an impression that unenclosed exit access stairs are now permitted in most four story sprinklered buildings. After much research and discussion did it become clear that the requirements of section 1021.3.1 are written to limit exit access travel beyond to two adjacent stories and that it requires an enclosed exit stair in tandem with an open exit access stair to work as a means of egress component for multi-story buildings. It was too late for this project to alter the design, hence this appeal request. However, we believe that the design with the modifications proposed here will meet the intent of the code. Jason Toves, Technical staff of the ICC upon our request clarified to us that the intent behind the provision of section 1021.3.1, is to allow occupants travelling down an unenclosed exit access

stair to transfer to an enclosed exit access stair after travelling one floor level. In case of the Faubion school enclosed stairs S2 and S4 are available to the occupants of stair S3 at the second floor to satisfy this intent.

The IBC commentary on section 1021.3.1 clarifies that vertical travel down a stair is slower than horizontal exit access travel. The total travel distance from the top landing of S3 to the bottom of the first floor is 179 feet, out of which 74 feet includes steps and landings and 105 feet is on horizontal walkway (bridge) at the second floor. The bridge is used by the occupants to transition at the second floor level from the bottom of the flight coming down from the third floor to the start of the flight going down to the first floor. A conservative egress analysis attached to this appeal shows that the egress time is only increased by 5.84 seconds due to the occupants having to travel down two flights of an exit access stair instead of exit access travel on horizontal walking surface to an enclosed exit stair.

The egress analysis does not take into consideration the reduction in overall exit times due to PPS schools policy of having trained staff direct building evacuation and that regular drills are done to practice response to emergency situations. The building is also equipped with voice annunciation, which is a proven method of speeding up the response to an alarm and reducing overall egress speeds.

The egress analysis assumed reduced travel speeds at all flights even though code permits travel down two connecting floors to be considered at the same speed as horizontal walking surfaces. Neither does it take credit for availability of enclosed stair S2 within 25 feet of the flight down to the first floor, or that there are three stairs at the second floor which have excess capacity to absorb all the occupants of stair S3 coming down from the third floor.

There are two heat and smoke vents adjacent to the open stair which will provide additional protection to occupants walking down the stairs. The draft curtains and sprinklers provided per section 1009.3 will prevent smoke and heat migration from the second or first floors.

Code section 1021.3.1 does not consider any of these protections and benefits included here. Therefore, we believe that design proposed here is equivalent to what is intended by the code, and request approval of this appeal.

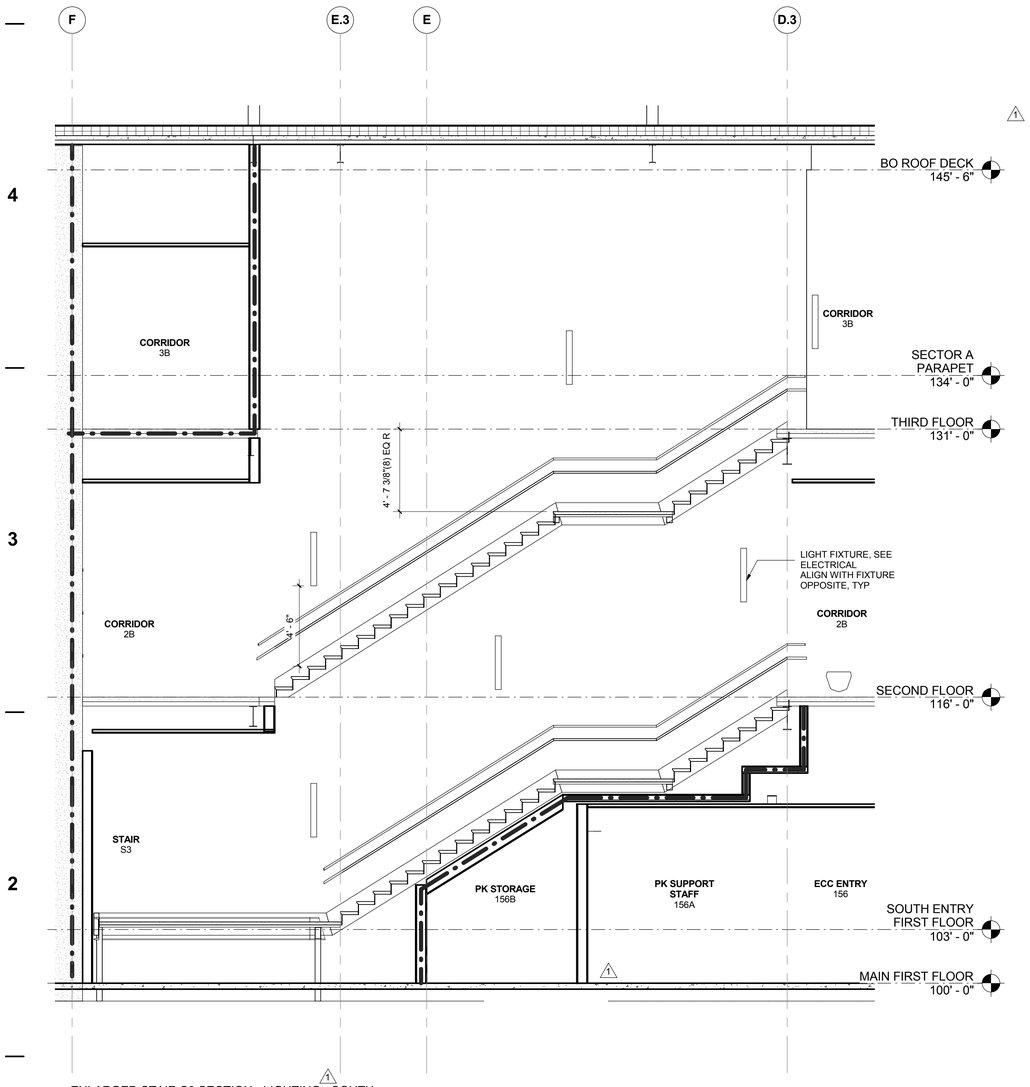
APPEAL DECISION

1. Vertical Opening to Three Stories with Required Egress Stair in the Opening: Granted as proposed.

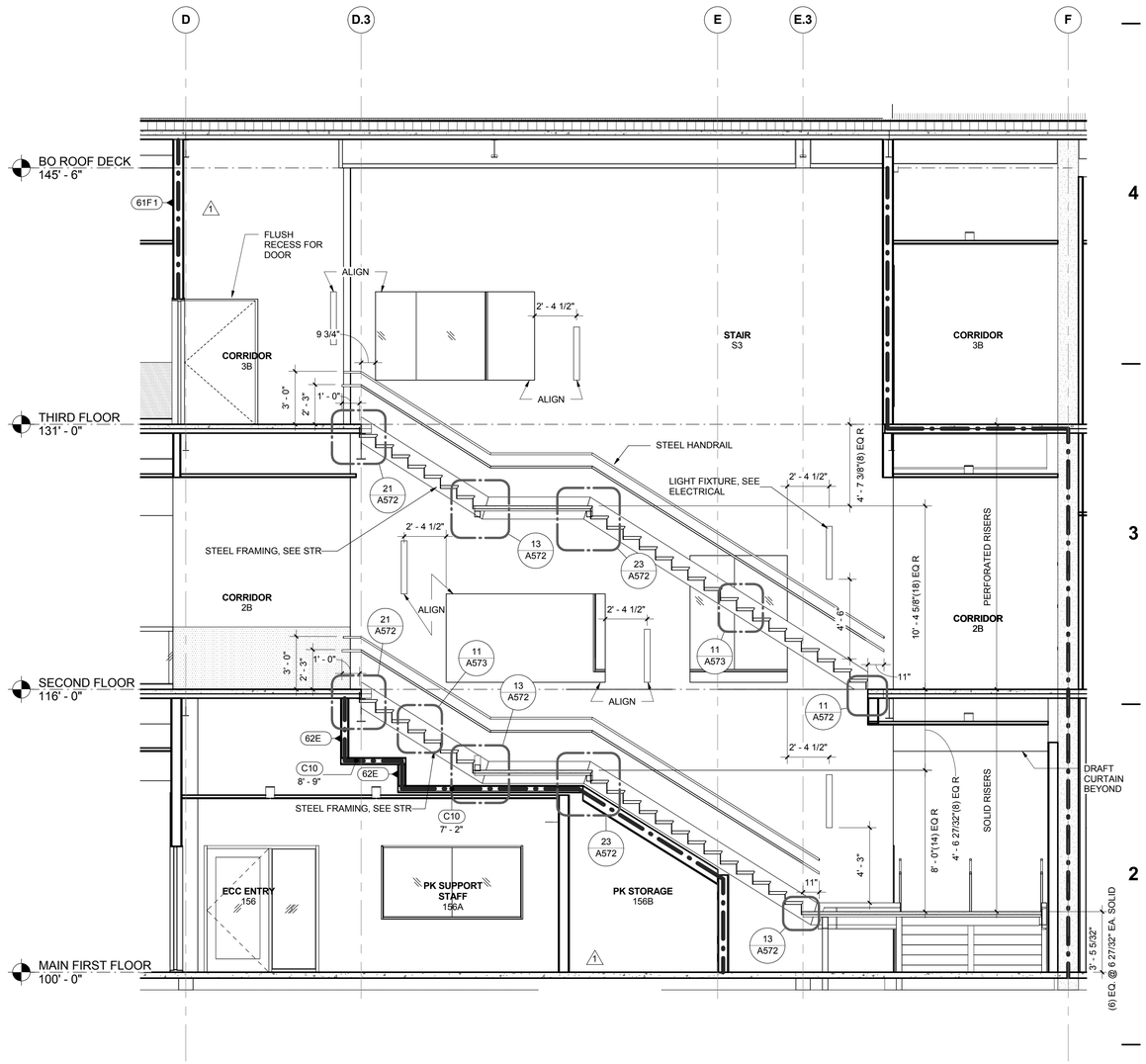
2. Exit Access Stairway S3 Serving Three Stories: Granted as proposed.

The Administrative Appeal Board finds that the information submitted by the appellant demonstrates that the approved modifications or alternate methods are consistent with the intent of the code; do not lessen health, safety, accessibility, life, fire safety or structural requirements; and that special conditions unique to this project make strict application of those code sections impractical.

Pursuant to City Code Chapter 24.10, you may appeal this decision to the Building Code Board of Appeal within 180 calendar days of the date this decision is published. For information on the appeals process and costs, including forms, appeal fee, payment methods and fee waivers, go to www.portlandoregon.gov/bds/appealsinfo, call (503) 823-7300 or come in to the Development Services Center.



02 ENLARGED STAIR S3 SECTION - LIGHTING - SOUTH
1/4" = 1'-0"



01 ENLARGED STAIR S3 SECTION
1/4" = 1'-0"

12/17/2015 5:44:36 PM

File #11

boora

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REGISTERED ARCHITECT
CHRISTOPHER LINN
OREGON
5145
STATE OF OREGON

New PPS Faubion PK-8 School
with Concordia University COE

3039 NE Rosa Parks Way
Portland, Oregon 97211

REV.	DATE	DESCRIPTION
1	10.29.2015	ADDENDUM #3

Issued: October 7, 2015
Scale: 1/4" = 1'-0"

Project Number: 13013

BID SET

STAIR S3 - SECTIONS

A425

December 20, 2015

File #12

Stephen Endy
Project Architect,
Boora Architects
720 SW Washigton Street, Suite 800
Portland, Oregon 97205

RE: Egress time analysis of Stair S3 – Faubion PK-8 School

Dear Mr. Endy,

This letter is written in support of the proposed appeal to permit a three story open stair in the new PPS Faubion School.

The proposed stair includes a single flight connecting the first and the second floors, then a wrap-around walkway at the second floor to get to the second flight of stairs that connect the second and third floors. The total distance traversed from the top of the third floor landing to the bottom of the final landing at the first floor is 200 feet. This analysis compares the time required to travel form the third floor to the first floor down the exit access stair S3 and compares that to equal distance travelled on a horizontal surface to reach an enclosed exit stair. This is based on the IBC commentary about the intent behind the requirements of section 1021.3.1 of the 2012 International Building Code.

The Society for Fire Protection Engineers (SFPE) Handbook, is accepted as the industry standard for evacuation analysis. This analysis follows the methodology established by SFPE and uses the travel speeds listed in table 3-12.4. The speeds for stair flights is based on stairs with 7 inch maximum riser and 11 inch minimum tread configuration. The walking speeds relevant to this analysis are:

- Horizontal surface speed for an able bodied person is 4.1 feet per second.
- Horizontal surface speed for a person with locomotive disability but without any aid during evacuation is 3.1 feet per second.
- Stair ascend & descend speeds for an able bodied person, adjusted for flow density of 2.5 persons per square meter compared to 2 persons per square meter of horizontal travel, is 2.87 feet per second.
- Stair ascend speed for a person with locomotive disability but without any aid during evacuation, adjusted for flow density of 2.5 persons per square meter compared to 2 persons per square meter of horizontal travel, is 1.76 feet per second.
- Stair descend speed for a person with locomotive disability but without any aid during evacuation, adjusted for flow density of 2.5 persons per square meter compared to 2 persons per square meter of horizontal travel, is 1.47 feet per second.

For the purpose of this analysis the conservative speed of 3.1 ft./sec for a person with locomotive disability but without any aid during evacuation is used for walking speeds along horizontal surfaces, and descending speed of 1.47 ft./sec for a person with locomotive disability but without any aid during evacuation is used for stair travel.

EVACUATION ANALYSIS

Assuming that the entire 200 feet travel is along a horizontal surface the required egress time is

$$200 \times 3.1 = 64.51 \text{ seconds (This is the benchmark to compare against)}$$

Based on the actual conditions that 103 feet travel is along a horizontal surface and 97 feet of travel is down a stair (landings are treated the same as stairs) the required egress time is

$$(103 \times 3.1) + (97 \times 1.47) = 99.20 \text{ seconds}$$

Adjusting the time required for 41% wider stair width than that assumed by the prescriptive code requirements, the required egress time is

$$99.20 \div 141 \times 100 = 70.35 \text{ seconds}$$

(The width at horizontal travel is wider than that at the stair but speed increase is limited to 41% increase same as that used for the stair)

Therefore the required egress time is (70.35 – 64.51) **5.84 seconds** more than what would be required by a person with locomotive disability but without any aid during evacuation of this building, to travel to an exit without going up or down a flight of stairs. This analysis has multiple layers of conservatism built in and therefore the actual time difference for elementary and middle school children directed by school staff is expected be less than this.

Sincerely,

Samir Mokashi
Principal/Code Analyst
Code Unlimited

Franklin Callfas
Principal/Fire Protection Engineer
Code Unlimited

ATTACHMENT #5

ATTACHMENT #6

Pathfinder, developed by Thunderhead Engineering, is a validated software for use in computer modeling of building evacuation as per Table 60.1 of the SFPE Handbook 5th Edition

Table 60.1 Model features

	Background of model		Model characteristics					
Model	Developer/institution	Validation	Availability	Modeling method	Refinement of population	Refinement of structure	Refinement of behavior	Output
EVACNET4	Kisko, Francis, and Nobel/Univ. of FL, U.S.	FD	Y	M-O	Ma	C	N/A	T
WAYOUT	Shestopal/Fire Modelling & Computing, AU	FD	Y	M	Ma	C	N/A	V
STEPS	Mott MacDonald, U.K.	C, FD, PE	Y	M/PB	Mi	F	D	V
PedGo	TraffGo, Germany	FD, PE, OM, 3P	Y	PB/B	Mi	F	S	V
PEDROUTE	Halcrow Fox Associates, U.K.	N	Y/N3	PB	Ma	C	D	V
Simulex	Thompson/IES, U.K.	FD, PE, OM, 3P	Y	PB	Mi	Co	D	V
GridFlow	Purser and Bensilum/BRE, U.K.	FD, PE	Y	PB	Mi	Co	D	V
ASERI	Schneider/I.S.T. GmbH, Germany	FD, PE	Y	B-RA	Mi	Co	S	V
BldEXODUS	Galea and FSEG/University of Greenwich, U. K.	FD, PE, OM, 3P	Y	B	Mi	F	S	V
Legion	Legion International, Ltd., U.K.	C, FD, PE, 3P	Y	B	Mi	Co	S	V
FDS + Evac	VTT, NIST, Helsinki Univ of Tech	FD, PE, OM	Y	PB	Mi	Co	S	V
PathFinder 2009	Thunderhead Engineering	C, FD, PE, OM	Y	PB	Mi	Co	D	V
SimWalk	Savannah Simulations AG	FD, PE, 3P	Y	PB	Mi	Co	S	V
PEDFLOW	Edinburgh Napier University, Transport Research Institute	PE	Y	B	Mi	Co	S	V
SpaceSensor	Sun/de Vries	FD, OM	Y	B	Mi	Co	S	V
EPT	Regal Decision Systems, Inc.	FD	Y, N1	B	Mi	C, F, Co	AI	V
MassMotion	Arup	C, FD, PE, OM	Y, N1	B	Mi	Co	AI, S	V
Myriad II	Keith Still	PE, 3P	Y, N1	B	Mi	C, F, Co	AI	V
Pathfinder	Rolf Jensen and Associates, Inc.	N	N1	M	Mi	F	N/A	V
ALLSAFE	InterConsult Group ASA, Norway	OM	N1	PB	Ma	C	D	V
CRISP	Fraser-Mitchell/BRE, U.K.	FD	N1	B-RA	Mi	F	S	V
EGRESS 2002	Ketchell/AEA Technology, U.K.	FD	N1	B	Mi	F	S	V
SGEM	Lo/University in Hong Kong	FD, OM	N1	PB	Mi	Co	D	V
EXIT89	Fahy/NFPA, U.S.	FD, OM	N2	PB	Mi	C	D	T
MASSEgress	Stanford University (Civil and Env Engineering)	PE, OM	N2	B	Mi	Co	S	V
EvacuatioNZ	Spearpoint/Univ of Canterbury, NZ	FD, PE, OM	N2	B	Mi	C	S	V

Key to reading the table:

Validation:
- *C* Validation against codes
- *FD* Validation against fire drills or other people movement experiments/trials
- *PE* Validation against literature on past experiments (flow rates, etc.)
- *OM* Validation against other models
- *3P* Third-party validation
- *N* No validation work could be found on the model

Availability to the Public:
- *Y* The model is available to the public for free or a fee
- *N1* The company uses the model for the client on a consultancy basis
- *N2* The model has not yet been released
- *N3* The model is no longer in use
- *U* Unknown

Modeling Method:
- *M* Movement model
- *M-O* Movement/optimization models
- *PB* Partial behavioral model
- *B* Behavioral model
- *B-RA* Behavioral model with risk assessment capabilities
- *B-AI* Behavioral model with artificial intelligence capabilities

Refinement of the Population:
- *Ma* Macroscopic
- *Mi* Microscopic

Refinement of Structure:
- *C* Coarse network
- *F* Fine network
- *Co* Continuous

Refinement of the Behavior:
- *D* Deterministic
- *S* Stochastic

Output:
- *T* Textual output
- *V* Visual output