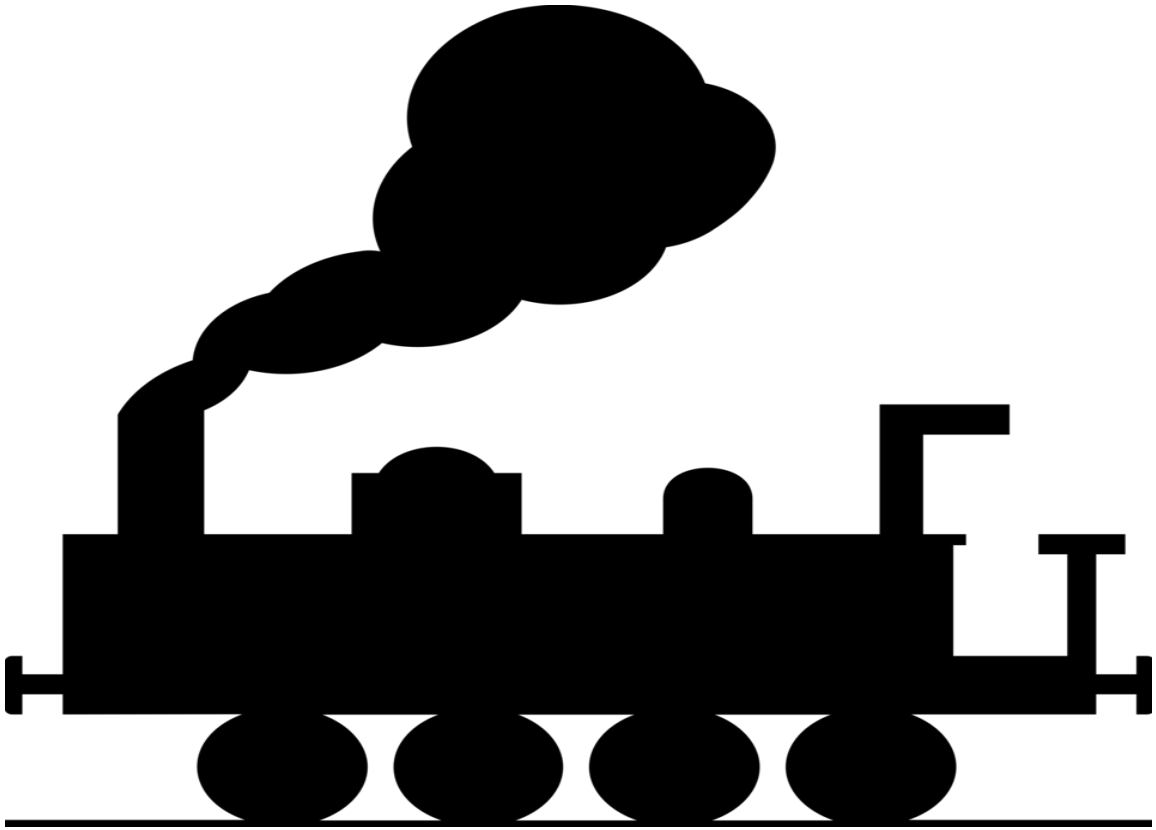
Engineering Code Review Training



February 5, 2019

Engineering Review - General:

- General intent of this presentation is to focus on mindset of Reviewers
  - Things to keep in mind during reviews
  - Won't necessarily repeat information contained within Guidance Document for Technical Project Review
  - Examples of some issues. (But we can't and won't cover every possible scenario)

Guidance Document for Technical Project Review

- Use the Guidance Document for Technical Project Review
  - Checklists point towards issues of concern, but don't contain wording of codes/rules and regulations.
    - Reviewers responsible to know enough of the codes/rules and regulations to find information they need.
  - Checklists do not cover all situations.
    - Call SED with questions/fuzzy issues.
  - Guidance Document available at following link: http://www.p12.nysed.gov/facplan/documents/GUIDANCEDOCUMENTFORTECHNICALPROJECTREVIEW.pdf

The technical review of a design for a school building, consists of the following general principles:

- The first may be taken from paragraph (b) of Section 155.1 of the Regulations of the Commissioner of Education
  - (b) Facilities shall be designed and constructed to provide for the health and safety of occupants, with consideration of educational and planning efficiency, conservation of natural resources, practicality, and initial and long-range economy, and shall support an environment within the facility which is conducive to learning.

- The second is alterations to an existing building may not make conditions worse in that building.

Review of documents in the Project/Building File:

- Engineering only scope of work, review the same documents as indicated in the Architect Review Training session
- Architect and Engineering work, review: second page of Evaluation of Existing Building Form for non-conformances; and Scope of the Proposed Project Form

THE STATE EDUCATION DEPARTMENT / THE UNIVERSITY OF THE STATE OF NEW YORK
Office of Facilities Planning, 89 Washington Avenue, Room 1060 Education Building Annex, Albany, NY 12234
Tel: (518) 474-3906
Fax (518) 486-5918
www.p12.nysed.gov/facplan/

SCOPE OF PROPOSED PROJECT

Instructions: Complete and submit one (1) copy of this form as part of the preliminary or final submission to the Office of Facilities Planning, Room 1060 EBA, Albany, NY 12234, for EACH capital construction project requiring approval of the Commissioner of Education pursuant to Education Law, Section 408 and the New York State Uniform Fire Prevention and Building Code. Please print legibly or type responses. (This form may be duplicated but may not be altered in any way).

1. District/BOCES: 0 Date Submitted: 0
2. Building Name: 0 County: 0
   Building Address: 0
3. Type of Project: ☐ New Building ☐ Addition ☐ Alteration ☐ Reconstruction ☐ Land Acquisition
4. District/BOCES Contact Person: 0
   Title: Telephone: 0
5. Project Manager: 0 Telephone: 518-474-3906
6. 0 0 - 0 0 - 0 0 - 0 0 - 0 - 0 0 0 - 0 0 0
   (BEDS Code) (Facility Code) (Project #)
7. Type of Project: (check all appropriate boxes)
   - ☐ Construction or acquisition of any facility (not additions)
   - ☐ Expansion of existing facility by more than 10,000 sq. ft. gross floor area
   - ☐ Acquisitions of land
   - ☐ Physical alteration of 5 or more acres
   - ☐ Structure more than 100 feet in height
   - ☐ Involves a building 50 years old or older
   - ☐ Located in an historic district
   - ☐ Located in an archeologically sensitive zone
   - ☐ None of the Above
8. Project Affects: (check all appropriate boxes)
   - ☐ Adirondack Park Agency - 9 NYCRR 570-588
   - ☐ Agricultural District - 1 NYCRR 371
   - ☐ Coastal Management Area - 19 NYCRR 600
   - ☐ Contiguous Public Recreation Area - 6 NYCRR 617
   - ☐ Critical Environmental Area - 6 NYCRR 617
   - ☐ Flood Plain - 6 NYCRR 500
   - ☐ Historical Landmark - 9 NYCRR 426-428
   - ☐ Wetlands - 6 NYCRR 660,662
   - ☐ None of the Above
9. Indicate below PERMITS which may be required from other government agencies. Obtaining necessary permits is the responsibility of the Board of Education and is a condition of Commissioner's Approval of Plans & Specification. NYCRR refers to the Official Compilation of Codes, Rules, and Regulations of the State of New York: 1-Agriculture and Markets; 6 - Environmental Conservation; 9 - Parks, Recreation, and Historic Preservation; 10 - Health; 19 - State. The list below is for assistance and is not all-inclusive.
   - ☐ construction of air contamination source - 6 NYCRR 20
   - ☐ indirect source of air contamination - 6 NYCRR 203
   - ☐ permits for on-site sewage system - (SPDES) 6 NYCRR 750
   - ☐ construction of on-site sewage system - 6 NYCRR 750
   - ☐ water well drilling, Nassau and Suffolk Counties - 6 NYCRR 602
   - ☐ construction in flood plain - 6 NYCRR 500
   - ☐ alteration of a stream - 6 NYCRR 608
   - ☐ alteration of tidal wetlands - 6 NYCRR 660
   - ☐ alteration of fresh water wetlands - 6 NYCRR 662
   - ☐ open burning - 6 NYCRR 215, 219, 222
   - ☐ water well drilling - 10 NYCRR 5
   - ☐ public water supply - 10 NYCRR 5
   - ☐ swimming pool construction - 10 NYCRR 6
   - ☐ DOT permits as necessary
   - ☐ other
10. Has the SEQRA process been completed? ☐ Yes ☐ No
    Name of Lead Agency:
    Final Determination: (Choose One):
    a. Type II - official copy of Board Resolution sent to SED (date of SEQRA Resolution)
    b. Type I - Negative Declaration or Statement of Findings sent to SED (date of SEQRA Resolution)
    c. Unlisted Action - Negative Declaration or Statement of Findings sent to SED (date of SEQRA Resolution)

11. a. Type of Facility: ☐ School ☐ Bus Garage ☐ Other (specify):

    If this facility is a school:
    - What grade levels are currently housed?
    - What grade levels will be housed when this project is finished?
    - What is the current enrollment of this building?

    b. Does this project involve an existing building? ☐ Yes ☐ No
    - If yes, what is the total gross square footage of the existing building?
    - If yes, what is the total square footage proposed for alterations and or reconstruction?
    - If yes, what is the age of the building to be altered?

    c. Does this project involve an addition to an existing building? ☐ Yes ☐ No
    - What is the gross square footage proposed for the addition?
    - What is the proposed gross square footage of the entire building including the addition?
    - If this is a student occupied building, what is the projected enrollment for this building?

    (Note: Using the actual enrollments for the current year as a starting point, project five years into the future for Kindergarten through Grade Six; eight years for Grades Seven and Eight; and ten years for Grades Nine through Twelve.)

    d. Does this project involve a new building? ☐ Yes ☐ No
    - If yes, what is the total proposed gross square footage for the new building?
    - If this is a student occupied building, what is the projected enrollment for this building?

    (Note: Using the actual enrollments for the current year as a starting point, project five years into the future for Kindergarten through Grade Six; eight years for Grades Seven and Eight; and ten years for Grades Nine through Twelve.)

    e. Does this project involve a purchase of additional site? ☐ Yes ☐ No
    - If yes, what is the size of the site to be purchased? _____ acres
    - How many of those acres are useable? _____ acres
    - Is the new site adjacent to the present site? ☐ Yes ☐ No
    - If no, how far away is the new site from the existing site? _____ miles

    f. Current site information:
    - What is the size of the current site? _____ acres
    - Are all acres useable on the current site? ☐ Yes ☐ No
    - If no, how many acres of the current site are useable? _____ acres

    g. Provide a comprehensive and thorough narrative. It must relate to the work detailed in the plans and specifications. If this project involves capital improvement, indicate which trades are included in the work. If this project involves new construction, indicate the type and number of rooms planned. Attach additional sheets if necessary to include details of the capital construction work. This form, including any attachments, is the controlling document for approval of state aid, including aid for change orders, and it will be required with each change order submission. Refer to publication "State Building Aid for Public School Districts and BOCES" for generally aidable and non-aidable capital construction expenses.

Scope of work in narrative should not be less than scope in design package.

12. **SIGNATURES**

_____ President, Board of Education _____ Date

_____ Superintendent of Schools _____ Date

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EVALUATION OF EXISTING BUILDING

Submit ONE COPY of this form with preliminary submission, if required, or with final submission for approval of plans and/or specifications. Each school building shall conform to the following items based on Part 155.7 of the Regulations of the Commissioner of Education. The board of education shall submit for consideration, a letter indicating positive corrective action on nonconforming items which will not be corrected by this work. Describe conditions as they now exist. Failure to answer ALL items will delay approval of the project.

Per Part 155.8 (e) (3) of the Regulations of the Commissioner of Education, a Certificate of Occupancy, a temporary certificate or a building permit may be denied or revoked for ... violation of ... health or safety standards, imposed by law or regulation, which indicate that a building is not suitable for occupancy or intended use.

SED Project Control Number: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
(8 digit district BEDS number | 4 digit building number | 3 digit project number)

(Check appropriate boxes)

1. Project: ☐ Addition ☐ Alteration ☐ Reconstruction ☐ Site Acquision
2. Grades: ☐ K-6 ☐ 6-8 ☐ 7-9 ☐ 7-12 ☐ _____ (other-specify)
3. Building Name: 0
   Address: 0
4. Size of Site: _____ total acres, and _____ usable acres.
5. Name of District: 0
6. Building Construction Information ..... Class A/Construction Type: IA IB IIA IIB | Class B/Construction Type: IIIA IIIB IV | Class C/Construction Type: VA VB

	Class A/Construction Type				Class B/Construction Type			Class C/Construction Type	
	IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
Original Building date _____	☐	☐	☐	☐	☐	☐	☐	☐	☐
Addition #1 date _____	☐	☐	☐	☐	☐	☐	☐	☐	☐
Addition #2 date _____	☐	☐	☐	☐	☐	☐	☐	☐	☐

7. Building floor levels ☐ Basement ☐ Ground Floor ☐ First Floor ☐ Second Floor Number of stories _____
8. a. Are stairways enclosed? ☐ Yes ☐ No ☐ NA b. If yes, do enclosure doors have magnetic hold-opens? ☐ Yes ☐ No

		*C	NC	NA
9.	There shall be at least two means of egress remote from each other, leading from each floor, including basement	☐	☐	
10.	Dead-end corridor pockets shall not exceed a depth of 1-1/2 times the pocket width	☐	☐	
11.	A handrail shall be provided on at least one side of each stairway	☐	☐	☐
12.	There shall be no storage under stairs or landings, or in combustible attic space	☐	☐	☐
13.	Corridors and exit ways shall be kept clear of obstructions	☐	☐	
14.	Security gates shall not be located where exits will be obstructed or unapprovable dead-end conditions will be created	☐	☐	☐
15.	Spaces of pupil occupancy over 500 square feet shall have two separate means of egress. The primary exit is commonly the opening to the corridor. The second exit may be a door into a separate smoke zone, a door directly to the exterior, or an emergency rescue window	☐	☐	
16.	Required emergency rescue windows and related hardware shall facilitate egress and shall be appropriately marked for identification. Size of CLEAR opening of rescue windows: _____ high, by _____ wide.	☐	☐	
17.	Any point in a space of pupil occupancy shall not exceed 50 feet to an exit door (except Places of Assembly)	☐	☐	
18.	In spaces of pupil occupancy in open-planned areas, there shall be free circulation for exiting within the open-planned area	☐	☐	☐
19.	Enclosed courts of over 700 square feet shall have remote exits with appropriate exiting hardware	☐	☐	☐
20.	Door hardware shall be a type which will permit the door to be opened from within the space without the use of a key	☐	☐	
21.	Exterior and interior doors in exit ways serving three or more spaces of pupil occupancy and from places of assembly shall have panic hardware	☐	☐	
22.	Exit doors shall not be locked, chained or rendered inoperable from the inside at any time	☐	☐	
23.	A building having wood structural members or wood roof deck shall not have a place of assembly above the first floor, unless a written exception has been granted by the Commissioner	☐	☐	☐

***C – Conformance; NC – Nonconformance; NA – Not Applicable**

Dates of construction are useful information.

Marks in boxes indicate non-conformances.

		*C	NC	NA
24.	Doors into stair enclosures shall swing in the direction of travel, be self-closing, and any glazing shall be appropriate safety glazing	☐	☐	☐
25.	Fire extinguishers with an Underwriter's label suitable for the type of fire likely to occur shall be provided in areas of fire hazard, and at each floor level so that no point in a corridor or stair is over 75 feet to a corridor located extinguisher	☐	☐	
26.	Two-hour fire rated floor, ceiling (where space above is occupied), and walls with 1-1/2 hour, self-closing doors shall be provided at:			
	a. boiler, furnace and incinerator room; transformer vaults	☐	☐	☐
	b. refrigeration, electrical, and mechanical equipment rooms	☐	☐	☐
	c. storerooms for fuel, flammable liquids, and gasoline powered equipment	☐	☐	☐
27.	Required fire doors shall be maintained closed, or on hold opens tied to the fire alarm system	☐	☐	
28.	Glazing within 48 inches of the floor in and adjacent to doors, and other glazed panels within 18 inches of the floor shall be of safety glazing material, unless glazed areas are protected by grilles or railings	☐	☐	
29.	Glazed doors and sidelights shall be marked in accordance with 12 NYCRR Part 47	☐	☐	
30.	Window cleaning provisions shall be in accordance with 12 NYCRR Part 21	☐	☐	☐
31.	Mechanical, heat-producing and cooling equipment, auxiliary apparatus and controls, and the installation of same shall be operable and in good condition	☐	☐	☐
32.	Unused ducts shall be sealed at each opening with fire resistive materials	☐	☐	☐
33.	Electronic flame safeguard controls shall, upon flame failure, respond in 2 to 4 seconds to cut off the fuel supply through the burner and the main fuel valve	☐	☐	☐
34.	All primary controls for fuel burning equipment operate on a 120 volt, single phase, grounded circuit	☐	☐	
35.	Fuel burning heating units shall not be used in any space of pupil occupancy	☐	☐	
36.	Ventilation with fresh air shall be available to all spaces of occupancy	☐	☐	
37.	Water supply and distribution systems shall be operable and in good condition	☐	☐	
38.	Plumbing fixtures and sanitary systems shall be operable and in good condition	☐	☐	
39.	Gas entering the building shall be low pressure, i.e., 1/2 psig or less	☐	☐	☐
40.	Electrical equipment, fixtures, auxiliary apparatus and controls, and wiring systems, and the installation of same, shall be operable and in good condition without recurring problems	☐	☐	
41.	Electrically operated partitions have safety controls in accordance with 155.25	☐	☐	☐
42.	Level of artificial lighting in teaching areas shall be a minimum of 30 foot candles, maintained	☐	☐	
43.	Exit signs: a. Buildings of 1 to 6 classrooms shall have exit signs	☐	☐	☐
	b. Buildings with more than 6 classrooms shall have exit lights	☐	☐	☐
	c. Places of assembly shall have exit lights	☐	☐	☐
44.	Emergency lighting shall be provided in all places of assembly for over 100 occupants or over 1800 square feet and in all exit ways leading from such places. Emergency lighting complies with Section 1029 of the Fire Code of NY State	☐	☐	☐
45.	Buildings of 1 to 6 classrooms shall be equipped with an approved manual or a manually operated electric fire alarm which is capable of sounding for such a period of time as to assure evacuation of all occupants	☐	☐	☐
46.	Buildings of 7 or more classrooms shall be equipped with an approved manually operated electric alarm system, which may include automatic detection, which will continue to sound for at least 30 seconds or until the tripped station is returned to normal	☐	☐	☐
47.	A telephone shall be provided in all buildings having pupil occupancy	☐	☐	

48. Are fire escapes provided? ☐ yes ☐ no If yes, what type? ☐ enclosed ☐ open ☐ steel ☐ wood
49. If yes, are fire escapes structurally sound and in good repair? ☐ yes ☐ no
50. Architect's general appraisal of building for: a. Physical Condition: ☐ good ☐ fair ☐ poor
    b. Safety: ☐ good ☐ fair ☐ poor
51. Does this building now conform and/or will this project result in the building conforming with Part 155.7 of the regulations? ☐ yes ☐ no If no, provide a written explanation. Number of pages attached: _____

Seal of P. E. or R. A. licensed in New York State

Print name: _____

Signature: _____

Date: _____ Telephone: _____

Signed/sealed. Non-conformances corrected as part of project, or explanation.

Oval indicates areas of concern for Engineering Reviews.

Whole Building Approach:

- Buildings consist of multiple interconnected systems. Of particular concern is work performed in existing buildings. Work performed in one area, may have potential negative impacts on other systems in the same area, or in other areas.

- Review with an eye for potential negative impacts. Negative impacts must be minimized.

- Tradeoffs.

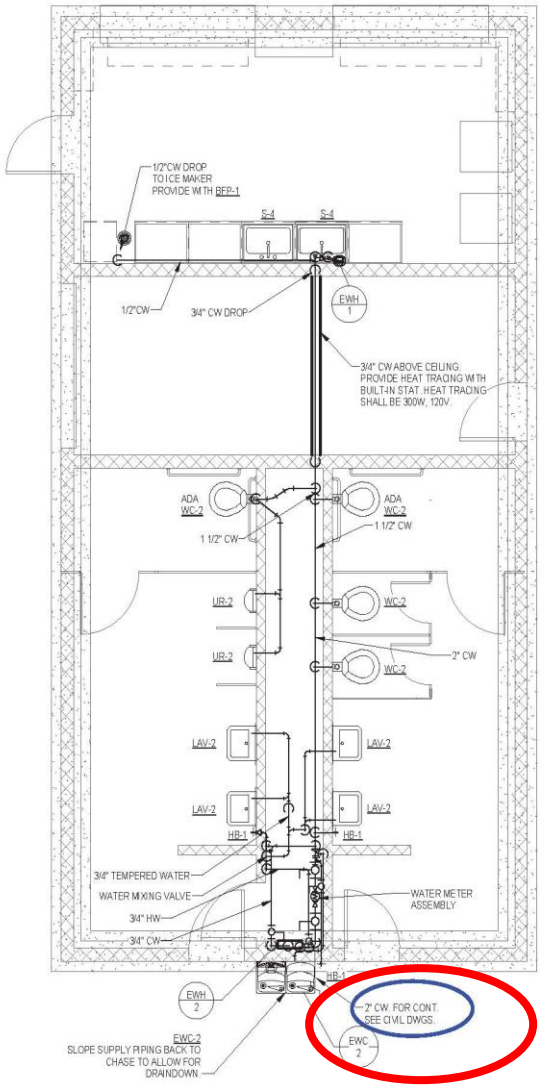
Whole Building Approach
Impacts from Other Trades - Coordination:

Any project, unless limited in scope to just MEP scope will need the Engineering Reviewer to look at what is going on in the Site and Architectural drawings.

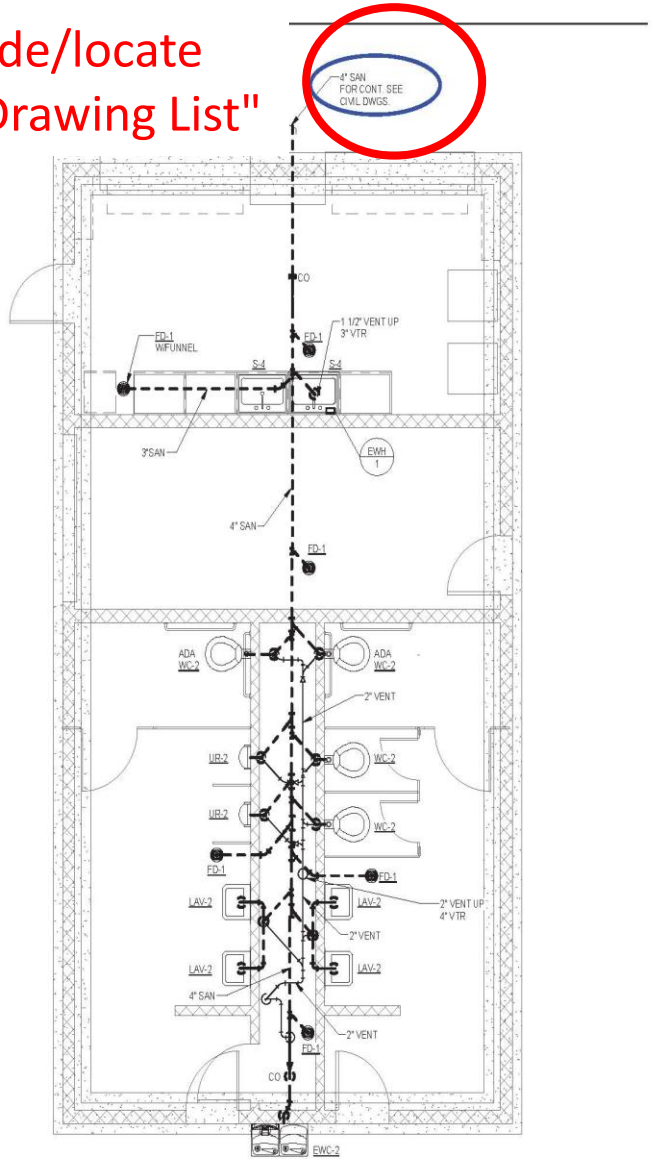
Whole Building Approach:

- Site Drawings:
  - Utilities: Sanitary, storm, domestic water, fire protection, natural gas, fuel oil, LPG, electric
  - Site lighting: Means of egress lighting in the exit discharge, field lighting

Typical for notes referencing civil drawings. Provide/locate drawings, or justify. Not readily apparent from "Drawing List"



1 CONCESSION STAND PLUMBING PLAN
P401-H SCALE: 1/4" = 1'-0"

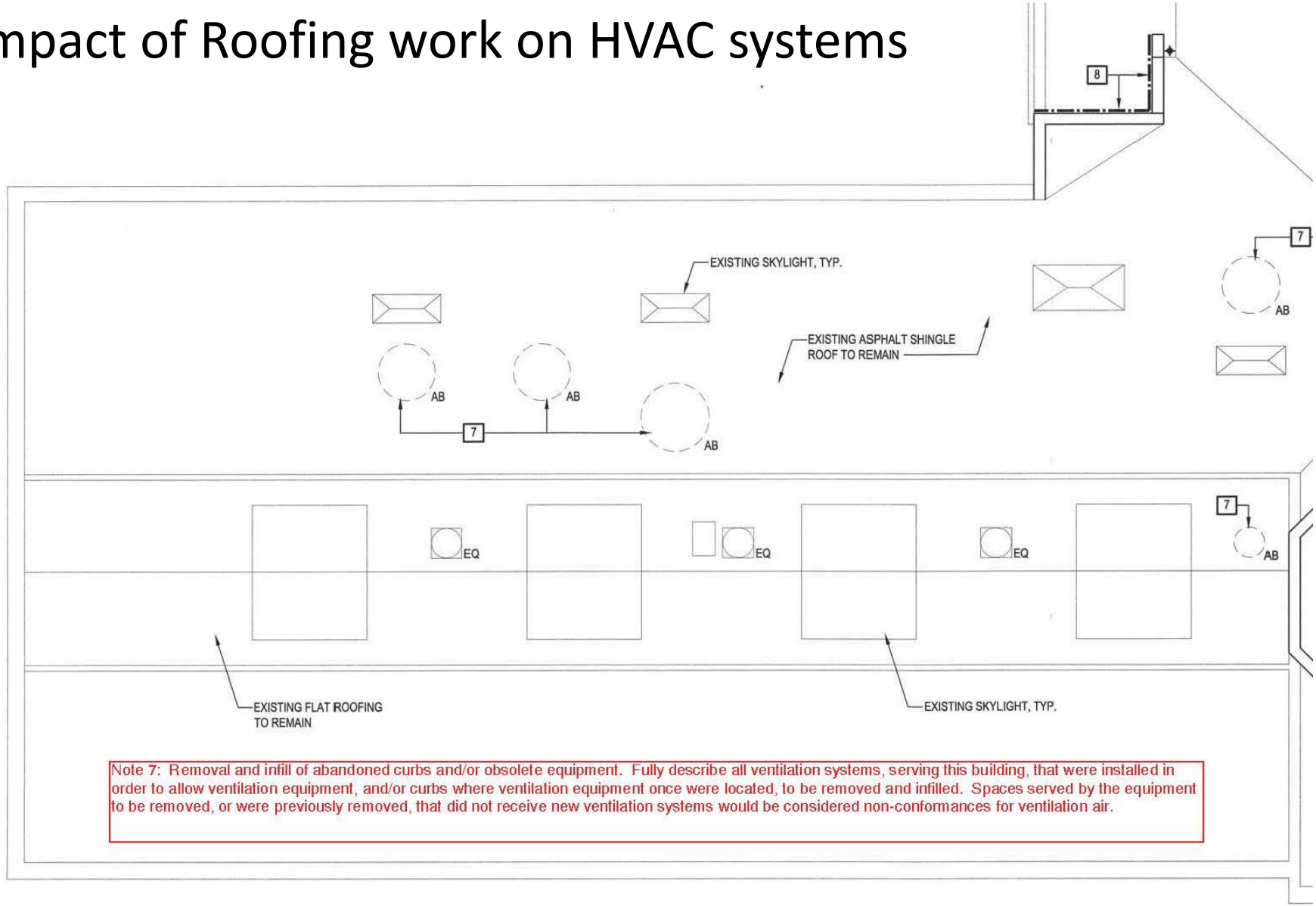


2 CONCESSION STAND UNDERGROUND PLUMBING PLAN
P401-H SCALE: 1/4" = 1'-0"

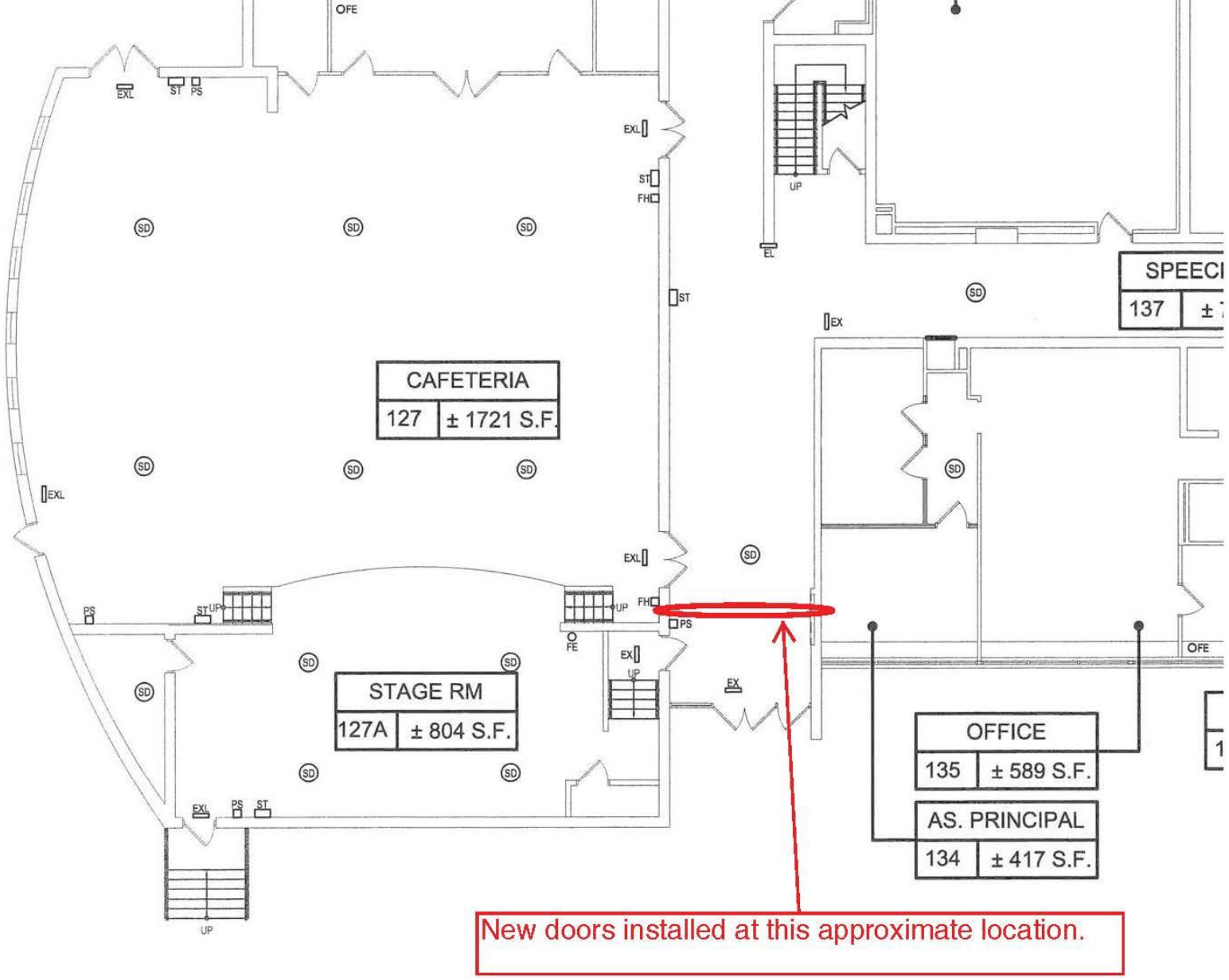
Whole Building Approach:

- Architectural Drawings:
  - Code compliance drawings
  - Revisions to Program use
  - Alteration Level 2 work
    - Interior
    - Exterior
- ADA Compliance

Impact of Roofing work on HVAC systems



Note 7: Removal and infill of abandoned curbs and/or obsolete equipment. Fully describe all ventilation systems, serving this building, that were installed in order to allow ventilation equipment, and/or curbs where ventilation equipment once were located, to be removed and infilled. Spaces served by the equipment to be removed, or were previously removed, that did not receive new ventilation systems would be considered non-conformances for ventilation air.



Impact of New Doors on Electrical and Mechanical Systems

Something as simple(?) as the addition or installation of new/relocated doors in a space (especially in a corridor) may have an impact on existing Electric and Mechanical Systems:

- Confirm no negative impact on the coverage of: means of egress lighting, emergency lighting, fire alarm strobes, smoke detector coverage, and in some cases fire alarm audible devices.
- Confirm no negative impact on visibility of exit lights.
- Confirm no negative impact on access to fire alarm pull stations.
- Confirm no negative impact on any relief/exhaust air path serving the building.
- If fire and/or smoke rated separation is provided, appropriate opening protectives must be installed at all existing and new penetrations at the door location.

Door Hold opens and door release Lockdown/Lockout:

If magnetic door hold opens are provided on new or existing doors, a means of release must be provided. Release requires intiating device(s) in accordance with NFPA 72. At a minimum at least one smoke detector must be provided on the side of the door opposite of the side that is to be protected. In the case of a corridor where each side of the door is as important to protect as the other, at least two smoke detectors, one on each side of the door, and within five feet of the door, must be provided. If the spaces on both sides of the door have full area coverage, then the doors may be allowed to release upon activation of fire alarm system. (See NFPA 72 for additional information)

Security Vestibules:

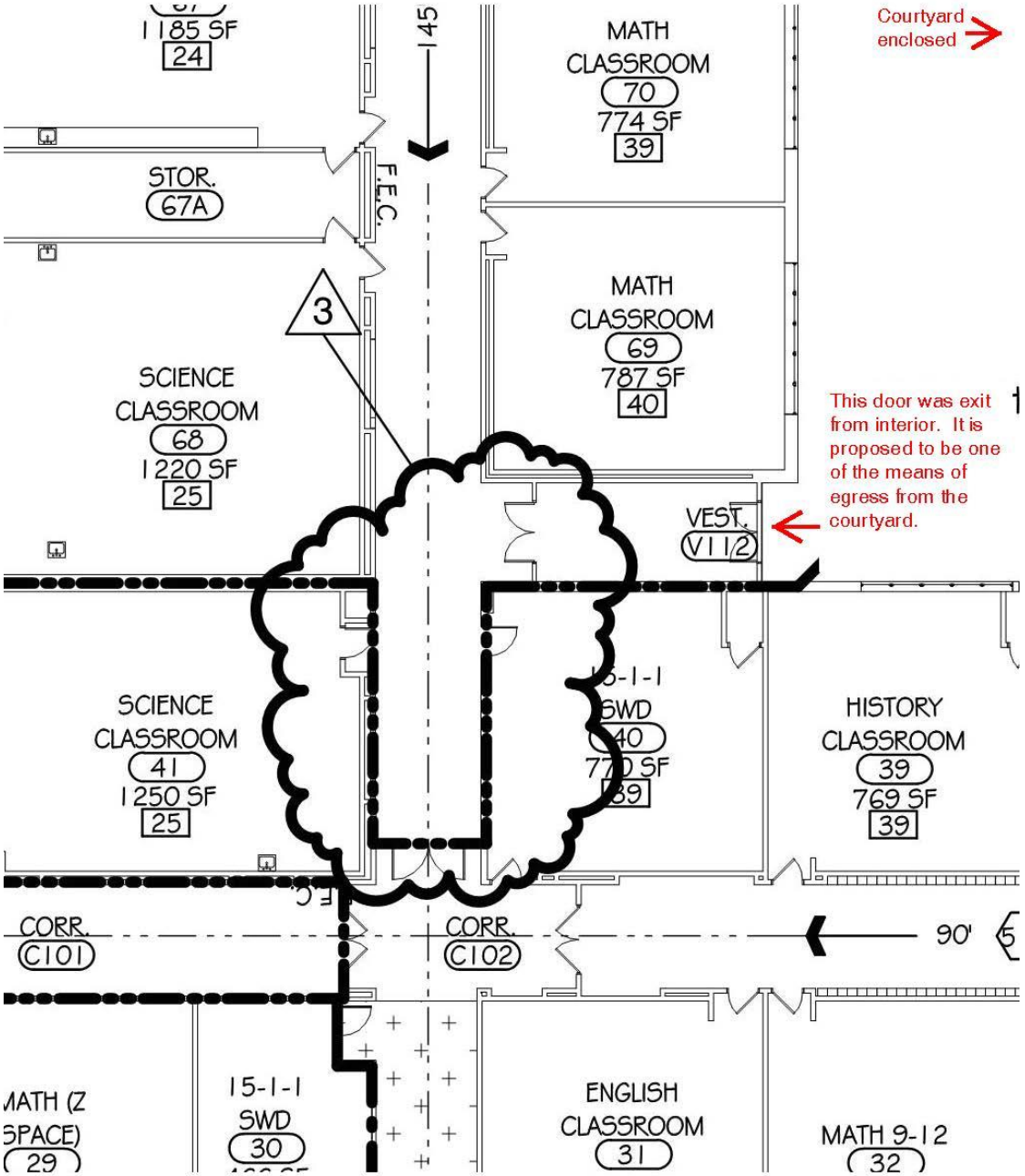
Creation of Security vestibules may require:

- Smoke Protection at new openings
- Relocation of pull stations
- Changes Coverage of fire alarm devices:
  - Smoke detector
  - Audible/visual notification devices
- Changes lighting:
  - Emergency lights
  - Exit lights
  - Normal means of egress

Creation of Enclosed Courts:

Additions that result in the creation of enclosed courtyards require:

- Evaluation of existing egress patterns
  - Existing exits to the exterior may now not be exits, or worse may become dead ends.
  - Exit signs in corridors. Need two ways out.
  - Electrical lighting plans need to be reviewed for revised egress paths. Existing exit lights – removed or modified to show proper path. New exit lights to show new paths.


1185 SF
24
145
MATH
CLASSROOM
70
774 SF
39
Courtyard
enclosed
STOR.
67A
F.E.C.
3
MATH
CLASSROOM
69
787 SF
40
SCIENCE
CLASSROOM
68
1220 SF
25
This door was exit from interior. It is proposed to be one of the means of egress from the courtyard.
VEST.
V112
SCIENCE
CLASSROOM
41
1250 SF
25
HISTORY
CLASSROOM
39
769 SF
39
CORR.
C101
CORR.
C102
90'
ENGLISH
CLASSROOM
31
MATH 9-12
32
15-1-1
SWD
30

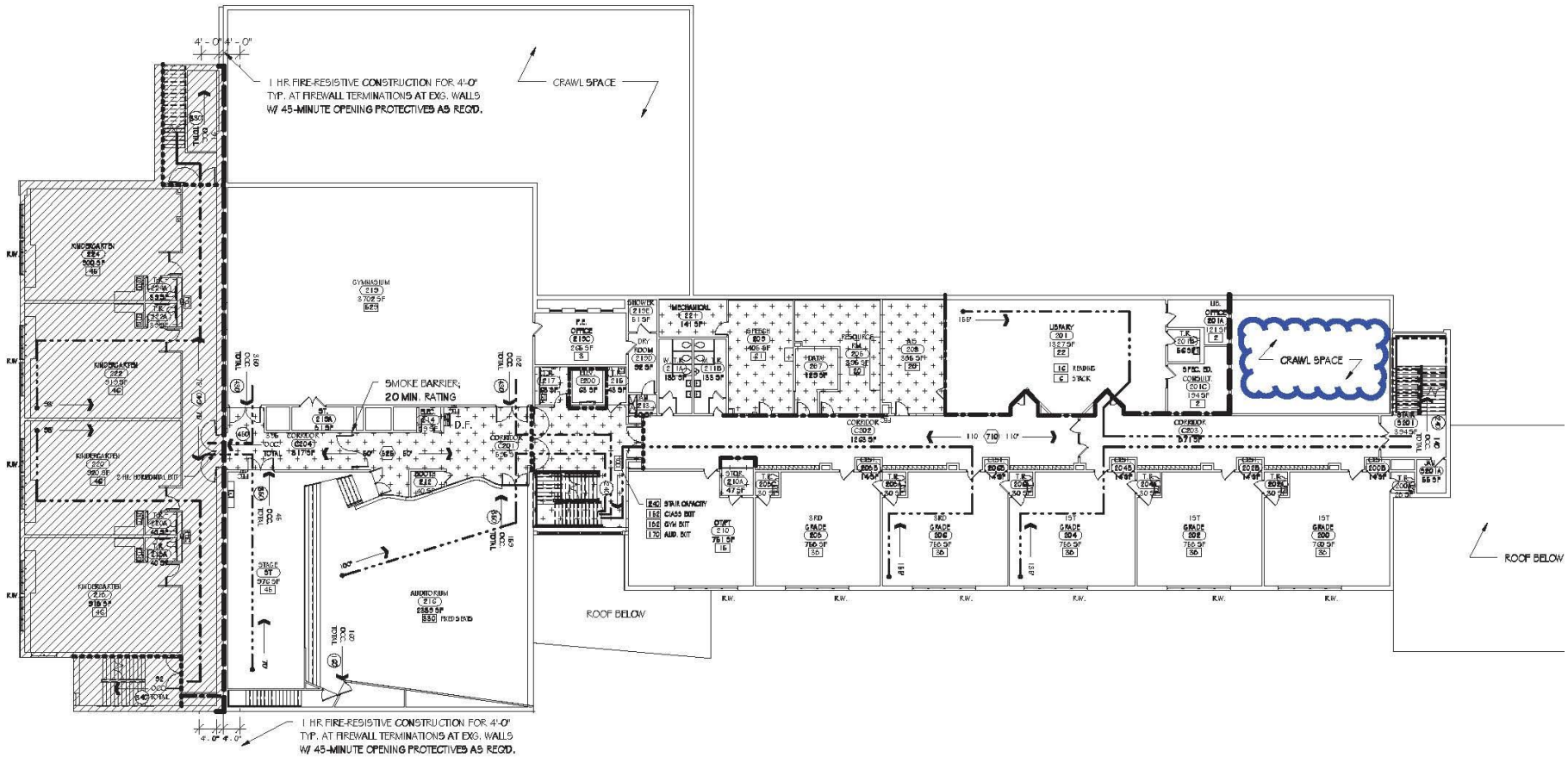
Other stuff:

- Wall revisions – new/relocated.
  - Light switching
  - Ventilation system
  - Coverage of fire alarm initiating and notification devices.
- Program revisions:
  - Space(s) with new program use need to be brought up to current code with respect to new program use. (including spaces revised for ADA compliance)

Code Compliance Drawings:

- Important to:

  - Determine locations of opening protectives
  - Determine if Sprinkler and/or Standpipe systems may be required
  - Assist in reviewing ventilation calculations
  - Exit paths (required means of egress)
  - Hopefully path for compliance with Energy Code is identified on code compliance plans
  - First pass new doors.
  - Other (Plumbing fixtures, etc.)



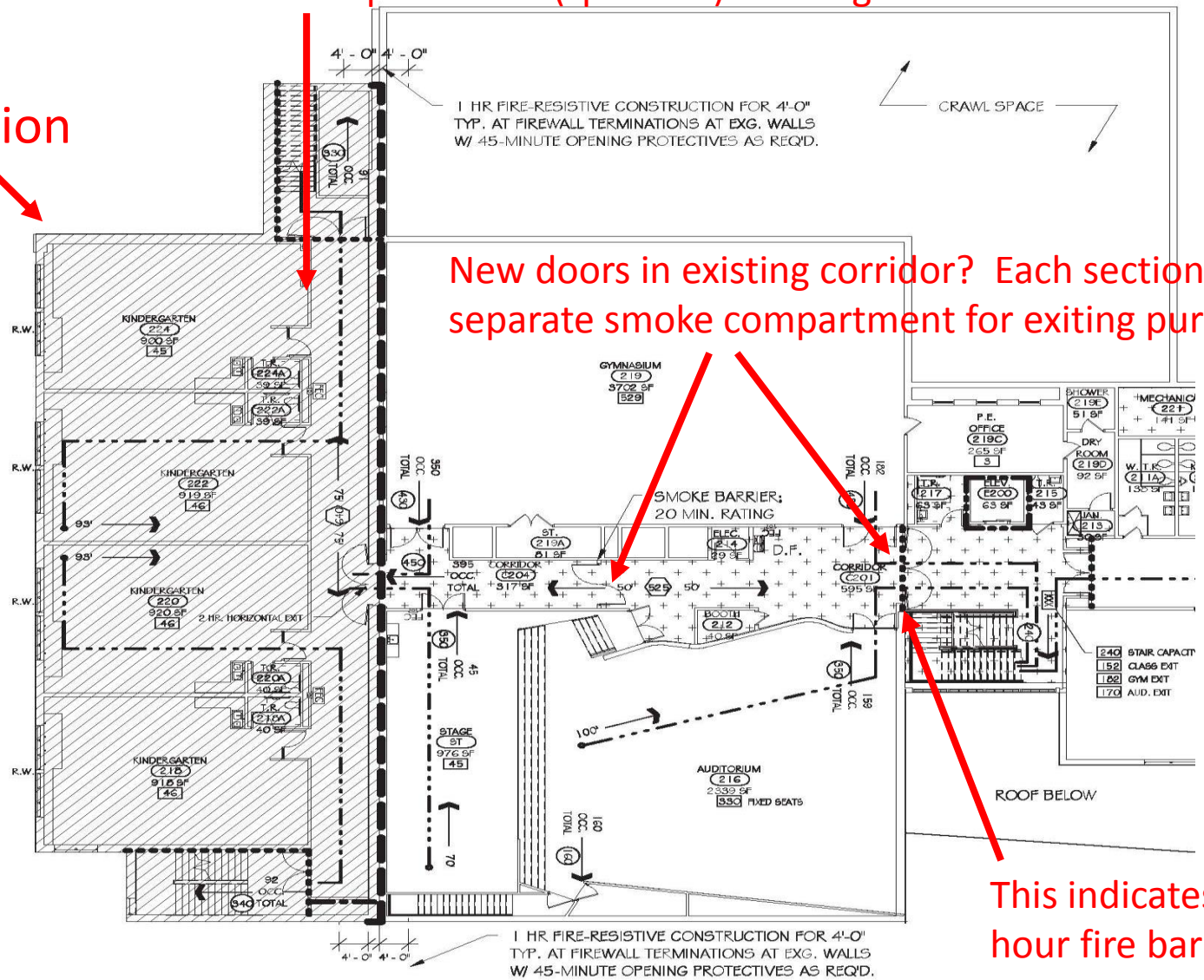
FIRST FLOOR PLAN - CODE COMPLIANCE

3/64" = 1'-0"

No fire rating on corridor walls in addition, indicate we should find fire protection (sprinkler) drawings.

Addition

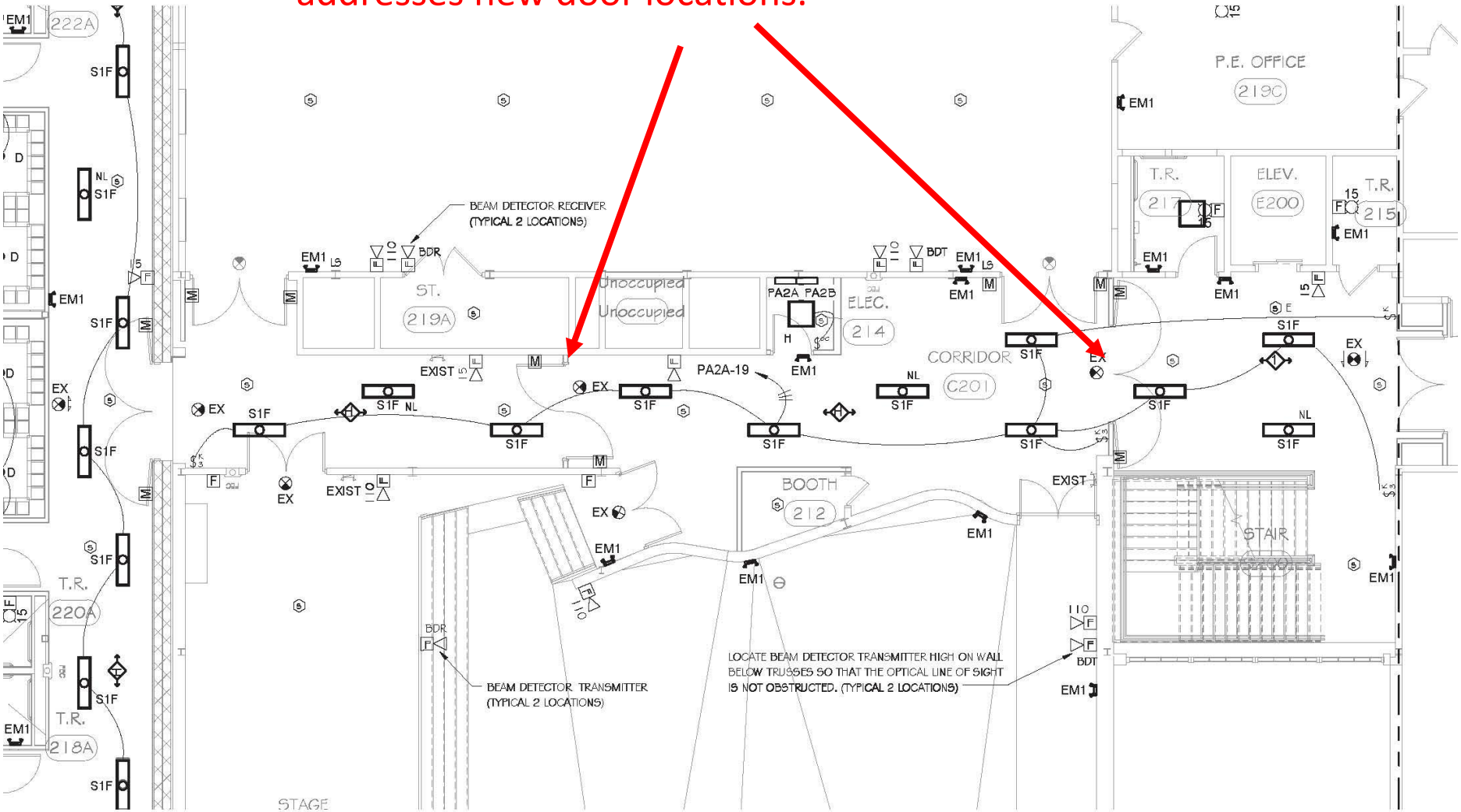
New doors in existing corridor? Each section of corridor is separate smoke compartment for exiting purposes.



This indicates 1 hour fire barrier.

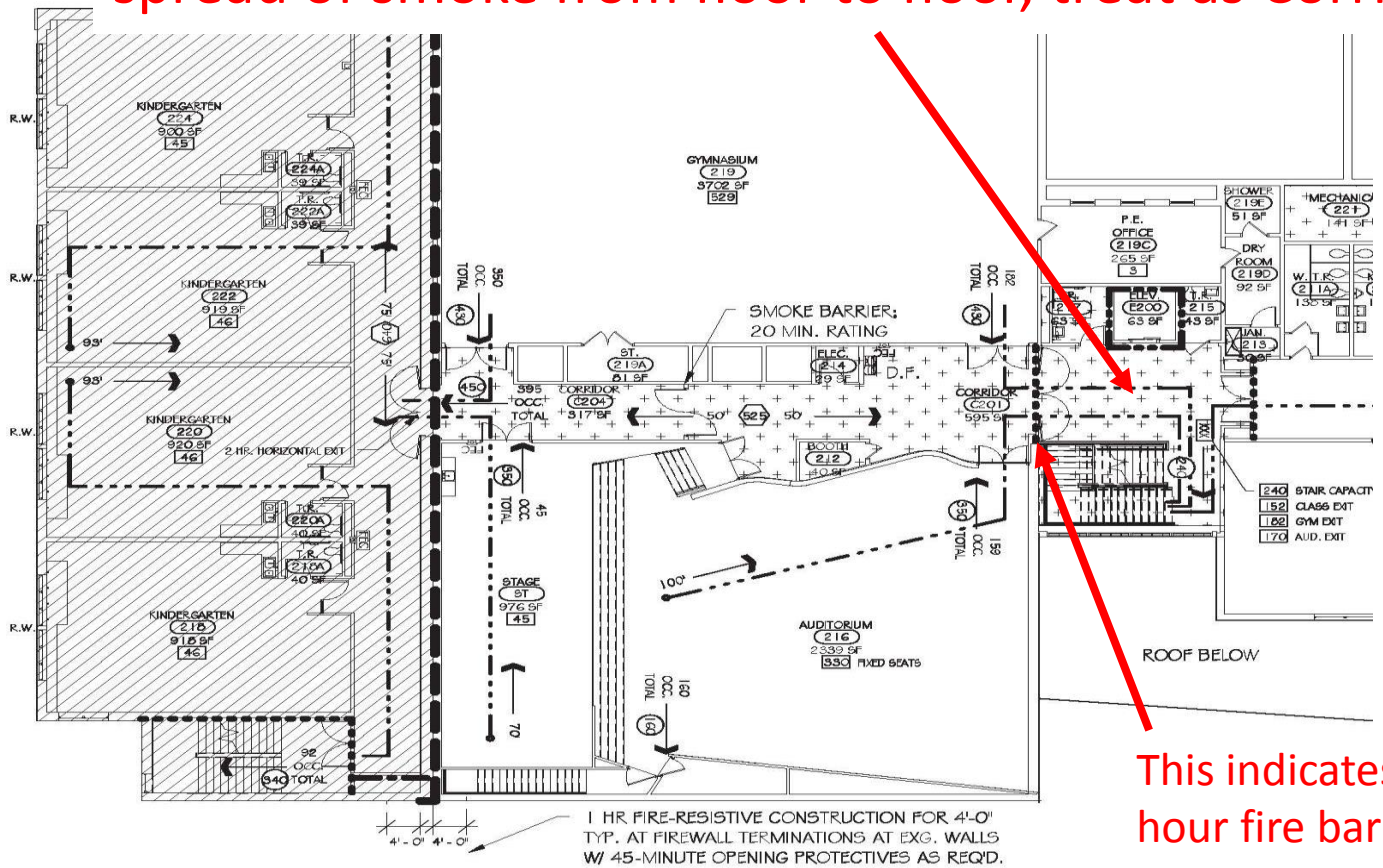
FIRST FLOOR PLAN - CODE COMPLIANCE
3/64" = 1'-0"

First look appears design addresses new door locations.



Enclosure of stairs at this level: Intent matters. If the intent is to create a stair (exit enclosure), then MEP stuff needs to comply with requirements for exit enclosure. If intent is to make things better as far as spread of smoke from floor to floor, treat as Corridor

Addition

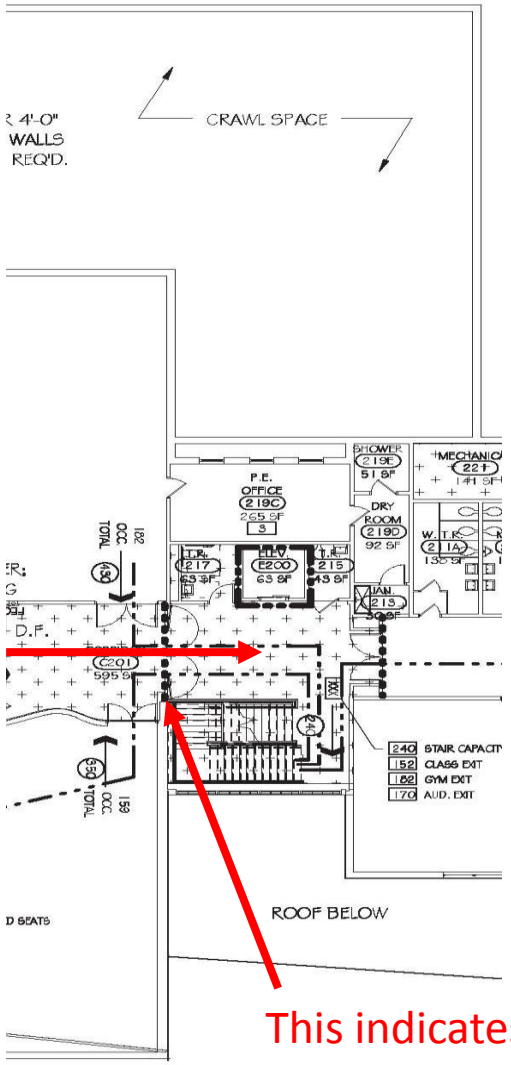


This indicates 1 hour fire barrier.

FIRST FLOOR PLAN - CODE COMPLIANCE
3/64" = 1'-0"

Whole Building Approach

Hopefully we will see that the Mechanical drawings have already addressed the potential impact of enclosing the stairs. If there is nothing obvious one way or the other, there needs to be a request for additional information. It needs to be clear that the enclosure of the stairs does not have a negative impact on the existing relief/exhaust air path. If it does, an alternate, code compliant path will be required. Comment applies to new smoke door in corridor also.

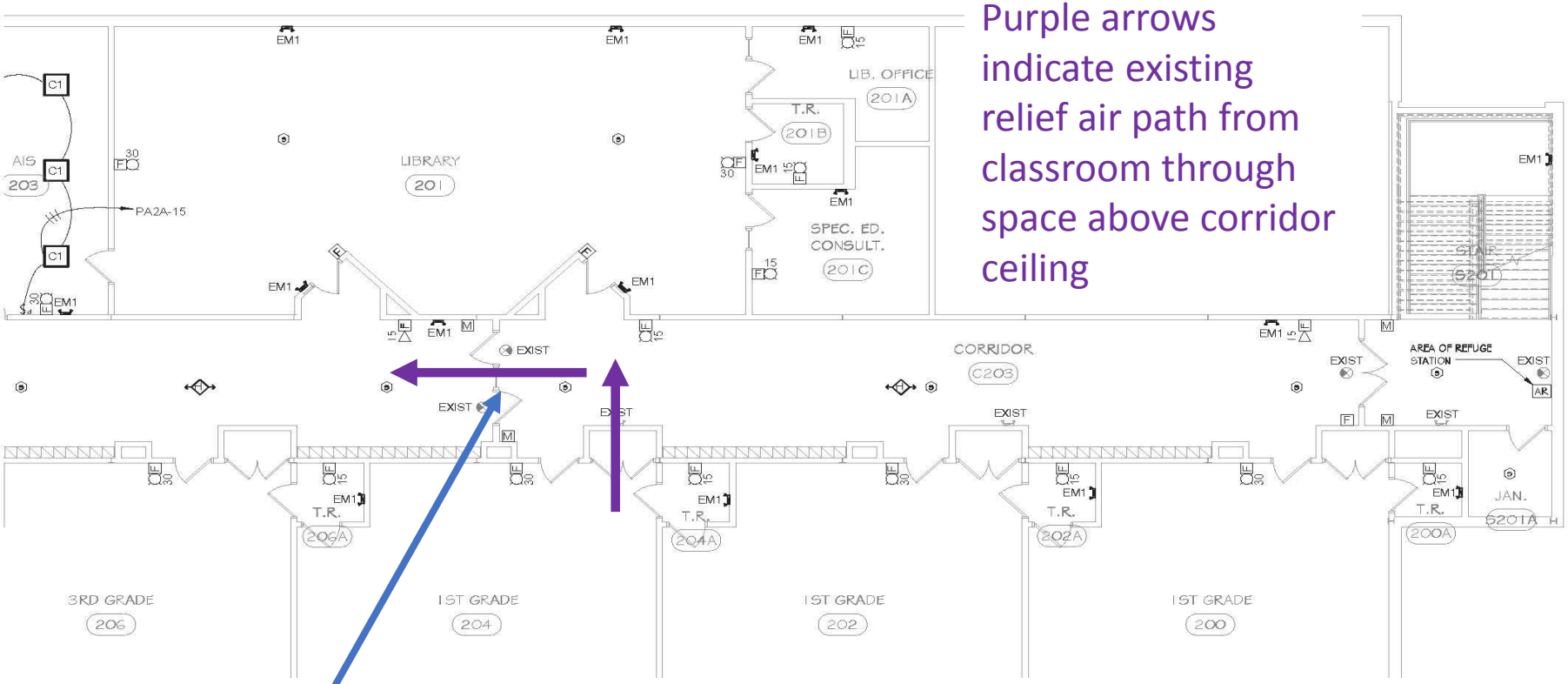


This indicates 1 hour fire barrier.

1 HR FIRE-RESISTIVE CONSTRUCTION FOR 4'-0" TYP. AT FIREWALL TERMINATIONS AT EXG. WALLS W/ 45-MINUTE OPENING PROTECTIVES AS REQ'D.

FIRST FLOOR PLAN - CODE COMPLIANCE
3/64" = 1'-0"

Whole Building Approach



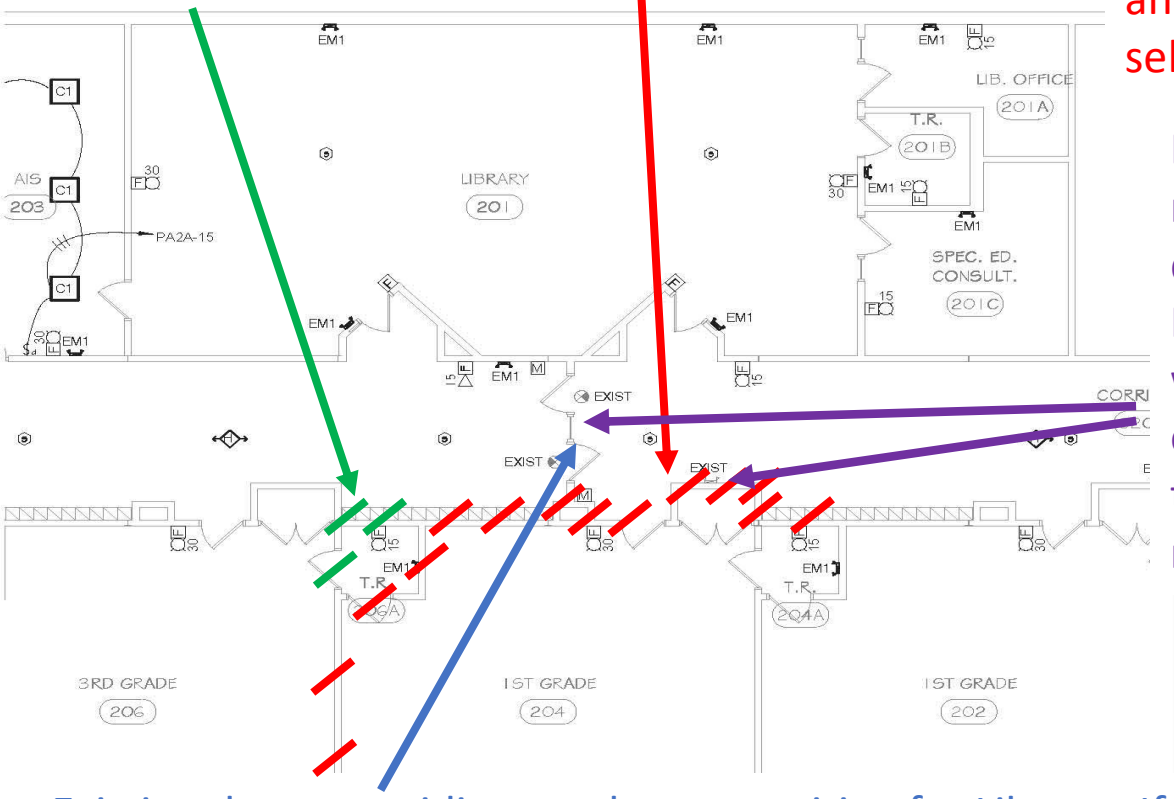
Existing doors providing smoke zone exiting for Library. If new, we would pursue question on through wall openings between 1st grade classroom (204) and Corridor; and between Classroom 204 and at least one of the adjacent classrooms. If these doors also provided smoke zone exiting for other spaces we would ask about through wall openings between Library and Corridor; and between Library and adjacent spaces on at least one side of Library, also. There is no smoke zone exiting, if adjacent space(s) are open to each side of smoke doors. Hopefully design firms have considered this also.

Whole Building Approach

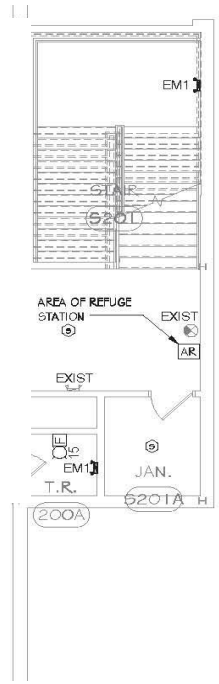
Alternate Wall Section

Walls of concern.

Note: Through wall openings includes both classroom door and toilet room door in wall selected for smoke separation.



Depending upon fire rating either smoke dampers, or combo. Fire smoke dampers would be required at existing and new transfer ducts for relief air



Existing doors providing smoke zone exiting for Library. If new, we would pursue question on through wall openings between 1st grade classroom (204) and Corridor; and between Classroom 204 and at least one of the adjacent classrooms. If these doors also provided smoke zone exiting for other spaces we would ask about through wall openings between Library and Corridor; and between Library and adjacent spaces on at least one side of Library, also. There is no smoke zone exiting, if adjacent space(s) are open to each side of smoke doors. Hopefully design firms have considered this also.

Coordination between Trades/Code Documents:

- There are multiple design features that require compliance with multiple code sections/books. We need to be aware of the need for design information to be provided for compliance with all applicable sections of codes.

- Examples:
  - Kitchen Hoods (in particular Type I (grease) hoods.
  - Plumbing fixtures.
  - Plenums

Coordination between Trades/Code Documents:

- Kitchen Hoods (in particular Type I (grease) hoods.
- Applicable Codes:
  - Building Code/Manual – Design of Kitchen and shafts
  - Mechanical Code – When/where/how
  - Fire Code – Fire suppression
  - Fuel Gas Code – Control products of combustion
  - Energy Code – Replacement/Transfer Air

Coordination between Trades/Code Documents:

- Fire suppression at kitchen grease hoods crosses trades.
  - Fire suppression system at hood.
  - Activation of fire suppression:
    - Initiating device for fire alarm system.
    - Shuts down fuel supply to equipment located under hood. (Gas and Electric)
  - Provision for manual activation required.

Coordination between Trades/Code Documents:

- Kitchen Hoods: Replacement/makeup air is balancing act.
  - Need to comply with both Mechanical Code and Energy Code.
    - Energy Code drives towards replacement air for hood coming from transfer air.
    - We haven't pushed it yet, but provision in Mechanical Code and coordinates with Energy Code for design to include schedule or diagram for outdoor air balance.
    - Potentially complicated by demand control ventilation for both exhaust and cafeterias

Coordination between Trades/Code Documents:

- Plumbing – Lavatory fixtures:
  - Need to comply with Plumbing Code, Energy Code, and Property Maintenance Code.
    - Codes are fairly coordinated.
    - Implementation is more difficult, especially in existing buildings.
    - Hot water source (recirculation loop for most school buildings) needs to be located close (very close) to the lavatory fixtures.
    - Tempered water provided at tap outlet.

Coordination between Trades/Code Documents:

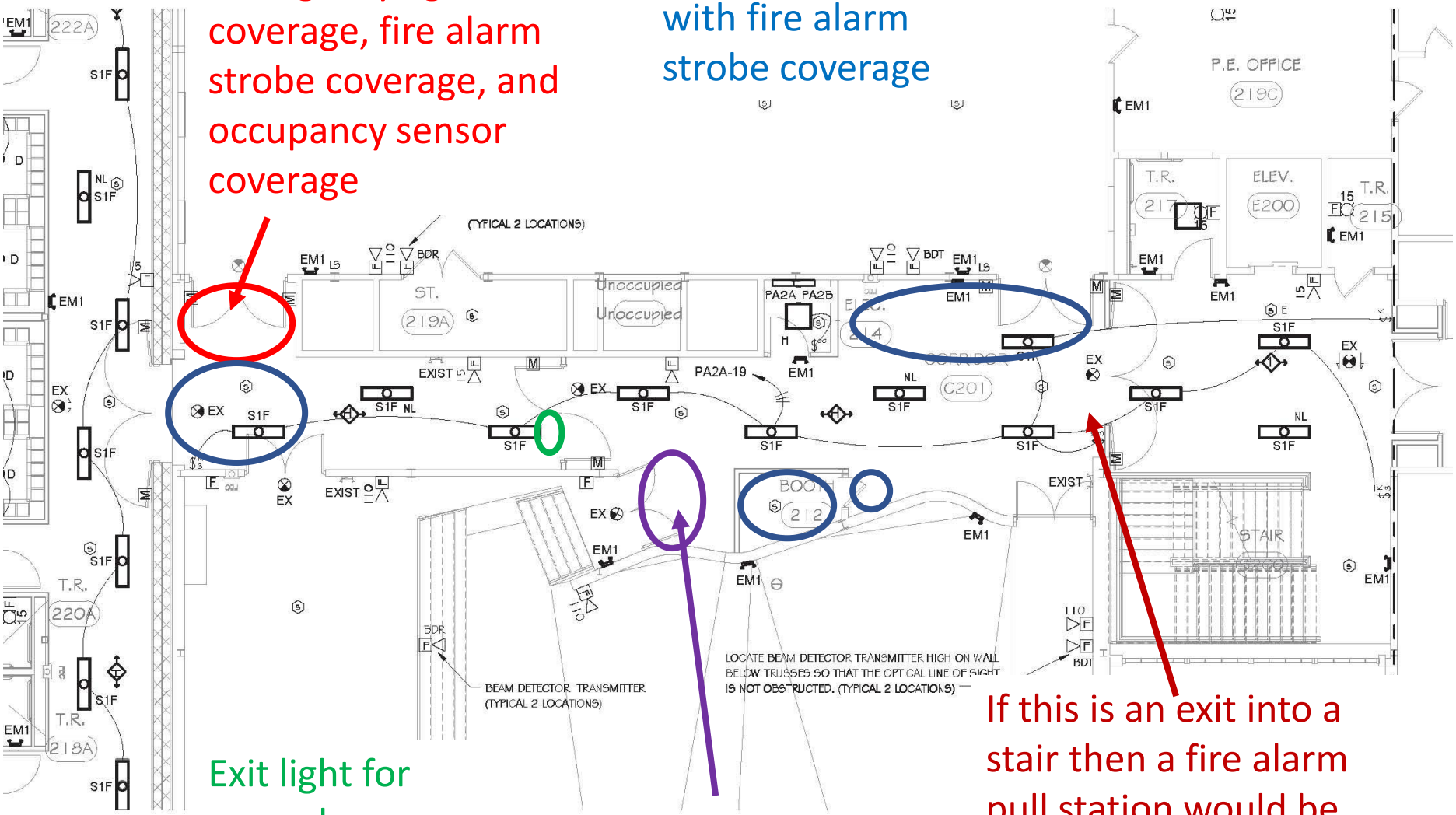
- Plenums:
  - Existing or new construction must be identified for plenums.
    - There are restrictions on the quality of materials that may be placed in plenums.
    - Impacts mechanical, electrical, plumbing, and construction. (See Section 602 of the Mechanical Code)

Details Matter:

- We don’t catch everything.
- We don’t expect Reviewers to catch everything.
- Perform reviews, keeping in mind Codes/Rules/Regulations and a Whole Building Approach.

Potential issue with emergency light coverage, fire alarm strobe coverage, and occupancy sensor coverage

Potential issue with fire alarm strobe coverage



Exit light for second means of egress

Potential problem with occupancy sensor coverage.

If this is an exit into a stair then a fire alarm pull station would be required within 5 feet of door entry into stair.

Engineering Review - Electric:

- General:
  - Take a good look at the General provisions in the Electric Review Checklist. All issues in this section are important.
    - Listing/labeling
    - Provisions for Electric Rooms – Working space, dedicated equipment space, door swings
    - Work in existing panels: AIC ratings, Tapping
    - Plenum rated cable
    - Removal of abandoned cable
    - No penetrations of exit enclosures

Lighting and Controls

General:

- The design must provide light levels that meet at least the minimum required for the means of egress along the entire path of the means of egress. Where the means of egress starts at any point that is occupied in the building, and continues out to the public way.
- Illumination levels in accordance with MPS (exception Pools).
- Lighting Power Density (both interior and exterior) in accordance with Energy Code.
- Controls in accordance with Energy Code. Energy Code States Safety First.

Means of Egress Lighting

General:

- The design must provide light levels that meet at least the minimum required for the means of egress along the entire path of the means of egress. Where the means of egress starts at any point that is occupied in the building, and continues out to the public way.
- Illumination levels in accordance with MPS (exception Pools).
- Lighting Power Density (both interior and exterior) in accordance with Energy Code.
- Controls in accordance with Energy Code. Energy Code States Safety First.

Means of Egress Lighting

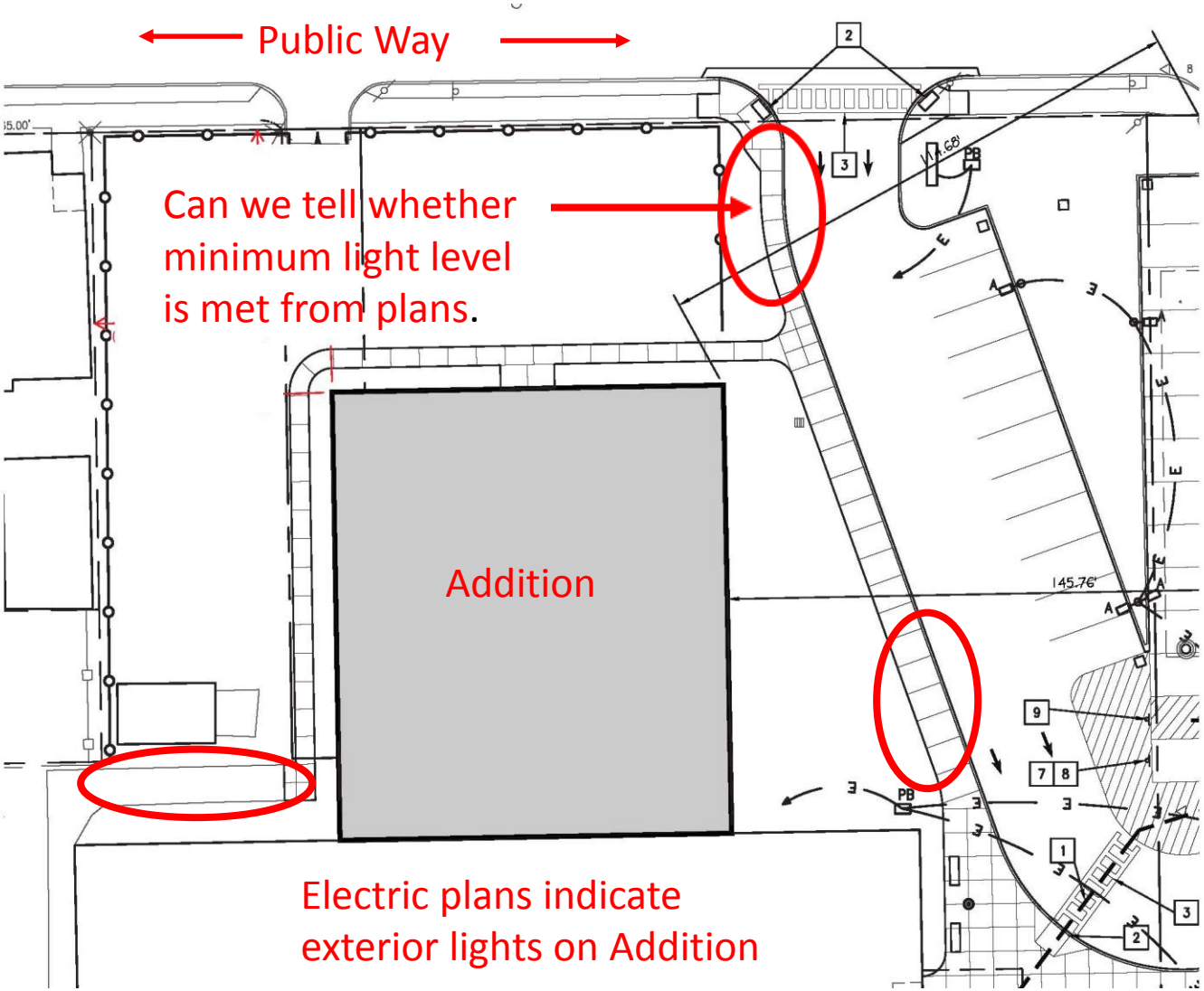
Means of Egress lighting is the normal power lighting.

Emergency lighting is the redundant lighting for those times when the normal means of egress lighting serving a space fails.

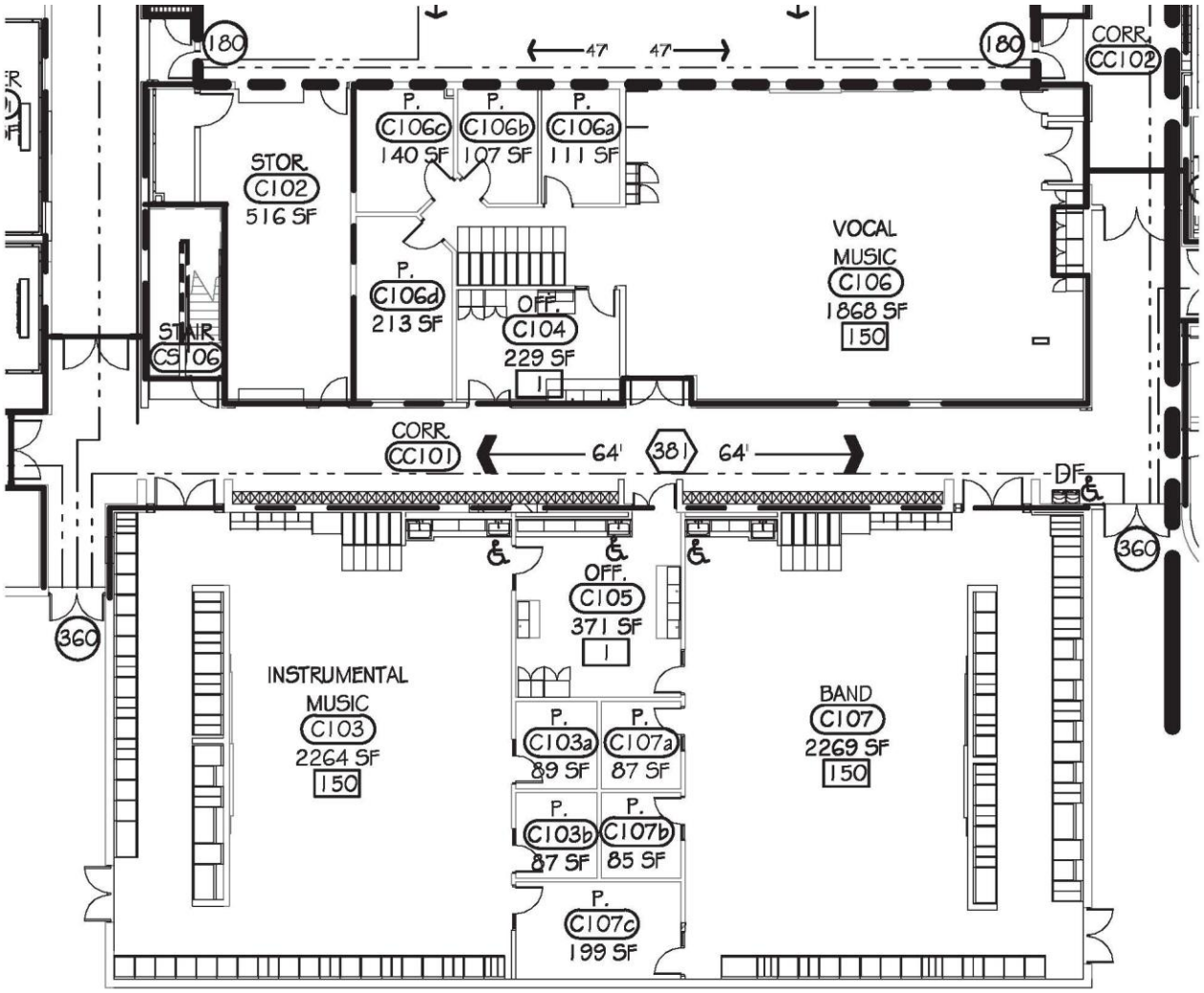
When we refer to the means of egress lighting we are referring to the normal power lighting.

When we refer to emergency lighting we are referring to the redundant lighting.

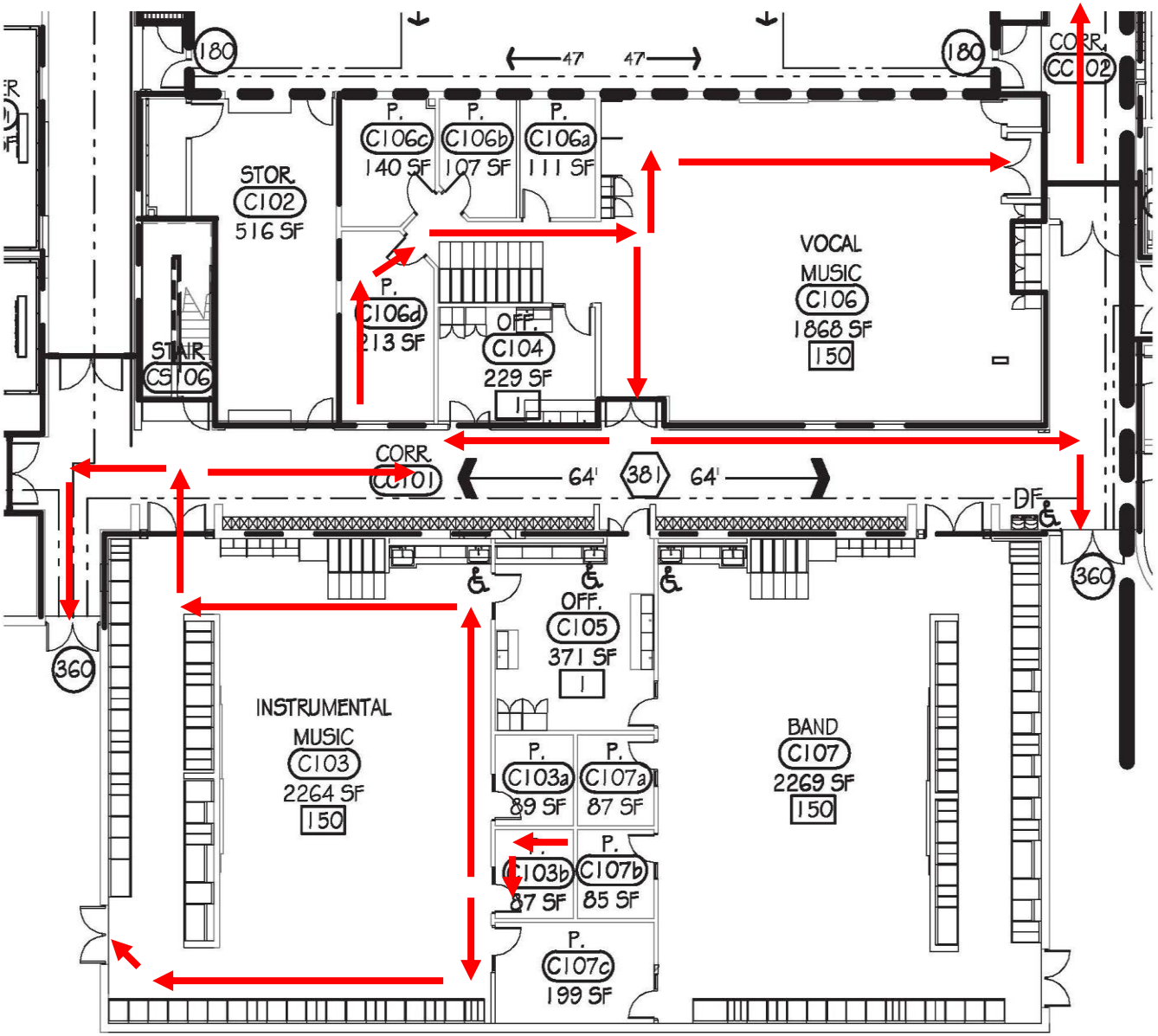
Means of Egress Lighting – Exit Discharge



Means of Egress Lighting - Interior

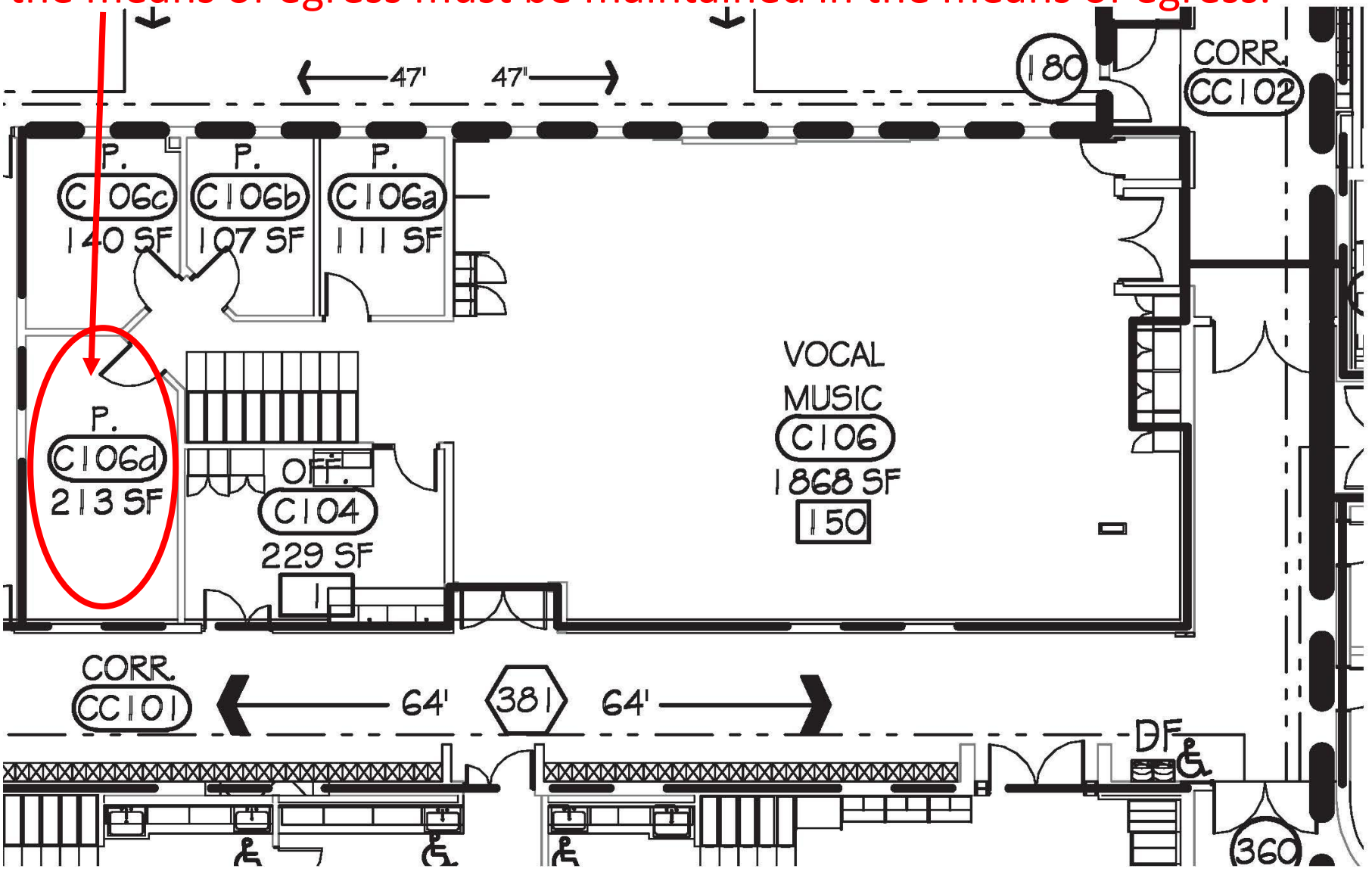


Means of egress from Practice Rooms

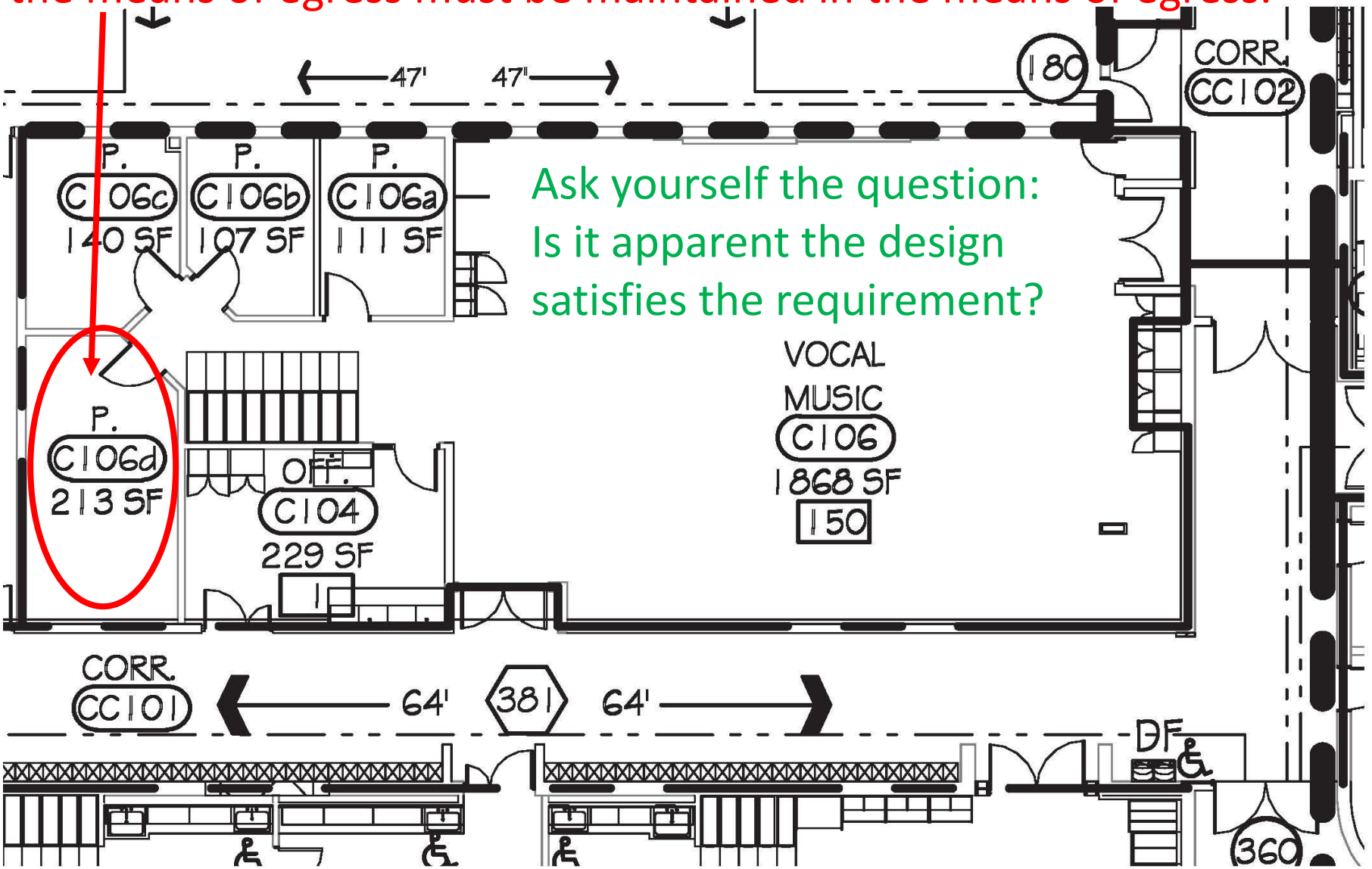


Exterior – Exit Discharge portion of means of egress

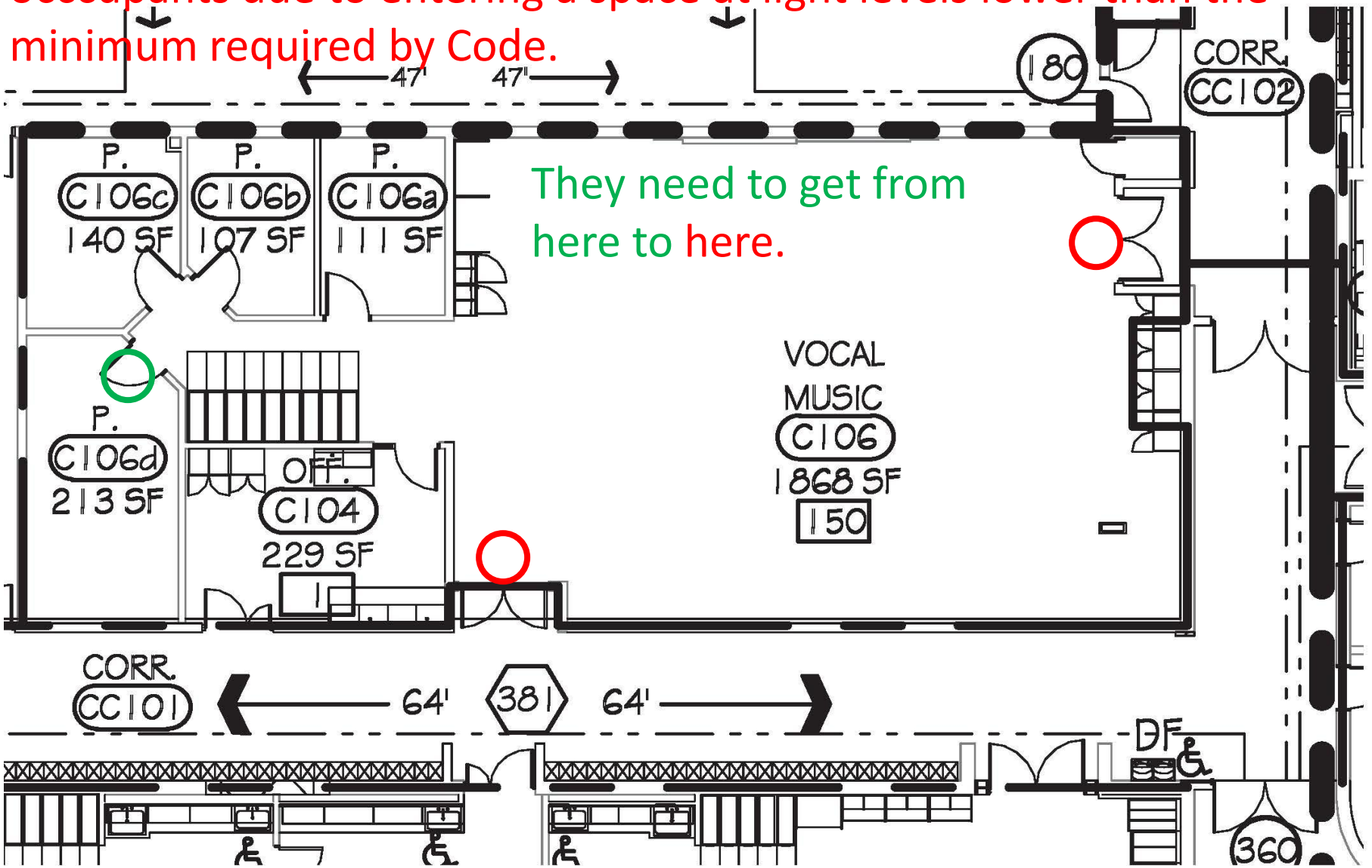
Anytime this space is occupied the minimum required light levels for the means of egress must be maintained in the means of egress.



Anytime this space is occupied the minimum required light levels for the means of egress must be maintained in the means of egress.



The design must not result in hesitation on the part of the occcupants due to entering a space at light levels lower than the minimum required by Code.



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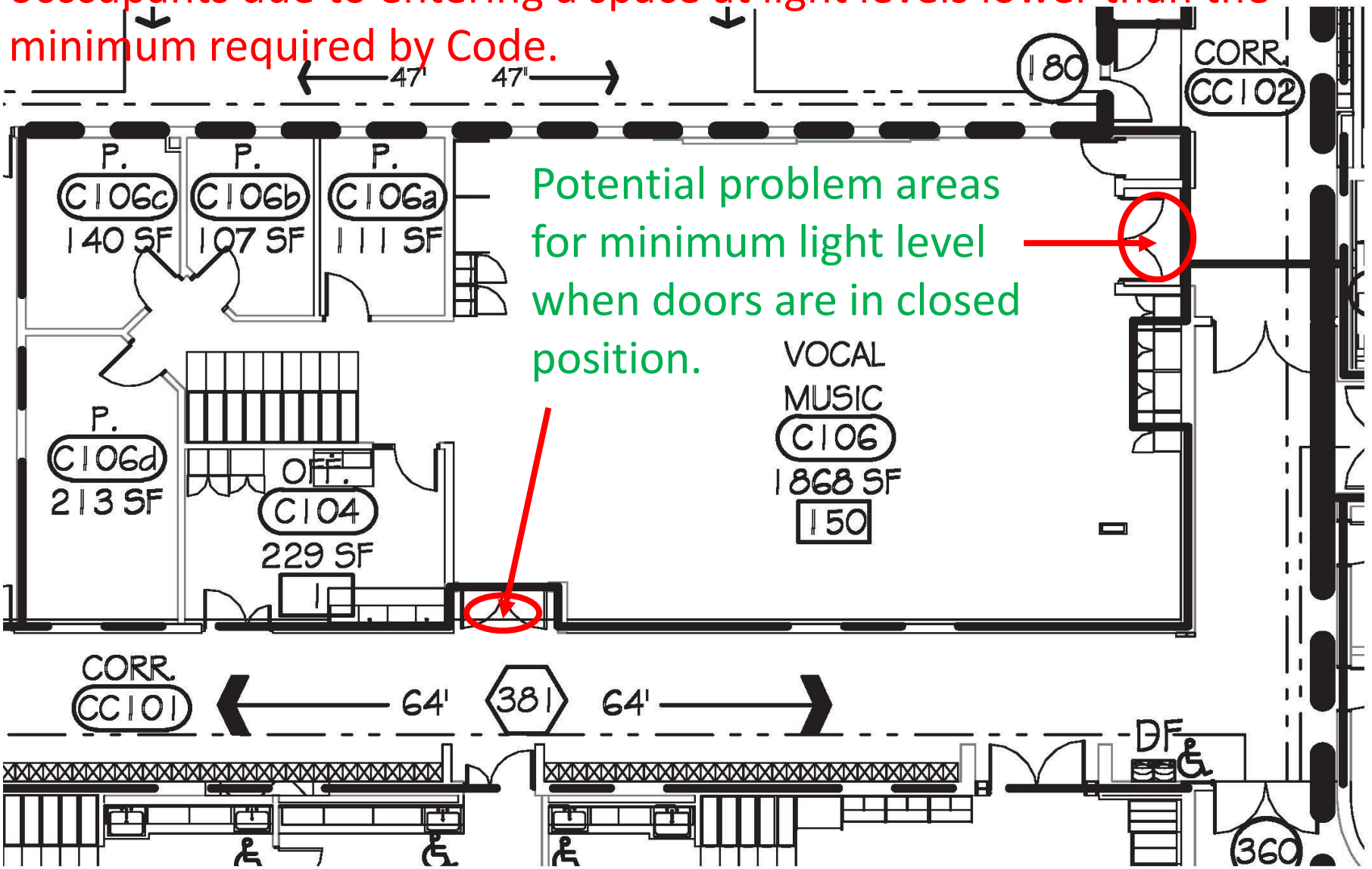


Minimum light level must be maintained in Corridors and Stairs

Lighting Controls

Lighting controls are required in accordance with the Energy Code and UFP&BC.

Energy Code:

- Space receiving 50% or more new light fixtures.
  - New fixtures receive controls in accordance with Energy Code.

Energy Code and UFP&BC:

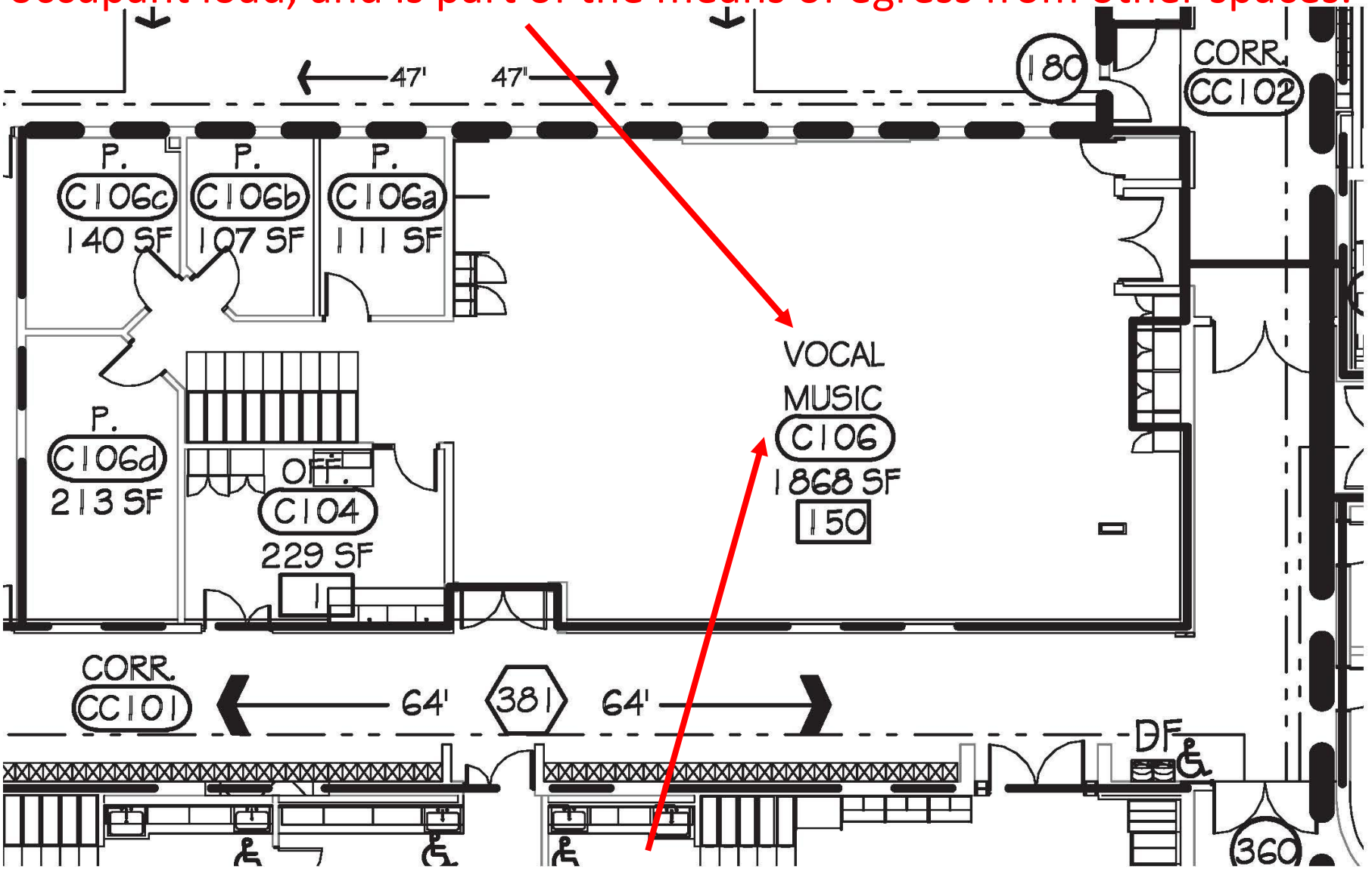
- Safety First : Does the system as set up provide for the safety of the occupants?

Manual Lighting Controls

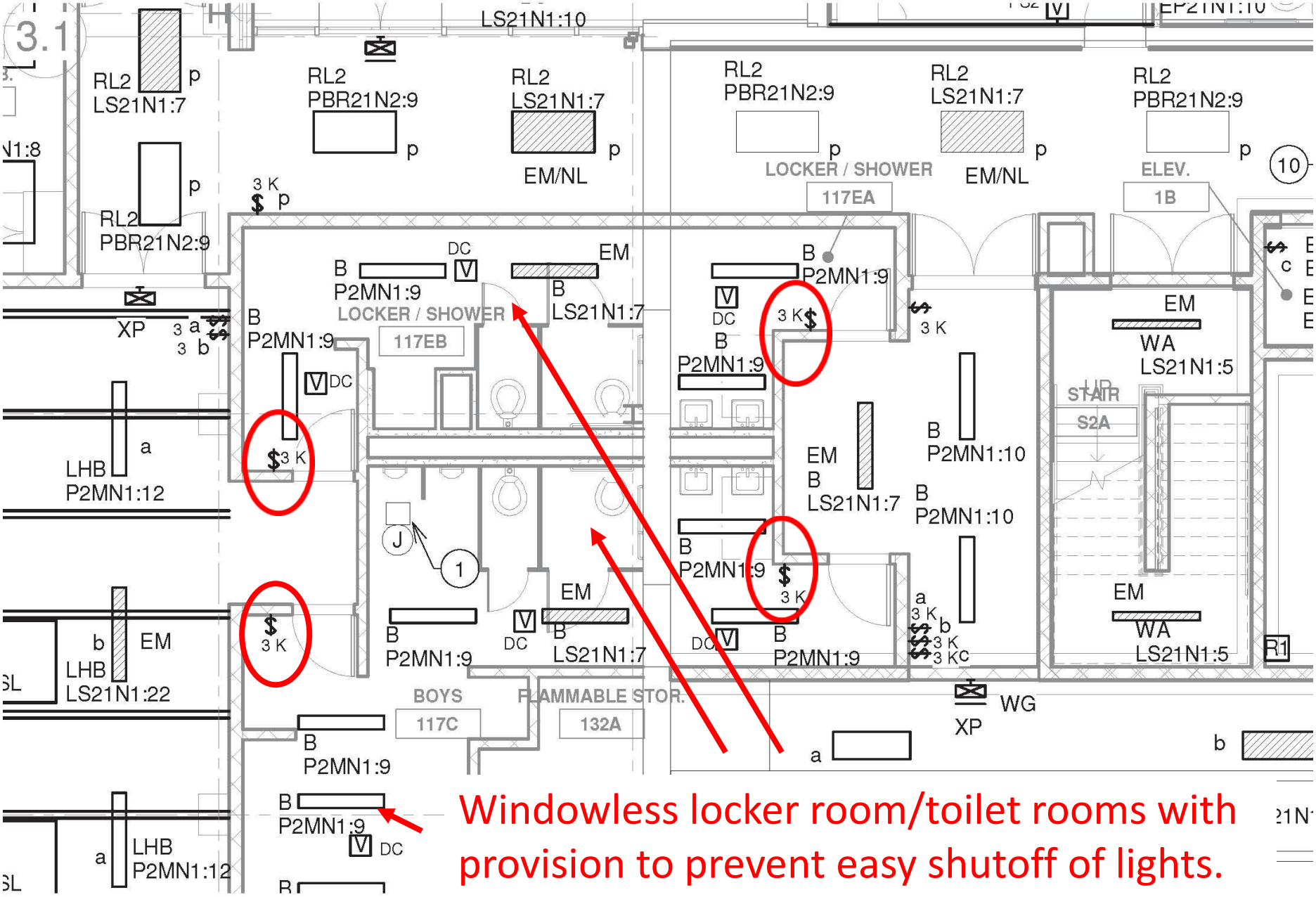
Potential Design Issues:

- The following types of windowless, student occupied spaces must have a means to prevent the spaces from being placed in darkness (minimum lighting level below that required for the means of egress) through an easily operated manual switch when the spaces are occupied:
  - Spaces with large occupant loads,
  - Spaces with obstructions (locker rooms, gang toilet rooms, conference rooms)
  - Spaces that are part of the means of egress from other spaces.

Windowless student occupied space that is both an area with a large occupant load, and is part of the means of egress from other spaces.

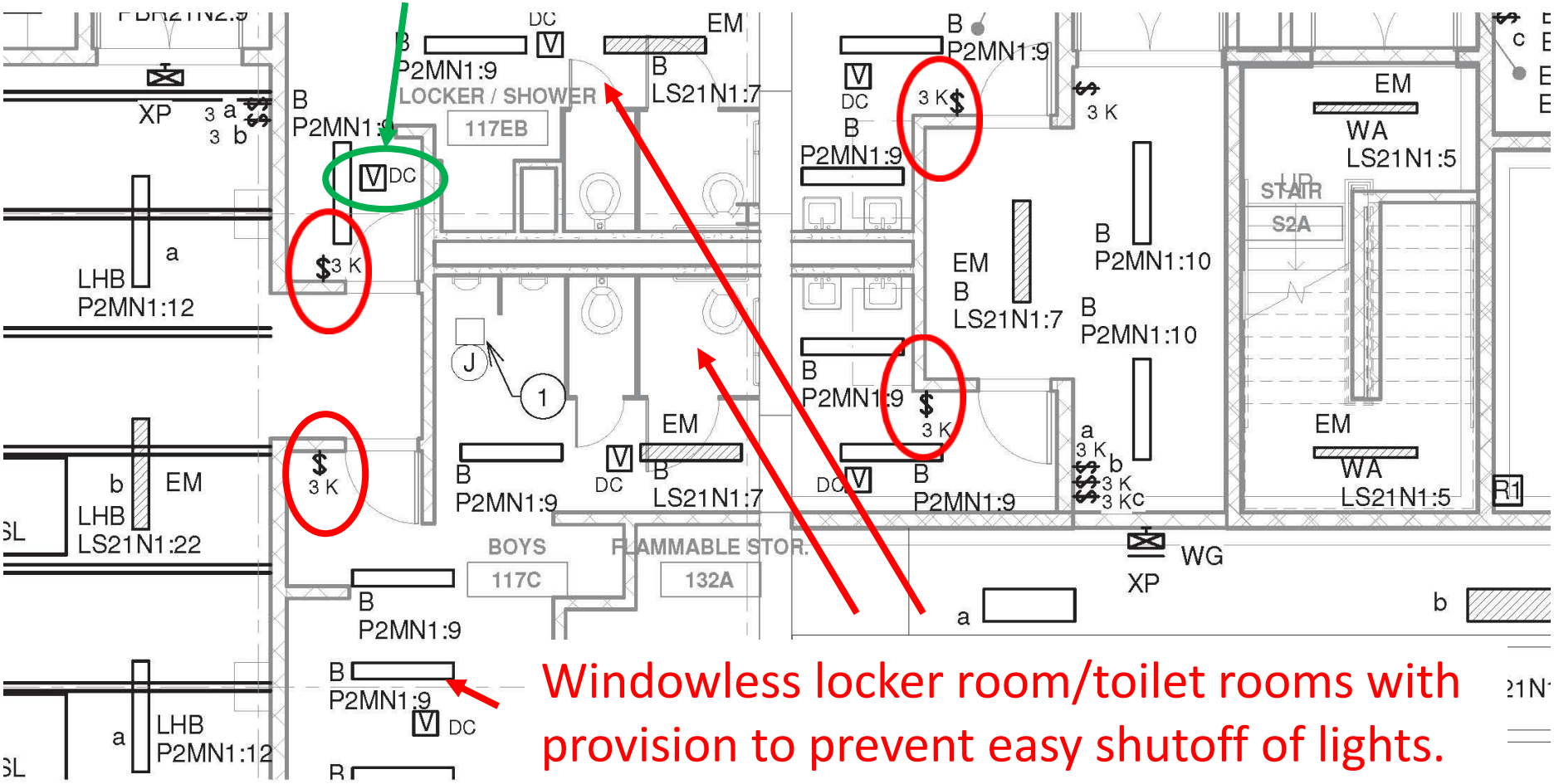


This space may also have risers, making egress difficult.



Windowless locker room/toilet rooms with provision to prevent easy shutoff of lights. (Key switches)

Occupancy sensor symbol. An occupancy sensor would not be allowed to control all lights in these spaces. Either some sort of continuous light, or a portion of the lighting would need to be controlled thru a Key Switch. Lighting controlled by the occupancy sensor would be controlled by a separate switch



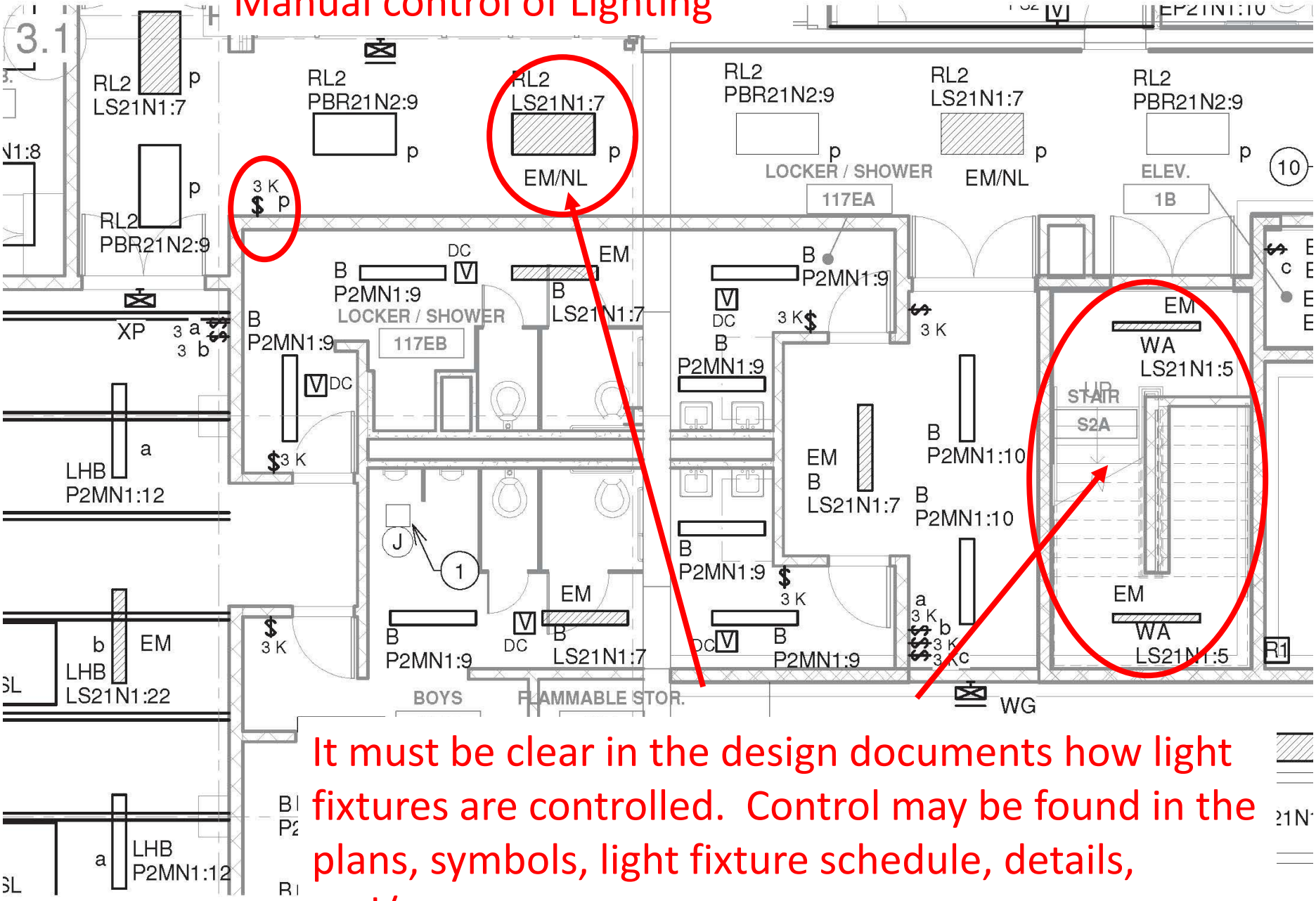
Windowless locker room/toilet rooms with provision to prevent easy shutoff of lights. (Key switches)

Manual Lighting Controls

Potential Design Issues:

- The following types of spaces must have a means to prevent the spaces from being placed in darkness (minimum lighting level below that required for the means of egress) through an easily operated manual switch when the spaces are occupied:
  - Stairs,
  - Corridors
  - Assembly Spaces

Manual control of Lighting



It must be clear in the design documents how light fixtures are controlled. Control may be found in the plans, symbols, light fixture schedule, details, and/or notes.

Automatic Lighting Controls

Lighting controls are becoming more complicated. Wider array of control systems.

Automatic Lighting controls:

- Time Clock
- Occupancy Sensors
- Photocell

Occupancy Sensors

Potential Design Issues:

- Sequences of operations
- Coverage
- Program uses of spaces to receive controls

Occupancy Sensors – Sequence of Operations

Two types of Sequences:

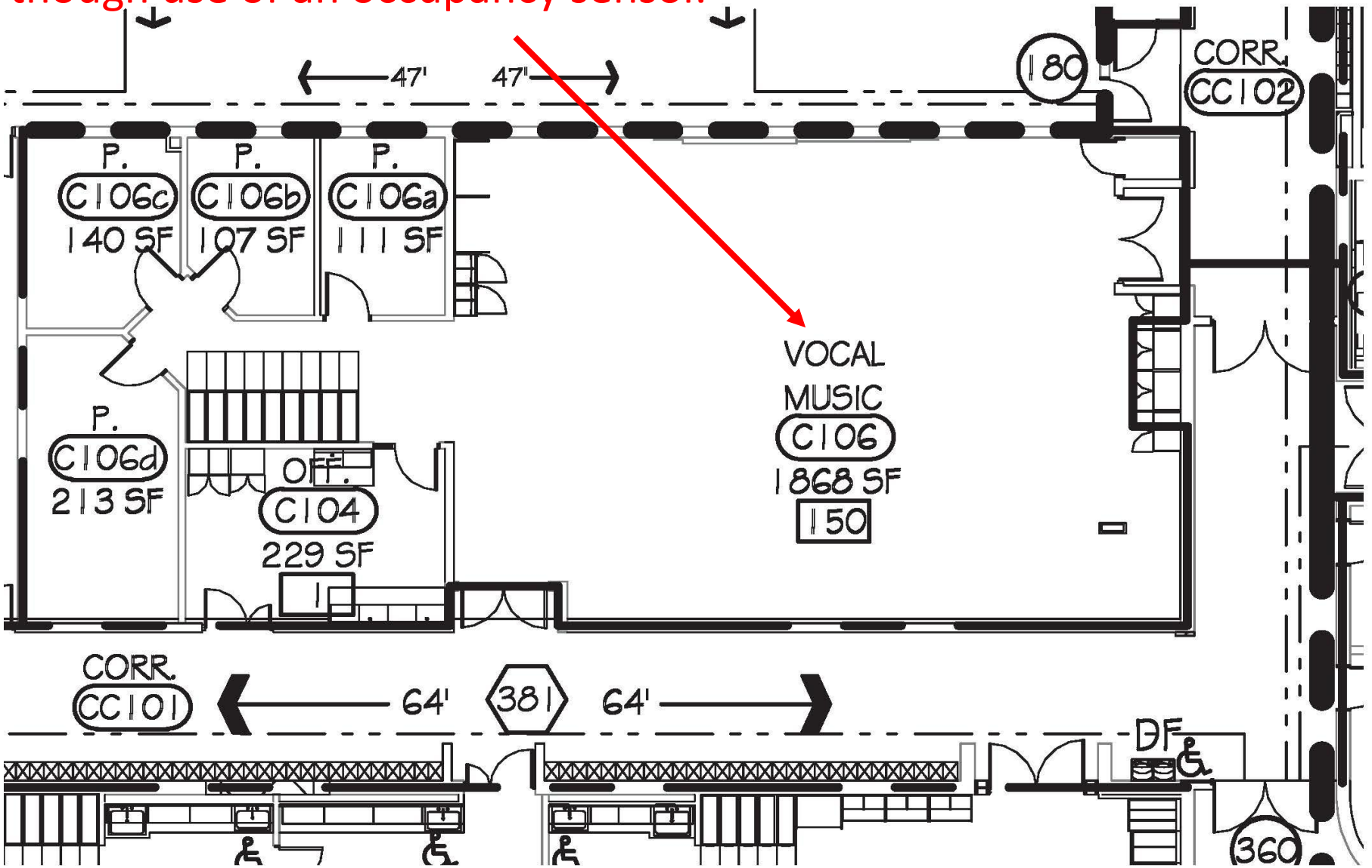
- Auto-Off with Manual-On
- Auto-Off with Auto-On (or partial Auto-On)

Energy Code calls for Auto-Off with Manual-On. Except where the use of Manual-On creates a safety hazard. Safety First.

Examples of locations where use of Manual-On sequence may result in a Safety Hazard:

- Corridors
- Stairs
- Assembly spaces
- Windowless student occupied spaces that would not be allowed to have all lights controlled by an easily operated manual switch.
- Any space served by a key switch.

It would not be acceptable to control all of the lights in this space though use of an occupancy sensor.



Occupancy Sensors – Coverage:

It must be clear from the design documents that the appropriate type and number of sensors are provided for each program space.

- Sensors used in classrooms may be different than those used in larger spaces, corridors, toilet rooms, high bay applications, etc.

- Spaces with nooks and crannies must have appropriate coverage (especially sensors with an auto-on sequence of operations)

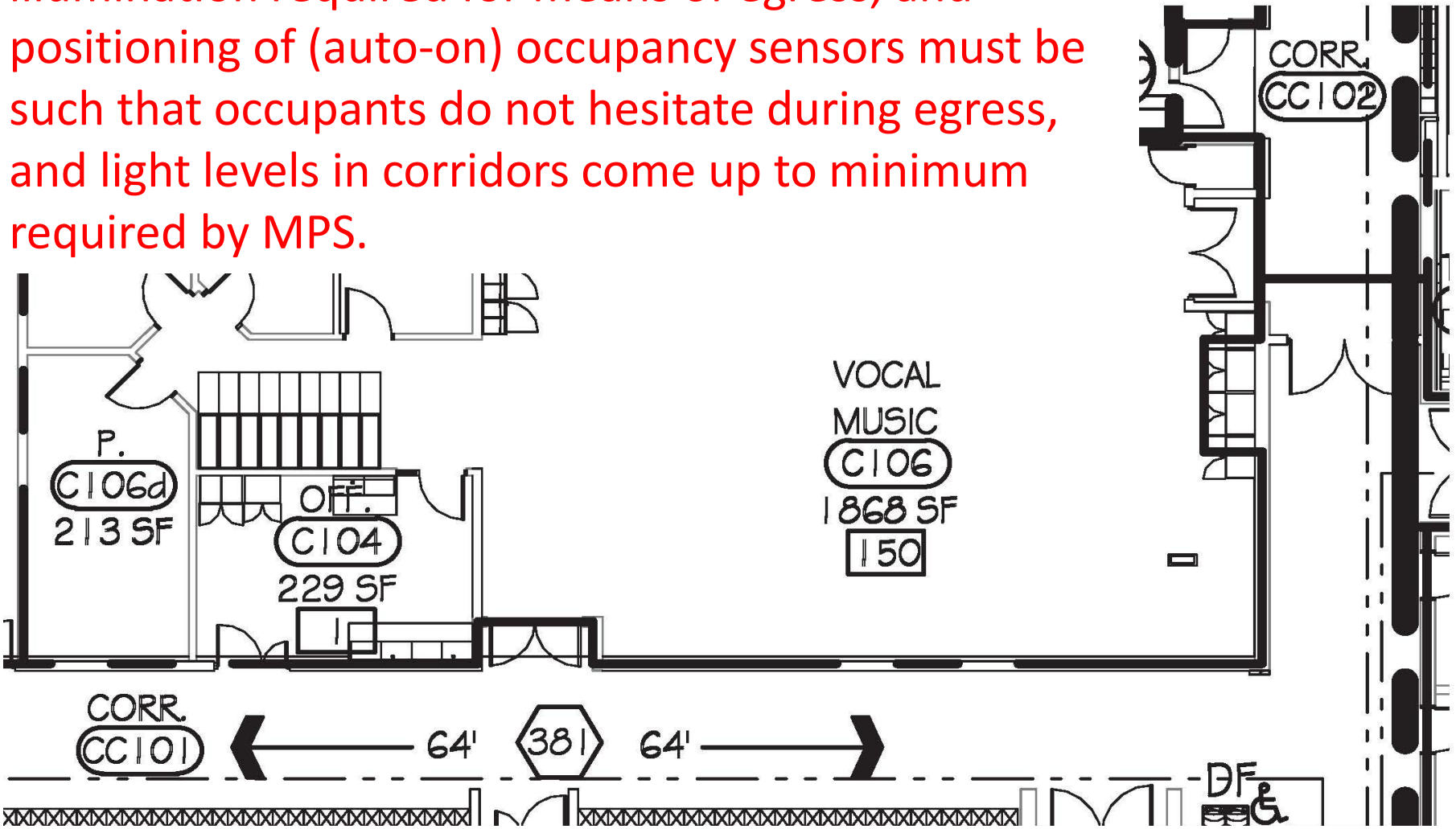
Occupancy Sensors – Coverage:

Corridors:

Light levels in corridors may not be reduced below that required for the means of egress at any time a space served by the corridor is occupied.

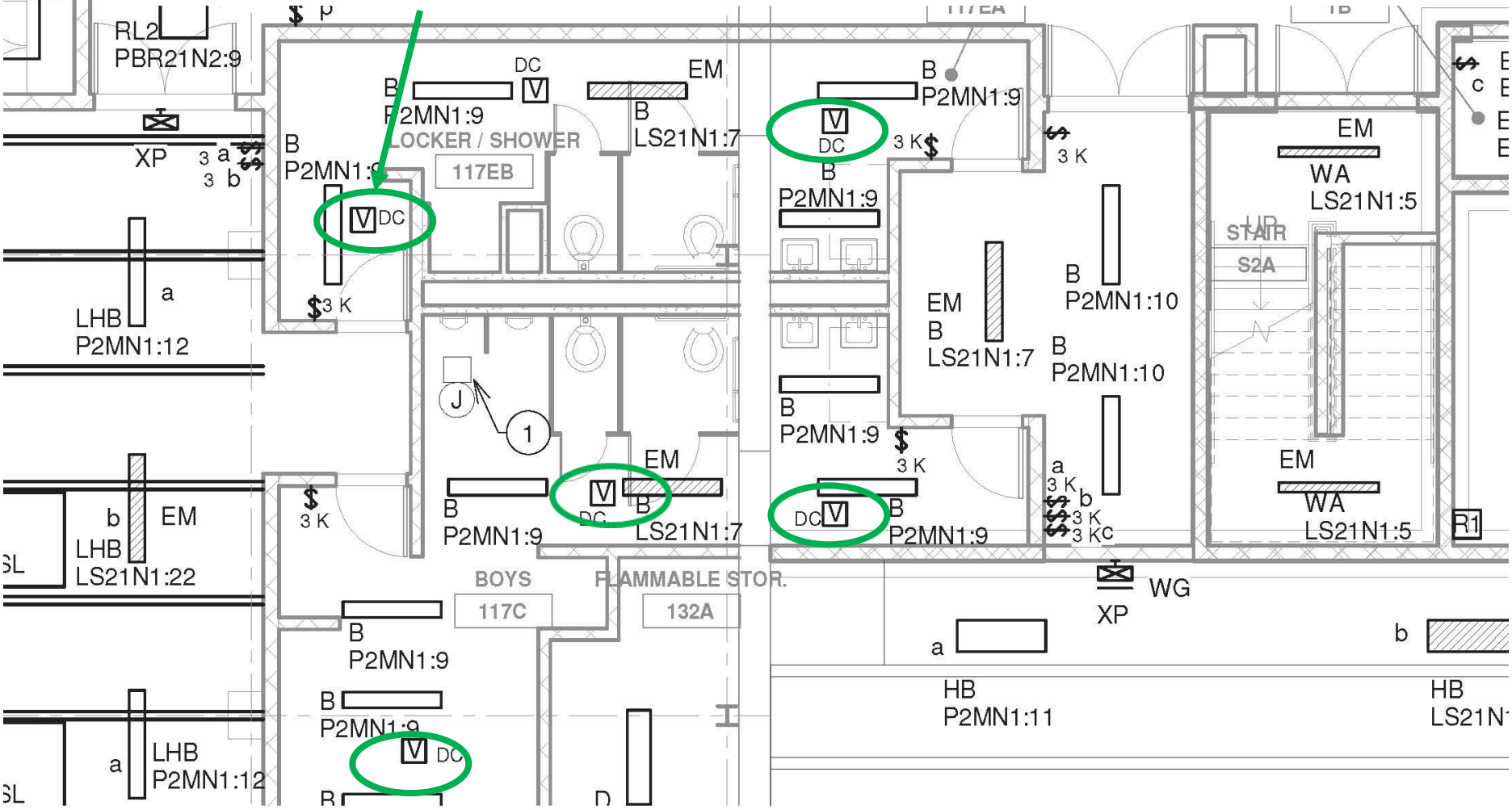
Where occupancy sensors are used to control lights above the minimum required for egress, the occupancy sensors must have an auto-on sequence, and must bring light levels up to the minimum required by the Manual of Planning Standards (MPS) when the corridor becomes occupied. Design documents must clearly indicate sufficient coverage.

Corridors: Positioning of lights, providing minimum illumination required for means of egress, and positioning of (auto-on) occupancy sensors must be such that occupants do not hesitate during egress, and light levels in corridors come up to minimum required by MPS.



Consideration should be provided when entering a space at lower illumination level from a space at normal illumination level. How dark will the corridor appear as occupants approach door to corridor.

Occupancy sensor. Sensor would not be allowed to control all lights in the space. Note: manual–on sequence, would not be advisable to control lights that are also controlled with a key switch.



Lighting Controls – Occupancy Sensors and Emergency Light Coverage

- Emergency light coverage is discussed separately. However, as part of redundant lighting system, when power is returned to the normal power light system, serving a space, light levels in the means of egress, serving the space must be maintained while the space is occupied. The use of occupancy sensors may not disrupt means of egress lighting.

Emergency Lights

Read/follow the Guidelines

The emergency lighting system serving a space shall be arranged such that failure of the normal area lighting serving the space in which the emergency light is located shall cause the emergency lighting in the space to automatically energize, within 10 seconds.

Likewise, if power returns to the normal area lights in less than 90 minutes, and the emergency lights serving a space go off, light levels in the means of egress, serving the space must be maintained while the space is occupied.

Emergency Lights

- Emergency Lighting required for spaces that require multiple exits (typically 50 occupants or more), corridors, stairwells, exterior areas at exit doors, elevators, windowless/interior student occupied spaces, gang toilet rooms, accessible single fixture toilet rooms, shops, labs, home economics, etc.
  - Program spaces with hot equipment, open flame, welders, kilns, rotating equipment and/or use of potentially hazardous chemicals to be in the same category as shops (ie. art, home economics, etc) for purposes of retroactive emergency lighting requirements

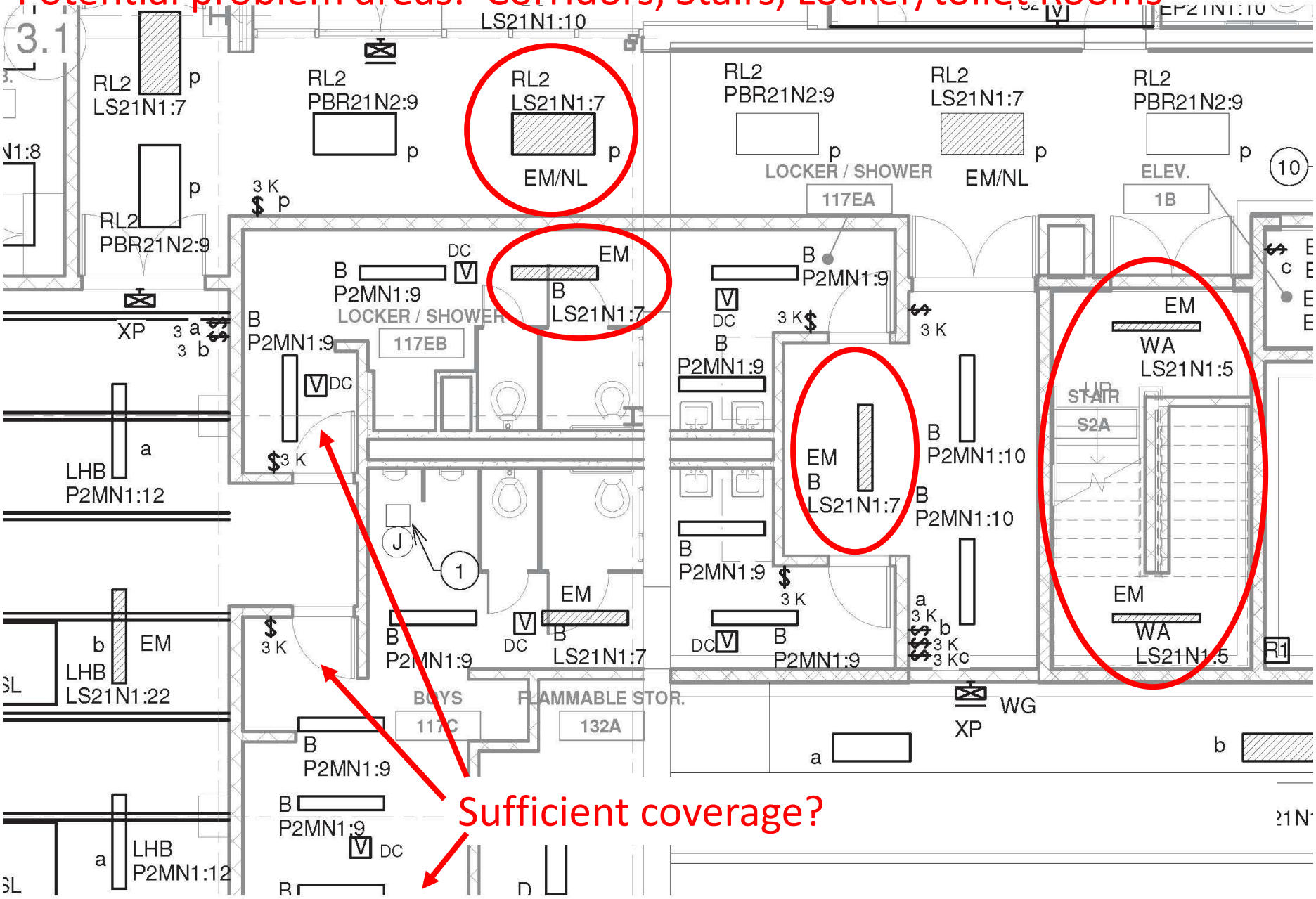
Emergency Light Systems are Redundant Systems

- Redundant system from normal means of egress lighting.
- Many different ways of setting up emergency light systems. Methods of setting them up must be consistent with Lighting systems being installed.
- The greater the number of ways to set systems up, the greater the number of ways to mess them up. Designs must be consistent.

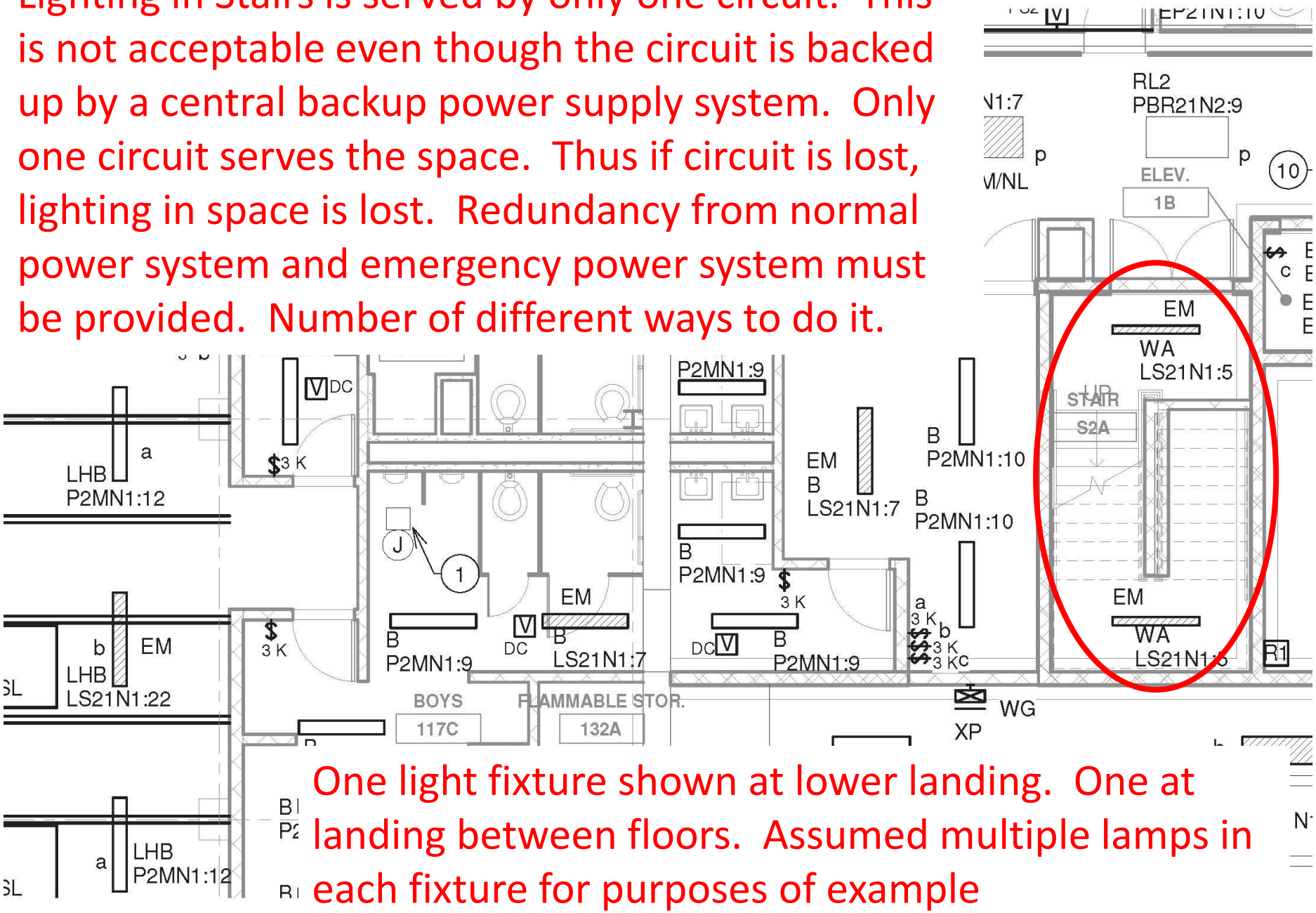
Emergency Light Systems – Consistent Designs

- Plans and details must be consistent.
- Where UL 924 Automatic Load Control Relays or UL 1008 Transfer Devices are used to energize or maintain energized emergency lighting in an area upon loss of the normal lighting supply in the area, wiring diagrams shall be provided.
- .

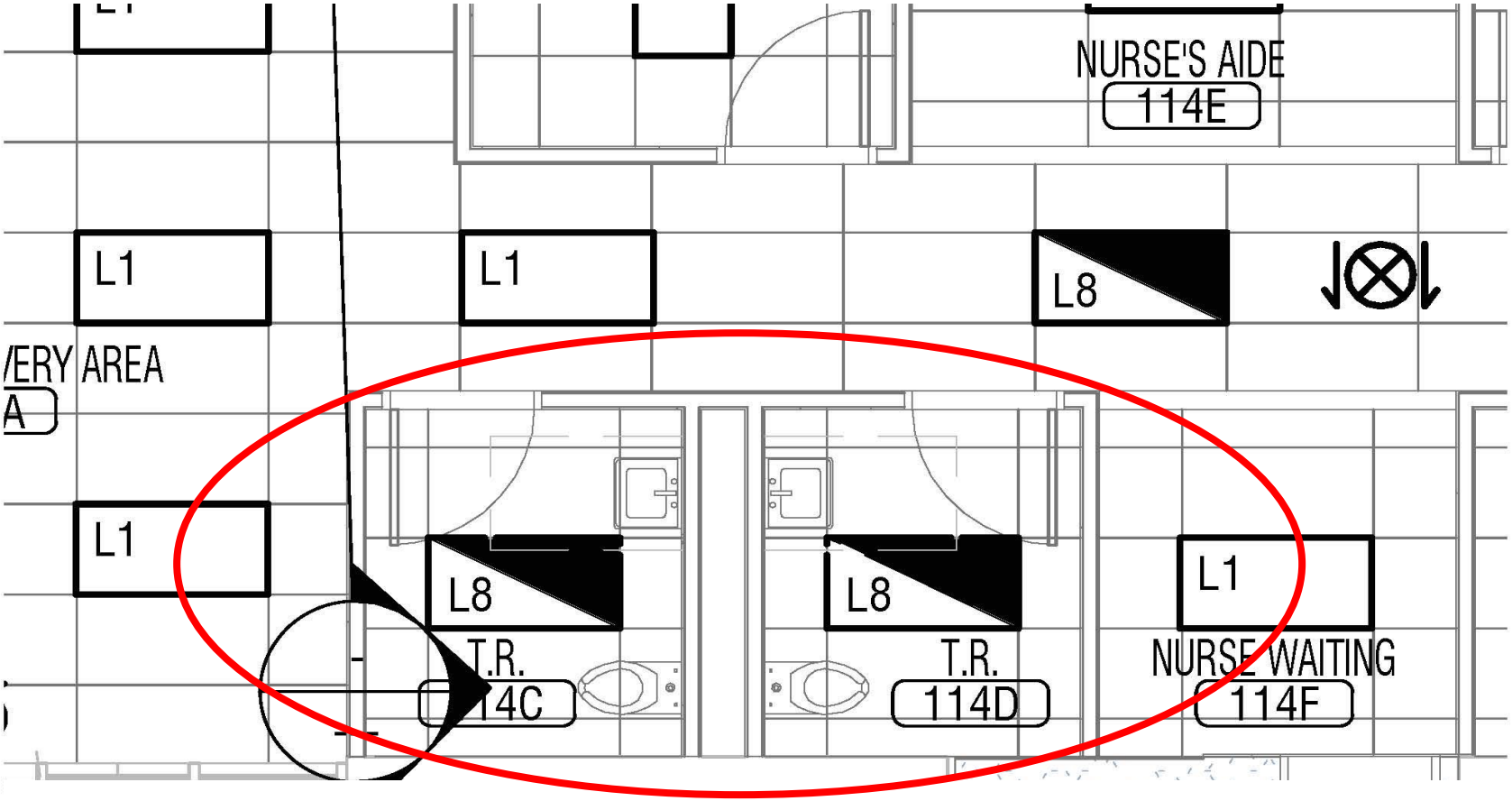
Potential problem areas: Corridors, Stairs, Locker/toilet Rooms



Lighting in Stairs is served by only one circuit. This is not acceptable even though the circuit is backed up by a central backup power supply system. Only one circuit serves the space. Thus if circuit is lost, lighting in space is lost. Redundancy from normal power system and emergency power system must be provided. Number of different ways to do it.



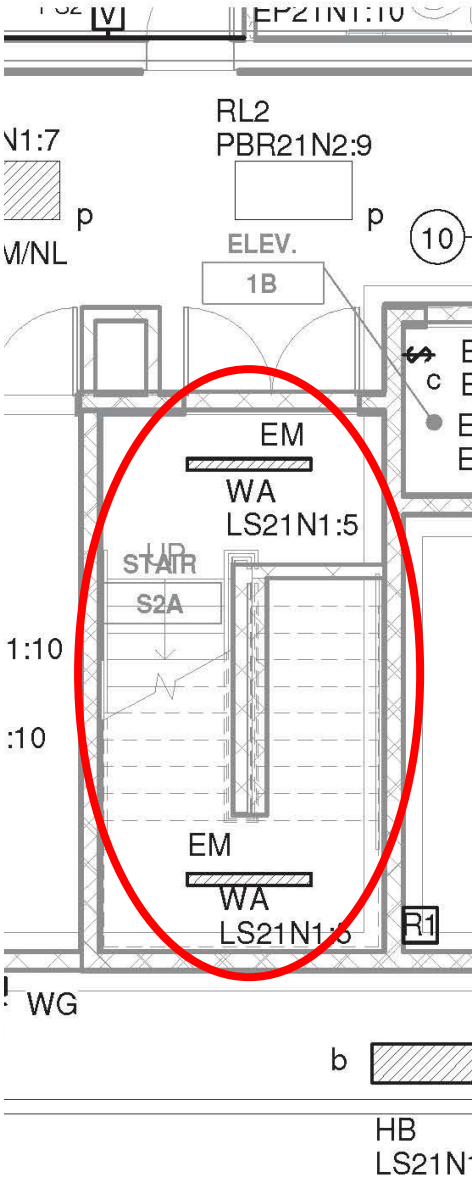
One light fixture shown at lower landing. One at landing between floors. Assumed multiple lamps in each fixture for purposes of example

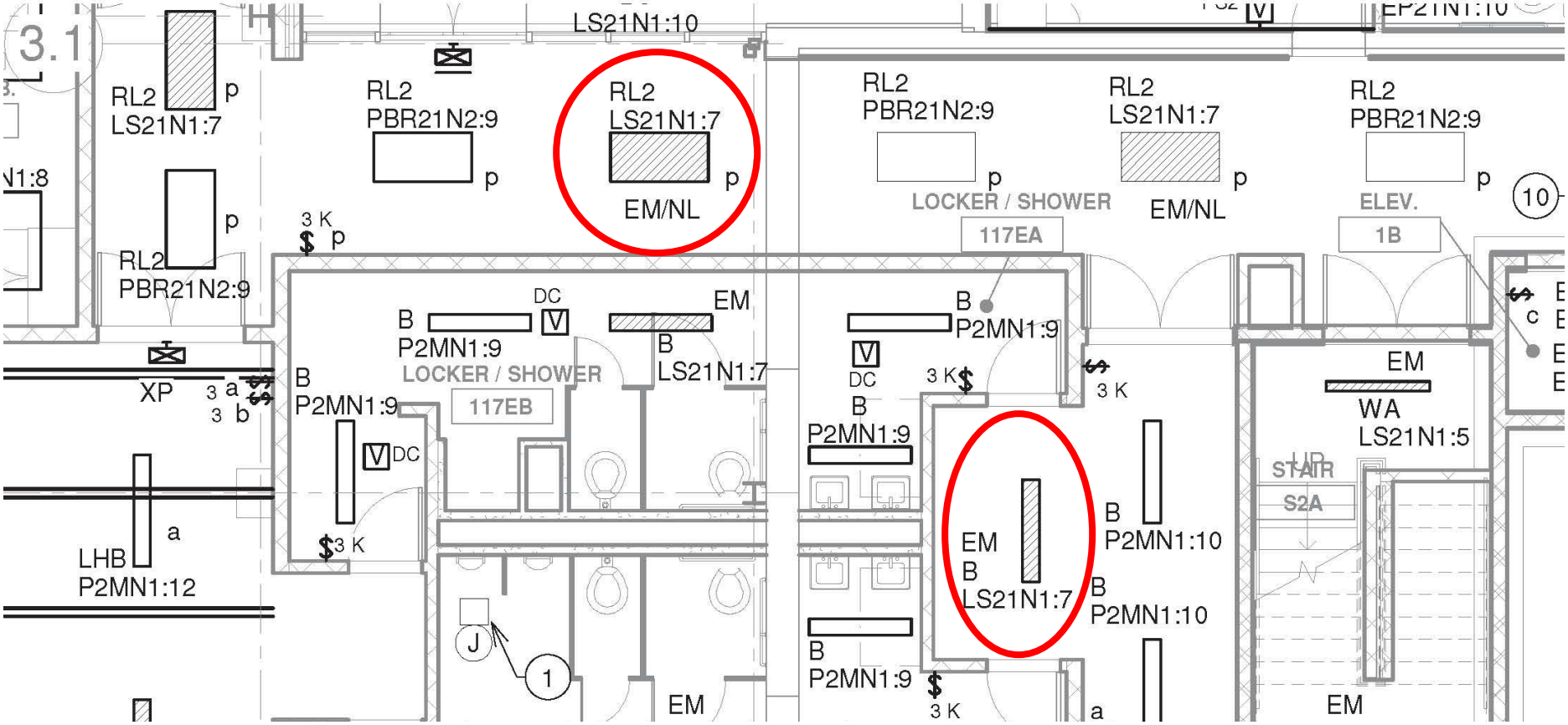


Example: Lighting in Toilet Room is served by only one circuit. This is not acceptable even though the circuit is backed up by a central backup power supply system. Only one circuit serves the space. Thus if circuit is lost, lighting in space is lost. Redundancy from normal power system and emergency power system must be provided.

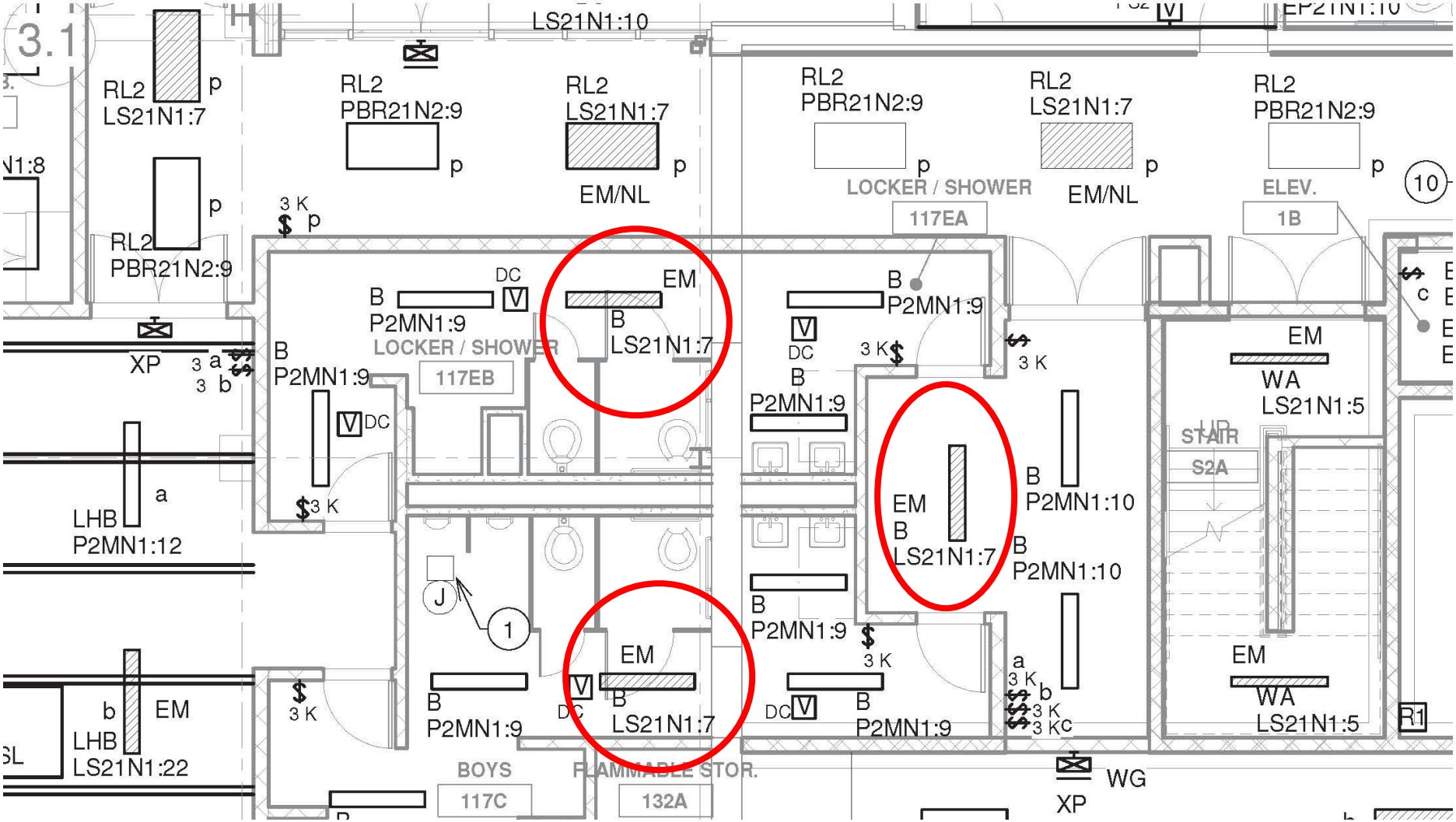
Potential acceptable designs for code compliance.
List is not advocating any particular solution.

1. Unit equipment (battery packs) tied into revised lighting circuit, ahead of any switches. Circuit must be revised such that it does not come from a panel, served by the emergency transfer switch.
2. Two circuits serve the lights - one from normal power, one from emergency panel through listed/labeled transfer device. Transfer device located at fixtures, or in same space as fixtures.
3. Multiple lights served by separate circuits - one from normal power, one from emergency panel. Lighting levels must apply to each system.
4. Others.



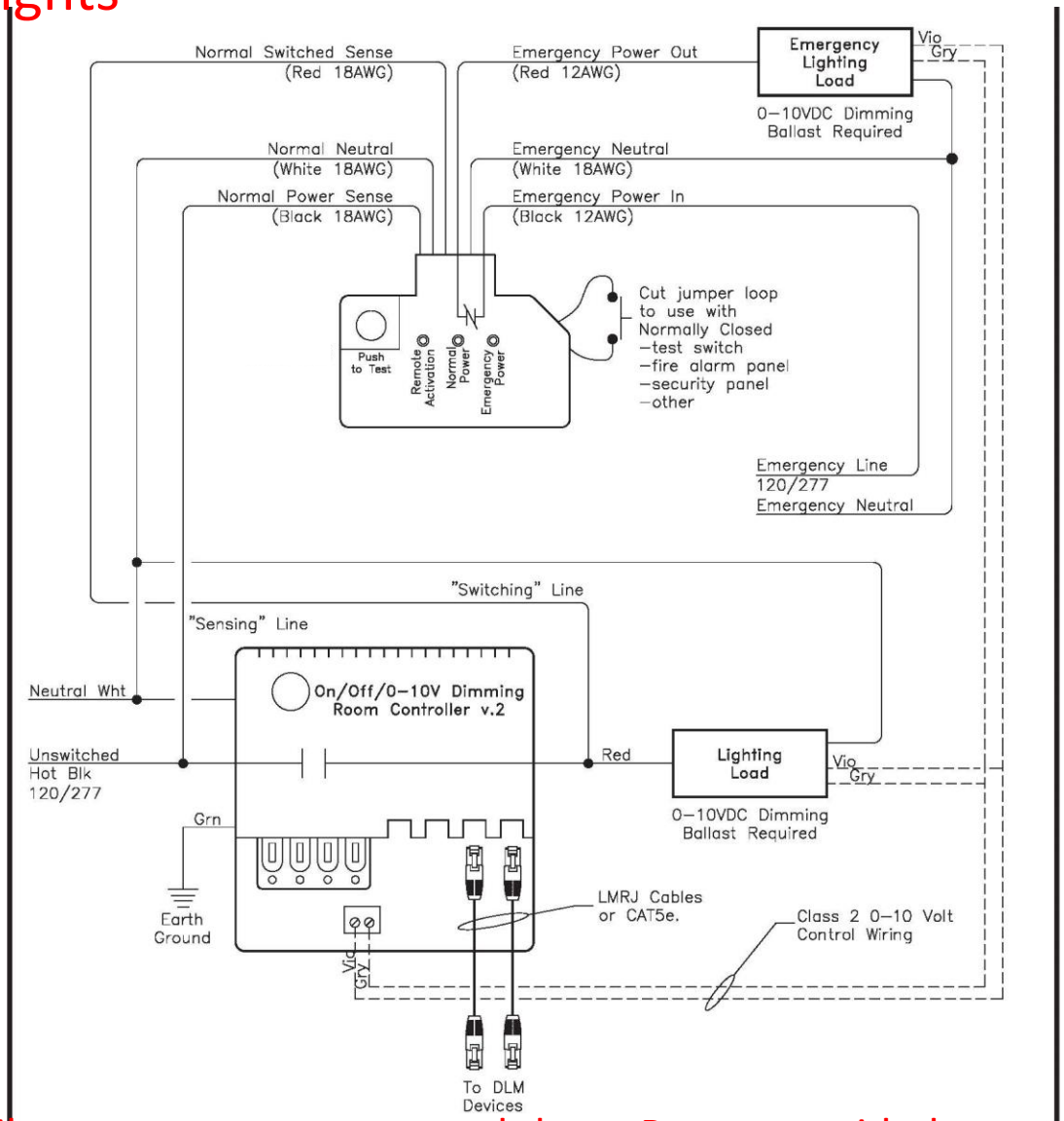


Corridors switched or unswitched lighting? Maintain minimum light levels in the means of egress. Acceptable to provide key switch control together with normal lights. Acceptable unswitched control. Additional occupancy sensor control would create problems for corridor lighting. Different details would be required for switched emergency lights and unswitched emergency lights.



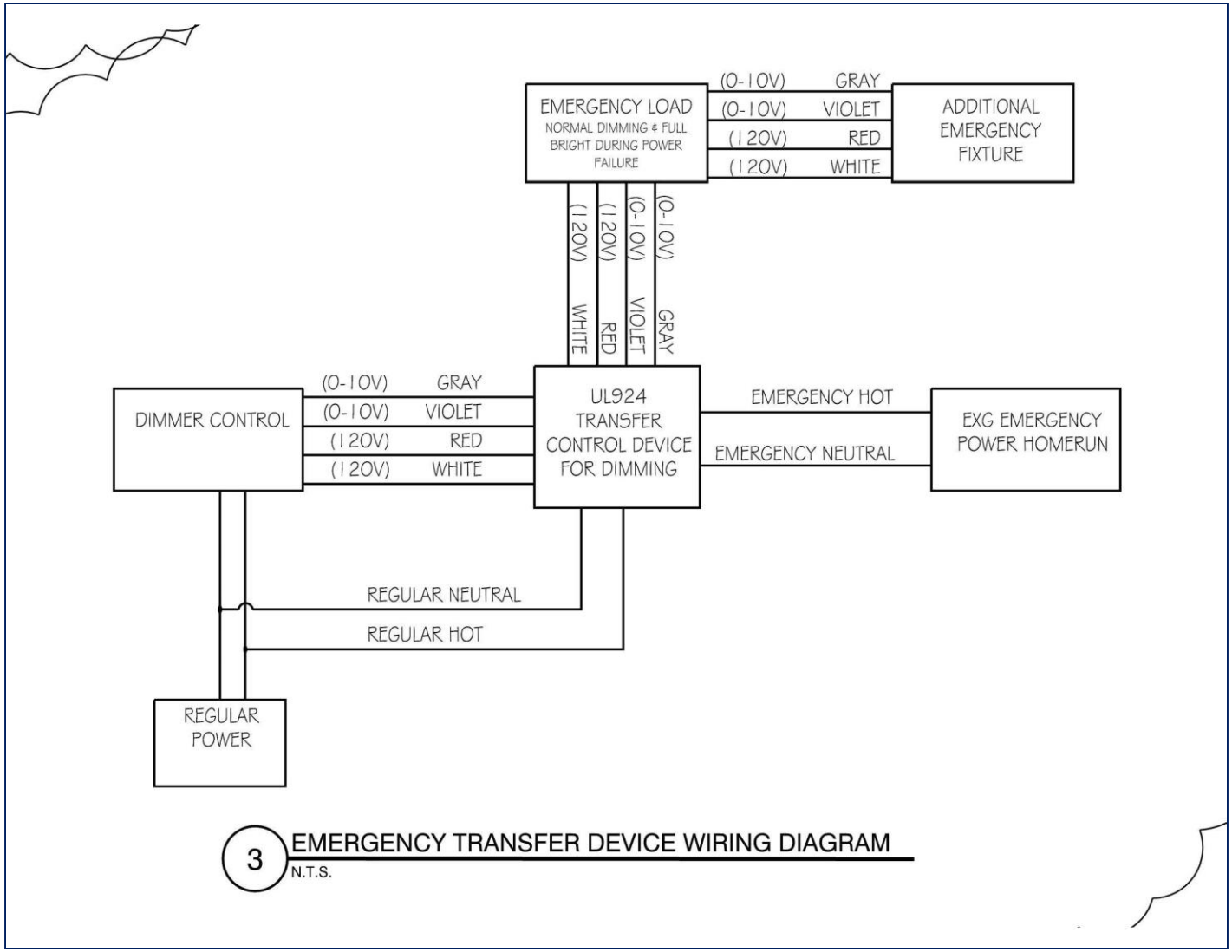
Details required for switched emergency lights. Type of switching system makes a difference. Low voltage controlling line voltage at fixture. Control of line voltage ahead of fixture(s).

Details Matter – Example Low Voltage Dimming Controls and Emergency Lights



This detail or similar pops up every now and then. Power provided to emergency light, but light does not come on because ballast receives low voltage signal that light is off.

This detail works with the sequence provided.



Fire alarm

- Voice/alarm communication systems in “E” occupancies.
  - Required in New Construction, Additions, and Replacement of Fire alarm systems.
  - Impact on types and numbers of audible notification devices. Need to meet both the performance requirements for fire alarm sound levels and be intelligible.
  - Review issues: Similar to reviews of projects with just fire alarm notification devices – Does coverage appear sufficient on plans.

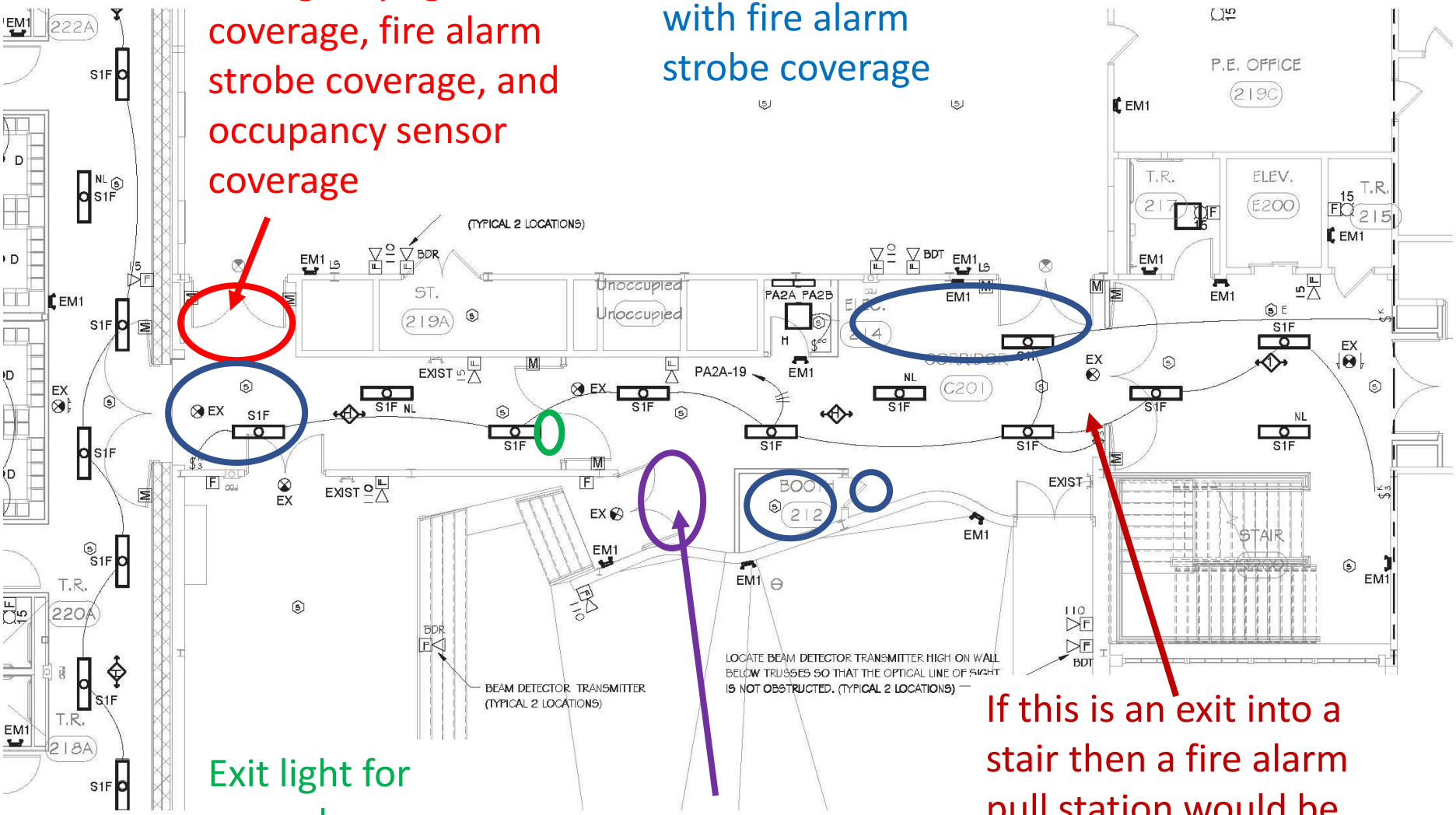
Fire alarm

- Voice/alarm communication systems in “E” occupancies.
  - Additional types of devices call for revisions to symbol lists

Fire alarm

Potential issue with emergency light coverage, fire alarm strobe coverage, and occupancy sensor coverage

Potential issue with fire alarm strobe coverage

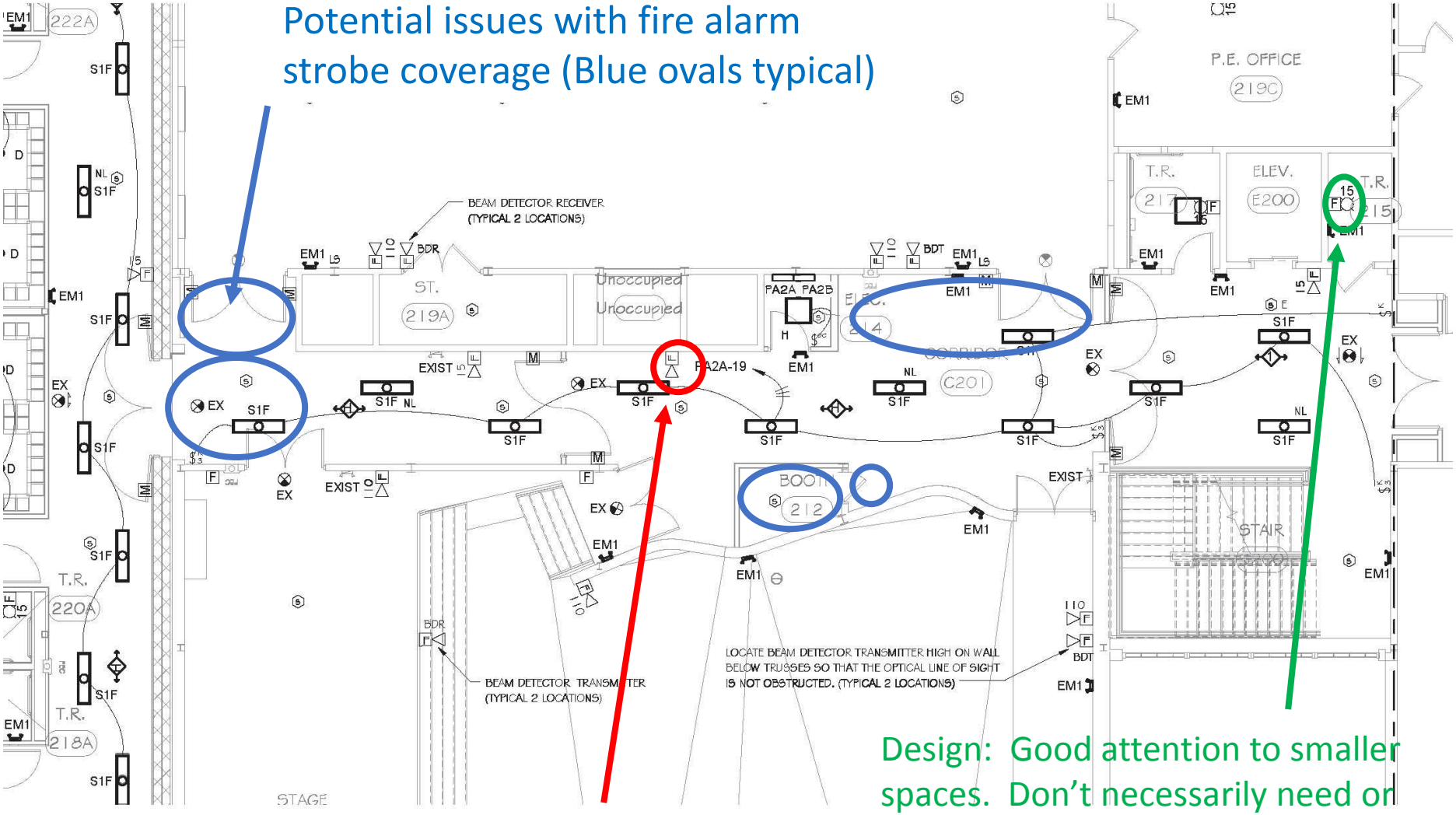


Exit light for second means of egress

Potential problem with occupancy sensor coverage.

If this is an exit into a stair then a fire alarm pull station would be required within 5 feet of door entry into stair.

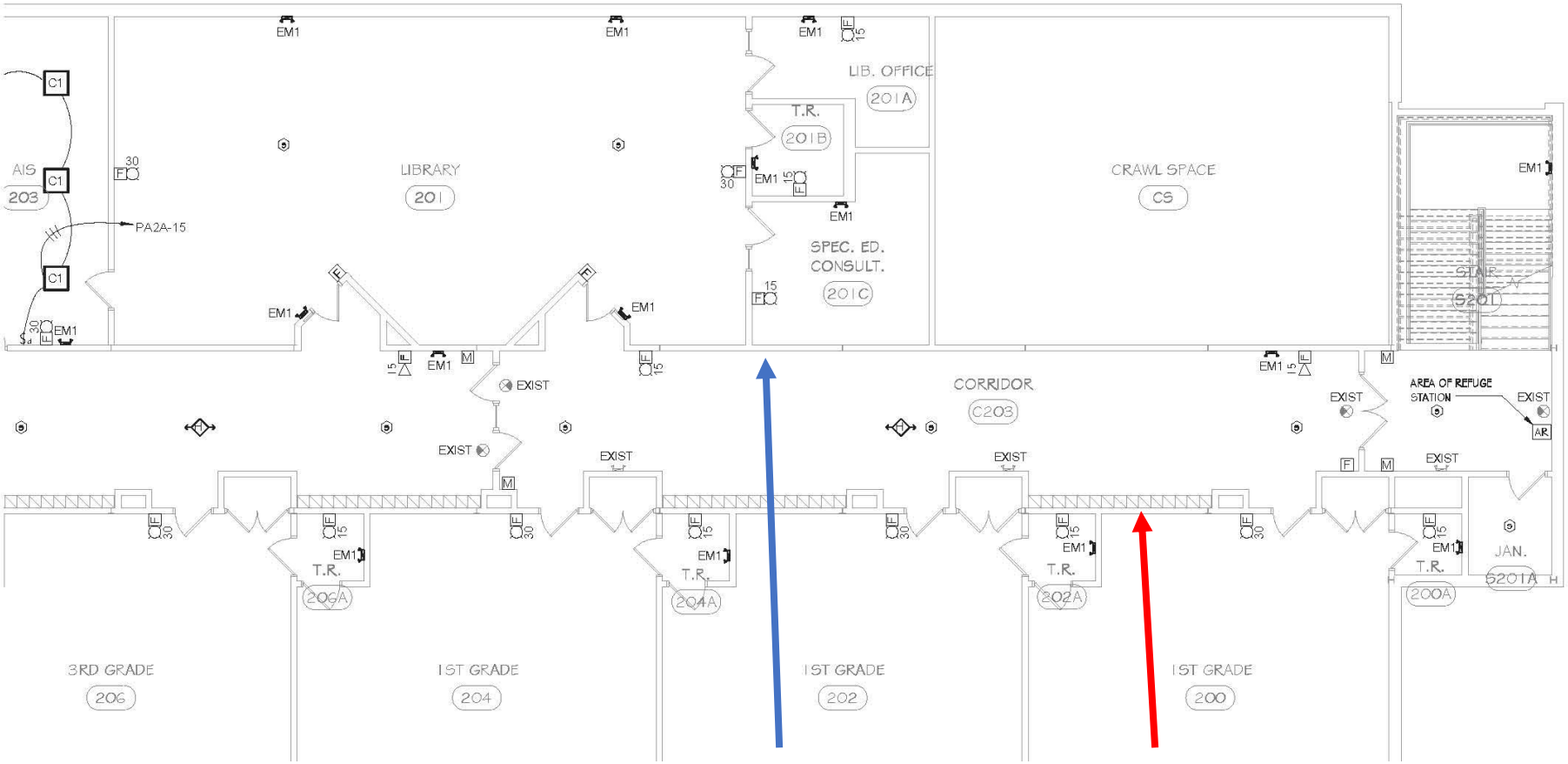
Fire alarm strobe (visible notification device) coverage



Symbol list indicates strobe without candela rating is set to 75 candela output

Design: Good attention to smaller spaces. Don't necessarily need or want 75 candela in small spaces

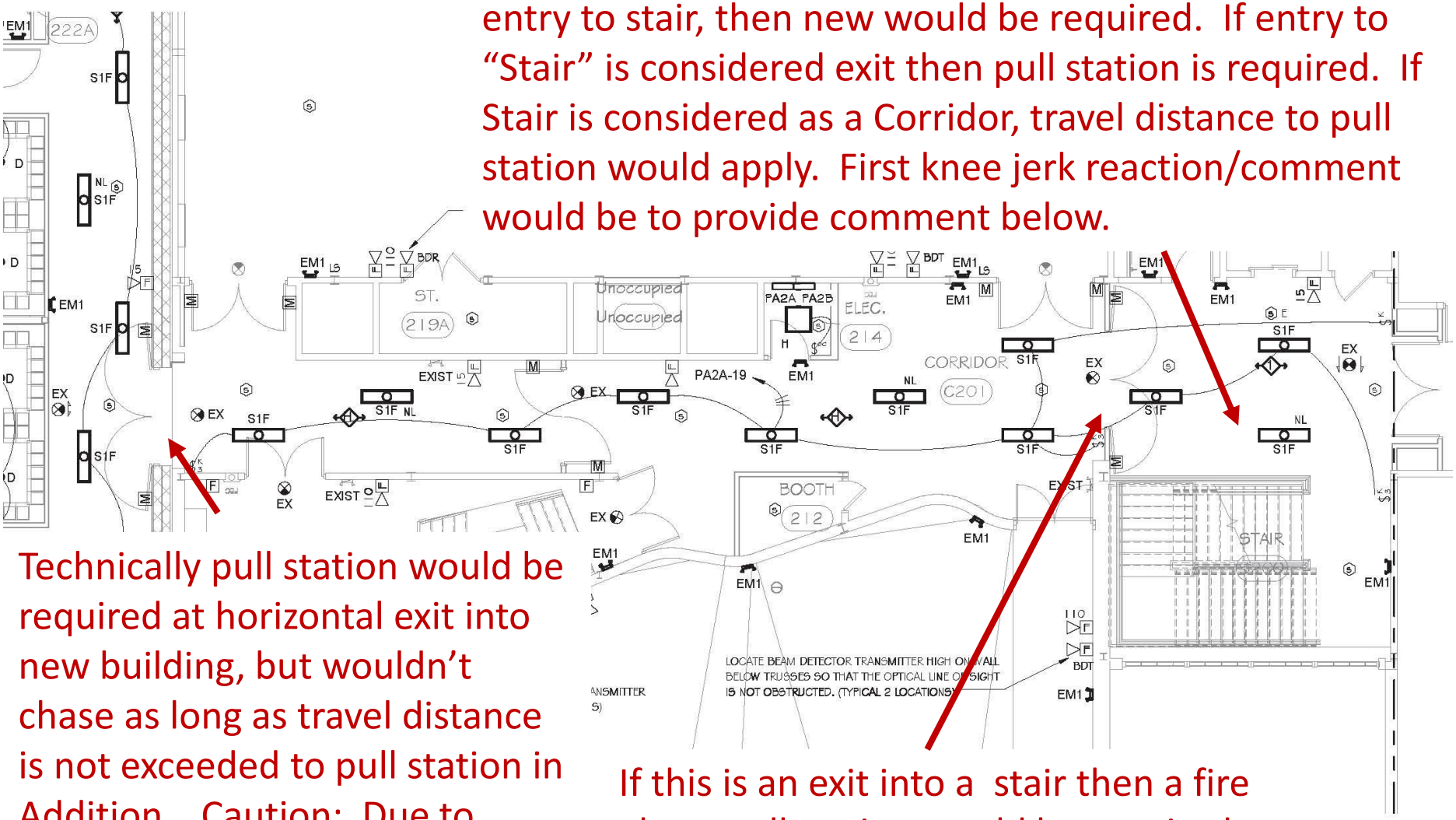
Fire alarm strobe coverage



Providing fire alarm strobes on side of corridor indicated by blue arrow pretty much will provide minimum coverage. If strobes had been located on opposite wall, indicated by red arrow, there may be a greater number of potential coverage issues.

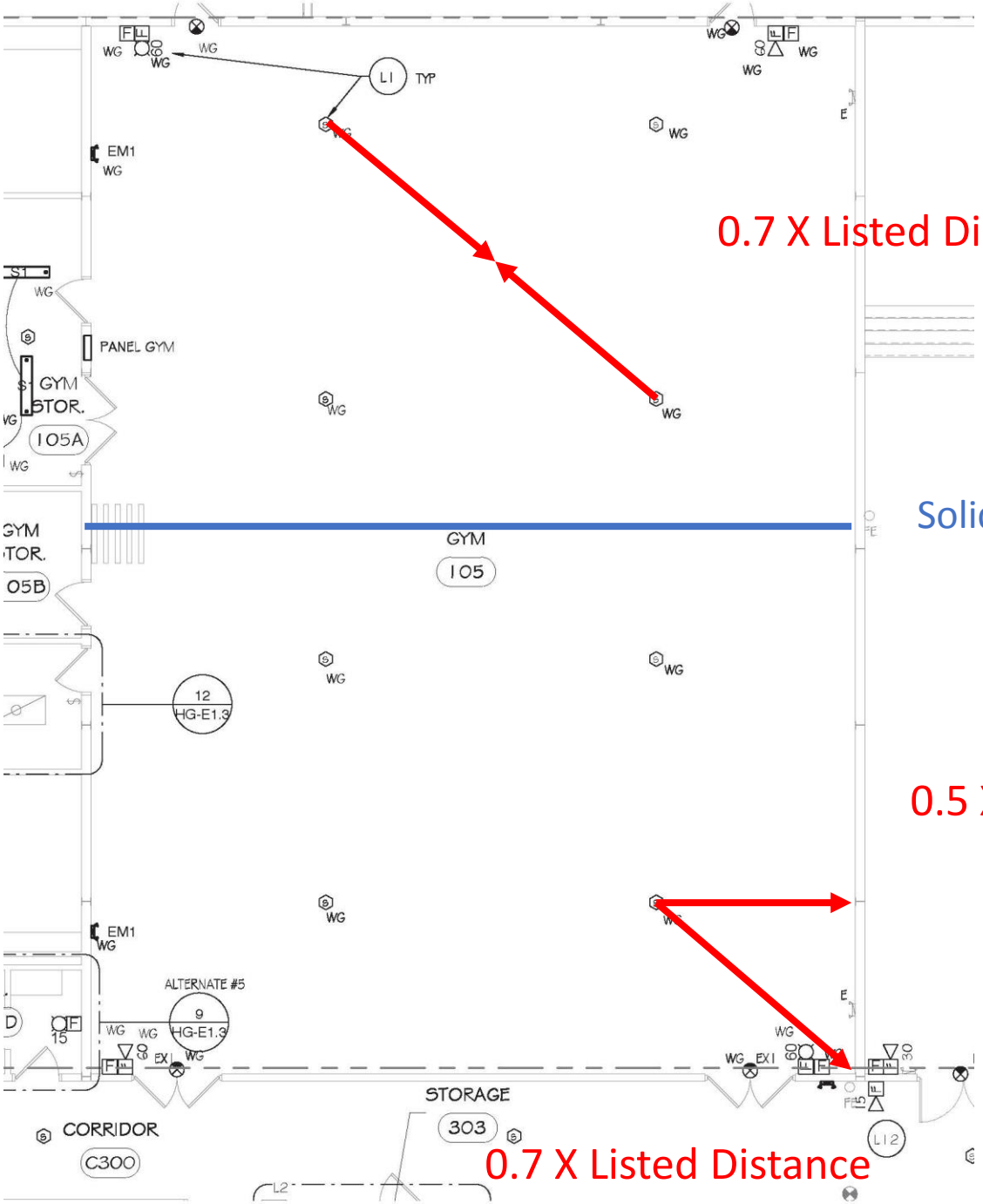
Pull station initiating devices:

Stair or Corridor: If there is an existing pull station at entry to stair, then new would be required. If entry to "Stair" is considered exit then pull station is required. If Stair is considered as a Corridor, travel distance to pull station would apply. First knee jerk reaction/comment would be to provide comment below.



Technically pull station would be required at horizontal exit into new building, but wouldn't chase as long as travel distance is not exceeded to pull station in Addition. Caution: Due to Addition, travel distance may well be exceeded.

If this is an exit into a stair then a fire alarm pull station would be required within 5 feet of door entry into stair.


L1 TYP
EM1
WG
PANEL GYM
GYM STOR.
105A
GYM
105
12
HG-E1.3
ALTERNATE #5
9
HG-E1.3
EX1
STORAGE
303
CORRIDOR
C300
L12
0.7 X Listed Distance
Solid folding partition
0.5 X Listed Distance
0.7 X Listed Distance

Other Stuff:

- Exterior Toilet Rooms/Concession Stands/Storage Buildings:
  - Local fire alarm system is required.
- Assisted listening systems – Where a sound system is provided for audience/spectators.
  - Number of receivers
  - Number of hearing aid compatible speakers

Engineering Review - Mechanical:

- General:
  - Read/Follow the Guidelines
  - Comply with provisions of Energy Code.

Creation of an environment that is conducive to learning

There are only a few things on the MEP side that help to create a living environment that is more conducive to learning:

- Thermal comfort
- Quality of Lighting
- (Control of) Noise
- Ventilation

Ventilation

Ventilation is important not only for a healthy environment, but also has been shown to be conducive to creating a better learning environment.

The results of a study by Dr. Richard Shaughnessy, et. al., was published in the "Journal of Indoor Air" (December 2006). The study showed that increased ventilation rates (within a certain range) had a positive impact on math and reading test scores of students. See Office of Facilities Planning Newsletter 105.
http://www.p12.nysed.gov/facplan/Newsletter/Newsletter_105a.htm

Ventilation

Newly installed ventilation systems don't always meet minimum requirements of Code. Design must meet minimum.

- The results of a study by Stuart Batterman, et. al., was published in the "Indoor Air" (August 2016). Paper is entitled "Ventilation Rates in Recently Constructed US School Classrooms"
  - Findings indicate ventilation rates did not meet (Code) requirements in nearly all classrooms. Ventilation rates were lower in schools that used unit ventilators.

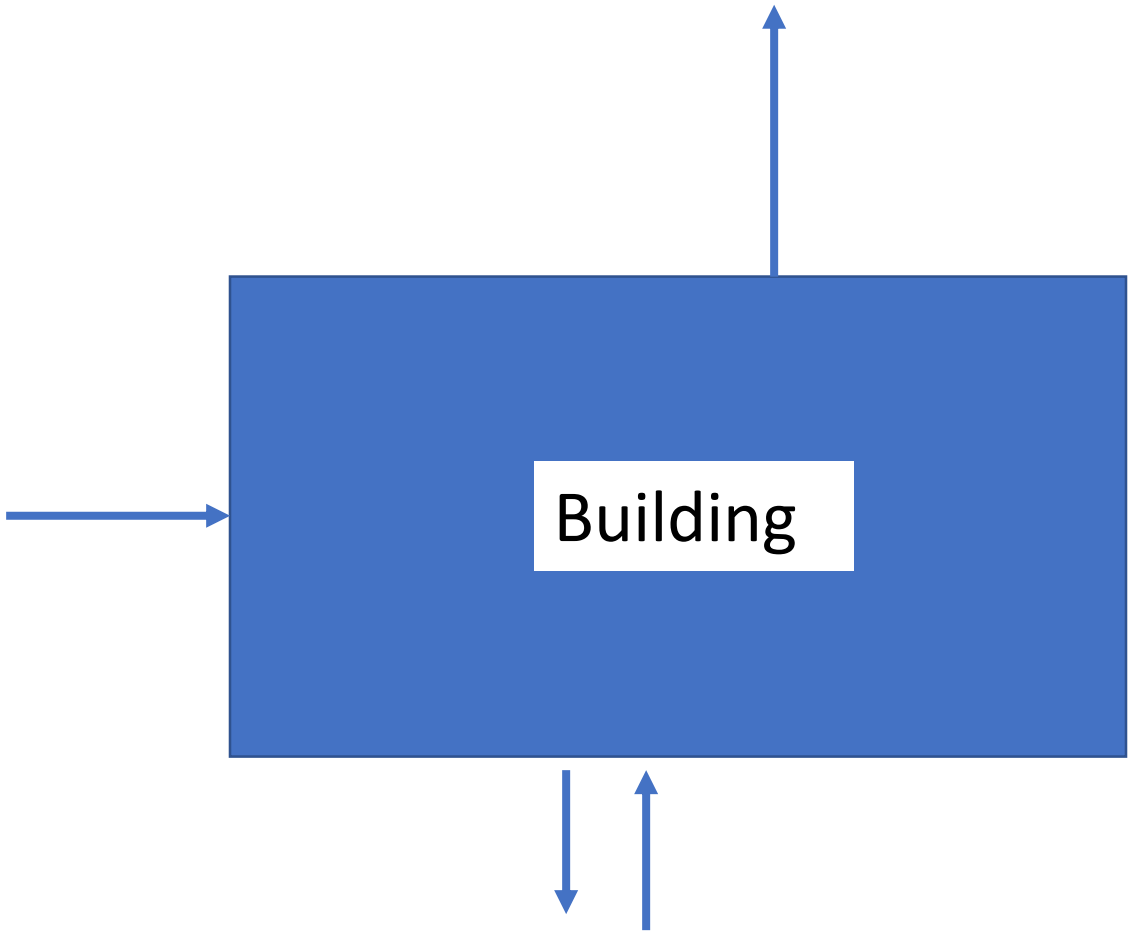
- Other paper on NYS Schools indicate NYS better.

Ventilation

Read/Follow the Guidelines

Mass Balance:

Volumetric flow rate of air out of building from controlled sources

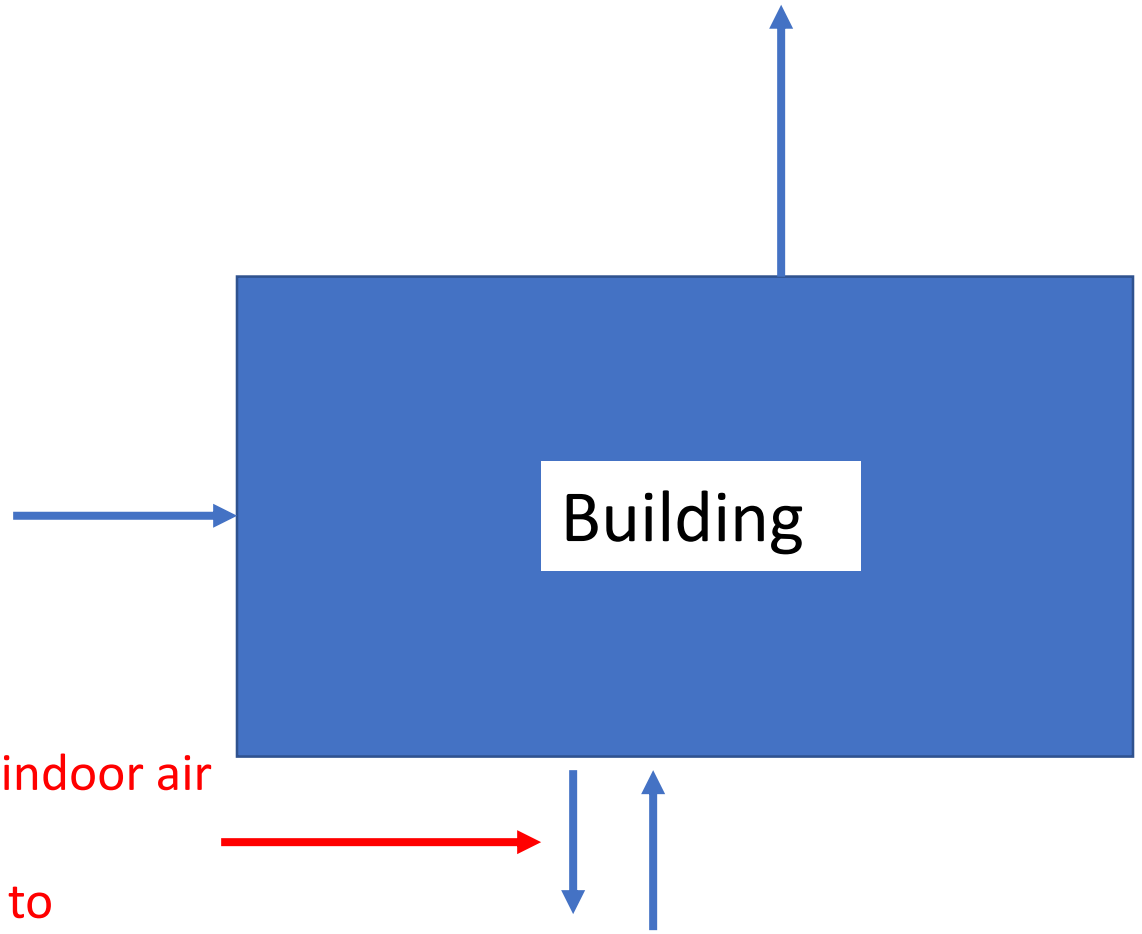


Volumetric flow rate of air into building from controlled sources

Volumetric flow rate of air into and/or out of building from uncontrolled sources

Mass Balance:

Volumetric flow rate of air out of building from controlled sources



Volumetric flow rate of air into building from controlled sources

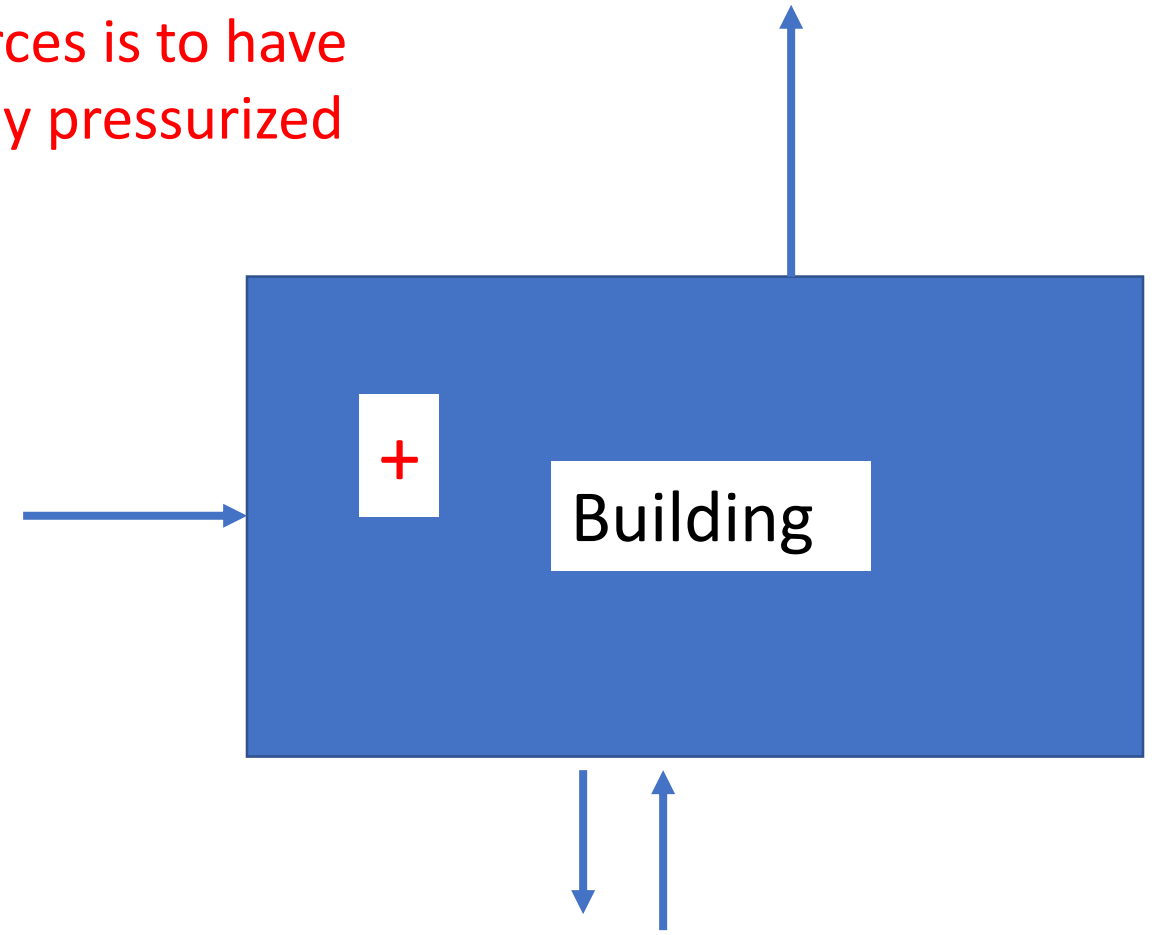
For thermal comfort, indoor air quality, and energy consumption, ideal is to minimize flow in/out from uncontrolled sources.

Volumetric flow rate of air into and/or out of building from uncontrolled sources

Ideal for building with respect to reducing potential indoor air quality problems from uncontrolled sources is to have a slightly positively pressurized building overall.

Volumetric flow rate of air out of building from controlled sources

Volumetric flow rate of air into building from controlled sources



Radon

Volumetric flow rate of air into and/or out of building from uncontrolled sources

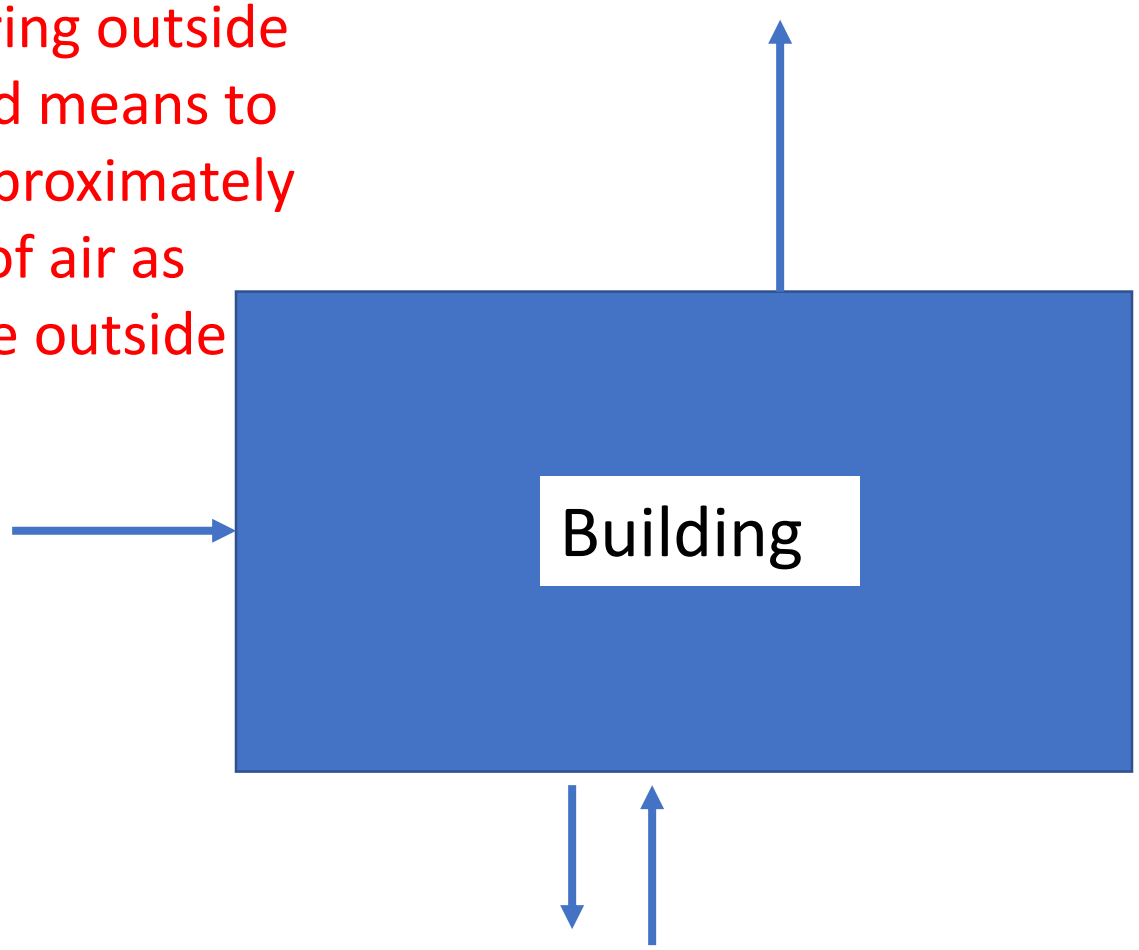
Existing buildings could have been designed (and even new buildings could be designed) to be either slightly positive or slightly negative.

Portions of buildings are designed to be either more positive or more negative with regards to other spaces in the building. Examples: Locker Rooms more negative. Corridors more positive.

Existing buildings could have been designed (and even new buildings could be designed) to be either slightly positive or slightly negative.

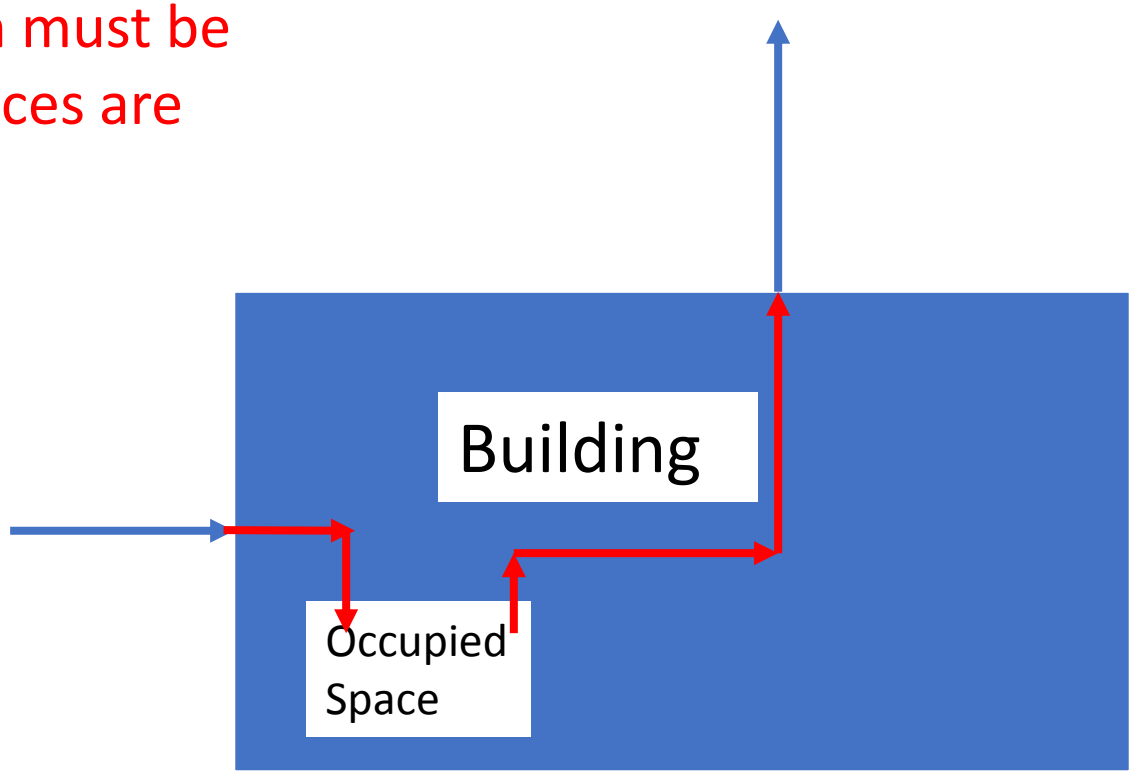
Designs for existing buildings may not make Corridors more negative than the original design.
Smoke control issue.

Designs for ventilation systems must incorporate a controlled means to bring outside air into every space, requiring outside air, and a controlled means to relieve/exhaust approximately the same amount of air as brought in from the outside

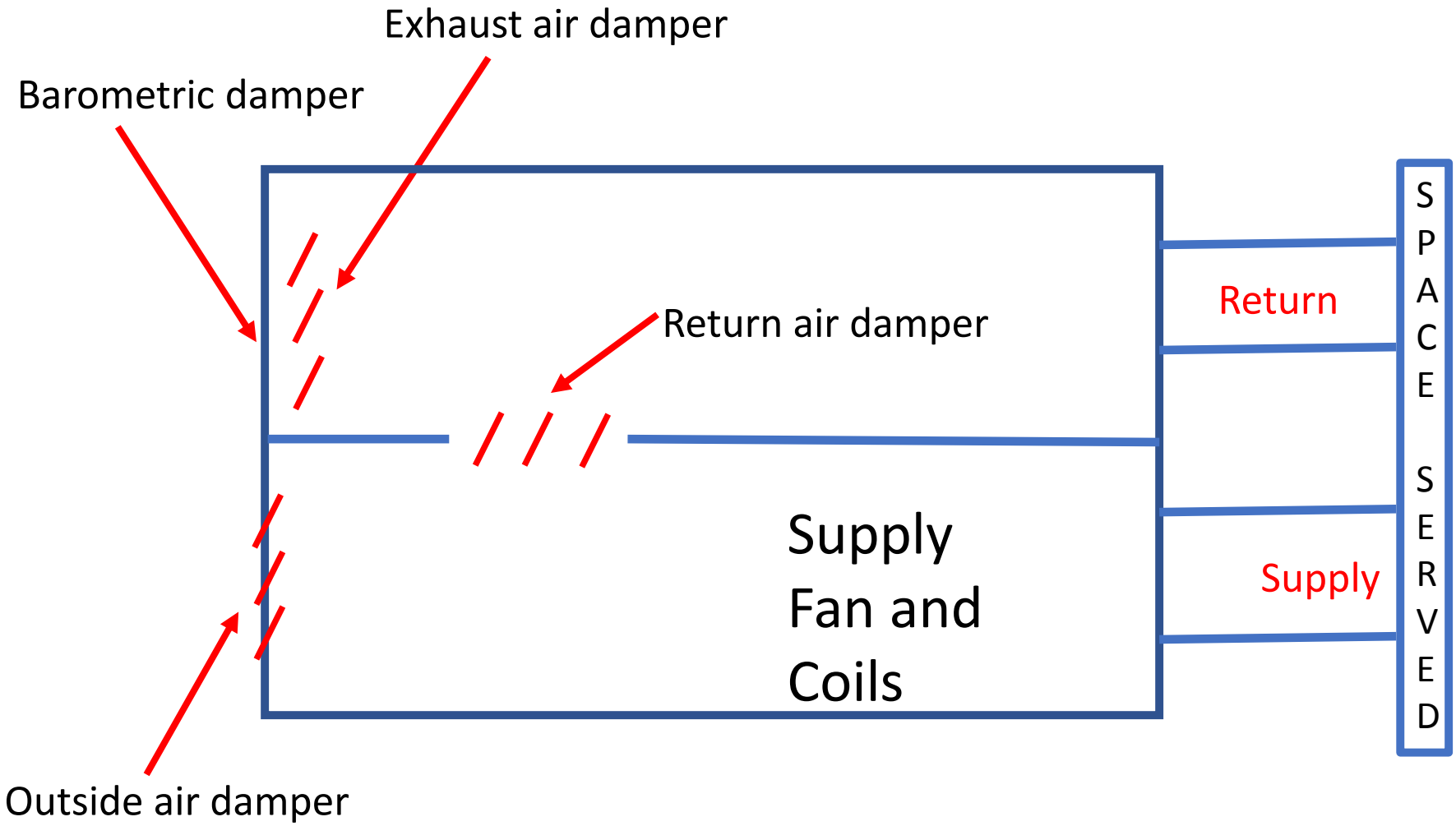


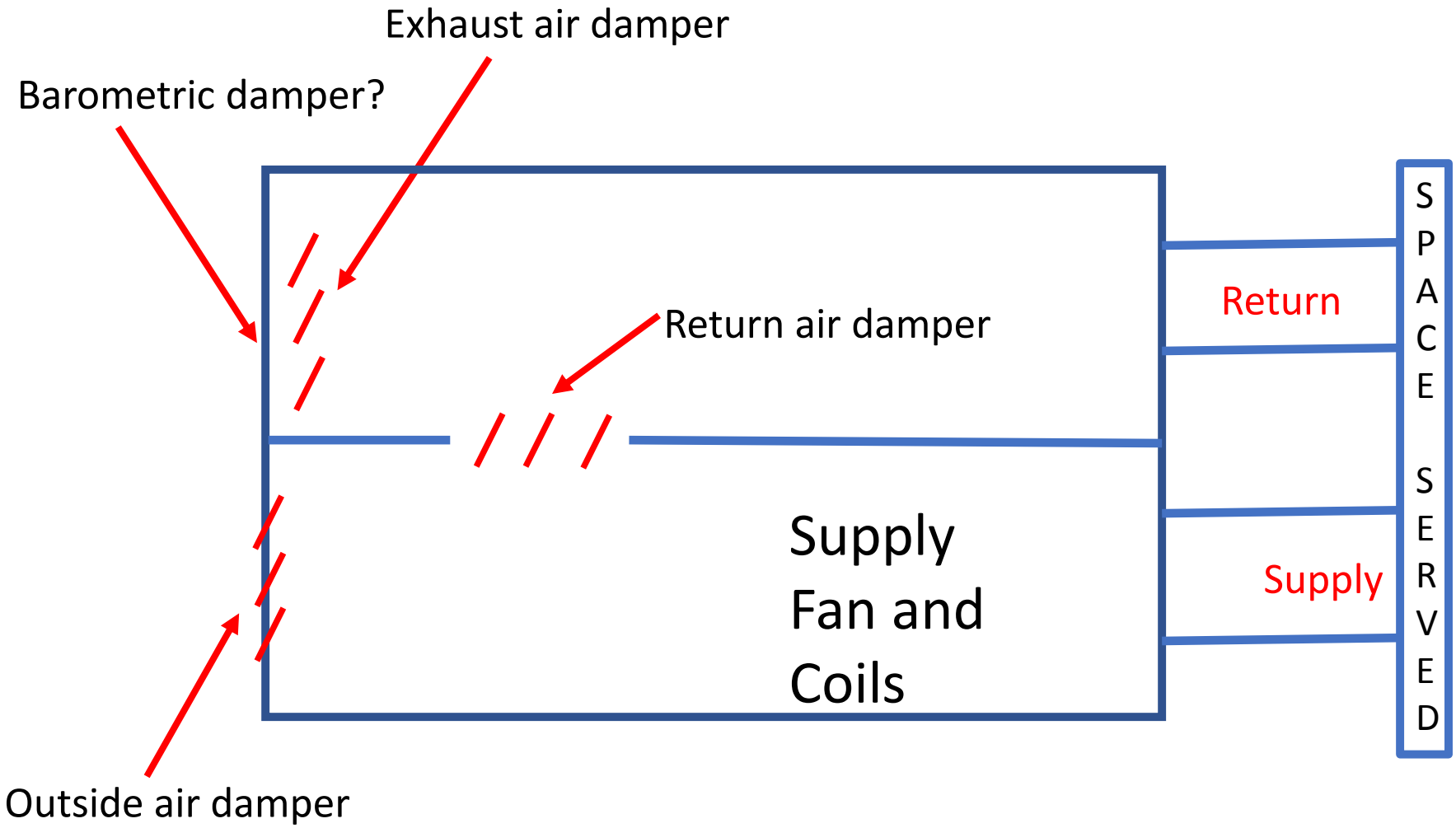
There must be an operable path to bring outside air into and relieve air from all occupied spaces. Ventilation must be provided when spaces are occupied.

Volumetric flow rate of air out of building from controlled sources

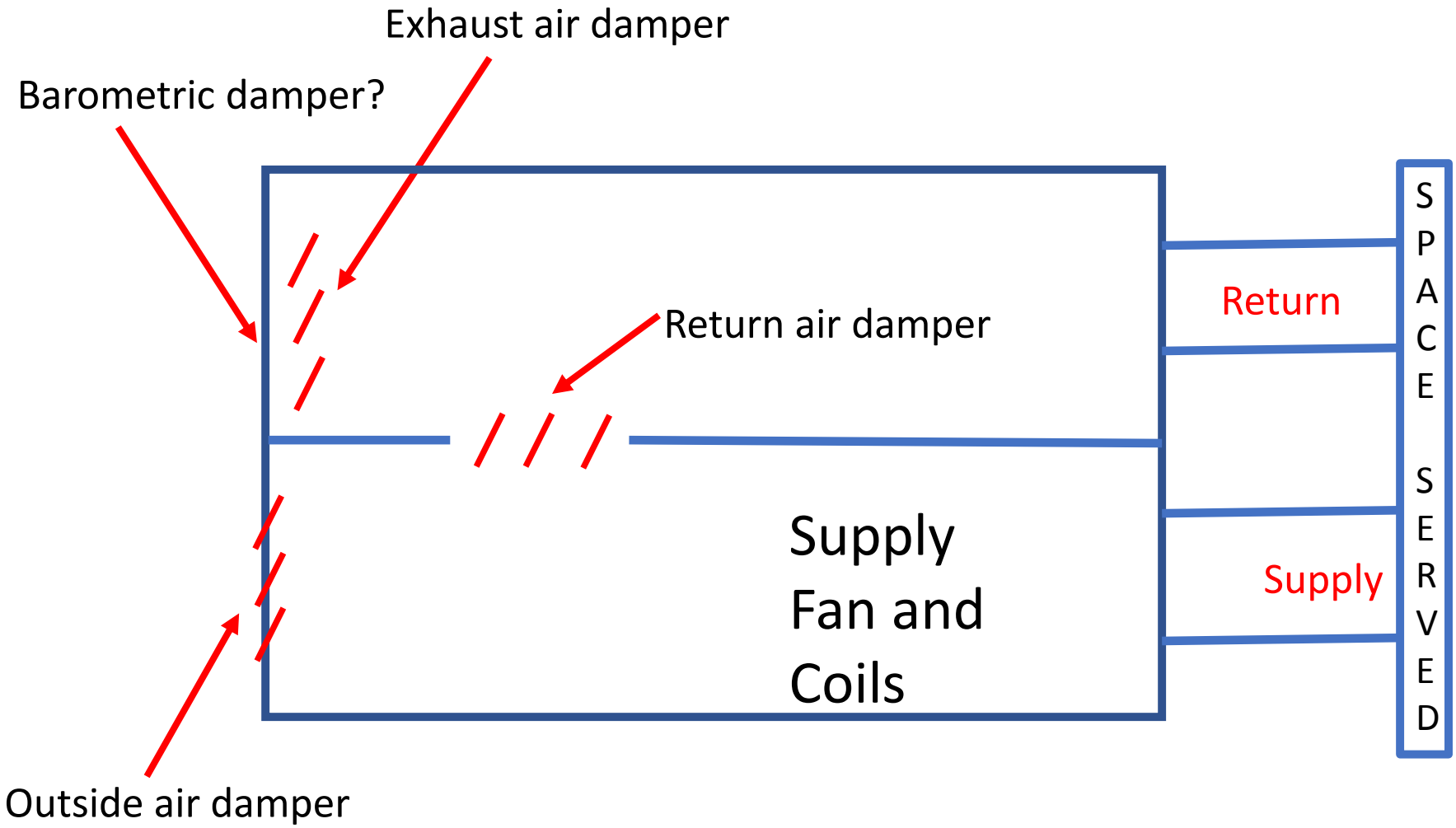


Volumetric flow rate of air into building from controlled sources

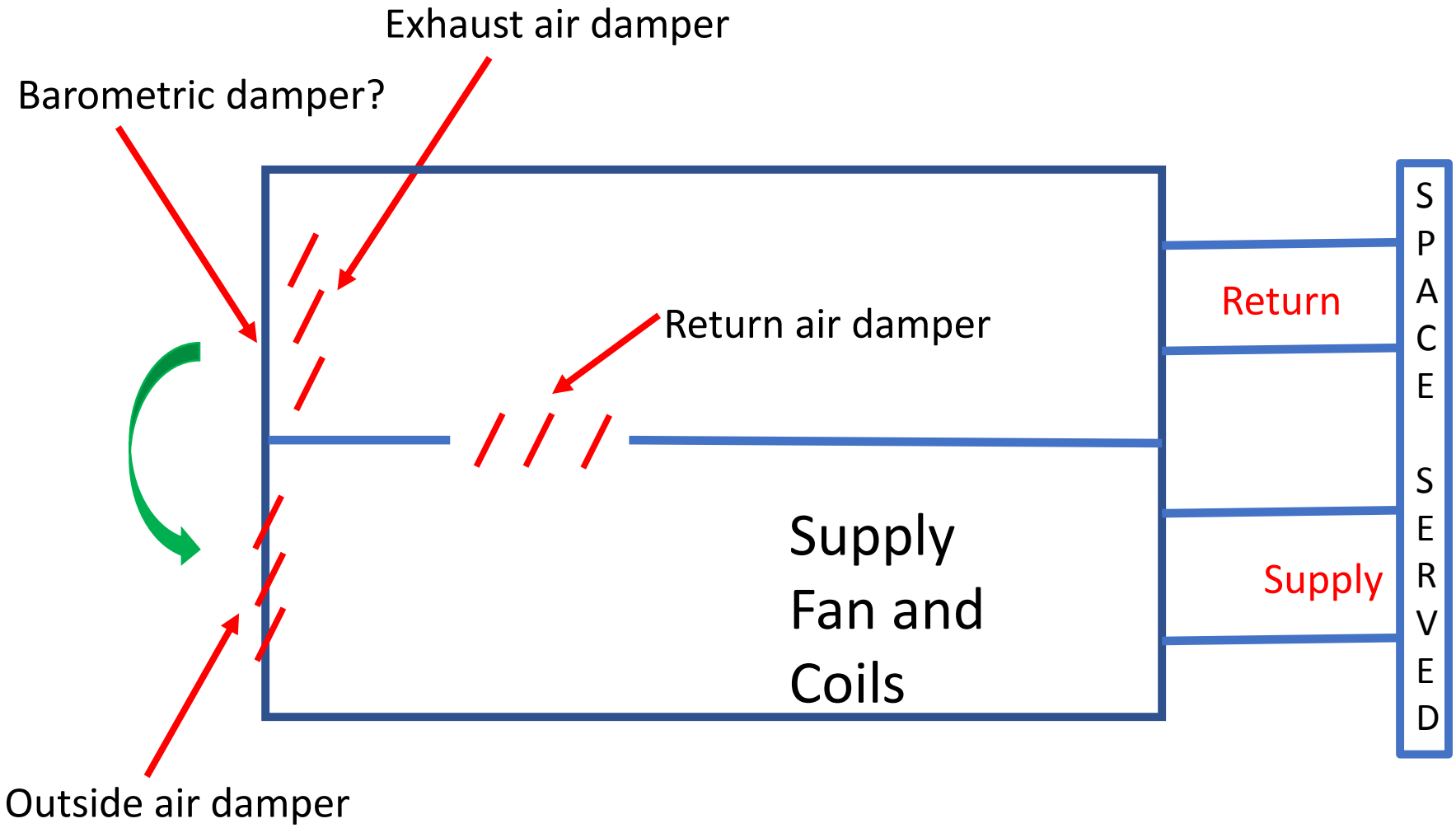

Exhaust air damper
Barometric damper
Return air damper
Supply
Fan and
Coils
Return
Supply
SPACE SERVED
Outside air damper



What is the driving force for relief at this AHU?



Can a space be maintained positive enough and the return air damper choked off enough to open a barometric damper. Assuming outside air and exhaust air dampers are open.



If the point of exhaust is located in close proximity to point of air intake, what fraction of the air entering the unit through the outside air intake is is composed of relief/exhaust air from the unit.

Ventilation

Whole Building Approach:

- Existing buildings –Reductions (or increases) in ventilation air, based upon Current Code. If existing air handling unit is replaced (or modified), and relief/exhaust is provided at a separate location, the relief/exhaust must be modified to ensure the changes do not make the corridors more negative than the original design.
  - This is a particular problem with AHU's intended to supply varying ventilation rates. Varying outside air intakes, requires varying relief/exhaust.

Ventilation

General Exhaust:

- Indoor air quality: Remove air from spaces at the source.

- Science Labs/Shops/Art Rooms/Dressing Rooms/Sports Locker Rooms/Toilet rooms/Chemical Storage Rooms/ Others (Removal of heat/odors)

    - Makeup air required: Makeup may not be provided from corridors for Labs/Shops/Art Rooms/Chemical Storage Rooms associated with Labs.

General Exhaust

Labs:

- All spaces with provisions, either permanent or portable, to allow students to apply heat to any material will be considered a Lab. (Example: Student stations with turrets supplying natural gas)

- Program areas: High School Level Chemistry, Biology, (Physics?),

  - Shared spaces: Spaces that do not meet the exhaust requirements would not be acceptable to be used for High School Chemistry, Biology, program uses.

General Exhaust

Art Rooms:

- Art Rooms utilized by students in Grade Levels greater than 5th Grade will require exhaust in accordance with Mechanical Code.

Ventilation

Local Exhaust:

- Indoor air quality: Remove sources. Remove air from the space at the source.

- Home and Career Program uses. Local exhaust at equipment sufficient to remove products of combustion, heat, and odors. Exhaust required to remove products of combustion may be determined in accordance with Fuel Gas Code.

Ventilation

Indoor air quality:

- Independent air handling systems for spaces with program use where air quality in the spaces may be worse than general classrooms.

Ventilation - Calculations

Calculations in accordance with Mechanical Code:

Replacement of existing equipment (serving areas with same program use)– Ventilation rates may be the lesser of:

- Rate determined by Current Code

- Rate determined by original design as long as design complied with (most strict) Codes/Standards at that time.
  - Exception: Those ventilation systems that were designed to shut off ventilation air, at an air temperature greater than design day conditions.

Ventilation -Calculations

Replacement of existing ventilation equipment

- Rate determined by Current Code - Whole Building Approach:
  - Designs must not make conditions worse in other spaces of the building.
  - Designs must take into account entire ventilation system of spaces served by replacement equipment

Ventilation - Calculations

Replacement of existing ventilation equipment

- Rate determined by original design as long as design complied with (most strict) Codes/Standards at that time.

- If this ventilation rate is less than what is acceptable under current Code, then the sequence of operations can not be modified to reduce ventilation provided to the spaces served.
  - Exception: Those ventilation systems that were designed to shut off ventilation air, at an air temperature greater than design day conditions. These must be brought up to current Code

Ventilation - Calculations

- Ventilation calculations must be provided where ventilation is to be provided under current Code.

- Ventilation in accordance with codes/standards at time of original design may need to be justified.

Ventilation – Calculations

Occupancy Classifications

- Stages/Platforms are “Stages, studios”
- Libraries in Schools are “Media Centers”
- Cafeterias are “Cafeteria, fast food”
- Gyms are “Gym …(play area)” (and “Spectator areas”)
- Vocal and Band Rooms are “Music/theater/dance”
- OT/PT are “Classrooms”

Ventilation – Calculations – Occupant Density

Classrooms:

- Past practice: For many years we have gone with an occupant load based upon the greater of:
  - The number of work stations shown in the design documents.
  - 30 occupants in a general classroom. General classroom size in the 770 square feet to 1000 square feet range. Occupant loads in General Classrooms less than 770 square feet were based on 40 occupants per thousand. Classrooms greater than 1000 square feet were 50 occupants per thousand.

Ventilation – Calculations – Occupant Density

General classroom size in the 770 square feet to 1000 square feet range. – All Ages:

- Current: Occupant load based upon the greater of:
  - The number of work stations shown in the design documents.
  - 30 occupants (as per past practice) or 35 occupants per thousand square feet.
    - Note: It will not be acceptable to mix and match occupant densities. (Say calculations, based upon 30 occupants in a 950 square foot space, and 35/1000 in a 770 sqft space.)

Ventilation – Calculations – Occupant Density

General classroom size less than 770 square feet – All Ages:

- Current: Occupant load based upon the greater of:
  - The number of work stations shown in the design documents.
  - 35 occupants per thousand square feet.

Ventilation – Calculations – Occupant Density

Classroom size greater than 1000 square feet – All Ages:

- Dependent upon program use:
  - Lecture Classroom: 65 occupants per thousand square feet.

Ventilation – Calculations – Occupant Density

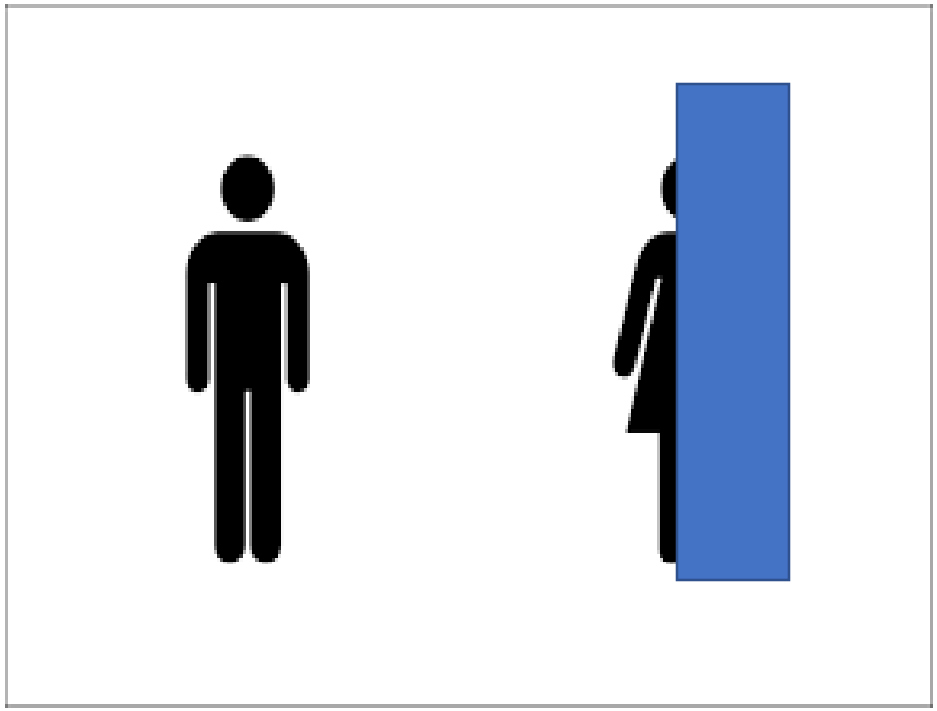
Vocal Rooms – Band Rooms:

Use outdoor air flow rates and area flow rates for Music/theater/dance. Do not use occupant density for Music/theater/dance.

- Occupant load based upon the greater of:
  - The number of work stations shown in the design documents.
  - Maximum occupant load shown on Code Compliance Drawing(s).
  - (If neither is indicated use “Stage, studio”)

Ventilation – Calculations – Rounding Occupants

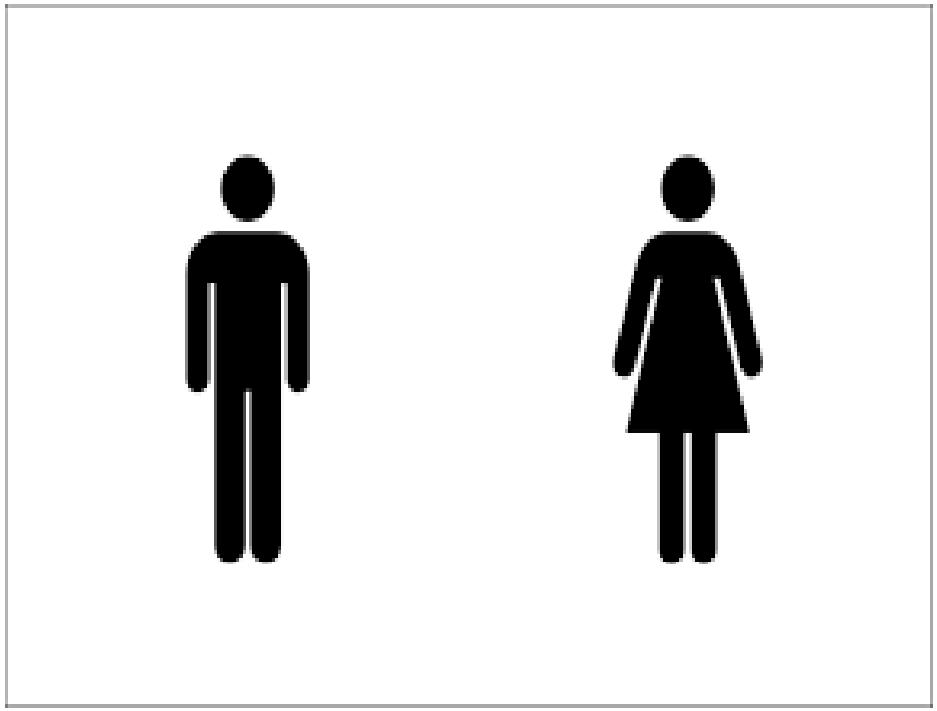
No partial occupants. Always Round up.



Calculated = 1.4 occupants

Ventilation – Calculations – Rounding Occupants

No partial occupants. Always Round up.



Occupant Load for ventilation = 2 occupants

Ventilation – Calculations – Corridors

Corridors: Maintained positive with respect to all other spaces – Smoke Control

Outside air delivered to corridors must be greater of:

- Outside air greater than required to satisfy the makeup air requirements of spaces pulling off corridors.
- Outside air based upon area rate in Mechanical Code.
- Corridors are not part of the supply, return or relief/exhaust systems serving other spaces.
  - Exception: Makeup air as allowed by Code

Ventilation – Calculations

Zone Air Distribution Effectiveness:

Generally – Heating – Overhead supply with return or separate relief/exhaust in space that is not located below the breathing zone – Factor of 0.8 is applicable.

- Factor of 0.8 applies to returns, or separate relief/exhaust that are located overhead, and those that may be at some elevation down to 3 inches above the floor.

- Conservative approach. Until such time as testing is performed to demonstrate different value is applicable.

Ventilation – Calculations

Zone Air Distribution Effectiveness:

Vertical Unit ventilators: Use factor of 0.9

- Until such time as testing is performed to demonstrate different value is applicable.

- The results of a study by Stuart Batterman, et. al., was published in the "Indoor Air" (August 2016). Paper is entitled "Ventilation Rates in Recently Constructed US School Classrooms"
  - Findings indicate ventilation rates did not meet (Code) requirements in nearly all classrooms. Ventilation rates were lower in schools that used unit ventilators.

Ventilation – Calculations

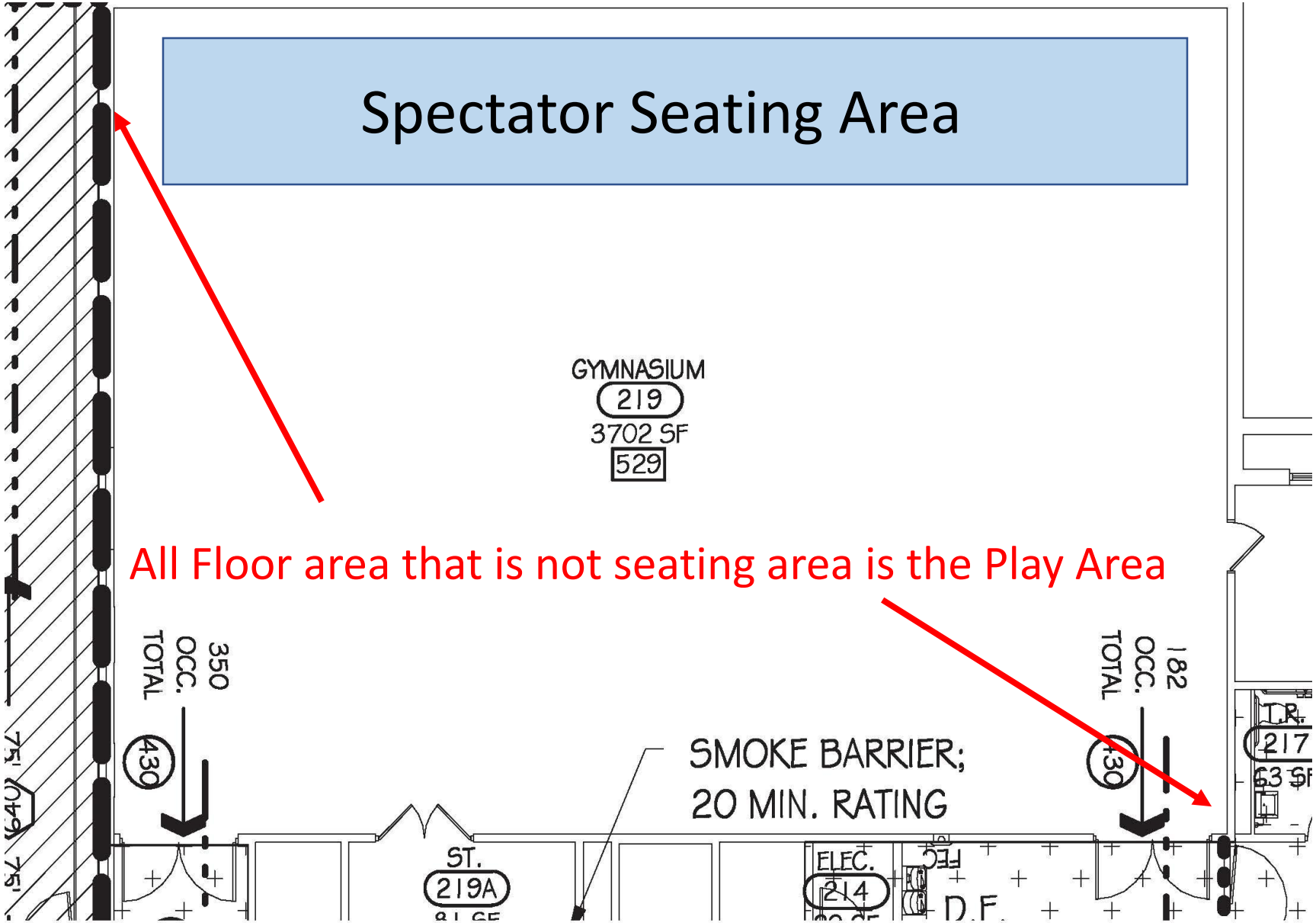
Single Zone versus Multiple Zones:

Single space served by one or more AHU's is a single zone. Regardless of how the breathing zone outdoor airflow was determined.

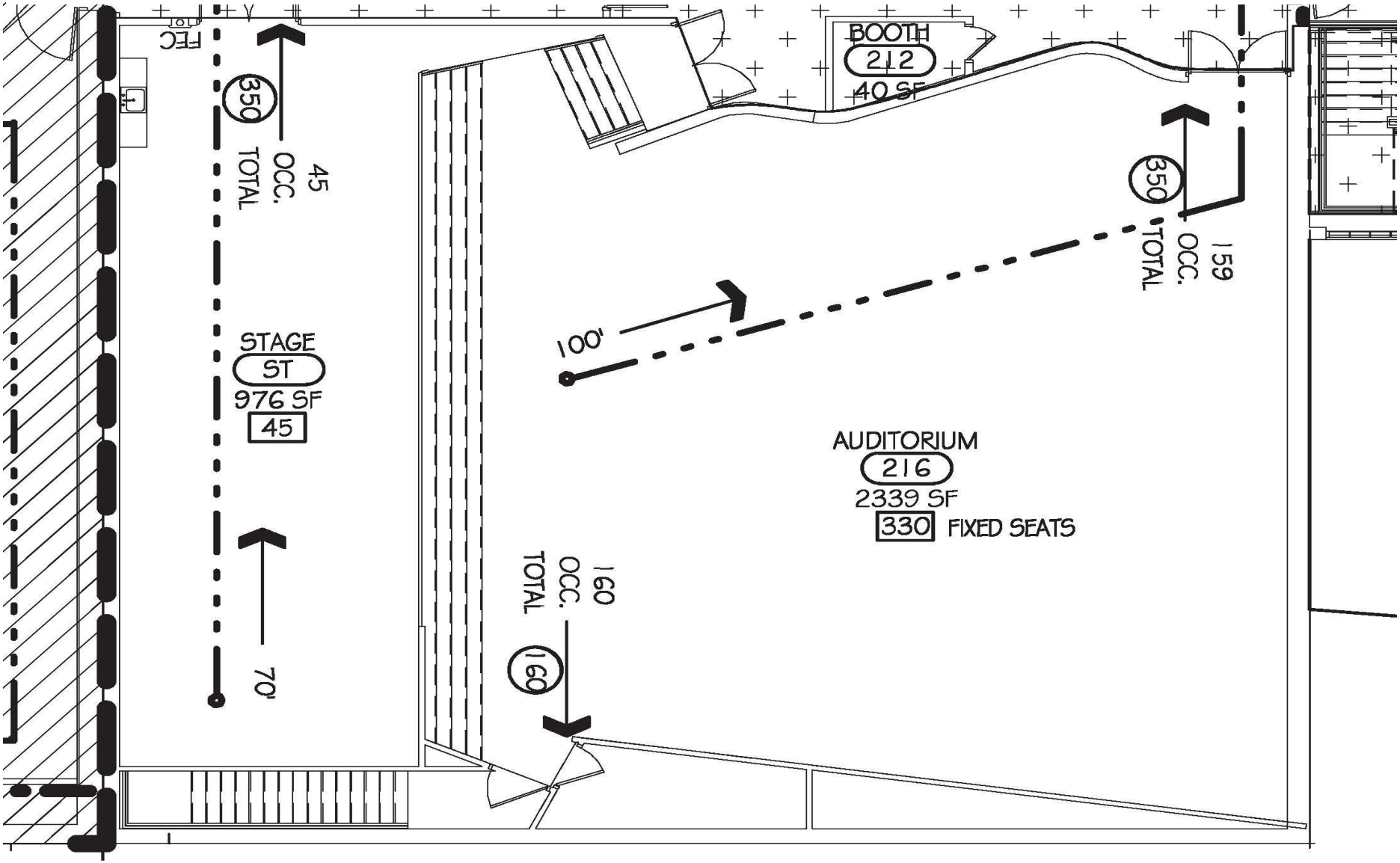
Examples:

- Gym with spectator seating
- Auditorium and Stage.

The Gym is **one zone** containing two different occupancy classifications



The Auditorium/Stage is **one zone** containing two different occupancy classifications



Ventilation – Calcs – Exhaust :

- For those spaces requiring exhaust – Provide makeup air/replacement air in calculations, and provide source(s).
  - Corridors: Ventilation air to corridors is typically driven by the makeup air requirements of spaces pulling off the corridor. The relationship between makeup air pulled off corridors must be provided in the ventilation air calculations. Doors in corridors have an impact on the ability to supply sufficient makeup air to spaces pulling off the corridors.

- Science labs/art rooms. Identify sources of makeup air for the required exhaust.

Ventilation – Calcs – CO2 Concentration Setpoint:

- Calculations for CO2 control setpoints must be calculated for each and every space where used. Use ASHRAE 62.1 (2007) or (2010) Appendix C, or use values from a table. Ventilation requirements for the whole space at the maximum occupant load must be calculated. (This includes area component.) This value is divided by the maximum occupant load to determine ventilation rate per person for CO2 calculation.

- Metabolic rate: In the past we have used CO2 concentration setpoints based upon a metabolic activity rate of 1.2 met units for all spaces. This will continue.

Ventilation –CO2 – Base Ventilation Rate

Base (minimum) ventilation rate:

- When DCV using CO_2 sensors is utilized, a base (minimum) ventilation rate must be provided, during all occupied times, regardless of whether the space is occupied, or not. The base ventilation rate may be different for all spaces to receive this type of DCV.
- Minimum (base) ventilation rate provided to a space will be the greater of 20% of the outside air required for the maximum occupant load, outside air required to satisfy the makeup air requirements for other spaces, or the outside air required to satisfy the building component of the ventilation air, whichever is greater.

Ventilation –CO2 – Multiple Spaces and VAV

Variable air volume (VAV) terminal devices and CO2 for DCV:

- It becomes difficult to design a successful system using variable air volume (VAV) terminal devices and CO2 for DCV.
  - When using CO2 sensors in a space with a large occupant load, they can't rely on the excess air from other spaces to keep CO2 concentration in the congested space from creating problems.
  - Some spaces must maintain a constant volumetric flow rate of makeup air/outside air. (Corridors – Toilet rooms)

Ventilation

Sequence of Operations- Occupied times:

- It must be clear that all fan motors modulate to speeds, and all dampers modulate to positions to provide at least the minimum, required, volumetric flow rate of outside air (ventilation) during occupied times.
  - A sequence that just includes operation of an outside air damper will not be acceptable.
  - Sequences that appear to incorporate blockage to the ventilation path will not be acceptable. (Relief/exhaust fans that do not run. Relief/exhaust dampers that do not open.)

Opening Protectives:

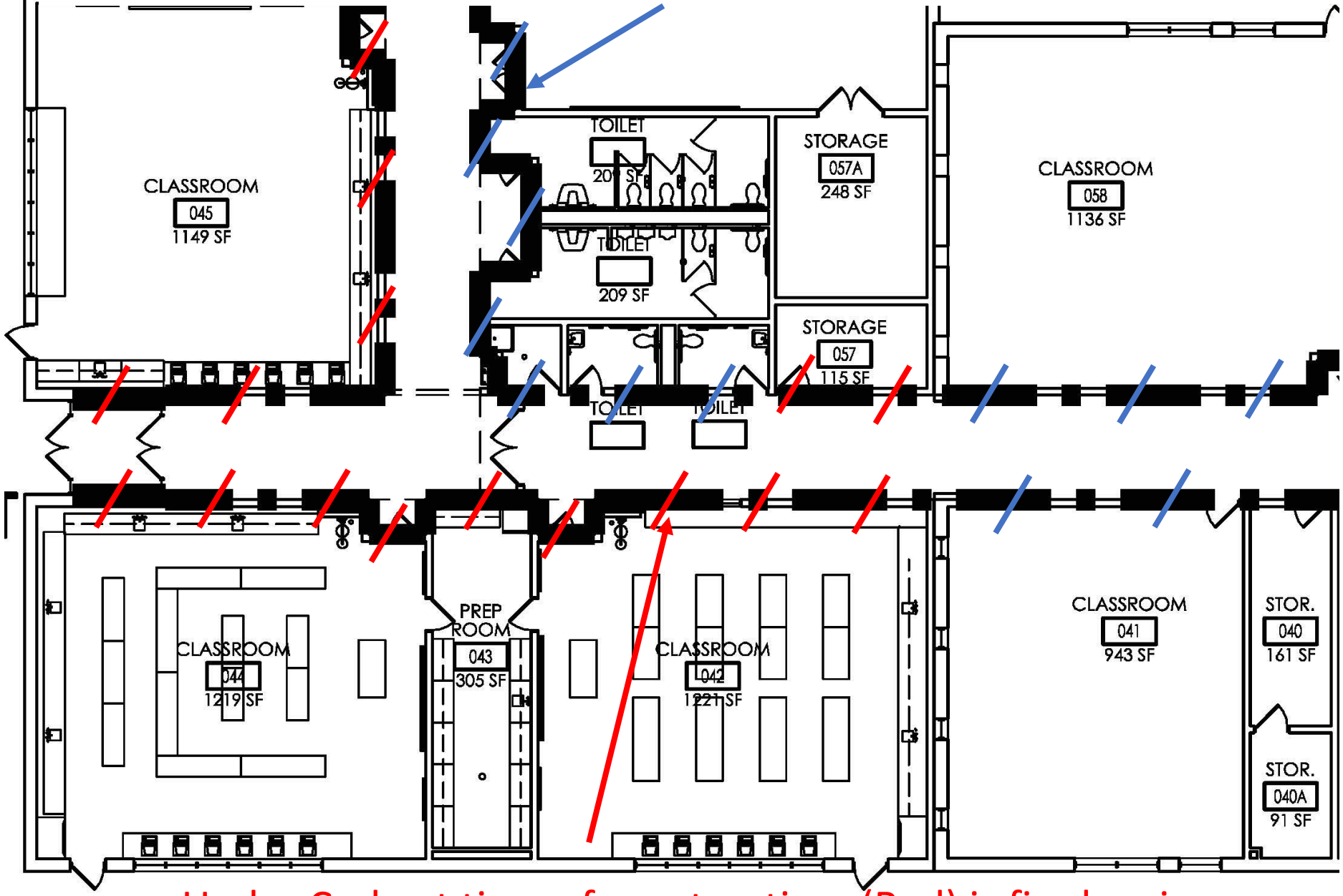
Read/follow the Guidelines. See Architect portion of presentation for control of smoke in corridors

Common problem areas:

- Fire Barriers: There are no outs for fire dampers in fire barriers. Wall between Lab/Shop/Storage room and Corridor is a fire barrier not a fire partition.

- Exceptions for Fire dampers in Corridor walls (fire partitions) where building is not sprinkled: All provisions of exception must be met to allow exception.

Under Code at time of construction, (Blue) is fire partition



Under Code at time of construction, (Red) is fire barrier.

Opening Protectives:

Read/follow the Guidelines. See Architect portion of presentation for control of smoke in corridors

Common problem areas:

- Smoke control of corridors: Corridors with door closers must be protected from the passage of smoke from all adjacent spaces, including separate sections of corridors that are separated by smoke/fire doors.

- Creation of security vestibules: Exceptions for Fire dampers in Corridor walls (fire partitions) where building is not sprinkled: All provisions of exception must be met to allow exception.

Opening Protectives:

Common problem areas:

- Non-rated floor opening protectives

Boilers:

Read/follow the Guidelines.

- One of common reasons for fires in boiler rooms.
  - Dry – Hot. Problem with boiler feed water, low water sensors/cutoffs. We require two low water cutoffs. One with manual reset.
- Whole building approach: Comply with Code when removing, adding, or replacing appliances tied into an existing vent/chimney. Both Mechanical Code and Fuel Gas Code have provisions for existing chimneys/vents.

New Carbon Monoxide Sources:

New Sources include new fuel fired furnaces (Gas fired RTU's), new fuel fired equipment, gas outlets for student and/or teacher use.

Ask/look for compliance with Fire Code.

Other Stuff:

- Dust Collectors: 10 feet from combustible construction and openings into the building.

Engineering Review – Plumbing – Fuel Gas:

- General:
  - Read/Follow the Guidelines
  - Comply with provisions of Energy Code.

Plumbing - Lead in Potable water:

- In Code and Federal Law (Amendment to Safe Drinking Water Act): "Lead free" materials.

- Designs to include provision for (acceptance) testing of water outlets (potentially) used for drinking and cooking purposes. New/replacement water outlets must be demonstrated to not exceed the action level prior to first use. Installations tested in accordance with "Initial first-draw sampling" as identified in NYS Department of Health "Lead in water regulation (10NYCRR 67-4). Installation accepted if sample result does not exceed the "Action level" indicated in regulation. They will be sampling in 2020. Minimize surprises.

Plumbing – Issues that have been popping up:

- Fire suppression systems associated with (dust collector) ducts. Use of “Limited area sprinkler systems”
  - Use of wet automatic standpipe system required if available. Typically not available.
  - If not available, use of domestic water system is acceptable, if the system is capable of simultaneously providing both domestic and sprinkler demands,
  - Control valves or lack thereof. No valves, or supervised valves, secured open.
  - Hydraulic calculations provided to demonstrate waterflow and pressure will be sufficient to provide all demands.

Plumbing – Issues that have been popping up:

- Water coolers
  - Reasonable accommodation must be provided – wheelchair and standard heights.
- Urinal partitions and spacing
- Floor drains and trap seals
- Roof drains – secondary drainage system

Fuel Gas – Above-Ground LPG Tanks:

Distance separations in accordance with Code. (Fire Code)

- "Special hazards": Separation distances between LPG and: above-ground tanks containing flammable/combustible liquids; flooding; electric power lines. Fire Code sends specifically to NFPA 58.

Engineering Review - Energy:

- General:
  - Read/Follow the Guidelines
  - Comply with provisions of Energy Code.

Energy Code:

Read/follow the Energy Code - Path Chosen

Paths: Prescriptive – Performance – IECC (2015) as Supplemented by the NYS ECCC – ASHRAE 90.1 (2013) The as Supplemented by the NYS ECCC

Balancing Act: Health and Safety First

Energy Code:

- Provide Energy Recovery where required

Energy Code:

(Sort of) New Stuff to consider:

- Commissioning-functional testing
- Commercial Refrigeration
- Walk in Coolers and Freezers
- Kitchen Exhaust systems
- Duct/plenum insulation
- Fan motor horsepower
- Part load controls
- Transformers
- Electric Motors
- Plug load controls

We need to work as partners to ensure safe, healthy, comfortable, and exceptional educational facilities which promote effective and efficient learning for all New York State students.

Thank You!

Office of Facilities Planning

518-474-3906

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