Structural Review

Refer to Existing Plans and Exterior Elevations marked up with our site observations following this narrative, along with our preliminary chapter 34 evaluation information. Text in bold represents our recommended scope of work.

ROOF FRAMING

Not all attic framing was visible during Structures North's site visit. Snow guards were observed on the east and west sides of the building. It is assumed that the guards were not a part of original construction, and it is unknown whether the roof was evaluated or is capable of supporting the additional snow loads caused by snow guards. **The roof might need a full evaluation, and if found to be undersized, reinforcing and/or additional columns installed.**

ATTIC FLOOR FRAMING

Not all attic framing was visible during Structures North's site visit. Joists and beams that we were able to observe typically had mortise and tenon connections when supported by other wood beams. The tenons were relatively small, likely only one or two inches tall. At several locations, horizontal splits in the supported framing were observed originating at an edge of tenon and extending several feet along the length of the member. Joists often had a small (1/4" to 3/8"+/-) gap between their ends and the supported member. Light gage metal joist and beam hangers, such as Simpson face mount hangers, should be installed throughout the building (all floors) at mortise and tenon connections.

The two trusses, which are the full height of the attic to roof space, and which appear to clear span the building in the east-west direction, would need further evaluation. We suspect that under a modern code analysis they would be considered overstressed and either need reinforcing or additional framing systems added to lessen the load the trusses take. **Given the general open space layouts of the proposed rooms below the trusses, we suspect the more expensive truss reinforcing option would be required to prevent new framing from interfering with the occupancies below.**

Our preliminary calculations indicate that at the center of the building, where attic joists span approximately 18.5 feet, they have an approximately 60psf live load capacity, which would be suitable for offices (without partitions), or residential occupancy. At the south and north ends of the buildings, where the spans are approximately 22 feet, the joists have only an approximately 30psf live load capacity, which is not suitable for occupancy. **We would anticipate that in order to use the attic, ALL joists would need to be sistered, and/or new beams and columns introduced to shorten existing joist spans.**

2ND FLOOR

Wall, floor, and ceiling surfaces were typically covered with finishes, obscuring framing, during our site visit. There were some walls that appeared to have older (original) plaster finishes that were cracked, as noted on the plans. These walls may need further investigation once finishes are removed. It is uncertain at this point if the cracks were caused by foundation settlement, temperature and moisture shrink/swell effects, or by other causes.

We would expect that the walls noted as presumed bearing walls on the attached plans would remain. Further investigation will be required once interior finishes are removed, but **any bearing wall removal would require new post and beam replacement framing**. Some of these walls, notably the masonry shaft/chimney walls, might be shear walls. We would expect shear walls to remain, but if any are removed, new lateral load resisting systems would need to be installed in alternative locations, especially in the east-west direction. Given the rigidity of the existing masonry shear walls (including exterior walls), **any replacement lateral load resisting systems would ideally be masonry also**. Using steel braced frames or moment frames would likely be cost prohibitive and/or structurally inefficient due to their lesser rigidity than masonry shear walls. Replacement masonry shear walls would need to stack from floor to floor.

2ND FLOOR FRAMING

Existing framing is unknown because none of the second floor framing was visit during site visit. Based on our assumed bearing wall locations (see attached plans), we are anticipating joists have up to 26 foot spans. Joist sizes and spacing are unknown, but we would expect to see something on the order of 2x12's at 12"o.c. Joists this size and spacing would be more than 100% overstressed under a 100psf assembly live load for a 26 foot span, and would deflect 2.8 inches. This deflection is much more than what we generally consider tolerable. Unless existing beams were found to shorten joists spans, we would expect the need for new lines of steel beams and columns, down to new footings in the basement, to be required to shorten the joist spans. New footings would require the involvement of a geotechnical engineer's services. Even if existing beams were found, our experience has been that beams in building this age often are undersized based on modern building code requirements, and they would likely need strengthening or replacement. It was noted that the central space was originally used as an auditorium that served 275+/- people. Based on our limited observations, we would not expect it to allow for use as assembly space without significant reinforcing.

Existing framing condition is unknown. Although current office tenants mentioned leaking roofs, rotted window sills, and animal infiltrations, attic joists appeared to be in acceptable condition where we observed them. We would recommend allowance for possible rot problems where joists bear on masonry, especially at exterior walls. This assumption is especially applicable where we noticed bulges and waviness in exterior walls. Assume that new PT ledgers will need to be installed, and existing joists fastened to the ledgers, an operation which would require temporary shoring of joists throughout the building.

1ST FLOOR

We would expect the 1st floor conditions to be similar to the 2nd floor conditions. Please refer to 2nd floor comments.

We would add that lateral loads typically increase in magnitude the lower in the building you are, until you reach exterior grade level. As such, the wide open Multipurpose room shown in option 2 would likely require a considerable amount of new lateral load resisting systems, preferably masonry shear walls, but given the layout shown, possibly a mix of masonry shear walls and braced steel frames. It may be preferable to move the Multipurpose room to the 2nd floor, and allow for more shear walls on the first floor and lower level.

1ST FLOOR FRAMING

We would expect the 1st floor framing to be similar to the 2nd floor framing. Please refer to 2nd floor framing comments.

BASEMENT

We would assume that existing brick walls (noted on the attached plans) are bearing walls, and CMU (also noted on the plans) walls are later infill partitions. As such, the removal of any brick walls would require new steel beam, column, and footing replacements.

FOUNDATIONS

A geotechnical engineer's involvement in the project is anticipated. The geotechnical engineer will likely require soil borings and/or test pits. New foundations including the pit required for installation of the elevator, as noted elsewhere in this narrative will be required. New foundation locations will depend on new lower level column, bearing wall, and shear wall locations. The adequacy of existing foundation will need to be further investigated where loads to the foundations are increased of presumed past loads, and potentially new underpinned footings added where existing footings are insufficient for the new loads.

EXTERIOR WALLS

Please refer to our markups of exterior elevations and the corresponding notes.

At the south portico, existing steel reinforcing of the 3 arches was observed. A previous engineer's report noted the need for temporary reinforcing of the arches. Our elevation markups note using similar reinforcing at the north

portico, which is exhibiting serious cracks in the arch. If the steel reinforcing at the south portico was intended to be temporary, then a new reinforcing scheme will need to be developed for both porticos. Assume extensive brick re-setting and repointing at the north portico, along with temporary arch shoring and permanent tension rods at the spring of the arches at all arches in both porticos.

STAIRS & ELEVATORS

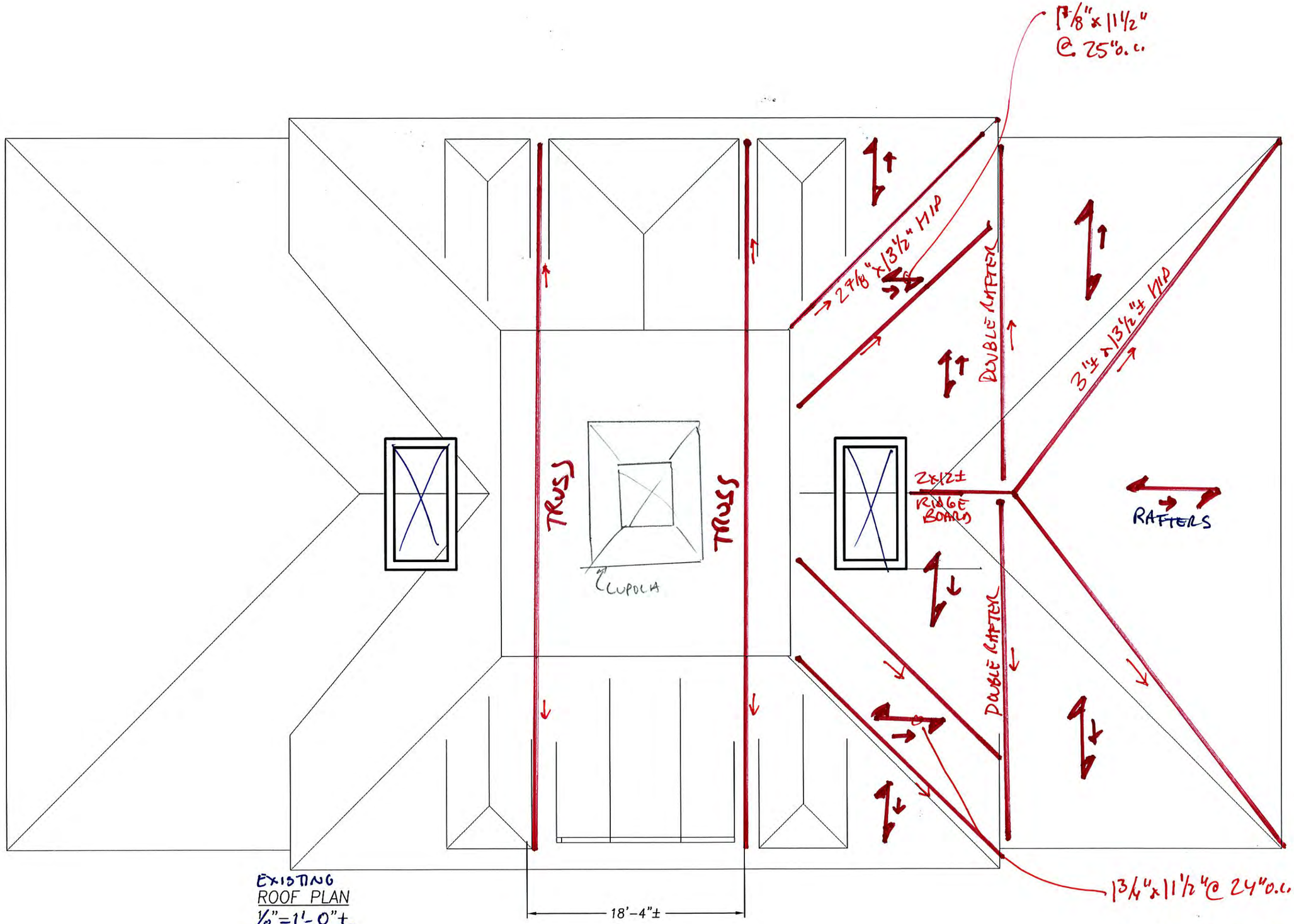
The two existing stairs appear to be in need of replacement. New stairs should be installed, and the new stairs should be self-supporting on new footings in the basement, rather than hanging from roof hips as the existing stairs do. (These hangers appear to have been added after original construction, and may be the cause of the ceiling cracks noted on the plans).

A new elevator would require new framing (beams and columns or ledgers with light gage hangers to support existing joists) at each level, and a new elevator pit and footing. Depending on the elevator pit's proximity to existing footings, the existing footings may need underpinning, or the framing above resupported in an alternative manner involving new beams, columns, and footings in order to relocate footings away from the elevator pit.

LATERAL LOAD RESISTING SYSTEMS

Refer to the Chapter 34 (state building code) level of work determination table under the Code Analysis section of this report. The table assumes the least anticipated amount of work that may be required. We would recommend designing the renovations such that the existing building remains in level 2.

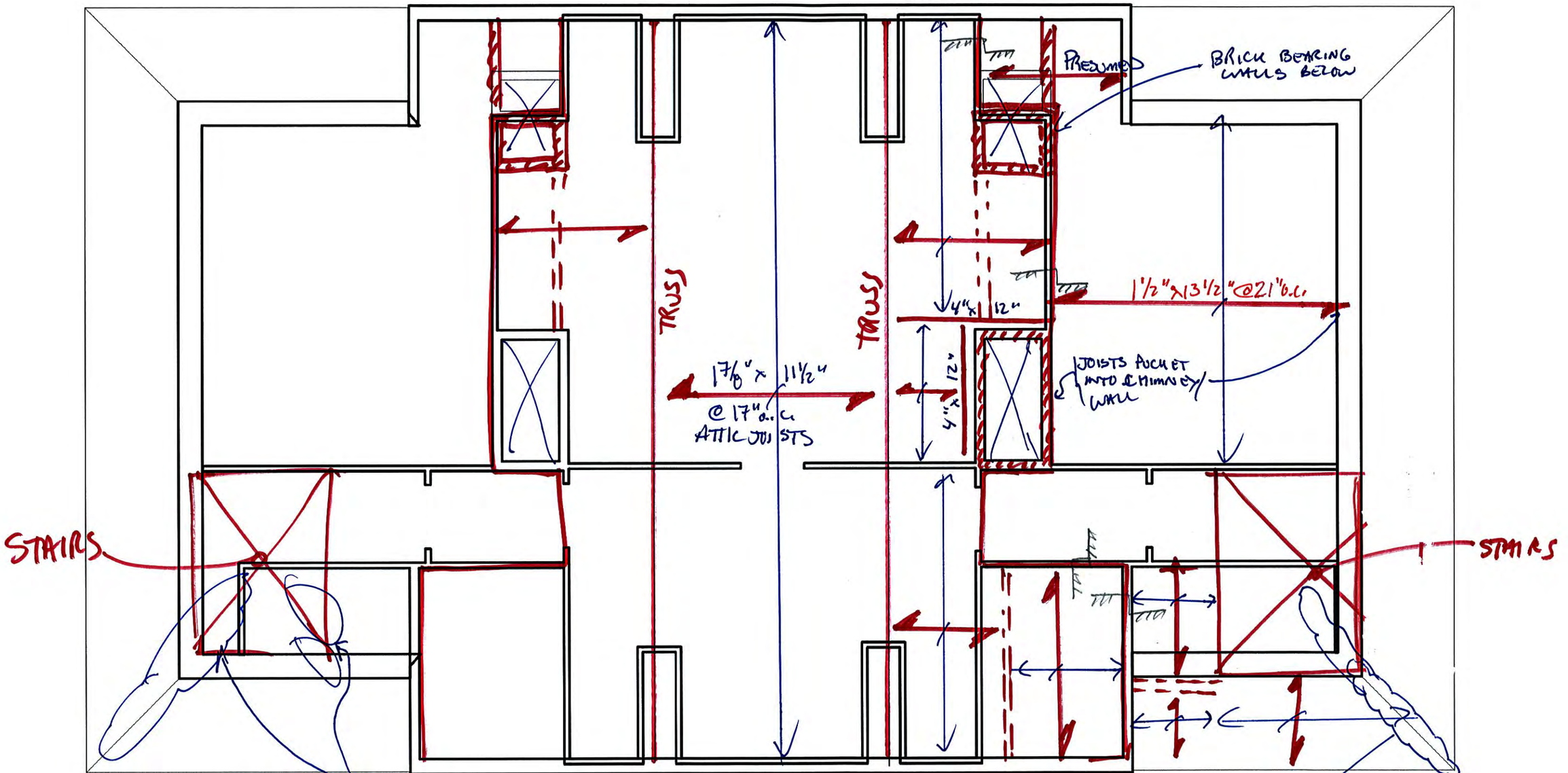
Z:\CADD\Projects\2010\10124 Emory Grover Building\arch\Recd 2010-07-13 EOD\convert pdfs to scale\Shortcut to CAD 10124 Emory Grover Building.dwg, Model, 7/19/2010 4:51:45 PM, Jeff Reese, Ledger (11



EXISTING
ROOF PLAN
⅛"=1'-0"±

EMERY GROVER
JULY 28, 2010

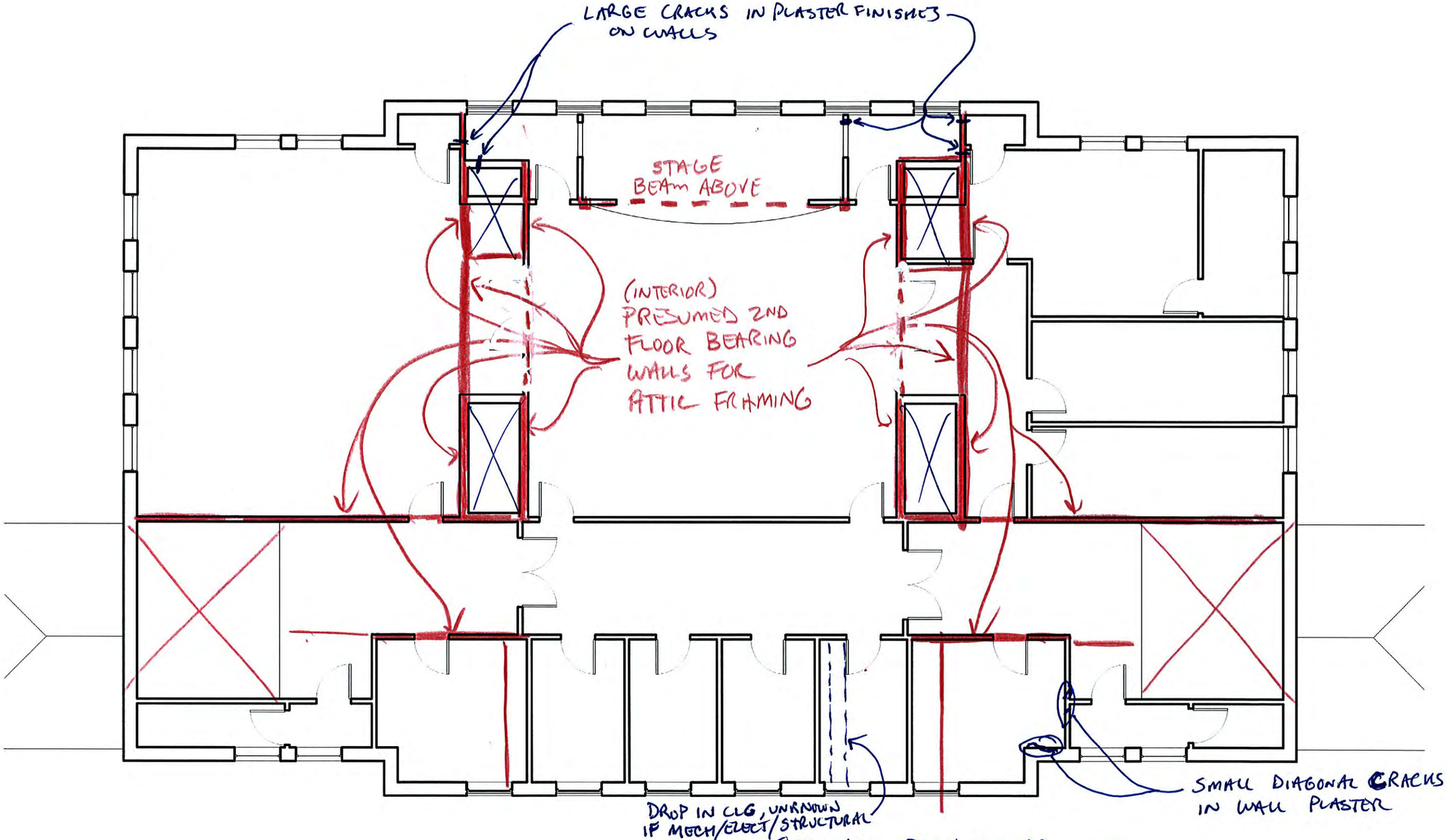
Z:\CADD\Projects\2010\10124 Emory Grover Building\arch\Recd 2010-07-13 EOD\convert pdfs to scale\Shortcut to CAD 10124 Emory Grover Building.dwg, Model, 7/19/2010 4:48:42 PM, Jeff Reese, Ledger (11



EXISTING
ATTIC PLAN
1/8"=1'-0"±

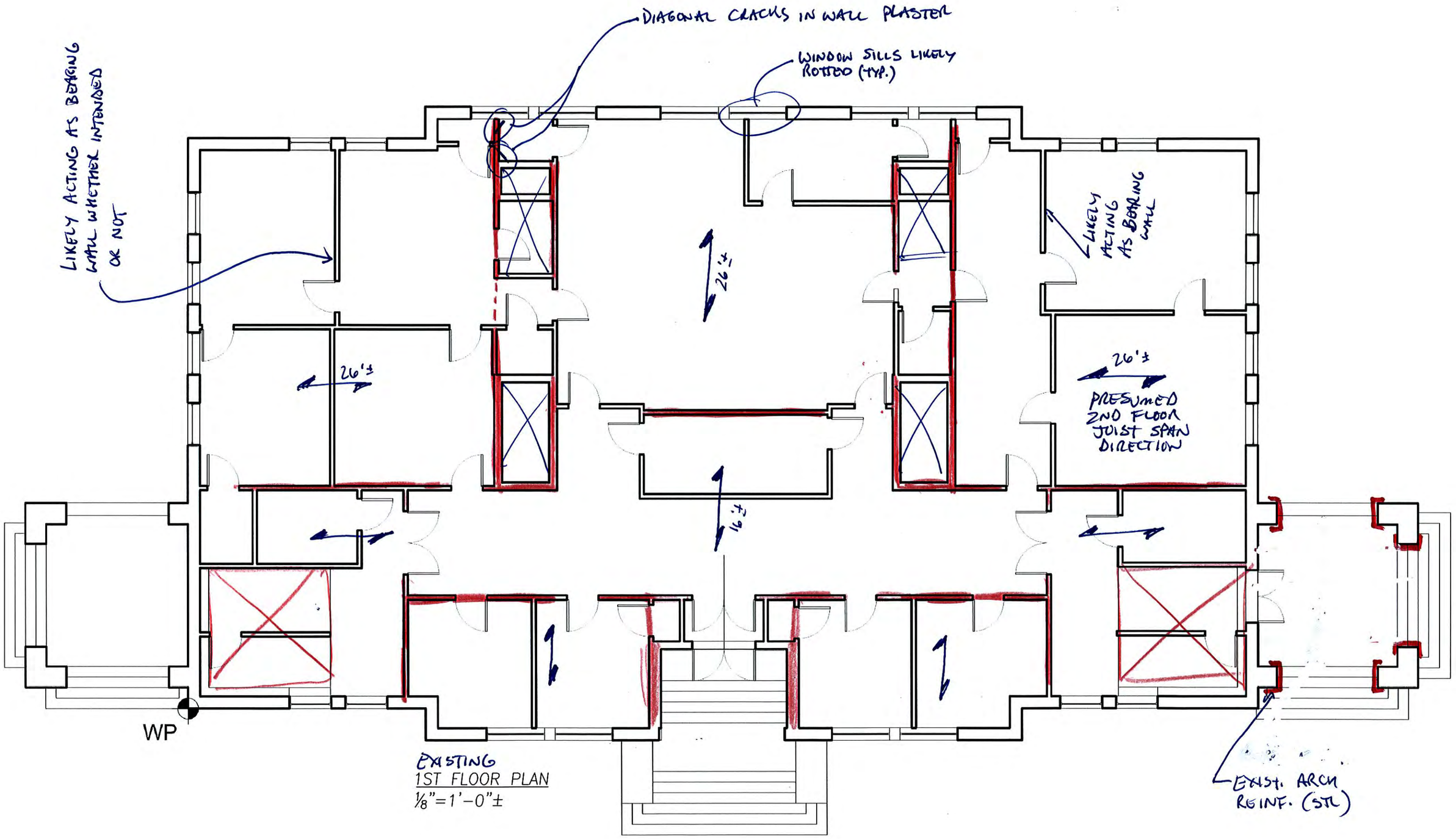
EMERY GROVER
JULY 28, 2010

Z:\CADD\Projects\2010\10124 Emory Grover Building\arch\Recd 2010-07-13 EOD\convert pdfs to scale\Shortcut to CAD 10124 Emory Grover Building.dwg, Model, 7/19/2010 4:49:30 PM, Jeff Reese, Ledger (11



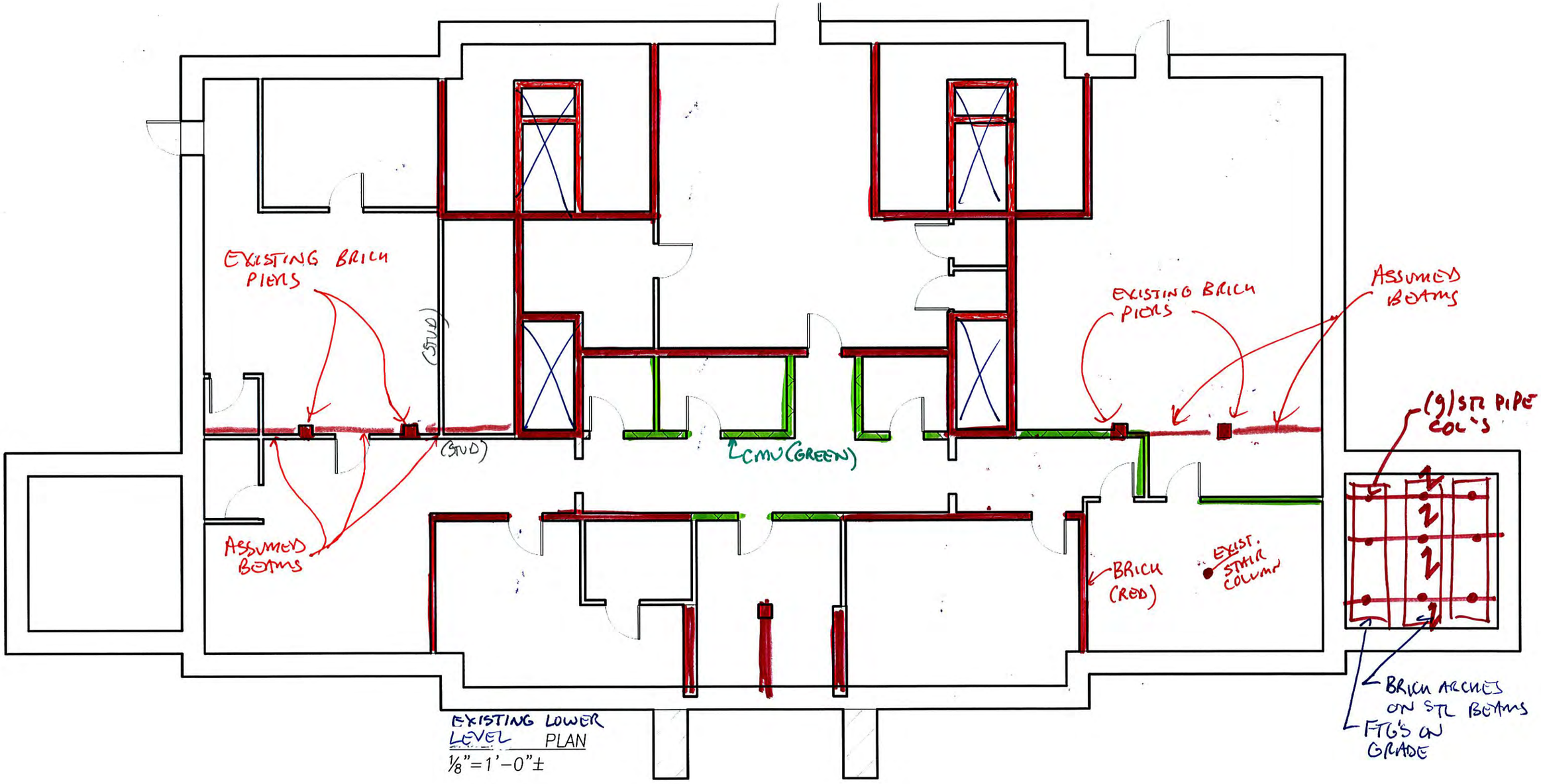
EXISTING
2ND FLOOR PLAN
⅛"=1'-0"±

EMERY GROVER
July 28, 2010



EMERY GROVOR
JULY 28, 2010

Z:\CADD\Projects\2010\10124 Emory Grover Building\arch\Recd 2010-07-13 EOD\convert pdfs to scale\Shortcut to CAD 10124 Emory Grover Building.dwg, Model, 7/19/2010 4:50:05 PM, Jeff Reese, Ledger (11



EXISTING LOWER LEVEL PLAN

1/8"=1'-0"±

EMERY GROVER

JULY 28, 2010

Structures North
CONSULTING ENGINEERS, INC.

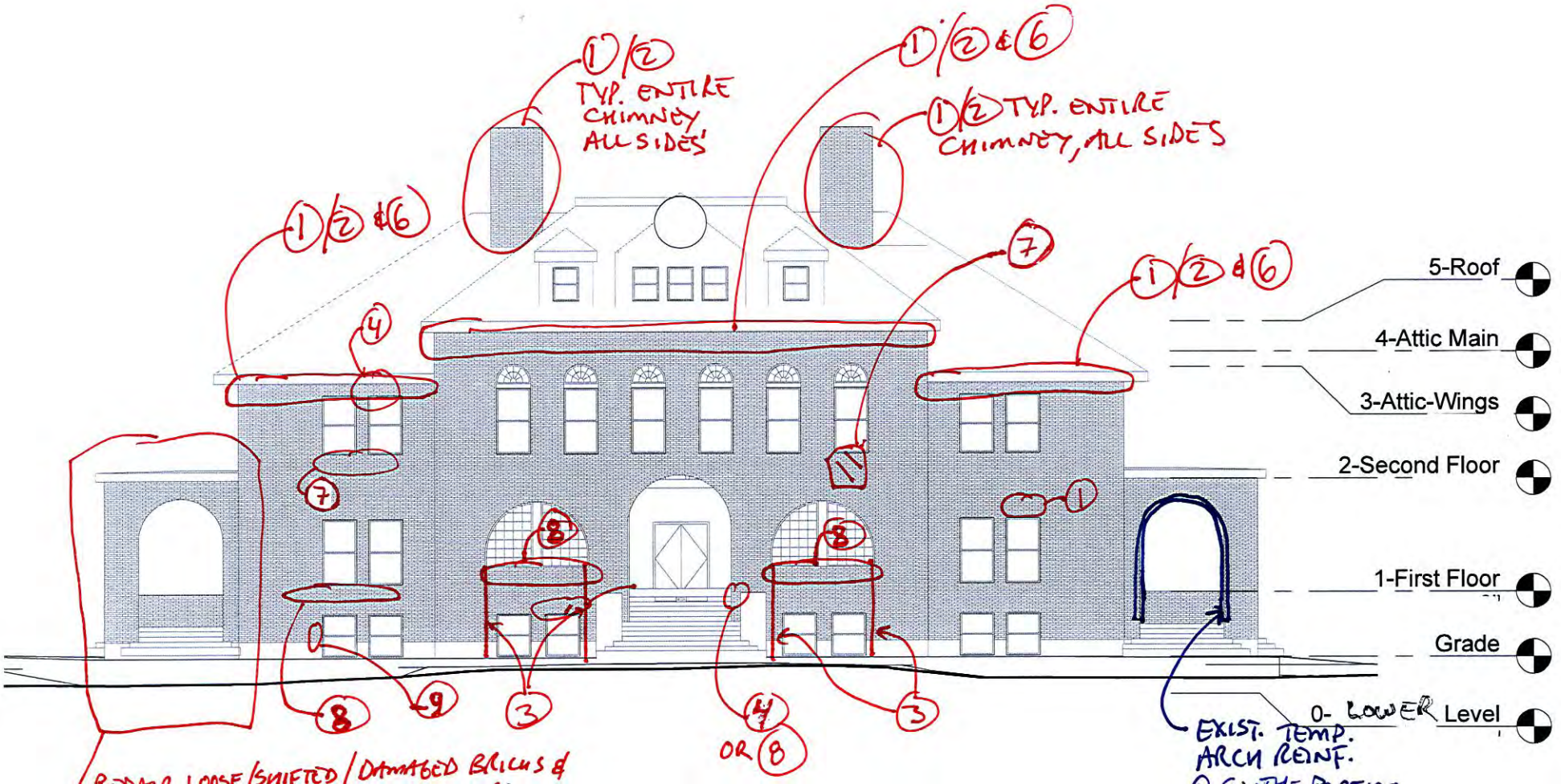
60 Washington St, Suite 401
Salem, MA 01970
www.structures-north.com
T 978.745.6817 | **F** 978.745.6067

Exterior Elevation Notes: Emery Grover Building, Needham, MA

Date: **July 28, 2010**

ALL ELEVATIONS: Investigate existing connection of veneer to backup. Smaller dimensions of veneer brick, combined with likely larger brick dimensions for backup brick, likely resulted in infrequent connection between veneer and backup. Assume pinning of veneer to backup will be required.

1. Repoint.
2. Re-set or pin loose or shifted bricks or stone sill.
3. Caulk joints.
4. Reset, replace, and/or stitch brickwork at cracks or damaged bricks.
5. Possible localized bow or bulge in wall. Will require further investigation into cause. Assume pinning, brick resetting, and re-detailing of connection of interior framing to exterior wall. A lift inspection should be performed and the masonry sounded out with a hammer.
6. Further investigation is required to determine whether roof thrust loads or rusting embedded metals are causing brick movement.
7. Consider flashing under the brick soldier course. Reset bricks. (Water is soaking into joints, combined with no brick weight above this level at windows but brick weight from above on adjacent bricks, causing bricks at this location to bow upward).
8. Pull bricks out and perform a deep re-packing and resetting of bricks. (Issue with brick that readily absorbs water and swells, in combination with a lack of window drip, in contact with stone sill that does not readily absorb water).
9. Mortar repair cracks. (Issue of brick moisture growth/swelling alongside a stone foundation that does not expand, leading to friction in the joint between the two differing materials).

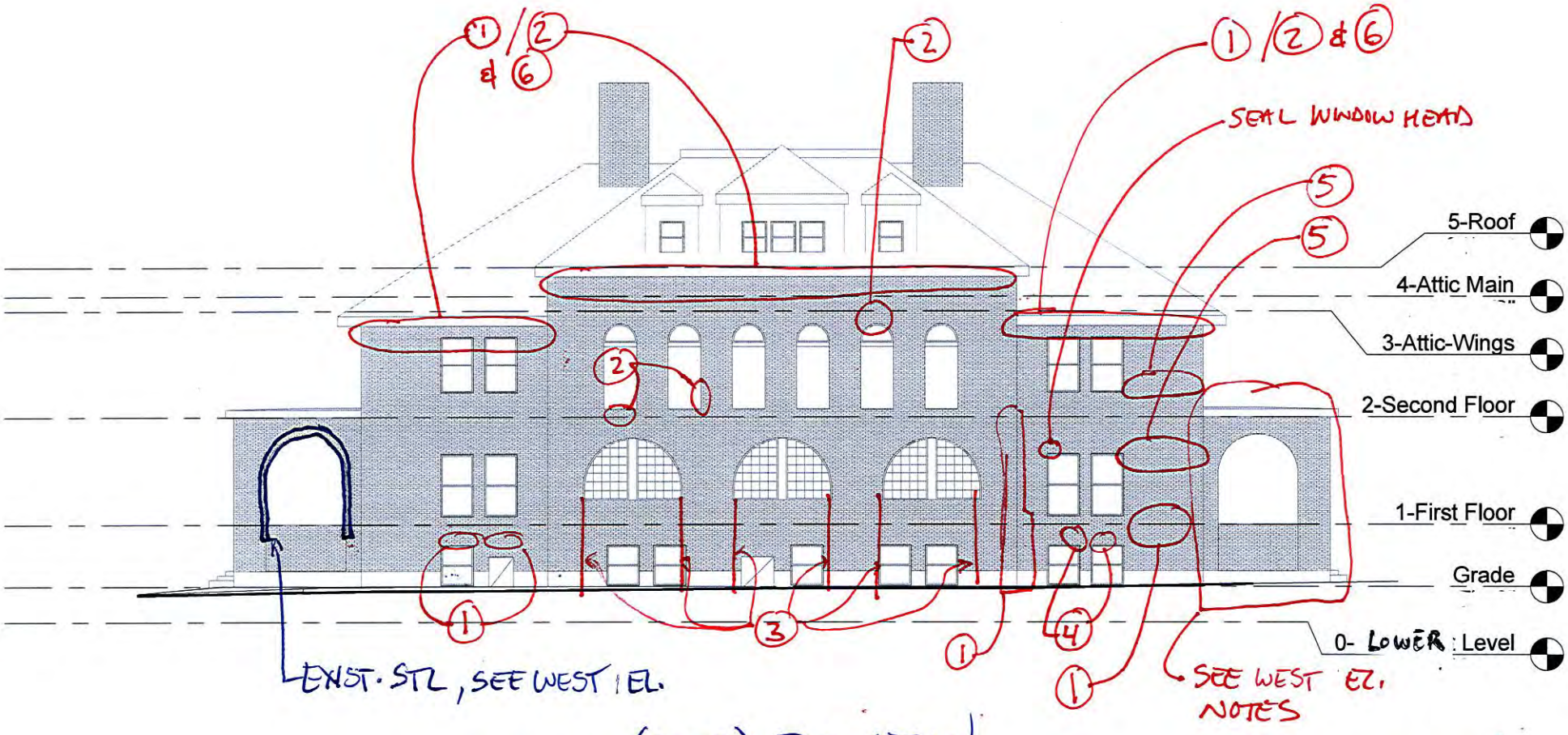


WEST (FRONT) ELEVATION

N.T.S.

EMERY GROVER

July 28, 2010

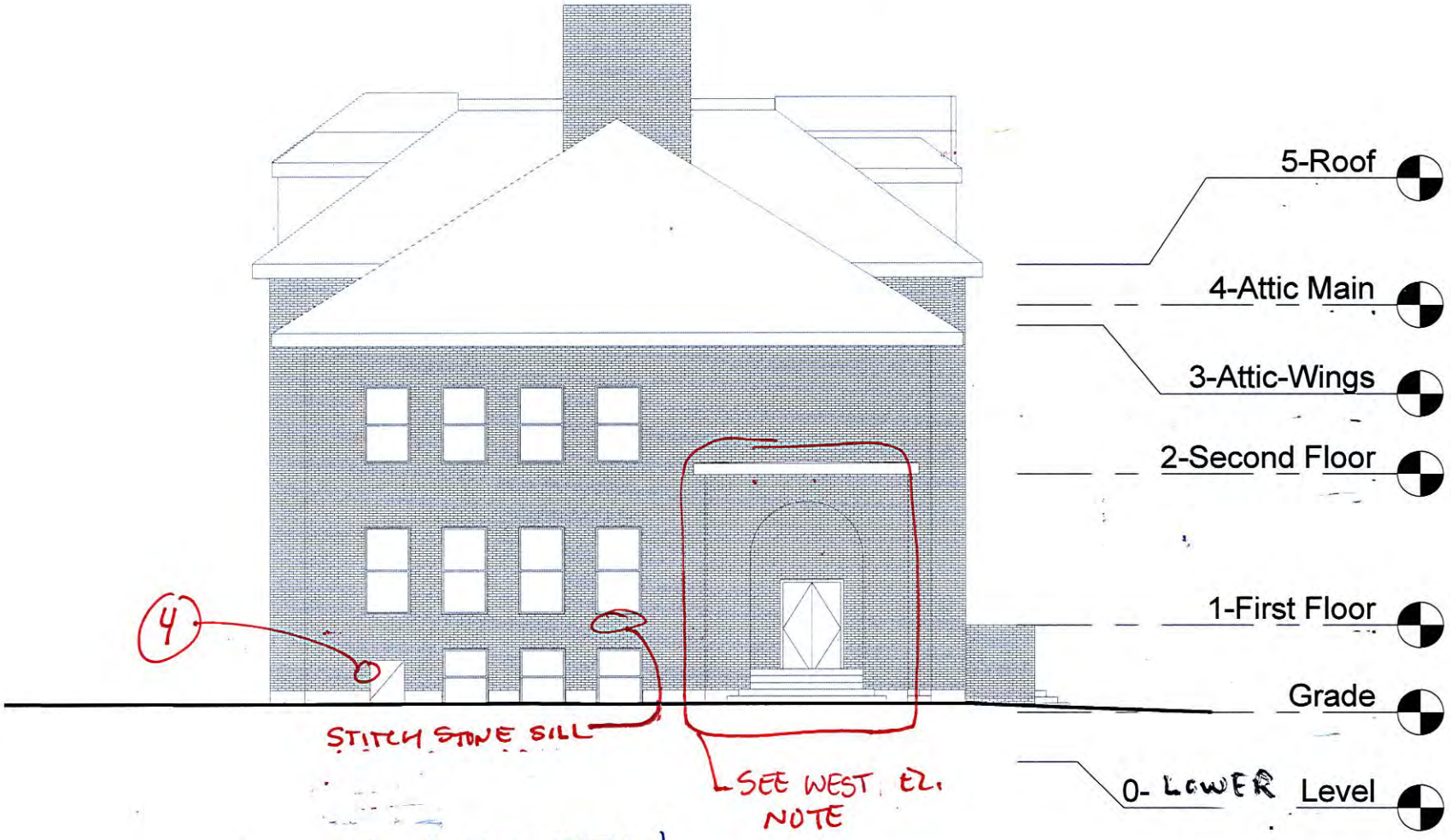


EAST. (REAR) ELEVATION

N.T.S.

EMERY GROVER

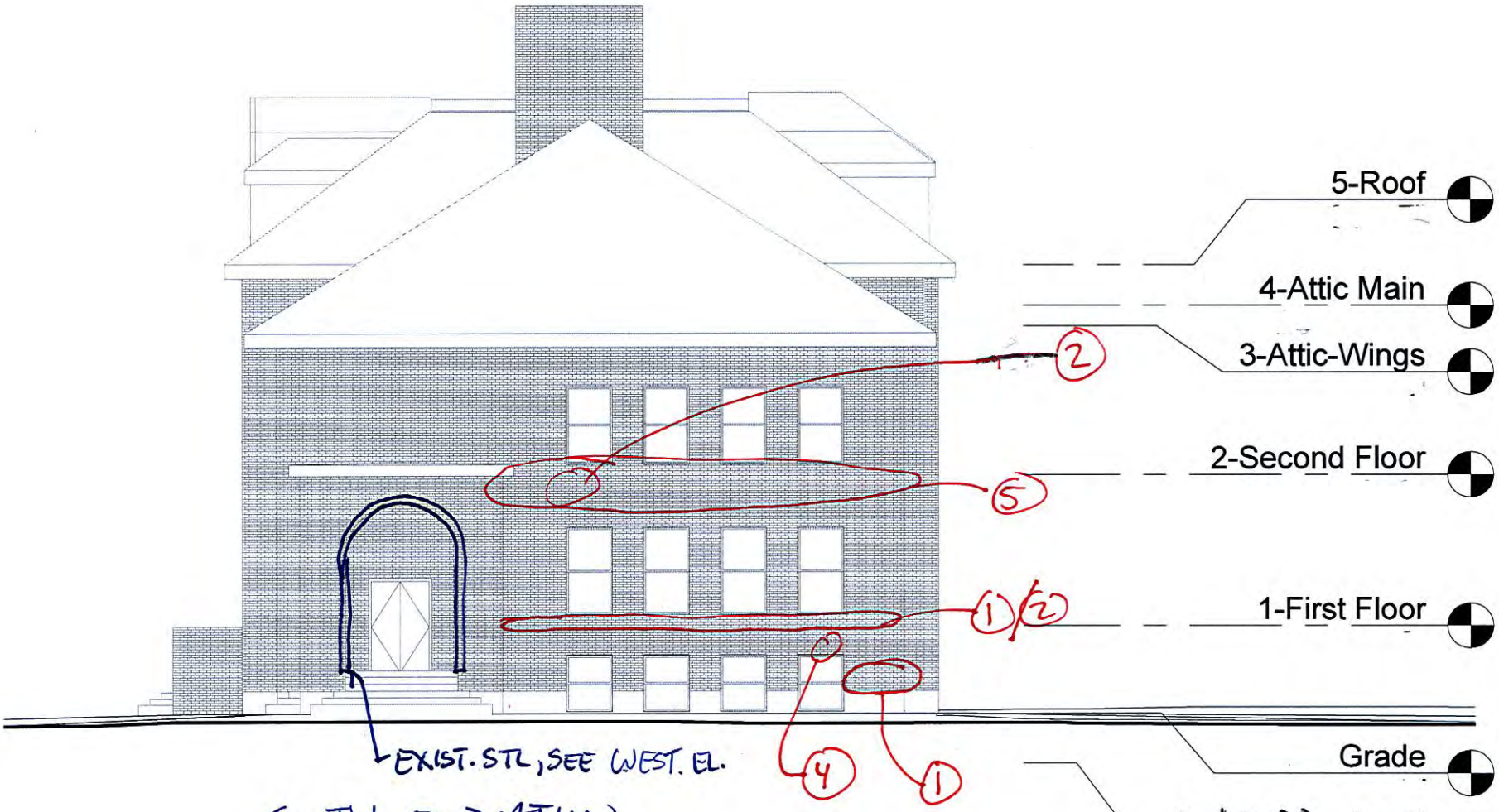
JULY 28, 2010



NORTH ELEVATION

N.T.S.

EMERY GROVER
July 28, 2010



SOUTH ELEVATION

N.T.S.

EMERY GROVER

JULY 28, 2010

Code Analysis

APPLICABLE CODES

Commonwealth of Massachusetts State Building Code 780 CMR, 7TH Edition
Commonwealth of Massachusetts Fuel Gas and Plumbing Code 248 CMR
Commonwealth of Massachusetts Elevator Regulations 524 CMR
Commonwealth of Massachusetts Architectural Access Board Regulations 521 CMR (MAAB)

PROJECT DATA

Areas:	Lower Level	5,890 GSF	
	Main Level	6,400 GSF	(includes portico areas)
	Upper Level	5,780 GSF	
	Attic	4,390 GSF	
	Total	22,460 GSF	
Occupant Count:	Total 560 Occupants		

CODE CLASSIFICATIONS

Construction Type: III B (Existing Masonry Bearing Wall Exterior, Wood Frame Interior)

Use Group: A-2 (This assembly use is intended for food and/or drink consumption including banquet hall. The large multi-purpose room will have lunch service and can be used or rented out for banquet type functions.)

	Allowable	Existing/Proposed
Area	9,500 SF	6,400 GSF
Stories	2 + 1 (sprinkler increase)	3
Height	55 FT + 20 FT (sprinkler increase)	+/- 44 FT

Fire Suppression: The existing building does not have a fire suppression system. A new fire suppression system will be installed as a part of this project.

Frontage Increase: The 96.6% of perimeter of the building is accessible (404'-0" of perimeter, 18'-0" without 20'-0" open space).

Required fire resistance ratings of structural elements:

Structural Frame	0 hours
Bearing Walls	20 min
Non Bearing Walls	0 hours
Floors	0 hours
Roofs	0 hours
Exits and stairs	1 hours (1 stair connecting 2 stories may be unenclosed)
Shafts	1 hours
Separations	Not Applicable
Corridors	0 hours

Egress: Minimum Stair Width: .2" x 280 occupants = 56" (4'-8")
Minimum Exit Discharge Width: .15" x 280 occupants = 42"
Allowable length of exit access travel = 250 feet.

Plumbing Fixtures: There are mens and womens toilet rooms on each floor. For "Hall" occupancy with 560 Occupants.

280 women:	1 per 50	= 6 toilet fixtures
	1/200	= 2 Lavatories
280 men:	1 per 100	= 3 toilet fixtures
	1/200	= 2 Lavatories

CHAPTER 34 LATERAL LOAD RESISTING SYSTEMS

Chapter 34 of the state building code deals with evaluation of existing buildings. This chapter has changed frequently in the last few years, and is expected to be completely overhauled in the near future with the 8th Edition of the state building code. The following analysis is based on the International Existing Building Code (IEBC 2009) with Massachusetts amendments and the latest version of the proposed Chapter 34 changes. Generally, the Massachusetts changes are not too significant from the base IEBC.

1. There is a "change of occupancy" as defined in the IEBC ("*A change in the purpose or level of activity within a building that involves a change in application of the requirements of this code*.") This project meets this definition on two counts: 1) the purpose or level of activity is changing and 2) the building needs to be re-evaluated in terms of egress, fire protection systems, etc. Changes of occupancy are addressed in Chapter 9 of the IEBC.
2. Since the work area will exceed 50% of the building area, the project would also be considered a "Level 3" Alteration under the IEBC.
3. Historic buildings are addressed in Chapter 11 of the IEBC. Chapter 11 references Chapter 9 for the change of occupancy; and Chapter 8 for the structural provisions of Level 3 Alteration. Note that the balance of Level 3 alteration requirements need not be met. The structural provisions of both Level 1 and Level 2 alterations would also need to be met.
4. Compliance Alternatives are still an option in Massachusetts (this concept is not in the IEBC).
5. A Chapter 34 report is required.

Following is our interpretation of the structural requirements referenced above. Basically, it looks like the building will need to be laterally load braced to new-construction requirements for wind and seismic loads.

Level 1 Alterations

- Reroofing which increases dead load by 5% or more must be evaluated for gravity loads;
- Reroofing must include installation of wall anchors at the roof line (This would likely be required under Level 3 anyhow).

Level 2 Alterations

- Alterations shall not decrease the capacity of gravity load carrying structural elements unless they comply with the IBC (ie the code for new construction)
- Section 707.5 addresses "demand-capacity ratio" of lateral-load resisting elements which are impacted by the alteration: where alteration results in a "structural irregularity" as defined in ASCE-7, upgrade is required in accordance with Section 807.4 (Level 3).

Level 3 Alterations

- Structural engineering analysis of lateral load resisting elements and upgrades to comply with the IBC for wind and seismic loads. Seismic compliance requirements are outlined in Section 101.5.4.1. State building code also added a section on cumulative effects, but that would not be applicable for this project.

Refer to the following Chapter 34 level of work determination table and excerpt from relevant section of the building code for descriptions of what these levels entail. The table assumes the least anticipated amount of work that may be required. The comments made here about chapter 34 requirements may become obsolete by the time any work on this building actually begins.

Massachusetts 7th edition commercial building code

Chapter 34 level of structural work determination (as of October 9, 2009)

includes emergency amendments up until 10/9/09

Anticipated Chapter 34 Structural Level

Basis for Estimate

issue #	level	issue	instruction	comments	enter the level (yellow cells only) that applies for this issue ("0" indicates "does not apply")
1	1	Level 1 is the default if none of the other levels apply	"1" entered automatically		1
2	1	Removal or repair of ceilings, partitions, or interior facing of exterior walls; new ceilings, partitions, or interior facing of exterior walls; reconstruction or repair of floors; new mechanical or electrical distribution systems within an area; or new elevators, escalators, or stairs within an area or serving an area, when the new openings in any framed floor or roof are 5% or less of the area of the framed floor or roof.	IF YES, ENTER "1"		1
3	-	Increase in total framed floor and roof area due to structurally attached additions	ENTER MAXIMUM OF BELOW	An addition is not being considered for this submission. If an addition is later added to the scope, then a seismically separated addition (has its own wall alongside the existing exterior wall with a gap between the two walls, instead of sharing the wall), then this could still be a zero. If the addition is structurally attached, this is likely a "4".	0
-	2	*Increase in total framed floor and roof area due to structurally attached additions up to a lifetime limit of 10% of the total framed floor and roof area of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.*	IF YES, ENTER "2"		----------
-	4	*Increase in total framed floor and roof area due to structurally attached additions that is more than 10% of the total framed floor and roof area of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.*	IF YES, ENTER "4"		----------
-	5	*Structurally attached additions that have a total framed floor and roof area greater than 100% of the total framed floor and roof area of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.*	IF YES, ENTER "5"		----------
4	-	Increase in effective seismic weight	ENTER MAXIMUM OF BELOW	Not anticipating any increase in building/seismic weight *(unless there is a future structurally attached addition)* . Anticipating that this will be a "zero" *(unless there is a structurally attached addition, in which case it will likely be a "4")* .	0
-	2	*Increase in effective seismic weight, with or without structurally attached additions, up to a lifetime limit of 10% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.*	IF YES, ENTER "2"		----------
-	4	*Increase in effective seismic weight, with or without structurally attached additions, that is more than 10% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.*	IF YES, ENTER "4"		----------
-	5	*Increase in effective seismic weight, with or without structurally attached additions, that is more than 100% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.*	IF YES, ENTER "5"		----------

5	-	structural work on existing framed floor or roof areas	ENTER MAXIMUM OF BELOW	Anticipate for study that at least 25% of the existing floor framing will need structural reinforcing, but that we will not be "removing or reconstructing" more than 15% of floors. Anticipate level "2" for this study.	2
-	2	*Structural work involving: More than 25% of the total existing framed floor and roof area or 20,000 sf of existing framed floor and roof area, whichever is less. Where the work involves existing beams or girders, the tributary area of the beams and girders shall be included in the count for framed floor and roof area.*	IF YES, ENTER "2"		----------
-	3	*Removal, or removal and reconstruction, of between 15% and 40% of the total tributary area of horizontal framing of existing framed floors and roofs.* Exception: Demolition of a previous addition to the building; demolition of an appendage to the building such as a loading dock outside of the exterior wall line; or demolition of a mechanical penthouse; with the condition that the demolition does not reduce the existing lateral load resistance of the remaining portion of the building below that provided before demolition.	IF YES, ENTER "3"		----------
6	-	structural work on lateral load resisting elements (existing shear walls, lateral load frames, or diaphragms, or new shear walls)	ENTER MAXIMUM OF BELOW	Anticipate that shear walls consist of exterior walls and possibly the pairs of interior shaft/chimney walls on each side of the building. We would expect these walls to be left intact for all options. We would anticipate that additional or new lateral load resisting elements are not likely to be needed, but this will depend on what chapter 34 structural level is required, as the higher the level, the higher the lateral loads that have to be designed for. Anticipate less than 90% of lateral loads would be taken by new framing.	0
	2	*Structural work involving: More than 25% of the total area of shear walls above the foundation*	IF YES, ENTER "2"		----------
	2	*Structural work involving: Changes to any structural wall that reduce its in-plane shear resistance (ability to act as shear wall) by more than 15%*	IF YES, ENTER "2"		----------
	2	*Structural work involving: Changes to any floor or roof diaphragm that reduce its in-plane shear resistance by more than 15%*	IF YES, ENTER "2"		----------
	2	*Structural work involving: Removal or reconfiguration of lateral load resisting frames, or foundations supporting them*	IF YES, ENTER "2"		----------
	3	*New shear walls and vertical frames which provide more than 35 % of the lateral force resistance required for Level 2 Work, in either of two orthogonal directions.*	IF YES, ENTER "3"		----------
	5	*New shear walls and vertical frames which provide more than 90% of the lateral force resistance required for Level 3 Work, in either of two orthogonal directions.*	IF YES, ENTER "5"		----------
7	-	structural work on openings and removal/reconstruction of floors/roofs	ENTER MAXIMUM OF BELOW	We would not anticipate that either of these to apply to this project	0
	2	*Structural work involving: Openings in any framed floor or roof that have an area more than 5% of the area of the framed floor or roof*	IF YES, ENTER "2"		----------
	5	*The removal, or the removal and reconstruction, of more than 40% of the total tributary area of horizontal framing of existing framed floors and roof.* Exception: Demolition of a previous addition to the building; demolition of an appendage to the building such as a loading dock outside of the exterior wall line; or demolition of a mechanical penthouse; with the condition that the demolition does not reduce the existing lateral load resistance of the remaining portion of the building below that provided before demolition.	IF YES, ENTER "5"		----------
8	-	structural work on columns or diagonal braces		Even if this clause were tripped, we would not expect it to control the chapter 34 structural level	----------
	2	*Structural work involving: More than 25% of the total length of columns and diagonal braces*	IF YES, ENTER "2"		2

9	-	change of use		We suspect that the proposed use as a Senior Center would make this an A-3 use group. This clause would only be tripped if there were a 1200 person or more occupancy load, which we are not anticipating.	----------
	5	*Change of Use and Work for Restricted Uses. Change of use of an existing building to a restricted use, or work above Level 2 for existing buildings with restricted uses, shall comply with the requirements for Level 5 Work. (See 3408.5.1 for Restricted Uses defined)*	IF YES, ENTER "5"		0
10	-	exemptions		We are not expecting this to be applicable	----------
	2	*Exemption for Pile Foundations.Structural repairs of pile foundations are exempt from Level 2 Work*	special condition		0
				MINIMUM anticipated level:	2

or without structurally attached additions, that is more than 100% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.

4. New shear walls and vertical frames which provide more than 90% of the lateral force resistance required for Level 3 Work, in either of two orthogonal directions.

3408.5 Restricted Uses.

3408.5.1 Restricted Uses Defined. For the purposes of 780 CMR 3408.0, restricted uses shall be as follows:

1. Assembly Groups A-1 and A-2 for an occupant load of 600 or more.
2. Assembly Group A-3 for an occupant load of 1200 or more.
3. Assembly Groups A-4 and A-5 for an occupant load of 600 or more.
4. Hazardous Group H.
5. Institutional Group I-2 for an occupant load of 400 or more.
6. Institutional Group I-3.
7. Buildings in Seismic Use Group III, as defined in ASCE, Table 9.1.3.

3408.5.2 Change of Use and Work for Restricted Uses. Change of use of an existing building to a restricted use, or work above Level 2 for existing buildings with restricted uses, shall comply with the requirements for Level 5 Work.

3408.6 Structural Investigation of Existing Buildings.

3408.6.1 Level 1 Work.

3408.6.1.1 Responsibility of the SER. Whenever there is any structural work for Level 1 Work, the SER shall perform the following tasks.

1. Verify that the work to be performed is in fact Level 1 Work.
2. Make a field investigation of the areas and structural members affected by the proposed structural work.
3. Evaluate the capacity of existing structural elements affected by the proposed structural work.

3408.6.1.2 Responsibility of the Architect. The architect of record shall verify that the changes to the existing building are in fact Level 1 Work, and so certify on the construction drawings.

3408.6.2 Levels 2, 3, 4, and 5 Work.

3408.6.2.1 Initial Survey of Existing Building. The SER shall make an initial survey of the existing building consisting of the following tasks. Alternatively, a registered architect, who will be the architect of record for the project, may substitute for the SER for the parts of the investigative work that do not require a structural evaluation.

1. Gather and catalog relevant available information on the existing building, such as drawings, specifications, shop drawings, geotechnical engineering reports, previous condition appraisal reports, and building department records.
2. Perform a field survey to either verify the available drawings or to establish dimensions of the existing building, including layout and sizes, of relevant structural components.
3. Perform a field survey to visually assess the condition of the structural components of the existing building.
4. Identify load paths (or lack thereof) to the foundation for gravity load and lateral load, based on information gathered in the above tasks.

3408.6.2.2 Foundation and Geotechnical Explorations.

3408.6.2.2.1 Level 2 Work. If the work does not involve an addition or does not include an increase in gravity loads, and does not involve new shear walls or vertical frames or reinforcement of existing shear walls or vertical frames to resist the lateral loads required in 780 CMR 3408.7.3, and if there is no indication of settlement or lateral movement of basement walls or foundations, no foundation or geotechnical exploration is required. Otherwise, explorations shall be performed as necessary to determine the foundation design parameters of the subsoils and the type and condition of existing foundations.

3408.6.2.2.2 Levels 3, 4, and 5 Work. Explorations shall be performed as necessary to determine the foundation design parameters of the subsoils, the type and condition of existing foundations, and the potential for liquefaction of soils during an earthquake where required in 780 CMR 3408.9.11.

3408.6.2.3 Structural Evaluation of the Existing Building.

3408.6.2.3.1 Existing Structural Materials. The SER shall determine the strengths of existing structural materials in accordance with 780 CMR 3408.9.2.3 and 3408.9.2.4.

3408.6.2.3.2 Repairs. The SER shall evaluate structurally hazardous conditions and determine which existing structural elements or systems are in need of repair or other remedial action, and determine the character and extent of the repairs or remedial action.

3408.6.2.3.3 Gravity Load Capacity -

Level 2 Work. Where there are structural changes to floors or roofs, the SER shall determine the total service load capacity, and the net unreduced service live load capacity or the net service snow load capacity, as applicable, in the affected areas.

3408.6.2.3.4 Gravity Load capacity - Levels 3, 4, and 5 Work. The SER shall determine the total service load capacity of the floors and roofs, the net unreduced service live load capacity of the floors, and the net service snow load capacity of the roofs.

3408.6.2.3.5 Lateral Load Capacity - Levels 2, 3, 4, and 5 Work. The SER shall determine the lateral load capacity of the existing building and its lateral load components relative to the lateral load resistance required for the level of work to be performed, and determine what is needed to provide the required lateral load resistance.

3408.6.2.4 Structural Details. The SER shall evaluate the following details.

1. Connectivity of the structural elements.
2. Existence of anchors connecting floor and roof decks to concrete or masonry walls, and if they exist, their ability to provide lateral support to the walls and transfer in-plane shear from the decks to the plane of the walls.
3. Existence of unreinforced masonry parapets, how they are supported at the roof diaphragm, their height measured from the roof diaphragm, and their thickness.
4. For masonry walls, the ratio of the distance between lateral supports to the thickness of wall.
5. Existence of brittle connections of precast concrete cladding components.

3408.6.3 Report on Structural Investigation. The SER shall submit a report on his structural investigation to the building official with the application for the building permit.

3408.6.4 Condition of Permit. The submission of the SER's report on his structural investigation and review thereof by the building official shall be a condition for the issuance of the building permit. The building official shall maintain this report for future renovations of the building.

3408.6.5 Field Observations During Construction. The SER shall make periodic field visits during the progress of the construction work on the existing building in order to observe and verify the assumed conditions on which the structural design was based, and shall modify the design, as necessary, should the observed conditions differ in any significant manner from those on which the structural design was based. The SER shall provide a written notification to the building official of changes to the contract documents submitted with the application for building permit.

3408.7 Lateral Load for Existing Buildings and Structurally Attached Additions.

3408.7.1 Application of Lateral Load. Where the work includes structurally attached additions to an existing building, the specified lateral loads in 780 CMR 3408.7 shall be applied to the existing building and additions acting together as a single structure.

3408.7.2 Level 1 Work. There are no requirements for lateral load for Level 1 Work.

3408.7.3 Level 2 Work. For Level 2 Work, each of the following lateral loads shall be applied to the building separately:

1. ⅔ of the wind load specified in 780 CMR 1609.0.
2. A lateral load in any direction which is 1% of the unfactored gravity load for Allowable Stress Design or 1.5% of the unfactored gravity load for Strength Design, distributed the same as the gravity load. For the purposes of this clause only, the gravity load shall be defined as D + 0.5S, where the notation is as defined in 780 CMR 16.00.
3. The wind load specified in the basic code, if any.
4. For Post-1975 buildings, the seismic load in accordance with the seismic provisions for new buildings of the basic code.

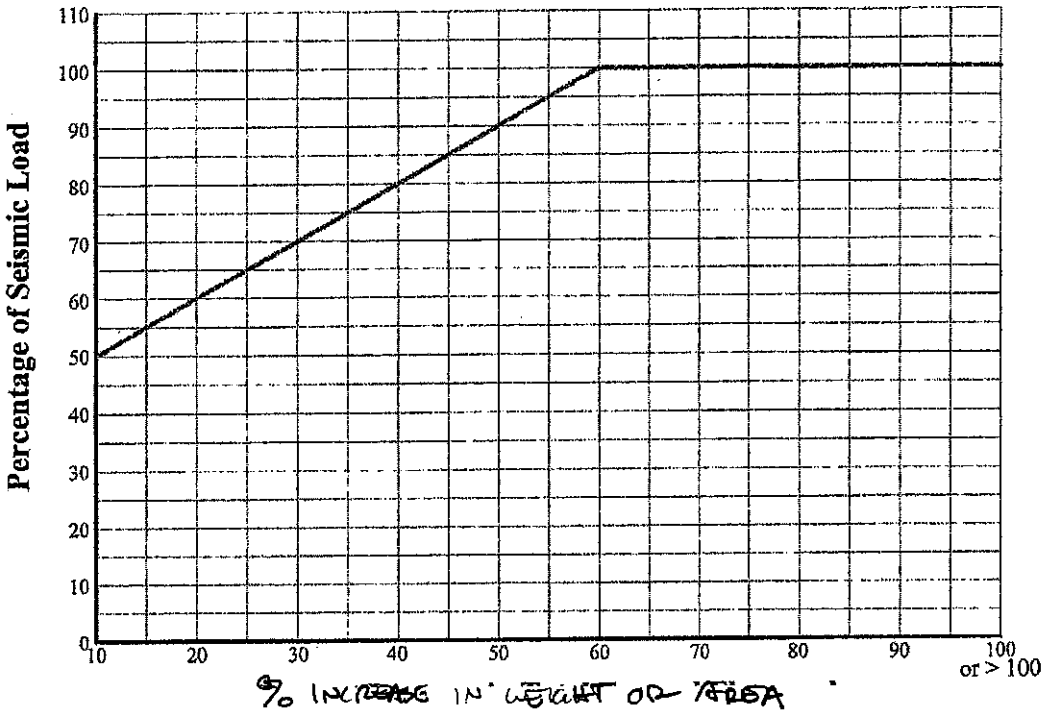
3408.7.4 Level 3 Work. For Level 3 Work, each of the following lateral loads shall be applied to the building separately:

1. The wind load specified in Section 1609.
2. 35% of the seismic load specified in 780 CMR 1614.0 and 1615.0, in accordance with the seismic criteria of 780 CMR 1614.0, 1615.0, and 3408.10, with a minimum seismic base shear of 0.01W.
3. For Post-1975 buildings, the seismic load in accordance with the seismic provisions for new buildings of the basic code.

3408.7.5 Level 4 Work. For Level 4 Work, each of the following lateral loads shall be applied to the building separately:

1. The wind load specified in 780 CMR 1609.0.
2. A percentage, given in Figure 3408-1, of the seismic load specified in 780 CMR 1614.0 and 1615.0, in accordance with the seismic criteria of 780 CMR 1614.0, 1615.0, and 3408.10. In Figure 3408-1, the meaning of the term *effective seismic weight* in the title of the abscissa shall be in accordance with Clauses 3408.4.1, Items 2. and 3.
3. For Post-1975 buildings, the seismic load in accordance with the seismic provisions for new buildings of the basic code.

FIGURE 3408.1 PERCENTAGE OF THE SEISMIC LOAD SPECIFIED IN 780 CMR 1614.0 AND 1615.0



3408.7.5.1 Buildings Designed for Additional Stories. For Post-1975 buildings which have been designed for additional stories, the seismic load and seismic criteria for new buildings of the basic code may be used in lieu of the criteria in 780 CMR 3408.7.5 , Items 2. and 3., with the following conditions:

1. The building (or an addition for which provision was made for the additional stories) was constructed under a building permit whose date is not more than 15 years prior to the date of the application for a building permit for the additional stories.
2. The number of additional stories shall not be more than the number of additional stories provided for in the original design.
3. The size of any story shall not be larger than the footprint of the story immediately below. For partial stories, account shall be taken of torsion induced by the eccentricity.
4. For buildings whose basic code was prior to the 6th Edition of the State Building Code and have rigid or semi-rigid diaphragms, new shear walls or frames shall be located as necessary such that the eccentricity of the shear center at each level from the center of mass at that level is not more than 20% of the building width in each of two orthogonal directions. Alternatively, new shear walls or frames shall be located as necessary so that the building complies with ASCE 7, Section 9.5.5.5.2, as modified by 780 CMR 1615.0. The mass at any level shall be all of the mass of the building at and above that level.
5. Buildings whose basic code was prior to the 6th Edition of the State Building Code and which have weak stories, as defined in ASCE 7, Table 9.5.2.3.3, shall be reinforced as necessary so that the building meets the criteria of ASCE 7, Section 9.5.2.6.2.4.

3408.7.6 Level 5 Work. For Level 5 work, each of the following lateral loads shall be applied to the building separately.

1 The wind load specified in 780 CMR 1609.0.

2 The seismic load specified in 780 CMR 1614.0 and 1615.0, in accordance with the seismic criteria of 780 CMR 1614.0 and 1615.0.

3408.7.7 Historic Buildings. House museums are exempt from the lateral load requirements of 780 CMR 3408.7. Preserved historic buildings shall meet all of the lateral load requirements of 780 CMR 3408.7.

3408.8 Gravity and Other Loads for Existing Buildings and Structurally Attached Additions.

3408.8.1 Live Load. Live load shall be in accordance with 780 CMR 1607.0, with the following exceptions:

3408.8.1.1 Reduced Live Load. Except for Use Groups, F, I, and S, wherever there is a new use in an existing building, and the new use requires a live load in accordance with

780 CMR 1607.0 that is greater than the original live load capacity, the floors may be posted for the original live load capacity, provided that the use is controlled in a way acceptable to the building official, and so that the public safety is not endangered thereby.

3408.8.1.2 Level 1 Work. Level 1 Work is exempt from the live load requirements of 780 CMR 1607.0 except in areas being altered or repaired.

3408.8.2 Snow Load. Snow load shall be in accordance with 780 CMR 1608.0, with the following exceptions.

3408.8.2.1 Ground Snow Load. For determining snow loads on existing buildings, ground snow load may be reduced to 85% of that required by 780 CMR 1608.0. There shall be no reduction of ground snow load for additions, or for drift loads on existing buildings created by higher additions.

3408.8.2.2 Level 1 Work. Level 1 Work is exempt from the snow load requirements of 780 CMR 1608.0, except for snow drift loads due to new roof top equipment or structures.

3408.8.2.3 Historic Buildings. House museums are exempt from the snow load requirements of 780 CMR 3408.8.2.

3408.8.3 Lateral Soil and Hydrostatic Loads. For additions, lateral soil and hydrostatic loads shall be in accordance with 780 CMR 18.00. There are no requirements for lateral soil and hydrostatic loads for existing basement or foundation walls provided said walls and the structure supporting them laterally do not exhibit structural distress due to lateral soil or hydrostatic load; otherwise, lateral soil and hydrostatic loads shall be in accordance with 780 CMR 18.00.

3408.8.4 Flood Loads. Flood load shall be in accordance with 780 CMR 1612.0 for Level 4 and Level 5 Work. There are no flood load requirements for Levels 1, 2, and 3 Work.

3408.8.5 Dead Loads. Dead loads shall be in accordance with 780 CMR 1606.0.

3408.9 Structural Design and Construction.

3408.9.1. Stiffness and Deflection Control. For Levels 2, 3, 4, and 5 Work, except for Level 2 Work where there are no changes to the existing lateral load resisting system, the building design shall comply with the following deflection criteria.

1. For seismic load on buildings with URM bearing or enclosure walls, the maximum inelastic story drift in the direction of the seismic load shall not exceed 0.007h, where h is the story height. Inelastic story drift shall be calculated in accordance with ASCE 7, Section 9.5.5.7 or 9.5.6.6, except that the drift determination shall be made for each shear wall and vertical frame. The drift of URM bearing or enclosure walls perpendicular to the direction of the seismic load shall not exceed 0.010h.
2. For wind load, or the lateral load defined in 780 CMR 3407.7.3, Item 2., on buildings with URM bearing or enclosure walls, the maximum story drift at each shear wall and vertical frame shall not exceed 0.002h. The drift of URM bearing or enclosure walls perpendicular to the direction of the lateral load shall not exceed 0.0025h. These values apply to unfactored load levels.
3. For seismic loads on buildings without URM bearing or enclosure walls, the maximum inelastic story drift shall be calculated in accordance with ASCE 7, Section 9.5.5.7 or 9.5.6.6.

3408.9.1.1 Reinforced Concrete Moment Frames. For seismic load on existing reinforced concrete moment frames of Pre-1975 buildings, including flat slab or flat plate buildings, whether supplemented with new lateral load resisting elements or not, the inelastic story drift shall not exceed 0.01 times the story height.

3408.9.2 Existing Structural Members and Systems.

3408.9.2.1 Strength of Existing Structural Members and Systems. Strength of existing systems, members, and connections shall be determined in accordance with the Code requirements for new construction and currently accepted engineering practice, using the actual strength and other physical properties of the existing materials, except as provided in 780 CMR 3408.9.2.2. and 3408.9.2.4.

3408.9.2.2 Compliance with Previous Codes. For evaluating capacity of existing structural systems, members, or connections for compliance with the basic code, structural design codes and standards in effect at the time of the basic code may be used.

3408.9.2.3 Strength of Materials. The strength of existing materials shall be determined by tests or from generally accepted historical records.

3408.9.2.4 Archaic Materials. Strength of existing systems, members, and connections made from materials no longer produced (archaic materials) may be evaluated from the archaic material codes and engineering practices at, or later than, the time said existing systems and elements were constructed. Existing systems and elements made from archaic materials shall not be used to resist seismic load.

3408.9.2.5 Deficient or damaged structural members. Existing structural members or their connections that are found to be deteriorated or damaged, either prior to or during an alteration or addition, shall be repaired, replaced, or reinforced. Existing structural members shall be considered deteriorated or damaged if their capacity is less than 85% of their original strength. Repairs, replacement, or reinforcement shall be in accordance with currently accepted engineering practice.

3408.9.2.6 Reuse of Existing Structural Members. Existing structural members in sound structural condition may be reused.

3408.9.3 Sheathing for Light-framed Shear Walls. The following types of existing sheathing over light-framed wood walls may be used to resist in-plane shear, where the walls are anchored to floors and to the floor or roof construction above such that they can transfer the shear between stories and to the foundation. wood structural panels, diagonal boards, wood siding over horizontal or diagonal boards, plaster on wood or metal lath, and stucco on metal lath. Gypsum sheathing, lath, wall board, and drywall; fiberboard; and particle board are not permitted for resisting in-plane shear.

Exception. Existing gypsum sheathing, lath, wall board, and drywall; fiberboard; and particle board may used to resist in-plane shear if originally designed in accordance with 780 CMR for that purpose.

3408.9.4 Connections of Lateral Load Resisting Frames and Walls to Diaphragms. For Levels 2, 3, 4, and 5 Work, all vertical lateral load resisting frames and shear walls (including all masonry and concrete enclosure, bearing, and fire walls) shall be connected to floor and roof diaphragms. The connections shall resist the in-plane forces between diaphragms and vertical frames, and between diaphragms and shear walls. The connections shall also resist imposed forces that are transverse to the vertical frames and shear walls. The in-plane and transverse design forces for these connections shall not be less than 190 lbs per foot for Allowable Stress Design or 280 lbs/foot for Strength Design.

3408.9.5 Shear Walls and Frames for Levels 2, 3, 4, and 5 Work.

3408.9.5.1 Distribution of Lateral Load with Flexible Diaphragms. For buildings with flexible diaphragms, such as wood floor and roof decks or unfilled metal roof decks, and with masonry or concrete shear walls or steel braced frames, the lateral load from each level shall be proportioned to shear walls and braced frames in accordance with their tributary width perpendicular to the load, unless a different distribution is justified by a lateral load analysis which accounts for the flexibility of the diaphragms and the stiffnesses of the shear walls and frames.

3408.9.5.2. Lines of Shear Walls or Frames with Flexible Diaphragms. For buildings or portions of buildings with flexible diaphragms, such as wood floor and roof decks or unfilled metal roof decks, there shall be a minimum of two lines of shear walls or frames to resist lateral load in each orthogonal direction (or the equivalent), located at or as close as practicable to the opposite sides of the building or portion of the building.

3408.9.5.3 Ductility Requirements for New Shear Walls and Frames. For Level 2 Work, where new shear walls or frames are required, said frames and shear walls shall be detailed in accordance with the seismic requirements of 780 CMR 19.00, 21.00., 22.00, or 23.00, as applicable. The new frames and shear walls shall be one of the types permitted in ASCE 7, Table 9.5.2.2, as revised by 780 CMR 1615.0.

3408.9.6 Row Buildings.

3408.9.6.1 Party Walls. A party wall is defined as a wall on a lot line owned in common by the two abutters. For the purposes of 780 CMR 3408.9.6, where a wall is on one side of a lot line and owned by one of the abutters, and the face of that wall nearest the lot line is within two inches of the lot line, the wall shall be considered to be a party wall.

3408.9.6.2 Lateral Resistance Parallel to Front and Rear Walls. When lateral load resistance of an existing building within a row of buildings with party walls is to be determined, said resistance parallel to the front and rear walls shall be the resistance of the entire row of buildings.

3408.9.6.3 Maintaining lateral load resistance. When an existing building within a row of buildings with party walls is altered, demolished, or replaced, the lateral load resistance and stiffness parallel to the front and rear walls contributed by the existing building to the row of buildings shall be maintained or replaced.

3408.9.6.4 Lateral Support of Party Walls. Where a building within a row of buildings is removed or partially removed, the party walls on each side of the removed structure shall be laterally supported by means other than friction.

3408.9.6.5 New buildings. New structures that replace an existing building in a row of buildings shall not impose lateral forces on the other buildings in the row in excess of what the existing building could have imposed.

3408.9.7 Precast Concrete Cladding Connections B Levels 4 and 5 Work. Connections of existing precast concrete cladding elements for Levels 4 and 5 Work shall be made to conform to the requirements of 780 CMR 1615.0.

3408.9.8 Special Requirements for URM Walls.

3408.9.8.1 Lateral Support. For Levels 2, 3, 4, and 5 work, the ratio of distance between lateral supports to the nominal thickness of wall shall be 18 or less; otherwise the walls shall be strongbacked. Strongbacks shall be designed to resist the full transverse (out of plane) design load on the URM walls, with a maximum transverse displacement of 1/600 of the distance between lateral supports. In ASCE 7, Equation 9.6.1.3-1, a_p shall be taken as 1.0 and R_p shall be taken as 1.5 for URM walls.

3408.9.8.2 Tying Back Parapets. For Levels 2, 3, 4, and 5 Work, the top of masonry parapets extending from URM walls with a height to thickness ratio of more than three shall be tied back to the roof. The height of parapet shall be measured from the level of where the URM walls are connected to the roof diaphragm.

3408.9.8.3 New Buildings Using Existing Masonry Facades. Existing URM facades may be used to enclose new buildings provided:

1. that the walls are laterally supported by the new building in such a way that there is no imposed in-plane shear transferred to the facade from the building;
2. that seismic load induced into the plane of the walls due to their own mass can be resisted by the respective walls; and
3 that the walls conform to the criteria of 780 CMR 3408.9.8.1 and 3408.9.8.2.

3408.9.9 Limits to Vertical Additions Having URM or Unreinforced Concrete Bearing Walls. For Level 4 Work, structurally attached vertical additions to existing buildings having URM or unreinforced concrete bearing or enclosure walls shall be limited as follows:

1. Only a lifetime one story is permitted to be added to one and two story buildings, and no vertical addition is permitted for buildings with more than two stories.
2. The area of the permitted vertical addition shall not exceed the footprint of the uppermost existing floor.

Exception. There is no limit to the number of stories of a vertical addition if the addition has a new lateral load resisting system such that lateral loads on the addition are not imposed on the existing URM walls, and if no additional gravity load is imposed on the existing URM walls.

3408.9.10 Seismic design with URM and unreinforced concrete shear walls.

3408.9.10.1 Uncracked Shear Walls. Existing URM and unreinforced concrete shear wall elements acting with a new lateral load resisting system shall be considered to remain uncracked during the design earthquake when the calculated in-plane seismic shear force on the elements multiplied by the system overstrength factor (Ω_o) of the new lateral load resisting system is less than or equal to the shear capacity of the elements.

3408.9.10.2 Levels 3 and 4 Work. When the in-plane seismic shear force in a URM or unreinforced concrete shear wall, calculated in accordance with the design coefficients in Table 3408-1, exceeds the in-plane shear capacity, a new lateral load resisting system of a type permitted in ASCE 7, Table 9.5.2.2, as revised by 780 CMR 1615.0, shall be added to the building to resist the seismic load. The new lateral load resisting system shall be designed to act with existing shear wall elements that remain uncracked in accordance with 780 CMR 3408.9.10.1, accounting for the relative stiffness of the new elements and the uncracked existing shear wall elements, using as an R factor the R factor for the new lateral load resisting system.

3408.9.10.3 Level 5 Work. The primary lateral load resisting system, in accordance with 780 CMR 3408.7.6, Item 2., shall be designed to resist seismic load independent of the URM or unreinforced concrete shear walls. The primary lateral load resisting system shall also be designed to interact with existing shear wall elements that remain uncracked in accordance with 780 CMR 3408.9.10.1, accounting for the relative stiffness of the elements of the primary system and the uncracked existing shear wall elements, using as an R factor the R factor for the primary lateral load resisting system.

3408.9.11 Liquefaction of Underlying Soils. For additions in Level 4 or Level 5 Work, the potential for liquefaction shall be considered in accordance with 780 CMR 1804.6.

3408.10 Supplementary Seismic Provisions for Existing Construction. Where seismic resistance is required in 780 CMR 3408.0, existing lateral force resisting systems that are not permitted in 780 CMR 1615.0 may be used for seismic resistance in accordance with the following requirements.

3408.10.1 Limitation. 780 CMR 3408.10 does not apply to Level 5 Work.

3408.10.2 Design Coefficients and Factors. Values of the Response Modification Coefficient, R, System Over-strength Factor, Ω_o, and the

Deflection Amplification Factor, C_d, for systems not permitted in 780 CMR 1615.0 shall be in accordance with Table 3408-1. Except as provided in Table 3408-1, there are no seismic design or detailing rules for the systems listed in the table.

TABLE 3408-1 DESIGN COEFFICIENTS AND FACTORS FOR SEISMIC FORCE RESISTING SYSTEMS NOT PERMITTED IN 780 CMR 1615.0

Basic Seismic Force Resisting System[1]	Respense Modification Coefficient, R	System Overstrength Factor, Ωo	Deflection Amplification Factor, Cd
Bearing Wall Systems			
Steel concentrically braced frame (CBF) with diagonal[3] or X-bracing			
CBF per 6th Ed SBC[2] except AISC 1992 Seismic Provisions, Sect 9.5	3.5	2	3.5
Otherwise[4]	3	3	3
Steel CBF with V, inverted V, or K bracing			
V or Inverted V bracing per 6th Ed. SBC[2]	3	3	3
V or Inverted V bracing, otherwise[4]	3	3	3
K bracing	1.25	1.25	1.25
Reinforced concrete shear walls with boundary elements and without coupling beams, in accordancre with 780 CMR 1113.5.1.4a, 5th Ed.	5	2.5	5
Reinforced concrete shear walls with reinforcing steel less than required by, or spaced further apart than, that required in ACI 318, Sec. 11.10.9	1.5	1.5	1.5
Unreinforced concrete shear walls	1.25	1.25	1.25
Reinforced masonry shear walls classified in accordance with 780 CMR 3408.10.2.1			
Class A	4.5	2.5	3.5
Class B	2.25	2.25	2.25
Class C	1.25	1.25	1.25
Unreinforced masonry shear walls	1.25	1.25	1.25
Light-framed walls sheathed with wood structural panels or diagonal sheathing	4	2.5	3
Other light-framed walls sheathed with materials permitted in 780 CMR 3408.10.6	2	2	2
Building Frame Systems			
Steel concentrically braced frame (CBF) with diagonal[3] or X-bracing			
CBF per 6th Ed SBC[2] except AISC, 1992 Seismic Provisions, Sect 9.5	4	2	3.5
Otherwise[4]	3	3	3
Steel CBF with V, inverted V, or K bracing			
V or Inverted V bracing per 6th Ed. SBC[2]	3	3	3
V or Inverted V bracing, otherwise[4]	3	3	3
K bracing	1.5	1.5	1.5
Reinforced concrete shear walls with boundary elements and without coupling beams, in accordancre with 780 CMR 1113.5.1.4a, 5th Ed.	6	2.5	5
Reinforced concrete shear walls with reinforcing steel less than required by, or spaced further apart than, that required in ACI 318-02, Sec. 11.10.9	1.5	1.5	1.5
Unreinforced concrete shear walls	1.5	1.5	1.5
Reinforced masonry shear walls classified in accordance with 780 CMR 3408.10.2.1			
Class A	5	2.5	4
Class B	2.25	2.25	2.25
Class C	1.5	1.5	1.5
Unreinforced masonry shear walls	1.5	1.5	1.5
Light-framed walls sheathed with wood structural panels or diagonal sheathing	4	2.5	3
Other light-framed walls sheathed with materials permitted in 780 CMR 3408.10.6	2.5	2.5	2.5

TABLE 3408-1 DESIGN COEFFICIENTS AND FACTORS FOR SEISMIC FORCE RESISTING SYSTEMS NOT PERMITTED IN 780 CMR 1615.0 - continued

Basic Seismic Force Resisting System[1]	Respense Modification Coefficient, R	System Overstrength Factor, Ωo	Deflection Amplification Factor, Cd
Moment Resisting Frame Systems			
Steel moment frames			
Special Moment Frame per 6th Ed. SBC[2]	8	3	5.5
Ordinary Moment Frame per 6th Ed. SBC[2]	3.5	3.5	3.5
Moment frame, otherwise[4]	3	3	3
Reinforced concrete moment frames classified in accordance with 780 CMR 3408.10.2.2			
Class A	5	3	4.5
Class B	2.5	2.5	2.5
Dual Systems (See ASCE 7, Section 9.5.2.2.1)			
Steel concentrically braced frame (CBF) with steel moment frames (MF)			
CBF and Special MF, per 6th Ed. SBC[2]	5	2.5	4.5
CBF and MF, per 1st-5th Ed. SBC[2], except V, Inverted V, or K Bracing	3.5	2.5	3.5
CBF and MF, per 1st-5th Ed. SBC[2], with V or Inverted V Bracing	3	2.5	3
Otherwise	1.5	1.5	1.5
Reinforced concrete shear walls with boundary elements and without coupling beams, in accordancre with 780 CMR 1113.5.1.4a, 5th Ed., with reinforced concrete moment frames in accordance with 780 CMR 3408.10.2.2, Class A.	6	2.5	5
Ordinary reinforced concrete shear wall, as defined in 7th Ed. SBC, with reinforced concrete moment frames in accordance with 780 CMR 3408.10.2.2, Class A	5.5	2.5	4.5

Notes:

1. Systems of previous editions of the State Building Code that meet the ductility requirements of the 7th Edition of the Code are not included in this table.
2. SBC = State Building Code.
3. A diagonal brace is one that frames from a beam to column connection diagonally to another beam to column connection or to a column at its base plate.
4. The seismic resistance of the frame shall be based on its seismic connections being subject to two times the computed forces and moments resulting from seismic load.

3408.10.2.1 Classification of Reinforced Masonry. Existing reinforced masonry shear walls shall be classified for Table 3408-1, as follows:

Class A Minimum total cross-sectional area of reinforcement in the vertical and horizontal direction is 0.002 times the gross cross-sectional area of wall, with a minimum in each direction of 0.0007 times the gross cross-sectional area of wall. Maximum spacing of reinforcing steel bars in grouted cells or bond courses is 6'-0" in one direction and 4'-0" in the other direction, but not less than ⅓ of the length or height of the wall, whichever is smaller, in each direction. Otherwise meets requirements for reinforced masonry of the basic code.

Class B Same as Class A, except spacing limits for the reinforcing steel bars are exceeded.

Class C Less than the minimum cross-sectional area of reinforcement required for Class A.

3408.10.2.2 Classification of Reinforced Concrete Moment Frames. Existing reinforced concrete moment frames shall be classified for Table 3408-1, as follows:

Class A Design in accordance with 780 CMR 1113.5.1, 1113.5.1.1, 1113.5.1.2 and 1113.5.1.3, 5th Edition; and ACI 318-83, Sections 11.12.1.1 and 11.12.1.2 for reinforcing of the beam-column joints.

Class B Does not meet all the requirements for Class A.

3408.10.3 Alternate Methods of Analysis and Design. In lieu of the requirements of 780 CMR 1615.0 and 780 CMR 3408.10.2, analysis and design for existing buildings may be in accordance with SEI/ASCE 31 for the loading specified in 780 CMR 1614.0, except that sheathing over light-framed wood walls that is not permitted in 780 CMR 3408.9.3 shall not be used to resist in-plane shear for shear walls, and wood foundations other than piles and poles shall not be used to resist any load. The SER shall document

the use of SEI/ASCE 31 in a report to the building official, and include in said report the assumptions, the methods of analysis, and a description of the analytical results

780 CMR 3409.0 *HISTORIC BUILDINGS*

3409.1 Scope. The provisions of 780 CMR 3409.0 shall govern all buildings and structures in the Commonwealth which are legally designated as *historic buildings*. 780 CMR 3409.0 shall preempt all other regulations of 780 CMR governing the reconstruction alterations change of use and occupancy, repairs maintenance and additions for the conformity of historic buildings and structures to 780 CMR, with the exception of 780 CMR 122.0 for appeals, or unless otherwise specified (*see* 780 CMR 120.Y). There is no obligation for owners of historic properties to apply for 780 CMR 3409.0.

3409.1.1 Key Definitions. The following five definitions are found in 780 CMR 3401.1, but are also presented here as such definitions form a significant portion of 780 CMR 3409.0.

Historic Buildings. (a) Any building or structure individually listed on the National Register of Historic Places or (b) any building or structure evaluated by MHC to be a contributing building within a National Register or State Register District. (c) any building or structure which has been certified by the Massachusetts Historical Commission to meet eligibility requirements for individual listing on the National Register of Historic Places. *Historic building* shall be further defined as *a house museum* or *preserved buildings.* All entries into the *house museum* list shall be certified by the Massachusetts Historical Commission. The Board of Building Regulations and Standards shall ratify all buildings or structures certified by the Massachusetts Historical Commission to qualify for *house museum* listing (see Appendix 780 CMR 120.Y).

Preserved Buildings. (a) Any building or structure individually listed on the National Register of Historic Places or (b) any building or structure certified as a *historic building* by the Massachusetts Historical (Commission/t and not designated a *house museum* in *Appendix 780 CMR 120.Y).*

Restoration. *Restoration* is the process of accurately reconstructing or repairing the forms and details of a building or structure or portion thereof as it appeared at a particular period or periods of time by means of removal of later work/or the replacement of missing original work

House Museum. A *house museum* is an *historic building* or structure. The principal use of such a building or structure must be as an exhibit of the building or the structure itself which is open to the public not less than 12 days per year, although additional uses, original and/ or ancillary to the principal use shall be permitted within the same building up to maximum of 40% of the gross floor area. *House museums* shall be those listed in *Appendix 780 CMR 120.Y.* All entries into the *house museum* list shall be certified by the Massachusetts Historical Commission. The Board of Building Regulations and Standards shall ratify all buildings or structures certified by the Massachusetts Historical Commission to qualify for *house museum* listing (See *Appendix 780 CMR 120.Y).*

3409.2 *House Museum.*

3409.2.1 State Building Code Exceptions. A *house museum* shall be subject to the following exceptions:

1. Repairs, maintenance and restoration shall be allowed without conformity to 780 CMR generally, if the provisions of 780 CMR 3409.2.2 have been met.
2. In case of fire or other casualty to a *house museum*, said building may be rebuilt, in total or in part, using such techniques and materials as are necessary to restore it to its original condition and use group.
3. If a *historic building* or structure, as a result of proposed work, would become eligible for certification as a *house museum* and the Massachusetts Historical Commission so certifies by affidavit, such affidadit is submitted to the building official with the permit application, and the building official shall then allow the work to proceed under the provisions of 780 CMR 3409.2.

3409.2.2 Mandatory Safety Requirements. All *house museums* shall comply to the following requirements.

3409.2.2.1 Fire Protection Equipment. Fire protection equipment shall be provided according to the following requirements:

1. **Manual Fire Extinguishing Equipment.** All use groups, other than Residential R-3 and R-4, shall have approved manual fire extinguishing equipment, as determined by the head of the local fire department.
2. **Fire Protective Signaling Systems (Fire Alarm Systems).** All residential buildings in use groups R-1, R-2 and R-3 shall conform to the applicable requirements of 780 CMR 918.0 and 919.0 as applicable. All other use groups shall comply with 780 CMR 3409.2.2.1 items 2.(a) and (b).

(a) **Locations.** Provide smoke detectors in accordance with manufacturers listing and spacing requirements, but not less than one, for every 1200 square feet of floor area per level. In addition, all lobbies, common corridors, hallways and exitway access and discharge routes shall be provided with approved smoke detectors installed in accordance with the

manufacturers listing and spacing requirements but not more than 30 feet spacing between detectors. All required smoke detectors shall have an alarm audible throughout the structure or building.

(b) Single station and multiple station smoke detection devices. Smoke detectors of single station and multiple station types shall meet the requirements of UL 217 and be listed or approved by a nationally-recognized fire-testing laboratory. All other smoke detectors shall be listed in accordance with UL 268.

3. **Manual Pull Stations.** A manual fire alarm pull station shall be provided in the natural path of egress in all use groups except R-3 and R-4. Manual pull stations shall be connected to the building fire warning system in conformance with NFPA 72.

3409.2.2.1.1 Supervision. Fire protective signaling systems required by 780 CMR 3409.2.2.1 shall be supervised in accordance with the requirements of 780 CMR 9.00.

Exception. Residential single and multiple station smoke detectors.

3409.2.2.2 Exit Signs and Emergency Lights. Approved exit signs and emergency lighting, where designated by the local building official, shall be provided in compliance with 780 CMR 10.00.

Exception. All *house museums* need not comply with 780 CMR 10.00 if not occupied after daylight hours, except that paths of egress shall have exit signs.

3409.2.2.3 Maximum Occupancy. Occupancy shall be limited by the actual structural floor load capacity as certified by a qualified Massachusetts *registered professional engineer* or *architect* or in accordance with 780 CMR 10.00, whichever is less. Said floor load shall be posted in accordance with the procedures set forth in 780 CMR 120.0, 780 CMR 10.00 and 780 CMR 1617.2. The owner shall submit evidence of this certification and related computations to the building official upon request.

3409.2.2.4 Limited Egress. Where one or more floors of a *house museum* are limited to one *means of egress*, the occupancy load shall be computed as follows:

1. **Floors below the First Story.** Not more than one occupant per 100 square feet of gross floor area with a maximum occupancy of 49.
2. **First Story.** Not more than one occupant per 50 square feet of gross floor area.
3. **Second Story And Above.** Not more than one occupant per 100 square feet of gross floor a area, or 30 occupants per unit of egress width, whichever condition results in the lesser occupancy load.

3409.2.2.5 Inspections. The *building official* and the fire official shall inspect all *house museums* not less frequently than once every year in order to determine that the building or structure continues to conform to 780 CMR 3409.2. A qualified Massachusetts *registered professional engineer* or *architect* shall certify every five years thereafter as to the exact floor load capacity of the building or structure. The building official shall certify all *house museums* not less frequently than once every year. Fees shall be established at $25.00 per building per inspection.

3409.2.2.6 Accessibility for Persons with Disabilities. Accessibility requirements shall be in accordance with 521 CMR.

3409.2.2.7 Energy Conservation. House museums are exempt from the requirements of 780 CMR 3407.0 and the energy conservation requirements of 780 CMR. Muntins, glazing, sills, molding, shutters) shall be permitted without requiring energy code compliance.

3409.2.2.8 Structural Requirements. House museums need not comply with the wind load and seismic load requirements of 780 CMR 3408.0.

3409.3 *Partially Preserved Buildings.*

3409.3.1 State Building Code Provisions. A *preserved building* shall be subject to the following provisions.

1. **Existing Systems** - individual components of an existing *building system* may be repaired or replaced in kind without requiring that system to comply fully with the code for new construction. (*See* 780 CMR 34.00, 780 CMR 3404.3. *New Systems.*)
2. **Replacement in Kind** - when the repair of historic materials including patching, splicing, piecing-in, consolidating or reinforcing is not possible, compatible materials may be substituted which closely convey the form and design as well as the visual appearance of the existing feature.

3409.3.2 State Building Code Exceptions. A *preserved building* shall be subject to the following exceptions. Repairs or in kind replacement of the following features will be allowed on partially preserved buildings so as not to compromise the architectural integrity of the historical characteristics and qualities which contributed to the eligibility for listing in the National Register of Historic Places.

1. **Roofing** - repair or in kind replacement of an existing historic roof system (i.e., slate, wood, clay, tile, metal) shall be permitted without requiring structural compliance for equivalent new construction providing that dead and live loading requirements have not changed.
2. **Windows** - repair or in kind replacement of existing historic windows (i.e., frames, sash, muntons, glazing, sills, molding, shutters) shall be permitted without requiring energy code compliance.
3. **Entries/Porches** - repair or in kind replacement of existing individual decorative features of an existing system (i.e. columns, balustrades, stairs, pilasters, doors, sidelights) shall be permitted.
4. **Wood Siding/Decorative Elements** - Repair or in kind replacement of an existing system including such items as clapboards, shingles, cornices, brackets, and window and door surrounds shall be permitted.
5. **Masonry** - repair or in kind replacement of masonry units as part of an existing system (i.e., brick, stone, terra cotta, concrete and stucco) shall be permitted.
6. **Metals** - repair or in kind replacement of existing architectural metals (i.e. cast and wrought iron, steel, tin, copper and copper alloys, aluminum, zinc) shall be permitted.
7. **Interior Features** - repair or in kind replacement of non-structural interior features that are important in defining the overall historic character of a building (i.e., columns, cornices, baseboards, fireplace mantels, paneling, window trim, doors, moldings, railings, flooring, plasterwork) shall be permitted.

3409.3.3 Applicability. 780 CMR 3409.3 and 780 CMR 34.00 shall apply to all *preserved buildings*.

3409.3.4 Continuation of Use and Occupancy. The legal use and occupancy of any *preserved building* may be continued without change or further compliance to 780 CMR.

3409.3.5 Inspection Certification and Fees. *preserved buildings* shall not require annual inspection unless otherwise stipulated in 780 CMR 106.5 and Table 106.

3409.3.6 Fire Damage. If a building or structure is damaged from fire or other casualty it may be restored to its original construction or it shall meet the requirements of 780 CMR provided these requirements do not compromise the features for which the building was considered Historic when listed in the National Register of Historic Places.

3409.3.7 Change in Occupancy. See 780 CMR 34.00.

3409.3.8 *New Systems*. See 780 CMR 34.

3409.3.9 Lesser and Equal Hazard. See 780 CMR 34.00. A *preserved building* classified under unprotected construction Type 2C or 5B shall have waived the requirement to add one to the Hazard Index number (See 780 CMR 34.00, Table 3403).

3409.3.10 Greater Hazard. See 780 CMR 34.00. A *preserved building* classified under unprotected construction Type 2C or 5B shall have waived the requirement to add one to the Hazard Index number (See 780 CMR 34.00, Table 3403).

3409.3.11 Energy Conservation. Preserved buildings are exempt from the energy requirements of 780 CMR 13.00 and 61.00.

Exception. Additions to partially preserved buildings shall comply with the energy provisions of 780 CMR 13.00 or of 780 CMR 61.00, as applicable.

3409.3.13 Accessibility for Persons with Disabilities. Accessibility requirements shall be in accordance with 521 CMR.