



MOUNT VERNON FIRE STATION STRUCTURAL ASSESSMENT STUDY Mount Vernon, Iowa

INTRODUCTION

Phase I of this investigation observed that the structure of the fire station's existing Apparatus Room is in fair to good condition and could be rehabilitated for continued use in conjunction with a building addition. Phase I also concluded that the structure of the administrative area to the north was not a good candidate for re-use, but should be razed and replaced with new construction if the building is to be continue in service as a fire station.

The current phase investigates how the existing facility may be rehabilitated and enlarged to provide the Fire Department with the space they need for their equipment and programs. Preliminary plans have been developed to illustrate how various space needs may be accommodated. Sketches of the building's main elevations have been made to illustrate how it could appear as a member of this historic neighborhood. A preliminary opinion of cost based on the square footage of the renovated building has been developed to assist the community in judging the feasibility of the project.

Space Needs

Apparatus Room:

- 3 existing bays - 2,977 g.s.f.
- 2 additional bays - 2,278 g.s.f.
- Features:
 - 14'-0" tall vehicle doors at new bays.
 - Overhead plumbing for fill stations.
 - New vehicle exhaust ventilation system.
 - Man door facing street.

Chief's Office:

- Desk
- Filing Cabinets
- Computer
- 160 s.f.



Assistant Chief's Office:

- 100 s.f.

Radio Room:

- 100 s.f.

Conference Room:

- 345 s.f.
- 12 occupants
- Library – Code Books, Study Materials

Day Room:

- 300 s.f.
- Seating for 8 to 12 people
- Flexible space

Kitchen:

- 220 s.f.
- Appliances: Refrigerator, dishwasher, double-bowl sink with garbage disposal, range with hood, microwave oven.
- Prep/service island with bar stool seating and storage below.

Laundry:

- 80 s.f.
- Washer, dryer, laundry tub, supplies storage

Firefighters' Gear Storage:

- 100 s.f.

Equipment Storage:

- 180 s.f.

Air Compressor/Tank Room:

- 60 s.f.

Hose Drying Tower:

- 36 s.f. on 3 levels = 108 s.f.

Men's Restroom:

- 80 s.f.

Women's Restroom:

- 80 s.f.

General Storage:

- 400 s.f.

Water Rescue Equipment Storage:

- Storage for boat, trailer and miscellaneous equipment - 400 s.f.

Men's Bathroom (Optional):

- 90 s.f.

Women's Bathroom (Optional):

- 90 s.f.

Bunkrooms (Optional):

- 140 s.f. ea. x 6 units = 840 s.f.

Strength Training (Optional):

- 750 s.f.

Training (Optional):

- 400 s.f.

Non-program Spaces:

- Emergency Generator: 100 s.f
- Trash Enclosure: 100 s.f
- Mechanical Rooms: 260 s.f.
- Janitor: 20 s.f.
- Corridors
- Stair Towers

Parking:

- 6 stalls under building.

Design Approach

For the purposes of this study it has been assumed that the existing fire station can be expanded eastward onto land that is currently used for parking and includes a platted alley. Some of the parking will be recovered on the alley side of the expanded fire station. The expansion eastward 34'-8" overall will provide two additional bays for the Apparatus Room and a human entrance from the First Street side of the building.

The existing administrative and storage areas located to the north of the Apparatus Room are proposed to be demolished. New construction would extend 40'-0" toward the alley from the north wall of the existing Apparatus Room structure, would be as wide as the newly expanded Apparatus Room. This new construction would be built on three levels: a basement level that opens to the grade of the alley north of the fire station; the



main level that would house administrative spaces, equipment storage, kitchen, laundry and restrooms; and an optional upper level that would provide space for bunk rooms, bath rooms and training rooms.

The main level would be at the same floor level as the apparatus room. A person door facing First Street provides convenient access to firefighters and provides an obvious entrance for the visiting public. A glazed partition would define the passage from this door to the administrative area for the safety of visitors while allowing them to observe the fire fighting equipment.

Spaces are arranged in the administration area to make visitors feel welcome while keeping them away from the fire fighters' living quarters, and to enhance the flexibility of the spaces. The kitchen and the day room have an open plan similar to the great rooms often seen in contemporary homes. The conference room is proposed to be built with a moveable partition so that it can be opened to the day room as well, making the combined spaces suitable for large group training sessions.

A laundry room is located on the main floor for easy access from the fire fighters' gear room as well as from the kitchen and sleeping rooms. The progress of laundry through its cycles can be monitored easily from the kitchen or the day room.

The radio/communications room is centrally located for easy access.

A room to house the air compressors and air tanks opens from the Apparatus Room. The floor and walls of this room will need to be treated to provide significant acoustical isolation of other spaces from this equipment.

if the optional upper level is constructed, the facility will need to have two stair towers for egress from that level. Drawings accompanying this report assume that the upper level will be constructed, and so show two stair towers. Only one stair tower would be required if the optional upper level is not built.

Bunk rooms are included as optional program space. The drawings accompanying this report show six individual sleeping rooms on the optional upper level rather than one bunk room for men and one for women. Individual sleeping rooms have become the

standard for fire stations, military barracks and college campuses because they provide more restful sleep than shared spaces and because they offer the greatest flexibility in assigning spaces to the different sexes. A given sleeping room may be occupied by a man during one shift and by a woman during the next shift if necessary.

The optional upper level would also have space for a strength training room and for a dedicated training classroom.

The basement level of the building would provide mechanical space, space for general storage and space for the storage of water rescue equipment, including a boat and trailer. Half of the basement level is shown as parking for six vehicles that is open to the alley. Space is also provided for the emergency generator and a trash enclosure.

Because this is only a preliminary design, not every potential problem is solved. One problem that has become apparent with the layout of the basement level is that the grade of the hillside on the east side of the building may make it necessary to open the water rescue storage to the north. Opening the water rescue storage to the north would eliminate at least one parking space.

The exterior of the renovated and enlarged building would be faced with brick trimmed with cut stone to harmonize with City Hall and with the commercial buildings in the historic district. A building of this size with five large vehicle bays facing the street can pose a scale problem with its neighbors. The design proposes using fine detailing in the masonry to give the fire station human scale and visual interest. Large expanses of blank concrete walls that disrupt the sense of human scale will be eliminated by extending the brick veneer down to grade along foundation walls exposed at the hillside.

The new Apparatus Room bays will probably be higher than the existing bays. A new roof structure is proposed to visually unify old and new and to provide another layer of visual detailing.



Opinion of Probable Cost

Demolition

Admin. Area	
Admin. Basement	
Detached, Frame Garage	\$ 42,000.00

Base Additions

Apparatus Room Addition	
Main Level – Admin Addition	
Bsmt. Level – Admin Addition	\$1,182,000.00

Base Renovation

Existing Apparatus Room	\$ 210,000.00
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Base Construction Sub Total	\$1,434,000.00
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<u>30% Design Contingency</u>	<u>\$ 430,000.00</u>
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Total Base Renovation and Additions	\$1,864,000.00
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Alternate

Upper Level Addition	\$ 459,000.00
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<u>30% Design Contingency</u>	<u>\$ 137,000.00</u>
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\$ 596,000.00

Total Including Alternate	\$2,460,000.00
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Excluded:

1. Alley reconstruction.
2. Tower(s) for radio antenna and warning siren.



Howard R. Green Company
www.hrgreen.com



**MOUNT VERNON FIRE STATION
STRUCTURAL ASSESSMENT STUDY
FINAL
Mount Vernon, Iowa**

March 12, 2009



**MOUNT VERNON FIRE STATION
STRUCTURAL ASSESSMENT STUDY
Mount Vernon, Iowa**

SUMMARY

Apparatus Room:

The structure condition for the Apparatus Room is fair to good. It is Howard R. Green Company's opinion that the Apparatus Room's could be rehabilitated and the area renovated in conjunction with an addition to the Fire Station.

North End:

It is Howard R. Green Company's opinion that the North End of the existing Fire Station should not be renovated as part of an addition to the building. The replacement recommended for the floor and roof structure makes it more feasible to demolish this end of the building and add a new structure with the addition to accomplish the space programming that may be utilized for this area.

INTRODUCTION

The City of Mount Vernon, Iowa retained Howard R. Green Company (HR Green) to perform a structural condition assessment of the existing fire station located at 217 First Street NW in Mount Vernon, Iowa. Richard Ward, P.E. performed the site investigation on March 3, 2009. A summary of our site observations and recommendations are included in this report.

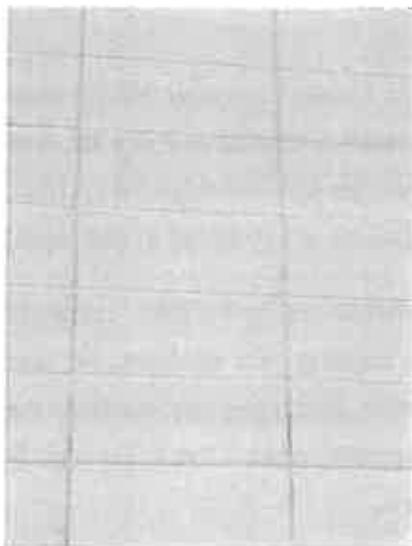
A set of plans for the Fire Station was provided to HR Green by the City. However, these plans did not indicate the as-constructed condition of the building. For example, the plans indicated a basement below the Apparatus Room, 12" CMU walls, and a pre-cast concrete roof structure. The actual building was constructed without a basement beneath the Apparatus Room, 8" CMU walls, and a steel bar joists/steel roof deck structure.

SITE OBSERVATIONS

Apparatus Room:

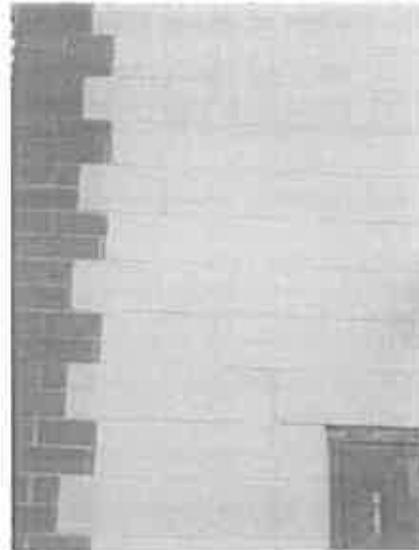
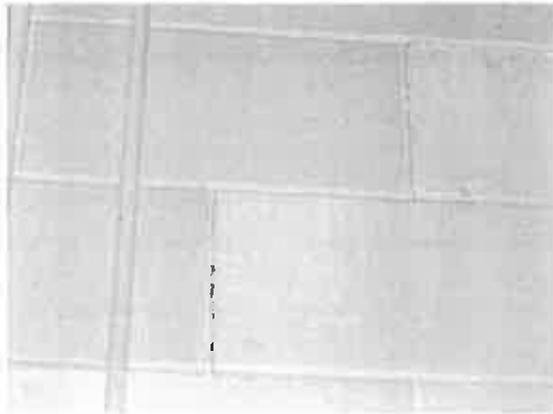
The Apparatus Room's roof structure is steel roof deck supported by steel bar joists. The bar joists are supported at the east and west exterior concrete masonry unit (CMU) walls. The CMU was measured to be 8" thick. A perimeter foundation wall supports the CMU walls. The interior slab is supported by the underlying soil.

1. The slab-on-grade in the north end of the Apparatus Room had settled approximately $\frac{1}{2}$ " to $\frac{3}{4}$ " relative to the perimeter foundation wall.
2. The perimeter foundation wall is cracked at the southeast pedestrian door.

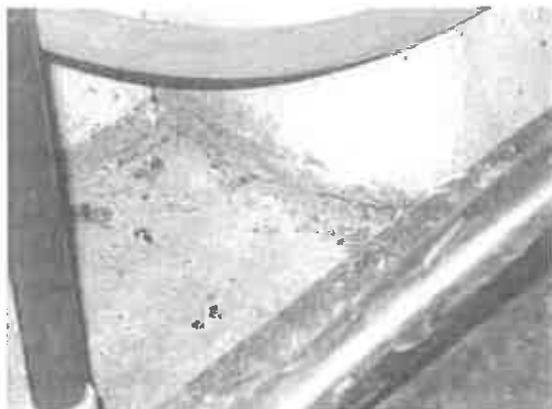
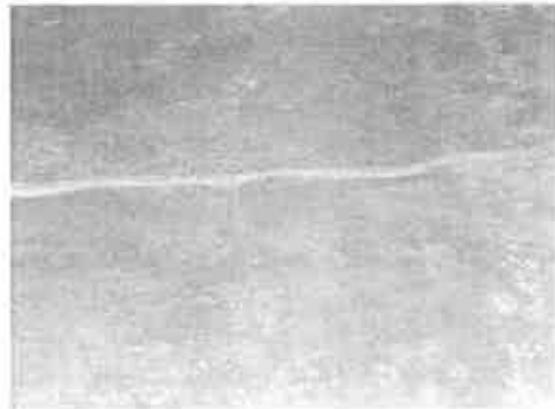


3. CMU pilasters are cracked vertically on the outside face. It appears that the joints are control joints and are intended to be a weak point for cracking to occur.

4. CMU joints in the southeast corner have stair stepped cracks in the interior and exterior face of the wall.

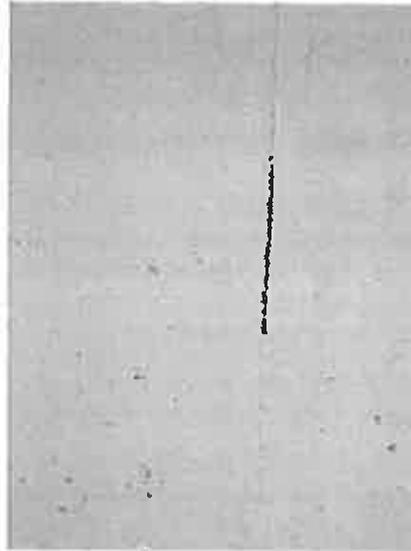


5. The slab-on-grade is cracked in several locations. Vertical displacement across the crack was noted in the south end of the Apparatus Room.

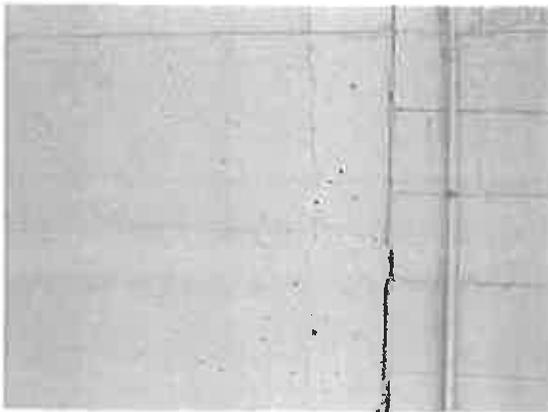


6. A gap was noted between the bottom of the CMU for the most northerly pilaster on the west wall and the concrete surface.

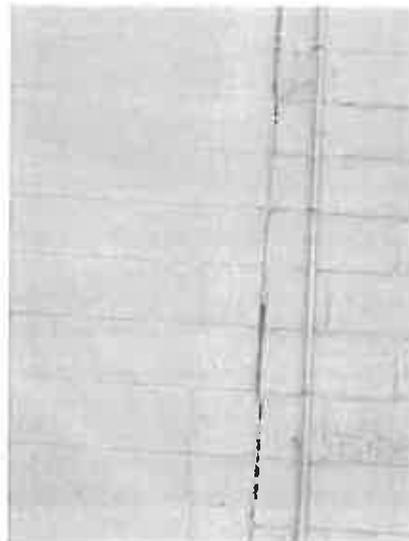
7. Vertical cracks spaced at approximately 6 feet on center were observed in the exposed exterior east perimeter foundation wall.



8. The sealant between the paving and perimeter foundation wall has deteriorated.



9. A vertical crack in the exterior face of the east perimeter wall was noted approximately 20' from the north end of the building. The crack width varied from 20 mils to 60 mils wide.



10. The joint in the CMU at the change in roof elevation has a gap.

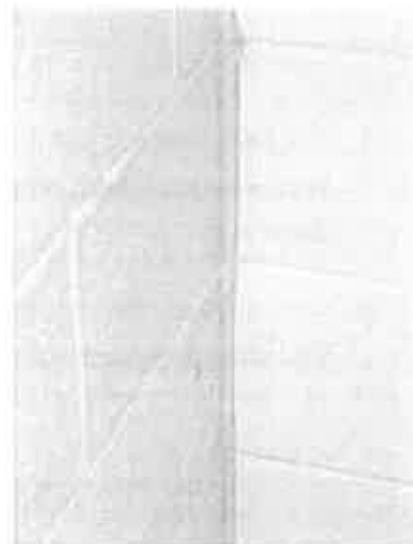
11. The grade elevation for the lot to the west of the Fire Station appears to be higher than the floor elevation.

North End, Main Level:

This end of the building on the main level consists of the kitchen area, restroom, communications room and hallway. Bar joists spanning from the north exterior CMU wall to the Apparatus Room's north perimeter foundation wall support a 3 1/2" concrete slab/steel form deck, except for the floor immediately north of the hose rack pit. The bar joists in this area span from the north exterior CMU wall to the CMU wall on the north end of the hose rack pit. The roof structure consists of bar joists with the same support conditions as the main level bar joists, except the main floor bar joists are spaced more frequently than the roof bar joists. The roof elevation for the north end of the structure is lower than the roof elevation for the Apparatus Room.

1. Clearance from the main floor to the bottom of the roof structure was measured to be approximately 9'-2".
2. CMU walls were measured to be 8" thick, same as the Apparatus room.
3. Roof bar joist spacing, or roof deck span, is approximately 6 feet. The bar joists were measured to be 12" deep.

4. Gaps were noted between interior non-load bearing intersecting walls.





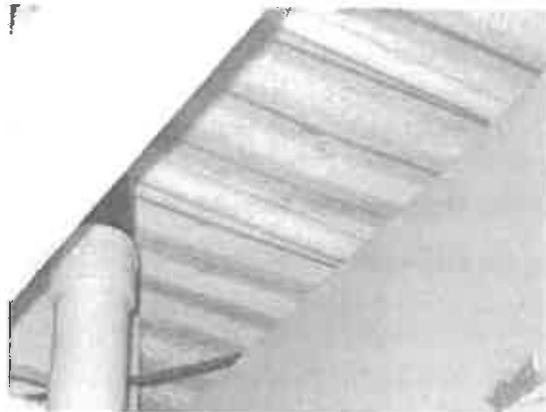
5. It appears that a roof drain header in the communication room has leaked in the past and stained the existing ceiling tile.
6. CMU joints in the south wall at the door into the communications room has a stair stepped cracks in the wall.

North End, Lower Level:

The lower level consists of a laundry area, men's and women's restrooms, a utility room, and what appears to have been a meeting room. The stairs between the main level and lower level were measured to have 16 risers at approximately 7" each riser. The lower level floor to the main level floor is approximately 9'-4". The exterior CMU walls appear to be supported by perimeter footings.

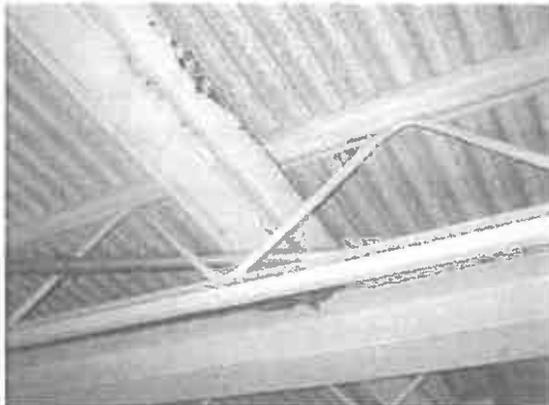
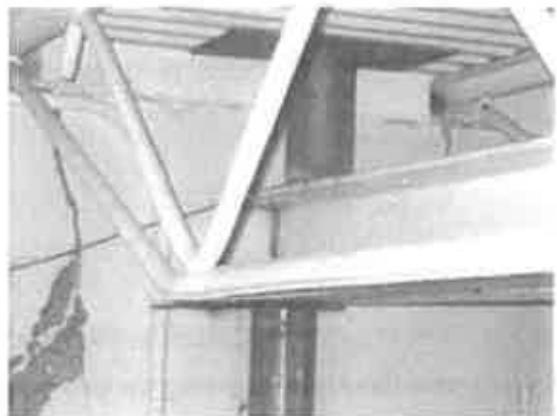
1. Cracks were observed in the CMU north exterior walls below the windows.

2. An area of damaged floor deck was noticed above the laundry area.



3. The main floor bar joist spacing (floor slab span) was measured to be approximately 2 feet. The bar joists were measured to be approximately 12" deep.
4. Vertical clearance from the lower level floor to the bottom of the bar joists was measured to be approximately 8'-1".

5. The main level floor framing above the Meeting Room has been shored. 5" wide flange members span approximately 18' in the east-west direction and provide support for the bar joists' top chord member. One beam was located approximately 5'-9" north of the south wall and the second beam approximately 6'-0" north of the first beam. The two beams are supported at the bottom flange by another 5" wide flange spanning from the south wall to the north wall. This is a span of approximately 20'-1". Each wide flange is supported by pipe columns at their ends.



6. A diagonal crack in the south cast-in-place concrete wall in the Meeting Room was observed. The crack is in the vicinity of the shoring member. The crack was measured to be approximately 20 mils to 30 mils wide.



7. Water damage on the floor structure and walls was observed in the northwest corner of the Meeting Room. The steel floor deck is corroded in this area.



8. Additional deck corrosion was noted near the center of the north wall.

RECOMMENDATIONS

Apparatus Room:

The structure condition for the Apparatus Room is fair to good. It is HR Green's opinion that the Apparatus Room's issues noted above could be rehabilitated and the area renovated in conjunction with an addition to the Fire Station.

North End:

The structure condition for the north end of the structure is fair to poor. The shoring installed below the main level in the meeting Room is inadequate to support the minimum design live loads per the International Building Code. In addition, the depth to span ratio for the members is less than what is considered good engineering practice. This could result in serviceability problems related to excess deflection when the members are subjected to maximum loads.

Based on field measurements of the roof bar joists and floor bar joists, it is believed that they are J series joists. The load capacity was evaluated for a range of J12 series joists, from the lightest J12 joist to the heaviest J12 joist. The evaluation determined that the roof bar joists would be overstressed when subjected to design snow load plus drift load



due to the upper roof level. For the main floor bar joists, only the heaviest section produced for a 12J (12J6) would be capable of supporting the 80 pounds per square foot live load specified by International Building Code for a corridor.

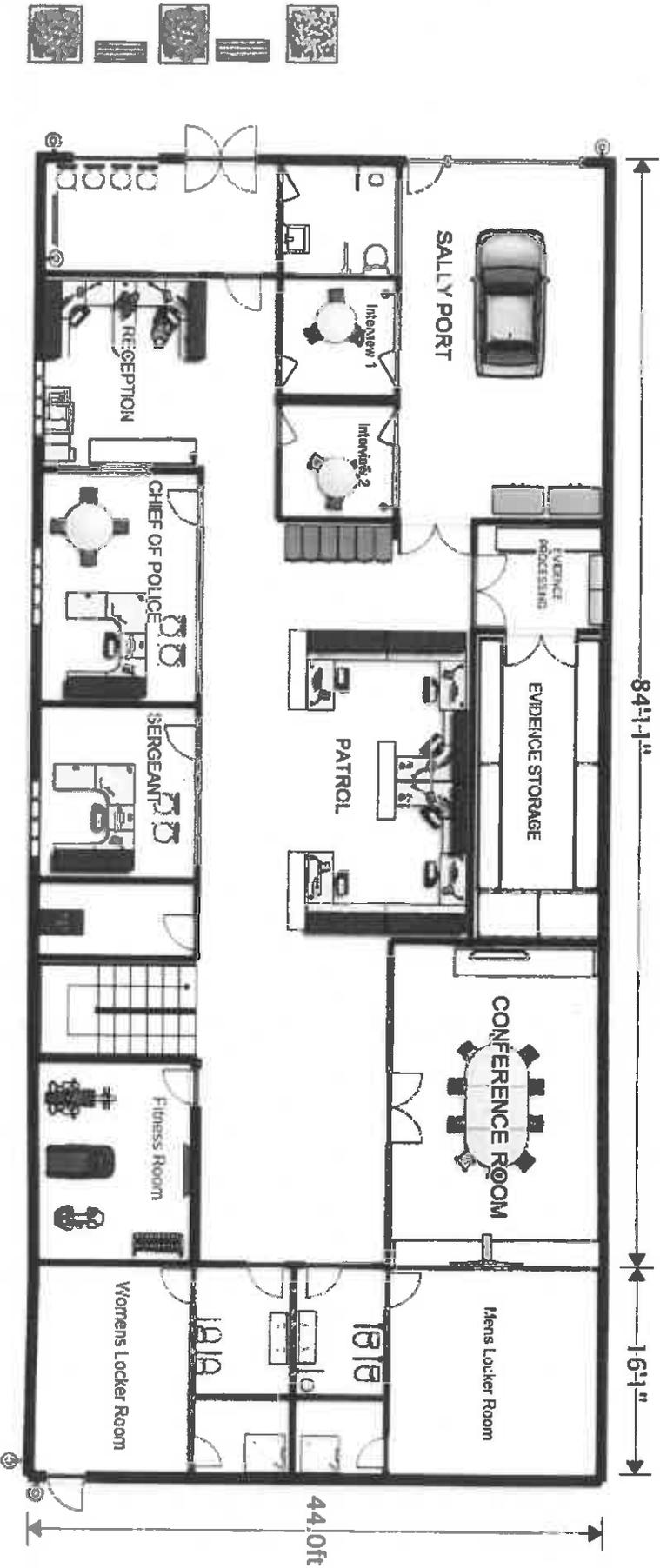
Bar joist top and bottom chord members are typically designed for axial loads (tension or compression) only. With the wide flange member supporting the top chord member between panel joints, the top chord is subjected to bending stresses. The bar joist was probably not designed for this loading condition.

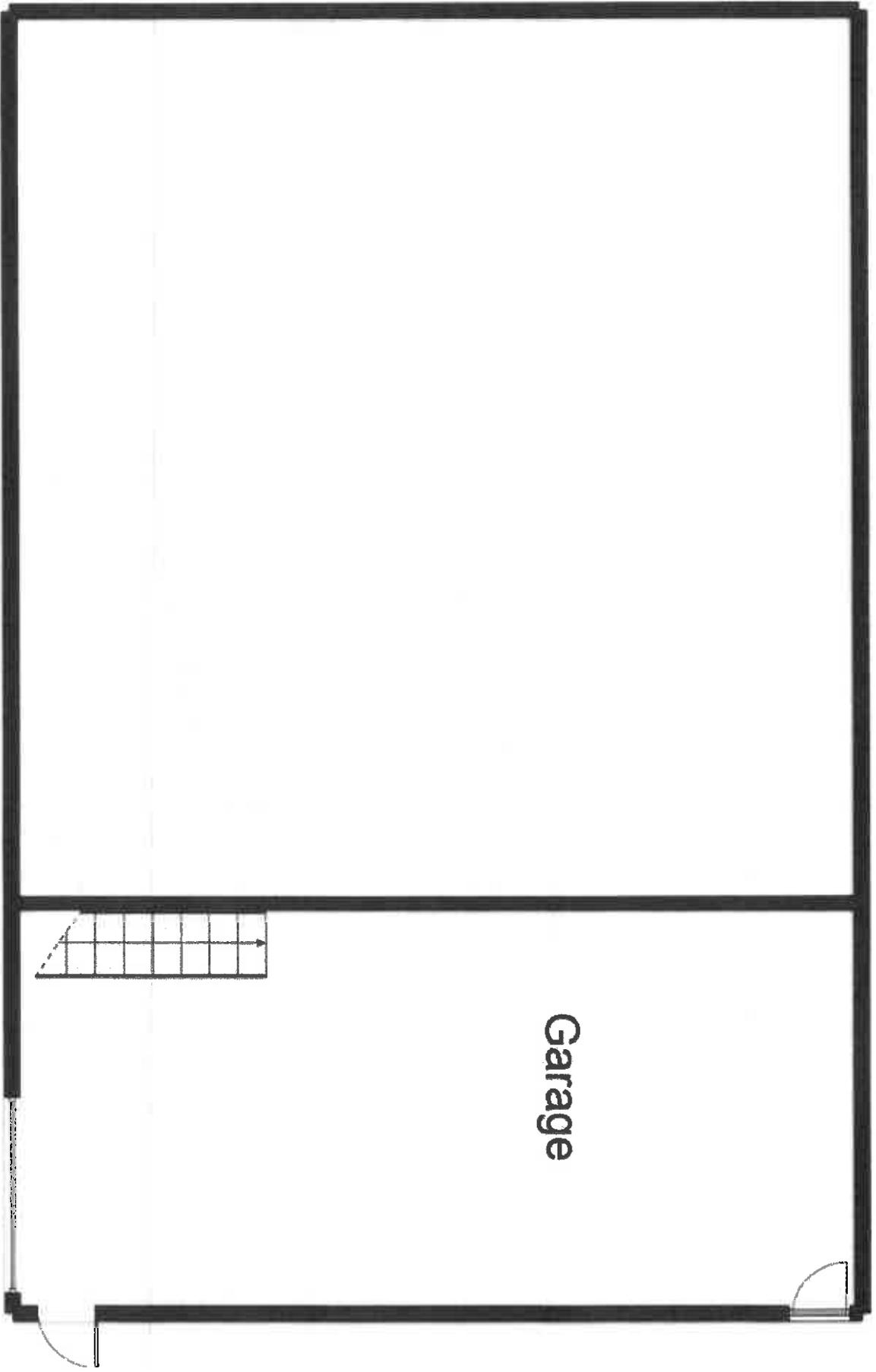
Areas of the steel floor deck at the north end of the building have corroded and would need to be replaced if the structure was rehabilitated as part of the building addition.

The vertical clearance between floors is very tight for renovated spaces.

It is HR Green's opinion that the North End of the existing Fire Station should not be renovated as part of an addition to the building. The replacement recommended for the floor and roof structure makes it more feasible to demolish this end of the building and add a new structure with the addition to accomplish the space programming that may be utilized for this area.

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