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Facility Assessment

Fire Station Building #1

Structural, Architectural, Mechanical, Electrical and Plumbing Systems

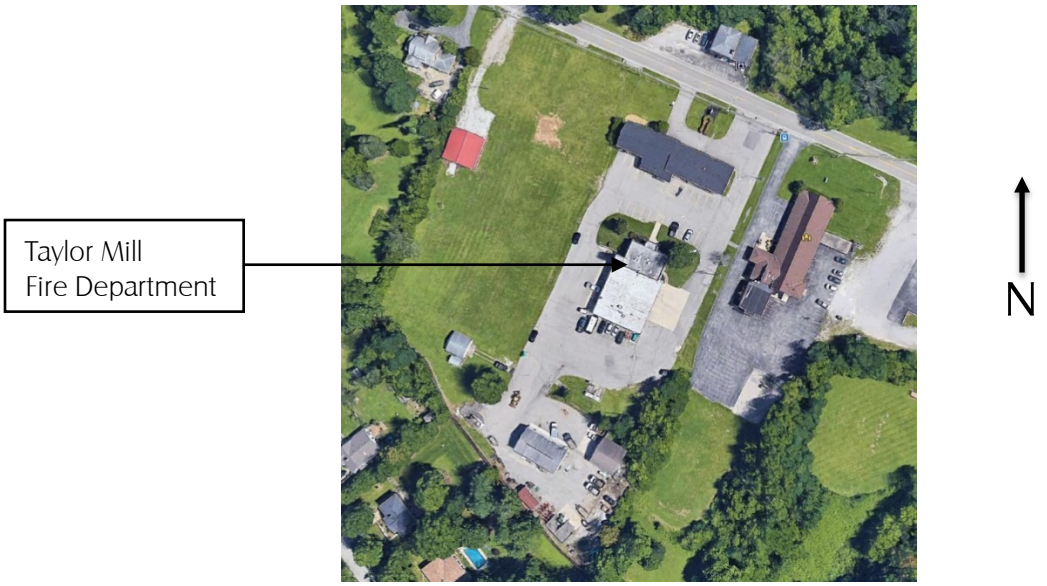
Prepared for

the City of Taylor Mill, Kentucky

January 5, 2021

Facility Assessment
Taylor Mill Fire Station #1

On December 15, 2020, Bob Dreyer & Neena Jud of CT Consultants and Paul Maxfield of KLH Engineering visited the city's firehouse located at 5231 Taylor Mill Road. They met with Fire Chief John Stager to tour the building and discuss the ongoing problems. The purpose of the visit was to observe several issues with the building, recommend repairs if necessary, and provide an opinion of construction cost to make the repairs if they are required.



History of the building:

Older residents of Taylor Mill remember a pay lake on this site, which was filled in and turned into ballfields. In the 1970's volunteers built this facility starting with the front two-story portion in 1979 then adding the pre-engineered metal building for the bays. The project was completed in 1980. At that time, it was a Volunteer Fire Department. Today a crew of four to five fire fighters, medics and emergency medical technicians are stationed at the building around the clock. There are three female and 24 male full time, part-time and volunteer personnel for a total of 27.
The building was re-roofed in 2018.
Front landscape removed and concrete walk installed in 2019.

Facility maintenance issues reported:

1. Water staining /dripping on inside of foundation walls.
2. Puddles of water near foundation walls.
3. Positive test for mold in day room.
4. Wall finishes bulging in day room.
5. Cracks in drywall at upper corners of windows.
6. Bulging of paint finishes due to corrosion of corner bead at window heads & jambs.
7. Movement in ceiling tile grid system (edge angle pulling away from the tiles and grid).
8. Staining of acoustical tile ceilings on both levels.
9. Separation between pre-engineered metal building system and concrete block Hose Tower.
10. Corroded steel lintels above exterior doors and windows.
11. Separation between courses of block in line with lintels.
12. Cracks in exterior masonry – both block and mortar joints.
13. Bulging and buckling of inside face of Hose Tower.
14. Cracks in concrete blocks scoring in line with cracks in mortar joints on Hose Tower.

The resulting assessment highlights our findings:

Description

The firehouse consists of two types of construction. The 1800 square foot +/- two story front section of the building consists of living quarters, storage areas and offices on two levels. The upper level is the entry level and grade drops off on both sides so that the lower level provides direct access to the apparatus bays. This front section of the building is constructed of exterior load bearing masonry walls, wood floor and roof joists with one steel beam spanning from east to west, and interior block walls on the lower level and stud walls on the upper level. The exterior masonry walls are 8" thick and consist of (2) 4" thick concrete blocks that bear on a concrete foundation.

The interior face of the exterior masonry (block) walls on the upper level was finished by adhering 1" expanded polystyrene insulation to the block, applying metal furring strips into the factory scored grooves in the insulation and attaching drywall to that. The concrete foundation or block walls on the lower level were simply painted. When the sleeping rooms were relocated to the lower level, the exterior wall was insulated and finished with beadboard. Matching partitions extending to within 6" from the ceiling were constructed providing privacy for each bed.

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The 4,900 square foot +/- single story rear section of the building consists of four structural bays constructed of steel beams, columns, and metal siding that are supported by a concrete foundation. There is a low wainscot of brick over concrete block on either side of the overhead doors. The upper portions of the walls and the roof were insulated with fiberglass bats in the manner of pre-engineered metal buildings with a plastic liner. The floor is poured concrete. The first three bays are in use as apparatus bays. The fourth bay is separated from the rest with a full height concrete block wall installed when the water department utilized that area. Within the last few years, this bay has been repurposed as a fitness center and storage room.

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Findings

1. Site Conditions

Description:

This building is located on the City of Taylor Mill property. Access to the building is via an asphalt drive from the Taylor Mill Road along the east side of the Administration Building to the facility. A parking lot separates the Administration Building from the visitor entrance to the Fire Department. The asphalt drive continues along the east side of the Fire Department providing access to the Public Works Department to the rear of the property and returning on the west side of the Fire Department and connecting to the parking lot. There are substantial concrete aprons on the east and west sides of the building.

A Community recycling bin is located across the asphalt service road.

Refer to Mechanical and Electrical Portions of this report for descriptions of the existing utility services serving the building.

Condition:

The site is in fair condition.

It was reported that the original fill on this site was not well compacted. This is supported by various cracks observed in the concrete as well as the condition of the building to be discussed later.

It was reported that storm water flows down the grassy slope and ponds on the concrete in front of apparatus bay 4, despite the trench drain.

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2. Structural System Office/Living:

Description: The Office/Living section of this building is constructed with a concrete foundation, which steps down towards the rear as the grade drops off. Above the foundation extends loadbearing masonry walls of 4" block faced with 4" integrally colored scored block. Most interior walls of the lower level are concrete block. The floor of the upper level is framed of wood joists running north-south hung supported on joist hangers connected to a ledger bolted to and/or resting on a ledge of the foundation wall. The floor joists also bear on an interior steel beam running from east to west. The roof is framed similarly.

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Condition: Steel lintels above the exterior doors and windows were observed to have a significant coating of rust (corrosion). See photos 10, 11, & 13. The expanded volume of these lintels has separated the mortar joint between the course below and course above the lintel extending around the structure, which allows water to get into the wall. In places, this separation is also observed from the inside.

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Additionally there is evidence of bowing in the east wall. This is visible on the outside between the door and the first window. On the inside of the Break Room, the ceiling edge angle moved with the wall's bowing and the perpendicular ceiling grids and tiles are pulling away. See photo 14. The white on the ceiling grid member indicates the edge angle has moved away from it. Therefore, we recommend connecting a steel angle to the exterior block wall and tying that back to several roof joists.

In a few locations, the brick is chipped or cracked. Inside corners exhibit separation. See photos below. The Apparatus Bays and the Office structure are separating above the upper floor line. Rust staining is visible in one area.

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The Hose Tower exhibits significant efflorescence on the interior with some of the blocks moving horizontally towards the interior of the tower at various heights. The exterior shows buckling and bulging of the outer wythe. The west face is breaking away from the remainder as evidenced by cracks through a few blocks at the score line alternating with separation between the mortar and the adjacent block.

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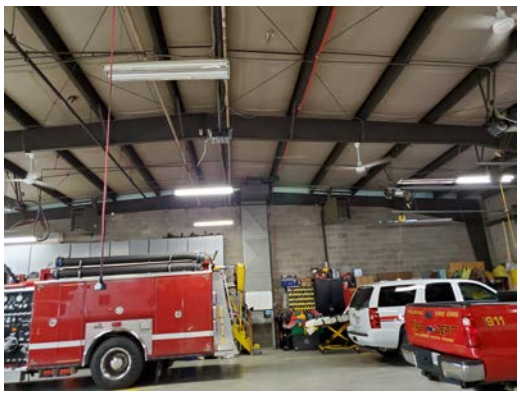
4. Structural System Apparatus Bays:

Description: The Apparatus Bays are constructed of steel beams, columns and metal siding over an 8" thick wainscot of brick over concrete block on a concrete foundation.

Condition: The Apparatus bays are in good condition. In three locations, deterioration of the lower two courses of concrete block were observed. See photo 24. These were near overhead doors where daylight was visible through gaps between the doors and frames at the base. This could allow moisture in the block to freeze and spall the inside surfaces.

Hairline cracks were observed in the concrete floor in most bays. No vertical offsets were observed. These are likely due to insufficient control joints in the slab.



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5. Roofing

Description: The roof of the Office/Living spaces is a membrane roof with parapets. It is a very low slope roof with parapets on front and two sides, draining to a gutter along the rear. This gutter drains into downspouts on each side, which discharge onto the Apparatus bays roof.

The roof of the Hose Tower is also a very low slope roof with parapets on front, rear and one side, draining to a gutter along the other side. This gutter drains into a downspout, which discharges onto the Office/Living roof.

The roof of the Apparatus Bays is standing seam metal with few penetrations. It is in a low slope gable shape with gutters and downspouts along each side.

Condition: The entire building was re-roofed two years ago with EPDM membrane and metal fascia drip edge. No roof leaks have been reported since this work was completed.

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6. Building Interior

Description:

The lower level of the Office/Living spaces typically are painted concrete foundation or painted concrete block walls with ceramic tile floors and lay-in acoustical tile ceilings. The exception is the Sleeping Quarters, which have been finished with insulation and beadboard. Partitions that stop 6" from the ceiling enclose each private bed space. The floor of this area has been carpeted.

The interior face of the exterior masonry (block) walls on the upper level was finished by adhering 1" expanded polystyrene insulation to the block, applying metal furring strips into the factory scored grooves in the insulation and attaching drywall to that. Partitions on this level have wood framing and are faced with drywall. Floors are typically ceramic tile with the exception of the Day Room (TV room) and the stair to the lower level. Ceilings are lay-in acoustical tile.

The interior of the Apparatus Bays is unfinished.

Condition:

Water has been observed running down the concrete foundation wall under the front entry and pooling on the floor. Staining on the wall and some ceiling tiles remain. Water has rusted the ceiling grid in the Men's toilet room and staining on the wall remains. Water has blistered the paint on the Shower room wall, rusted the ceiling grid, soaked and bowed a ceiling tile. Spalling of the interior concrete block is evident. Device boxes in the exterior walls are severely rusted.

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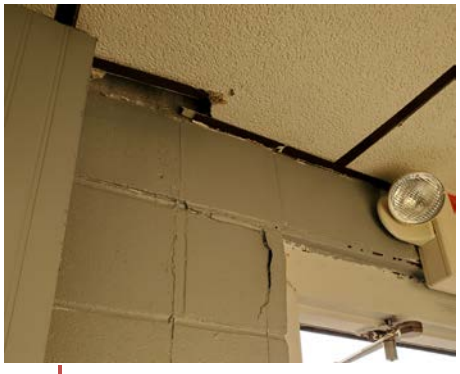

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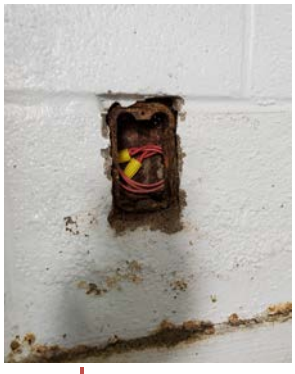

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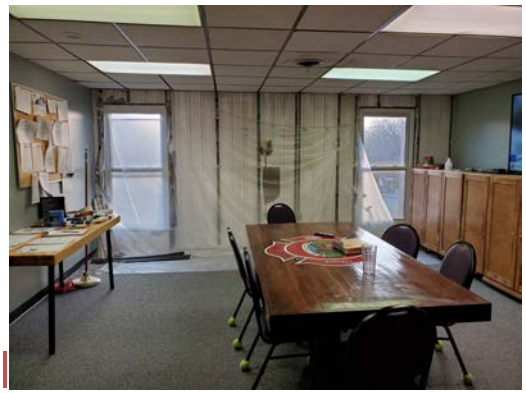
The finished drywall has been removed from the upper level Break Room exposing the insulation and rusted furring strips. The ceiling grid shows horizontal movement (bowing) of the exterior wall. Many other upper level rooms exhibit irregularities in the paint surfaces at the window returns, suggesting corroded corner beads. A few windows show cracks emanating from the upper corner of the window.



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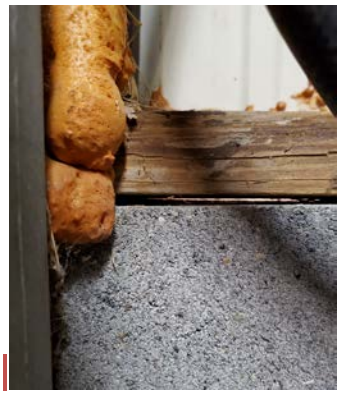
The condition of the Apparatus Bays is satisfactory. Light was observed between the wainscot and wall sole plate in one location and some of the wall insulation is damaged or missing. The concrete block separation wall between the Apparatus Bays and the current Fitness room is in good condition as is the insulation and firestopping sealant above the structural frame to the roof.



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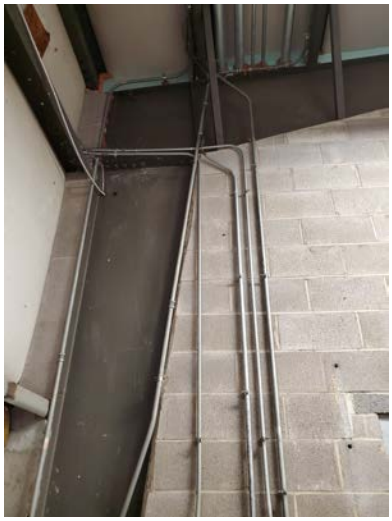

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Conclusions:

The issues of concern were observed primarily in the Office/Living section of the facility. Although the Apparatus Bays showed signs of aging, this structure was in satisfactory condition.

It is our opinion that the rainwater is penetrating the exterior concrete block of the Office/Living section through cracks in the block, cracks in the masonry joints and through the blocks themselves. It is also our opinion that the horizontal movement of the exterior 4" thick concrete blocks is most likely due to the metal ties that were installed to hold the two 4" block wythes together, breaking due to corrosion caused by the water that has penetrated the exterior block. This moisture intrusion has rusted the metal furring strips to which the drywall and other finishes are secured, rusted corner beads at window returns, rusted ceiling grids, stained and damaged ceiling tiles and allowed mold to develop in the building. We were told this mold has been removed. However, since moisture is continuing to enter the building, mold could be present in other locations. In addition, some of the cracks in the masonry walls appear to have been caused by the building settling. While on site, we were told that the building was constructed on fill that was not compacted.

Life Safety issues cross over between the Architectural and Mechanical/Electrical disciplines. If this facility were to be constructed today, a sprinkler system would be required. That was not the case in the 1970's, and as long as there is an outside door for the sleeping suite, it may remain unsprinklered. But smoke detectors and carbon monoxide detectors are currently required, due to the sleeping suite. The smoke and carbon monoxide deectors must be interconnected so that activation of any one will set all into alarm. Furthermore, they must be connected to the building's electrical power and provided with battery back-up or connected to the generator.

In the attached report prepared by KLH, they recommend replacing the HVAC equipment and electric heaters. The R-22 refrigerant in the condensers is outdated and shortly will no longer be available. Many of the electric heaters are badly rusted and out of service.

The plumbing fixtures are satisfactory for their age. They note that the water heaters are reaching the end of their expected service life and replacements should be scheduled.

KLH recommends upgrades in the electric devices, branch circuit wiring and possibly the power distribution. Some of these electrical recommendations are due to water infiltration and some are due to code changes for life safety reasons- i.e., the requirements for Ground Fault Circuit Interrupters and Arc Fault Circuit Interrupters.

The lighting in the Office/Living section is aging and not providing sufficient illumination. They recommend replacing these with LED fixtures and providing lighting controls. This will provide better lighting while saving energy. KLH also provided order of magnitude costs to improve to the outside lighting, replace the apparatus bay fixtures with LED and replace the Exit and Emergency lighting fixtures with LED.

If a sprinkler system is desired, KLH provides some cost recommendations.

A comprehensive Fire Alarm system is suggested for consideration. The minimum requirements for Smoke and Carbon monoxide detectors are described above and included in the costs.

Opinion of probable cost to restore the building to sound condition:

	Recommendation	Estimated cost
1	Remove and replace all of the corroded door and window lintels.	$ 18,300
2	Install retrofit brick ties to connect the exterior concrete block to the interior concrete block.	$ 15,400
3	Repoint masonry joints in the Office/Living section of the facility.	$ 30,000
4	Apply a sealer to the entire exterior concrete block surface. Please note that this must be re-sealed every five years.	$ 9,600
5	Underpin the Office/Living section of the building to minimize future settlement.	$ 57,000
6	Replace concrete slabs along front of building and in apparatus room after underpins are installed.	$ 4,800
7	Connect a steel angle to the west exterior wall and then install steel straps to connect the angle to several roof joists.	$ 8,500
8	Remove wall finishes from upper level exterior walls, including the rusted metal furring strips and insulation. Replace with fiberglass furring, polyisocyanurate insulation boards, mold & moisture resistant gypsum board and plastic corner beads. Repaint. Install new base to match existing elsewhere in rooms.	$ 14,000
9	Clean and repaint lower level exterior walls	$ 3,000
10	Remove and replace rusted ceiling grids. Replace all ceiling grids in shower room with fiberglass. Remove and replace damaged ceiling tiles. Some rooms will require all new ceiling tiles for consistency of appearance.	$ 6,400
11	Mechanical (HVAC)	$ 65,000
12	Plumbing	$ 20,000
13	Electrical - Power	$ 79,000
14	Electrical – Interior lighting and controls	$ 44,000
15	Fire Alarm – Smoke and carbon monoxide detectors	$10,000
16	Anticipated Architectural and Engineering Fees	$ 58,000
13	Contingency (20%)	$ 77,000
Total		$ 520,000

	Suggested for consideration	Estimated cost
1	Fire Alarm – comprehensive system	$ 15,000
2	Sprinkler system	$ 75,000
3	Electrical – lighting improvements	$ 66,000
4	Anticipated Architectural and Engineering Fees	$ 23,400
5	Contingency (20%)	$ 31,200
Total		$ 210,600