

Structural Investigation and Report for the

MILLBROOK ARENA

Township of Cavan Monaghan



BBA PROJECT NO. 19167

AUGUST 7, 2019



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PART 1 – INTRODUCTION

1.1 AUTHORIZATION

This structural condition audit has been undertaken by Barry Bryan Associates, Architects, Engineers, and Project Managers, for the Millbrook Arena, on behalf of the Township of Cavan Monaghan. Authorization to undertake this study was received from Mr. Gerry Barker, Park and Facilities Manager for the Township of Cavan Monaghan.

1.2 OBJECTIVES

The objective of the structural review, as outlined in Barry Bryan Associates proposal for Structural Investigation and Report, dated June 3, 2019 are as follows:

1. Gather and review all previous structural audit reports and existing building plans for Millbrook Arena.
2. Visit the building and perform a visual inspection of all accessible areas of the buildings structure and note the condition and status of the items observed. The reviews will be completed in accordance with the “Guidelines for the Investigation and Repair of Arena Structures” published by the Association of Professional Engineers of Ontario in cooperation with the Safety and Technical Services Division of the Ministry of Labour. We may require some assistance during our onsite review by a member of the staff from the Township. In order to complete a thorough review, we will require that the Township provide us with safe access to the building structure. This will require the rental of lifting equipment and the provision of qualified operators to assist in our review. We have not included the costs for equipment rental in our proposal.
3. Identify any items observed during the visual review which are of concern.
4. Prepare a summary report on the structural condition of the building based on the visual review. The report will include recommendations for remedial work as required for the building to remain in service.

1.3 REVIEW METHODOLOGY

Barry Bryan Associates completed a visual inspection of the building on August 7, 2019. During our inspection we undertook a detailed visual review of the various building structural components, and photographed areas reviewed including any areas of concern.

During the review we checked for evidence of deterioration and/or distress within the structural framing. In general, the structural review included looking for evidence of the following signs of distress:

- Surface deterioration on structural framing
- Deterioration/cracking of concrete
- Deterioration/cracking of concrete masonry block walls
- Excessively deflected structural framing

Complete reference drawings of the existing building structure were not available at the time of our review.

Where reference is made in this report to a Code or other standard, the most recent edition of that referenced material was used.

1.4 STATEMENT OF LIMITATION

All comments and observations contained in this report are based on visual observations made during the inspection on August 7, 2019.

No destructive testing or opening of the building systems was completed during the inspection. Further we did not review the structural steel connections.

We are unable to comment or access structure which is not exposed to view.

Any design and/or construction deficiencies not recorded herein were not evident at the time of the inspection.

PART 2 – BUILDING DESCRIPTION

The Millbrook Arena consists of a single pad arena, an ice re-surfacing room, changerooms, washrooms, furnace room, a foyer, and a compressor room. The second storey consists of a community gathering room, storage rooms, washrooms, a kitchen area and a small gathering room.

The original arena was constructed circa 1950's. In the mid-1970s there was an explosion in Millbrook which damaged one of the exterior walls and required that portion of the facility to be rebuilt. The building structure consists of metal decking cold form steel Z-purlins, pre-engineered steel frames, concrete masonry block walls, metal siding, precast concrete slabs and concrete slabs-on-grade.

PART 3 - OBSERVATIONS

BBA attended a site visit on August 7, 2019 to visually review the condition of the structural building components and exterior building façade.

We observed areas of minor to moderate deterioration and cracking at several locations. We have summarized our observations below:

3.1 BUILDING INTERIOR

3.1.1 *Roof Deck and Purlins*

The roof framing above the ice pad consists of steel roof deck spanning across cold formed steel z-purlins. We were unable to complete a detailed review of the steel roof deck or purlins directly above the ice rink as this framing was enclosed by the existing insulation system within the arena. However, there was one (1) localized area where the purlins and roof deck was visible for our review. Our observations at localized areas are as follows:

- The roof deck generally appeared to be in fair condition with no evidence of water/moisture damage (Photo 001). However, at the area exposed behind the net, there were visible minor damage due to puck impacts. For aesthetics purposes, we recommend that the damaged areas are cleaned and painted as required to match original conditions.
- The cold formed steel z-purlins was generally observed to be in fair to good condition.

Generally, the roof deck and purlins appeared to be in fair to good condition.

3.1.2 *Pre-Engineered Frames*

The main structure of the arena consists of a pre-engineered structural frame system with tapered steel girders supporting the steel purlins. The steel frames span approximately 90'-0" and are spaced at approximately 21'-1" centre to centre. We were unable to complete a detailed review of the entire extents of the tapered girders as this framing was enclosed by the existing insulation system (Photo 002). Our observations are as follows:

- Minor damage was observed at the surface of the frames resulting from repeated puck impacts (Photo 003). For aesthetics purposes, we recommend that the damaged area is cleaned and painted as required to match original conditions.
- Minor localized surface rusting was observed along several bracing members (Photo 004). This is likely due to condensation and high humidity during occupancy. We recommend for the rusted area to be wire brushed clean to bare metal and an epoxy protective coating is applied.
- Bolted connections at the braces appeared to be bent at several locations, effectively causing the nut to be displaced (Photo 005). This appears to be an original condition from the fabrication of the braced connections. Further, minor surface rusting was observed at several bolted connection locations (Photo 006). We recommend for the rusted areas be wire brushed clean to bare metal and an epoxy protective coating is applied.

- Insufficient anchor bolt thread protrusion was observed at several locations. The threads at several bolted connections were not observed to extend past the nuts at the pre-engineered frame base connections (Photo 007). As this condition does not meet the minimum code requirements for thread protrusion past the nut, we recommend that the locations be plug welded to ensure connection to the foundation below is adequate.
- The lower set of braces were observed to be missing along the bleachers (Photo 008). This appears to be an as-built condition as the braces would interfere with the bleacher seating area. A single brace at the south side of the arena appears to be experiencing some deflection, this appears to be an as-built condition (Photo 009).

Generally, the pre-engineered frames appeared to be in fair to good condition. The minor observations noted above are recommended to be addressed to maintain the original condition of the building structure.

3.1.3 Bleacher Seating Area

There are three (3) rows of bleacher seating along the East side of the existing arena. The bleachers are constructed with precast concrete slabs complete with a concrete topping supported on concrete masonry block walls at each end. Our observations are as follows:

- The concrete topping was observed to experience localized minor cracking and paint chipping at localized locations (Photo 010). We recommend that all loose paint be scraped and repainted to match existing conditions.
- Minor cracking was observed at the precast concrete joint location (Photo 011). This cracking is typical for concrete joint locations and is not a structural concern. We recommend for the joints to be routed out and infilled with a flexible calking material.

The precast concrete bleacher seating area was generally observed to be in fair to good condition.

3.1.4 Metal Siding

The building structure at the arena consists of concrete masonry block wall with partial metal cladding along the North, East and West elevations. Our observations are as follows:

- Minor damage to the metal siding at the North-East corner was observed (Photo 012). This damage is likely a result of repeated impacts from pucks/balls within the arena. For aesthetics purposes, we recommend that the cladding is cleaned and painted as required to match original conditions.
- Significant damage to the metal cladding at the North Wall was observed (Photo 013). The cause of the damage is unclear. However, we recommend that the cladding be replaced at this location to restore to original conditions.
- The metal cladding at roof level along the North elevation appears to be separating from the adjacent cladding. We recommend that the cladding at the roof level be re-secured to match the existing conditions (Photo 014).

- Metal cladding appears to be separating from the wall at one of the frames along the west side of the arena (Photo 015). We recommend that the panel be re-secured to match the existing conditions.

The metal cladding reviewed at the interior of the building generally appeared to be in fair condition.

3.1.5 Concrete Rink Slab

The reinforced concrete rink slab was exposed at the time of our site visit to complete our structural review. The concrete rink slab was approximately 200'-0"(L)x80'-0"(W). Our observations are as follows:

- Thermal cracking was observed throughout the entirety of the rink slab, the North side of the rink slab appeared to experience more cracking than the south side (Photo 016). This cracking is typical with age of concrete after years of pulldowns and thawing of the monolithic concrete slab.

The concrete rink slab generally appeared to be in fair condition.

3.1.6 Concrete Apron Slab

The reinforced concrete apron slab extends around the concrete rink slab at the base of the bleacher seating area and at the perimeter of the arena. The apron slab was exposed on the North side of the arena at the bleachers and wraps around to the benches at the opposite end. Our observations are as follows:

- Moderate cracking was observed near the entrance of the compressor room (Photo 017). We recommend to infill the void space with suitable mortar to match existing conditions.
- Moderate cracking and spalling were observed underneath the exterior garage door on the East side of the building (Photo 018). We recommend for all loose and unsound concrete to be chipped out and removed and patched with a suitable repair mortar.
- Significant cracking was observed adjacent to the ice-surfacing room (Photo 019). This is likely due to previous differential settlement of the structure. We recommend for the slab to be repaired and patched with a suitable repair mortar to prevent further deterioration.
- Rutting was observed in the ice-resurfacing room (Photo 020). This is likely due to driving on the slab prior to the concrete completely curing after the original pour, as well as the fatigue of the concrete over the decades of repeated loading.
- Significant cracking was observed in the ice-resurfacing room extending outwards towards the dasher boards of the pad (Photos 021 and 022). This is likely due to repeated water/salts brought through the room by the resurfacing equipment over the years. We recommend for all loose and unsound concrete to be chipped out and removed and patched with a suitable repair mortar.
- Two (2) separate cracks were observed at the base of two (2) of the steel columns at the North side of the arena (Photos 023 and 024). This is likely due to the absence of slab saw cuts at the column locations. This is a serviceability issue and not a structural concern at this time.
- Cracking was observed underneath the mechanical equipment stand supports at the North-West side of the arena (Photo 025). It appears as though a concrete levelling product has been implemented in the past, resulting in a slight transition between the floor elevations. We recommend that the transition be leveled, and the cracks be infilled with suitable mortar.

The concrete apron slab generally observed to be to fair condition, with several localized areas with cracking concerns. We recommend for all cracks to be cleaned and toured out, loose and unsound concrete be removed and infilled with a suitable repair mortar. with suitable mortar.

3.1.7 Concrete Masonry Block Walls

The concrete masonry walls within the complex were typically constructed of 8" and 12" thick concrete masonry blocks at the exterior and interior of the arena. Our observations are as follows:

- Significant moisture accumulation during the winter months was reported in the compressor room located at the North-East corner of the building. At the time of the review, rusting and evidence of moisture was observed on the masonry block wall (Photo 026). We recommend that the rusted sections be wire brushed clean and repainted to match the existing condition.
- Minor to moderate step cracking was observed at several localized areas within the arena (Photos 027, 028, 029, 030, 031, 032, 033 and 034). This is typical under the serviceability conditions for this type of structure and does not pose a structural concern. We recommend that all open/cracked joints be routed out and infilled with suitable mortar to prevent moisture from entering the building.
- Paint chipping and localized damage to masonry blocks was observed in the corridor leading to the compressor room. A section of one (1) masonry block appeared to be removed and infilled with wooden blocking (Photo 035). We recommend that this section be removed and replaced with new concrete masonry block to match existing and all joints be infilled with suitable mortar.
- Previous differential settlement was observed in the ice resurfacing room (Photo 036). The separation appeared to be infilled with spray foam insulation (Photo 037). This does not appear to be a new condition and does not pose structural concern. At this time we recommend that joint filler be removed and replaced with suitable mortar.
- Deterioration and displacement at the base of the concrete masonry block was observed at a localized area (Photo 038). We recommend that the deteriorated blocks be removed and replaced with concrete masonry blocks to match the existing condition.
- Minor step-cracking along at the north side exit was observed (Photo 039). The wall at this location appeared to be slightly displaced from the original location at the base (Photo 040). We recommend that the displaced section of the wall be temporarily shored to facilitate the removal and rebuilding of the wall to restore to original conditions.
- The block wall along the west elevation of the arena appeared to be in fair to good condition (Photo 041).
- Block walls within changerooms 1 through 4 appeared to be in good condition (Photo 042). Minor localized damage was observed in changeroom 3 (Photo 043).
- The bricks enclosing the steel columns within the lobby area appeared to be in good condition (Photo 044).
- The west stairwell was observed to experience minor moisture damage (Photo 045). This is exemplified by the paint chipping at the base of the stairs (Photo 046).
- Localized block failure was observed under the load bearing beam spanning into the wall on the West side of the stairwell (Photo 047). We recommend that all loose and unsound blocks be replaced, and an adequate bearing plate be implemented.
- A steel lintel in the mechanical room adjacent to changeroom 3 was observed to be bearing on a single masonry block experiencing localized cracking (Photo 048). We recommend replacing the steel lintel with a new, longer lintel with a minimum of 6" bearing on each side of the opening.

- Wall separation was observed in the storage room on the second floor (Photo 049). We recommend in filling this void space with suitable flexible mortar.
- The remainder of the south stairwell walls appeared to be in good condition (Photo050).

3.1.8 Concrete Slabs-On-Grade

The reinforced concrete slabs on grade were exposed for our review in the compressor room at the north-east end of the building as well as in the west stairwell. Our observations are as follows:

- The concrete slab within the compressor room appeared to be separated from the building structure locally at the north-east corner of the building (Photo 051). We recommend that this gap be infilled with an appropriate mortar to ensure that no moisture can accumulate at the base of the wall and cause further damage.
- Staining of the concrete surface was observed below the ammonia pump (Photo 052). This is not a structural concern at this time, however we recommend that the concrete surface is cleaned and an appropriate protective coating is applied to the concrete surface to prevent furthermore advanced deterioration in the future.
- Cracking and minor rusting was observed on the slab where the electrical conduits appear to be partially embedded in the concrete slab on grade. It appears that there may not be sufficient concrete cover around the embedded conduit (Photo 053). We recommend that the slab be cut and removed at this location and the conduit be adequately embedded within the concrete.
- Cracking and separation were observed at the base of the door in the west-side stairwell location (Photo 054). We recommend that the cracks be routed and infilled with a suitable repair mortar.

The concrete slab-on-grade generally appeared to be in fair to good condition.

3.1.9 Partial Second Floor Space

The partial second floor area is located along the South side of the arena above the changeroom areas and consists of storage rooms, community gathering room, lounge room, kitchen, bar and bathrooms (Photos 055 and 056). The roof structure consists of wood and steel decking spanning across structural steel beams supported on concrete masonry block walls (Photo 057). We reviewed the roof structure within the suspended ceiling spaces at select locations. Insulation along with plastic covering the roof framing prevented visual access to review the majority of the roof structure (Photo 058). Our observations are as follows:

- Moisture damage was observed at the underside of the insulation. (Photos 059 and 060). This moisture is possibly damaging the roof framing system. We recommend that further intrusive testing be done to inspect the condition of the roof framing system.
- Numerous signs of moisture damage was observed by the water stains and plastic breakthroughs of the ceiling tiles (Photos 061 and 062).

The steel beams and concrete masonry block walls generally appeared to be in fair to good condition. Signs of Moisture were found throughout the entire second floor roofing system.

3.2 BUILDING EXTERIOR

3.2.1 SOUTH ELEVATION

The exterior South wall elevation is generally constructed with prefinished metal siding above a load bearing block wall. Our observations are as follows:

- The foundation wall at the south-west corner of the building appeared to be experiencing localized cracking and spalling at the concrete surface (Photos 063 and 064). Cracking at the centre foundation wall was also observed. We recommend for the cracks to be routed out and infilled with a suitable repair mortar to restore original conditions.
- Minor cracking of the mortar joints was observed along the architectural precast concrete wall panels at localized areas (Photo 065).
- Localized damage to single brick in the architectural precast concrete wall panels was observed (Photo 066). We recommend for the architectural precast concrete wall panels to be repaired and patched with a suitable repair mortar to prevent further deterioration of the architectural wall.
- Localized block damage was observed near the roof at the South-East Corner (Photo 067). We recommend for the architectural precast concrete wall panels to be repaired and patched with suitable repair mortar to prevent further deterioration of the architectural wall.
- The architectural precast concrete wall panels at the South Wall was observed to be in fair to good condition (Photo 068).
- The metal cladding above the Architectural block walls generally appeared to be in fair condition (Photo 069).
- Localized minor cracking was observed at the concrete walkway adjacent to the south elevation (Photo 070). This cracking appears to be a result of freeze and thaw cycles and heaving below the slab. This is not a structural concern.

The architectural precast concrete wall panels and metal cladding generally appeared to be in fair to good condition. However, some of the areas of concern observed on site and noted above require immediate attention to help stabilize the wall structure and prevent deterioration to the point of structural instability.

3.2.2 EAST ELEVATION

The exterior East wall elevation is generally constructed of prefinished metal siding above a architectural precast concrete wall panels. Our observations are as follows:

- The foundation wall near the lobby has a significant gap, and the surrounding paved area is experiences minor deterioration (Photo 071). This is likely due to the damaged eaves that is leaking water onto the wall (Photo 072). We recommend that the crack in the foundation be repointed.
- Moss was observed to be growing along the east side wall (Photo 073). This is a sign of moisture accumulation and has resulted in deterioration of the precast concrete wall panels (Photo 074). We recommend for the architectural precast concrete wall panels to be cleaned at these locations and to prevent further more advanced damage to the wall system.

- Caulked panel joints along architectural precast concrete wall panels appear to be in good condition (Photo 075).
- Metal cladding above architectural precast concrete wall panels appears to be in good condition (Photo 076).
- Minor damage to the metal was observed above the garage door opening near the North side (Photo 077). A section of the steel lintel enclosed by the metal was visible at the damaged location and the lintel was observed to be in poor condition with significant rust accumulation and loss of cross-sectional area (Photo 078). We recommend that this lintel be exposed, removed and replaced with a new lintel to match existing conditions, and the damaged metal siding be repaired/replaced to restore to original conditions. to match the surrounding area.

The architectural precast concrete wall panels and metal cladding generally appeared to be in fair to good condition. However, some of the areas of concern observed on site and noted above require immediate attention to help stabilize the wall structure and prevent deterioration to the point of structural instability.

3.2.3 NORTH ELEVATION

The exterior North wall elevation consists of a low roof and high roof area. The north elevation of the low roof area generally consists of full height concrete masonry block while the high roof consists of partial concrete masonry block and prefinished metal siding. Our observations are as follows:

- Localized step Cracking and paint-peeling was observed along the north elevation (Photos 079, 080 and 081). We recommend for all cracked mortar joints to be routed and re-pointed to restore to original conditions. All areas of peeled paint should be cleaned, and new paint applied to match adjacent wall areas.
- Honeycombing at the foundation wall and mould growth was observed on the exterior of the ice-resurfacing room (Photos 082 and 083). We recommend for the block walls to be cleaned, mould accumulation to be removed at these locations. The honeycombing is likely a result from the pouring of the concrete at the time of construction and does not pose a structural concern.
- The metal cladding was observed to be in fair to good condition (Photo 084).
- Minor damage to the base of the exterior of the garage door overhead jambs was observed (Photos 085 and 086). This is likely due to Zamboni impact while travelling in and out of the ice resurfacing room. We recommend that the enclosures are repaired to ensure more advanced damage does not occur.
- Minor damage to the metal header covers was observed above the overhead door location (087). We recommend that the enclosures are repaired to ensure more advanced damage does not occur.
- Moisture accumulation was observed along the north elevation (Photo 088). We recommend for the block walls to be cleaned to restore the original building condition.

The concrete masonry block and metal cladding generally appeared to be in fair to good condition. However, some of the areas of concern observed on site and noted above require immediate attention to help stabilize the wall structure and prevent deterioration to the point of structural instability.

3.2.4 WEST ELEVATION

The exterior west wall elevation generally consists of prefinished metal siding above a load bearing concrete masonry block wall. Our observations are as follows:

- An open joint was observed between foundation walls and concrete pier at the north-west corner of the building (Photo 089). We recommend that the gap be cleaned and filled with suitable joint filler material to ensure that moisture cannot penetrate into the structure causing more advanced deterioration.
- Mould accumulation was observed at the top of the foundation wall along the entire extents of the west elevation (Photo 090). We recommend that the base of the masonry wall/top of the foundation wall be cleaned and mould to be removed at these locations to prevent future more advanced deterioration.
- One (1) of the masonry control joint locations was observed to be open (Photo 091). We recommend that this joint be cleaned and infilled with a suitable joint filler material to ensure moisture does not penetrate into the existing building envelope.
- Localized deterioration at the top of the foundation wall behind a rainwater leader location was observed (Photo 092). We recommend that this area be fixed with suitable repair mortar to ensure no further damage can be done to the structure.
- An opening was observed at the top of the masonry block wall near the south side of the wall (Photo 093). We recommend that the damaged concrete block at this location is removed and replaced with new block to match existing condition to ensure further, more advanced deterioration does not occur to the building system.

The concrete masonry block, architectural block and metal cladding generally appeared to be in fair to good condition. However, some of the areas of concern observed on site and noted above require immediate attention to help stabilize the wall structure and prevent deterioration to the point of structural instability.

PART 4 – CONCLUSION AND RECOMMENDATIONS

We completed a structural condition review of the existing building framing and exterior building façade where safe access was available for our review. Our general review of the building interior and exterior identified several issues which should be addressed to improve the long term serviceability of the building structure. We have summarized our remedial recommendations as follows:

RECOMMENDED IMMEDIATE REPAIRS: (Recommended to be completed within next 6 months – 1 year)

1. All deteriorated/open/cracked mortar joints should be routed and infilled with a suitable repair mortar to restore the integrity of the existing building envelop.
2. The efflorescence and mould accumulation on the building exterior should be cleaned from the structural systems and an adequate protective coating applied.
3. Patch any locations of spalled concrete masonry block and/or brick with a suitable repair mortar to restore the integrity of the existing building envelop. Replace any damaged/cracked concrete masonry block or brick with new block/brick to match existing asrequired.
4. Any rust accumulation on the existing roof framing should be wire brushed to bare metal and epoxy painted to prevent further deterioration of the structural framing.
5. Rout out existing cracked mortar joint locations and repoint with new mortar to match original conditions.
6. Replace lintels at the 1st floor mechanical room, and above the east overhead doorlocation.
7. Remove and replace the wooden block within the compressor room entrance way with concrete block to match the existing condition.
8. Plug weld the bolts along the base of the pre-engineered frames.

RECOMMENDED REPAIRS: (Recommended to be completed within next 2 – 5 years)

1. Clean existing exterior wall and chip off all locations of peeled paint. Provide new paint suitable for exterior applications to match existing building colour scheme.
2. All damaged metal cladding locations in the interior of the building should be repaired or replaced.
3. Minor cracking in the concrete slab-on-grade should be routed out and infilled with a suitable epoxy injection mortar.

All masonry repairs noted above must be completed using techniques which best match the original construction of the existing building.

The structural framing and exterior walls are in fair to good condition, however remedial repair work is required to preserve the integrity of the existing building structure and restore the building envelop to original conditions.

PART 5 – CONSTRUCTION BUDGET ESTIMATES

We provided an opinion of the order of magnitude costs for both the immediate remedial work and recommended remedial work. The budgets have been developed based on our observations from the site and our recommendations for the remedial repair work for each item. Detailed designs, drawings, and specifications regarding the repairs will need to be developed to confirm the actual project costs.

We have provided our opinion of the budget for the remedial scopes of work below. The budgets do not include HST, permitting, testing and inspection:

IMMEDIATE REPAIRS:

1. Mobilization/General Conditions	\$10,000
2. Masonry Repairs/Cleaning	\$40,000
3. Prepping of Structural Steel	\$15,000
4. Painting Structural Steel	\$15,000
5. Lintel Replacement	\$30,000
6. Miscellaneous Repairs	\$5,000
7. Mechanical/Electrical Upgrades	TBD
Sub-total	\$115,000
15% Contingency	\$17,250
8% Engineering	\$9,200
Total	\$141,540

RECOMMENDED RAPAIRS:

1. Mobilization/General Conditions	\$5,000
2. Masonry Cleaning	\$30,000
3. Metal Cladding Repairs	\$10,000
4. Crack Repairs	\$10,000
5. Mechanical/Electrical Upgrades	TBD
Sub-total	\$55,000
15% Contingency	\$8,250
8% Engineering	\$4,400
Total	\$67,650

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MILLBROOK ARENA
BBA PROJECT 19167**

We trust the above information meets your requirements. Should you have any further questions, please do not hesitate to contact our office.

Yours very truly,

BARRY BRYAN ASSOCIATES
Architects, Engineers, Project Managers

Logan Haupt, EIT

David Bovill, P.E., P. Eng.

LH/gs

APPENDIX A

PHOTOGRAPHS



Photo 001 Hidden Roof Deck & Z-Purlins



Photo 002 Roof Deck Insulation covering Pre-Engineered Frames



Photo 003 Pre-Engineered Frame



Photo 004 Rust on Frame Brace



Photo 005 Bent Connection



Photo 006 Rusted Bracing Connection



Photo 007 Pre-Eng Frame Base Connections

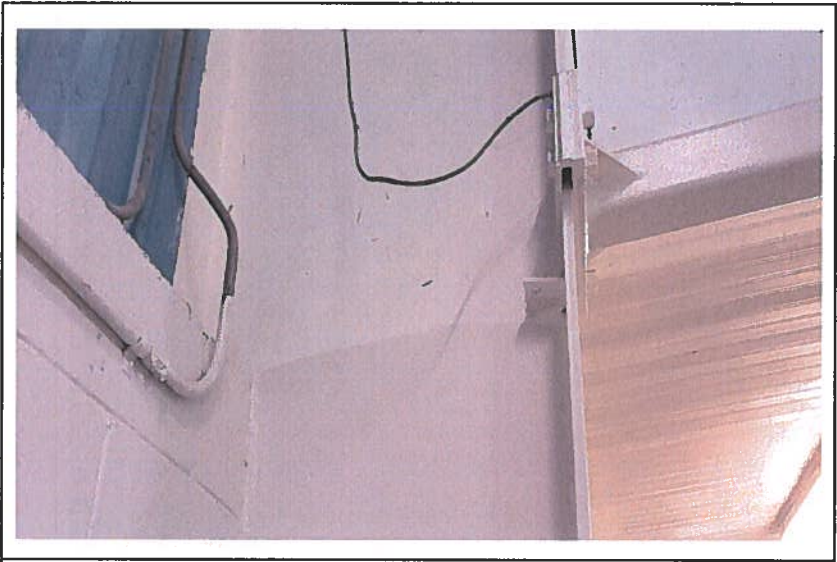


Photo 008 Missing Brace at Southmost Frame

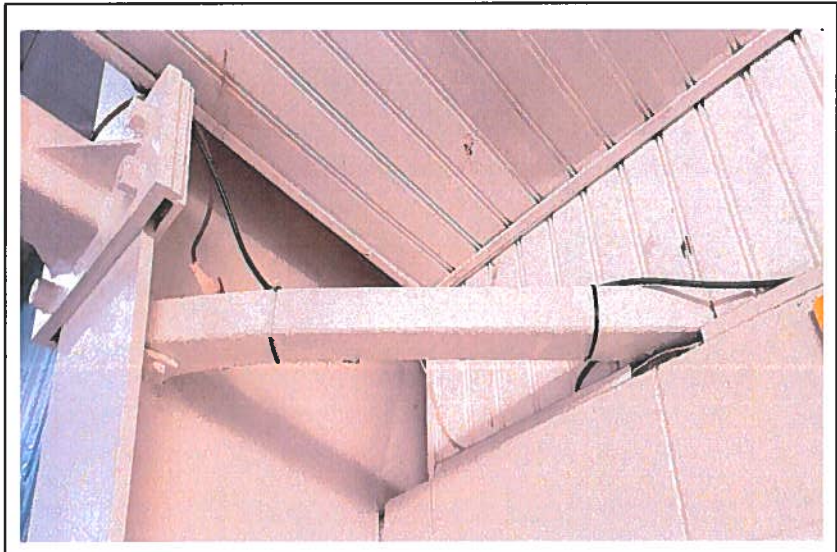


Photo 009 Bent Braced member



Photo 010 Paint Chipping and Crack on Bleachers

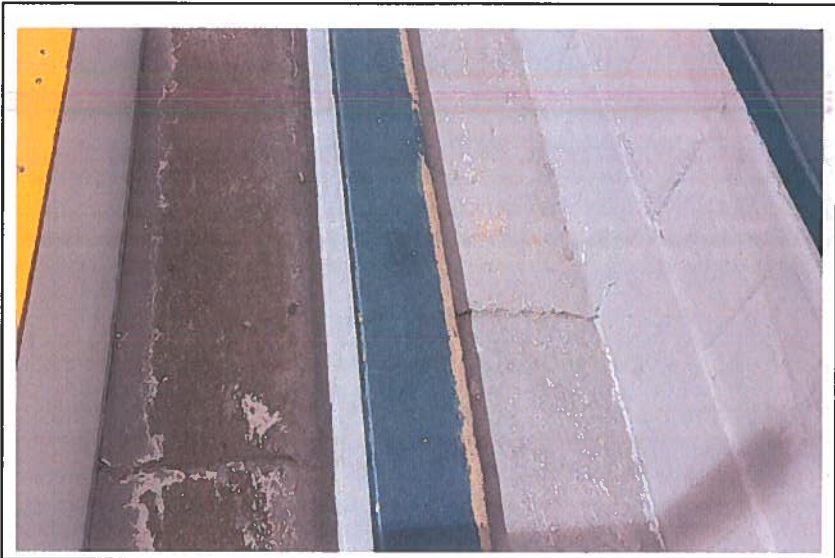


Photo 011 Bleacher Crack at Joint Location



Photo 012 Localized damage to MetalCladding

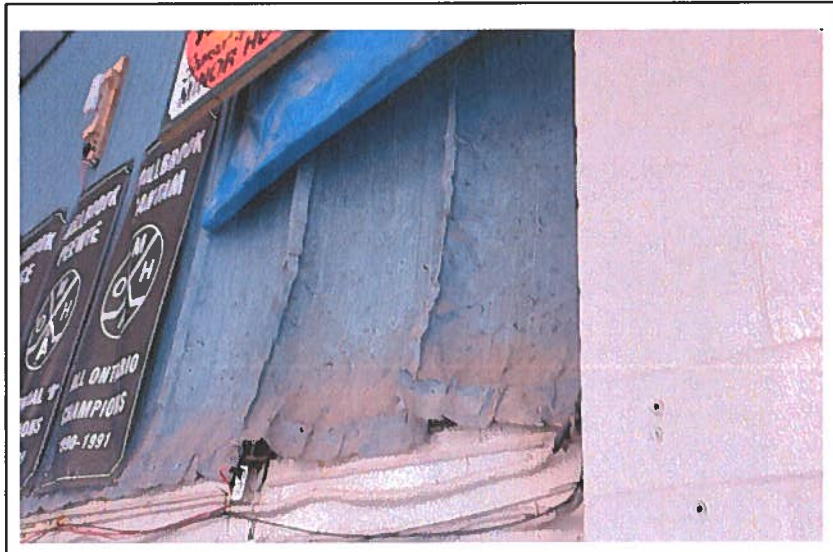


Photo 013 Significant Damage to Metal Cladding

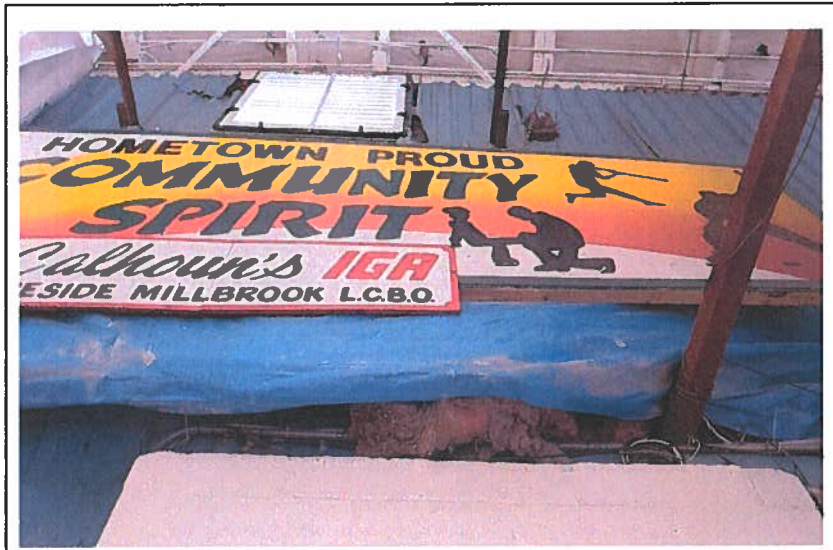


Photo 014 Metal Cladding Damage

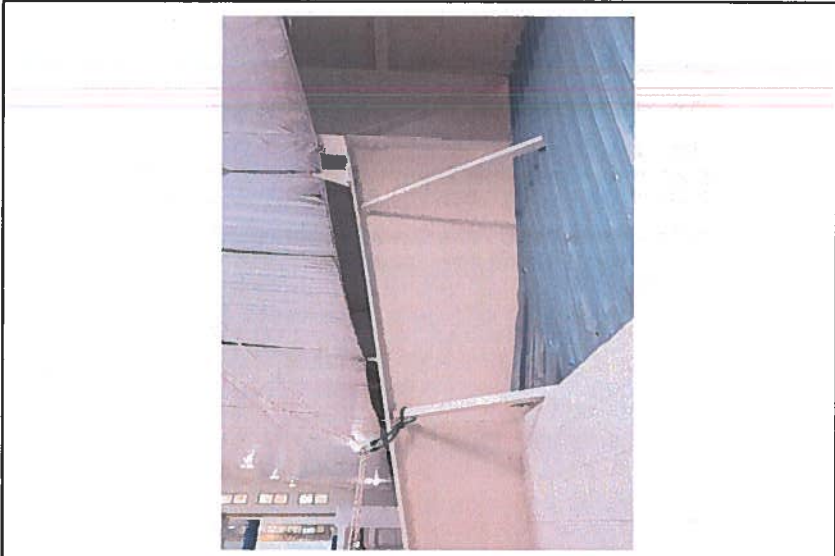


Photo 015 Metal Cladding Along West Side



Photo 016 Thermal Cracking on Rink Slab



Photo 017 Cracking Outside of Compressor Room



Photo 018 Apron Slab Under Garage Door



Photo 019 Major Crack in Apron Slab

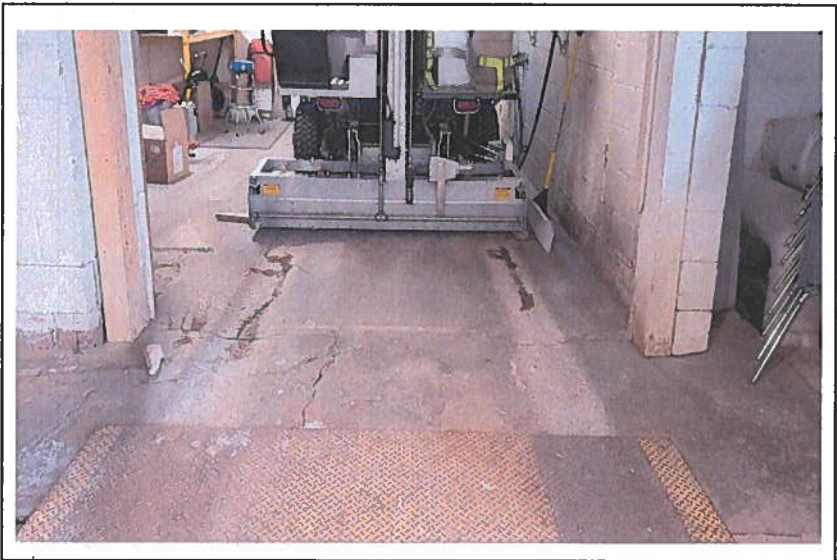


Photo 020 Resurfacing Room Rutting



Photo 021 Cracking Starting in Resurfacing Room



Photo 022 Extents of Resurfacing Room Cracking

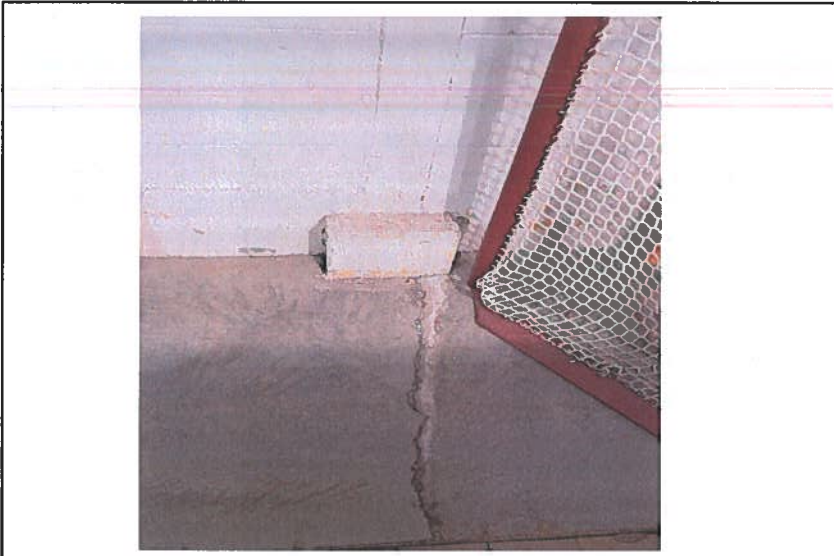


Photo 023 Cracking Under North-Side Column

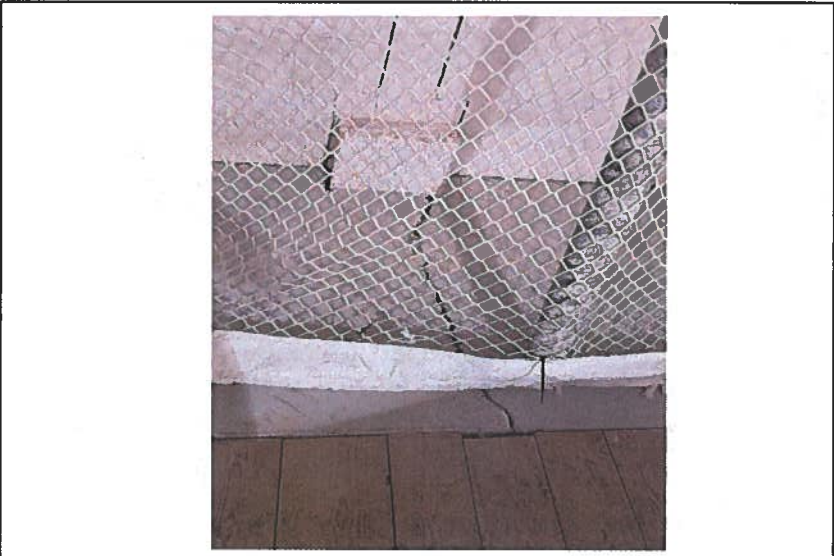


Photo 024 Cracking Under North-Side Column



Photo 025 Crack Underneath Mechanical Equipment Stand

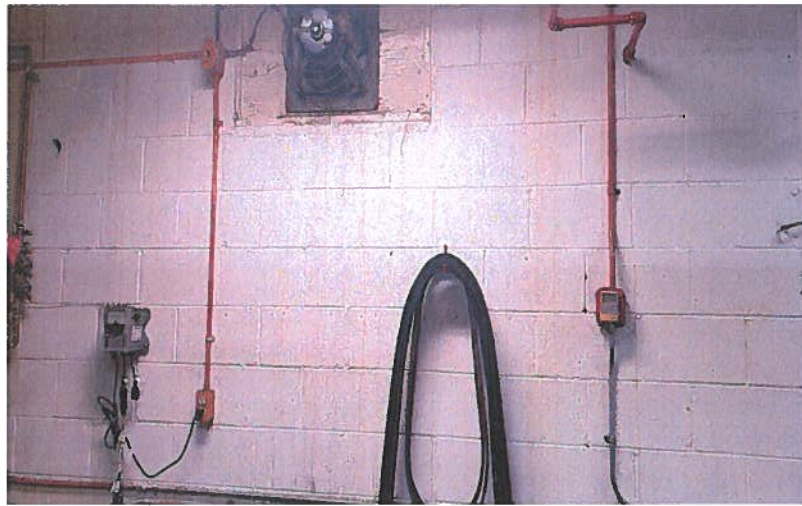


Photo 026 Block Wall in Compressor Room

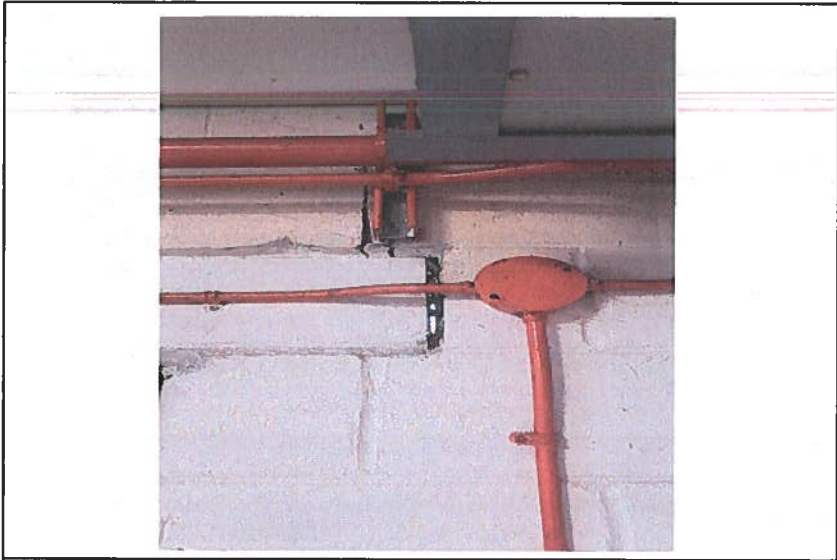


Photo 027 Step Cracking and Block Gapping

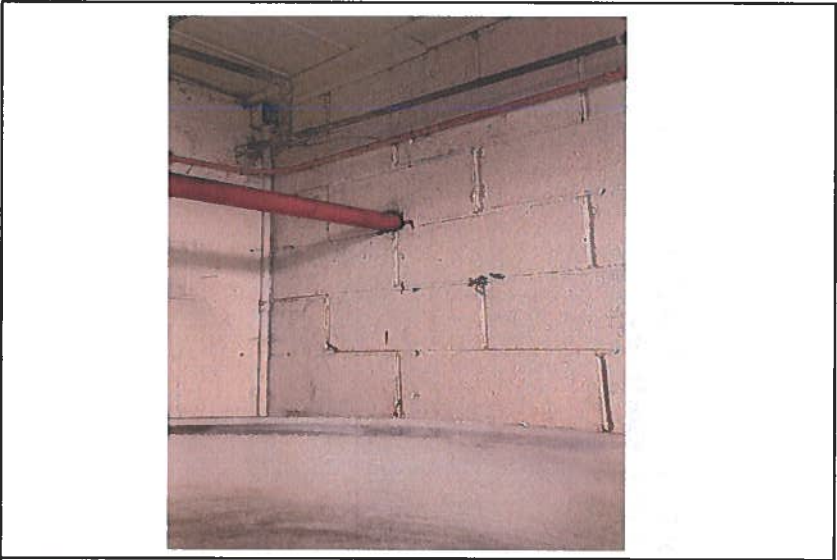


Photo 028 Multiple Step Cracks Behind Water Tank

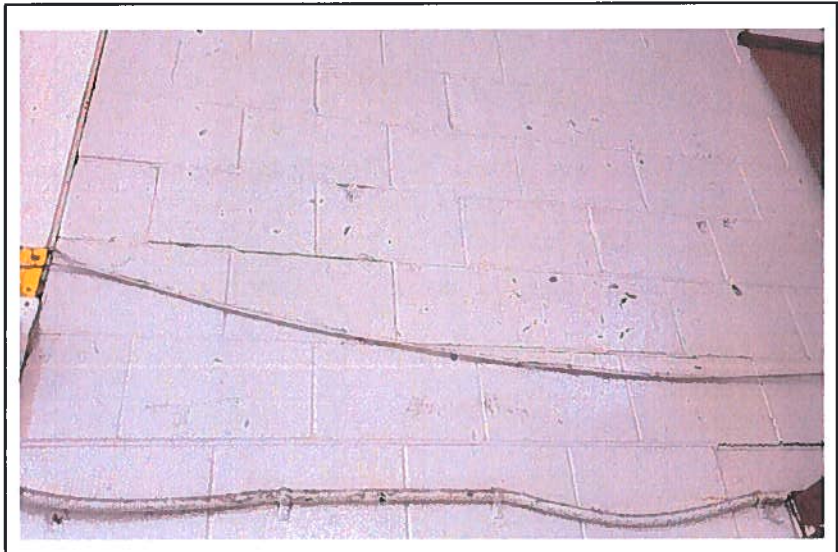


Photo 029 Step Cracking Along South-Face Wall



Photo 030 Step Cracking in Lobby



Photo 031 Minor Step Cracking in West-Side Stairwell

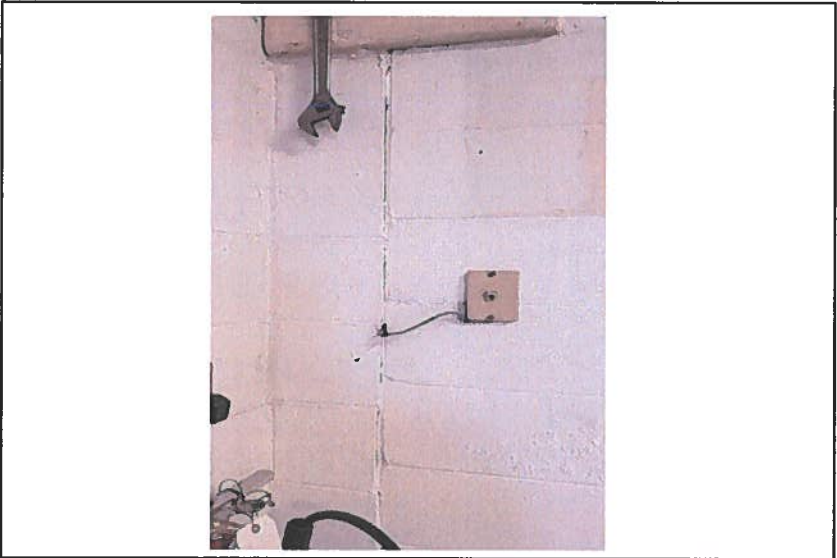


Photo 032 Mortar Joint Cracking in Compressor Room

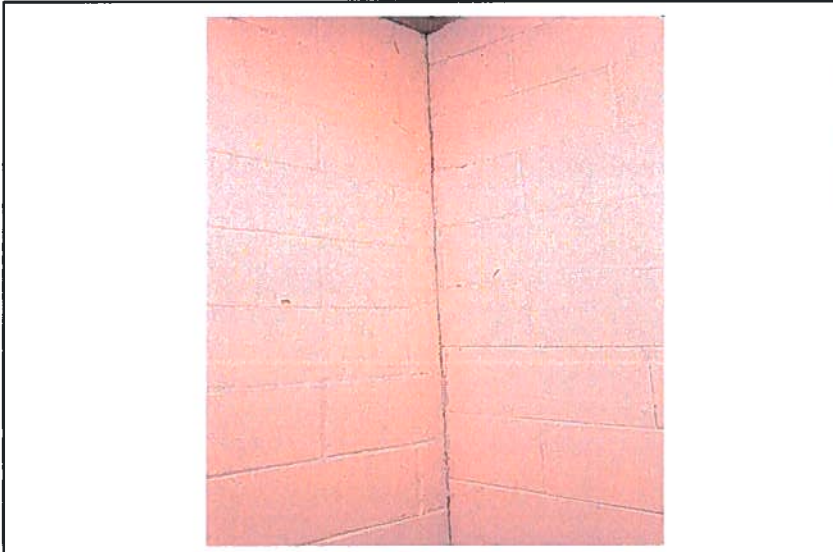


Photo 033 Mortar Joint Cracking in West-Side Stairwell



Photo 034 South-Side Stairwell Mortar Joint Cracking



Photo 035 Wooden Block Replacement and Cracking

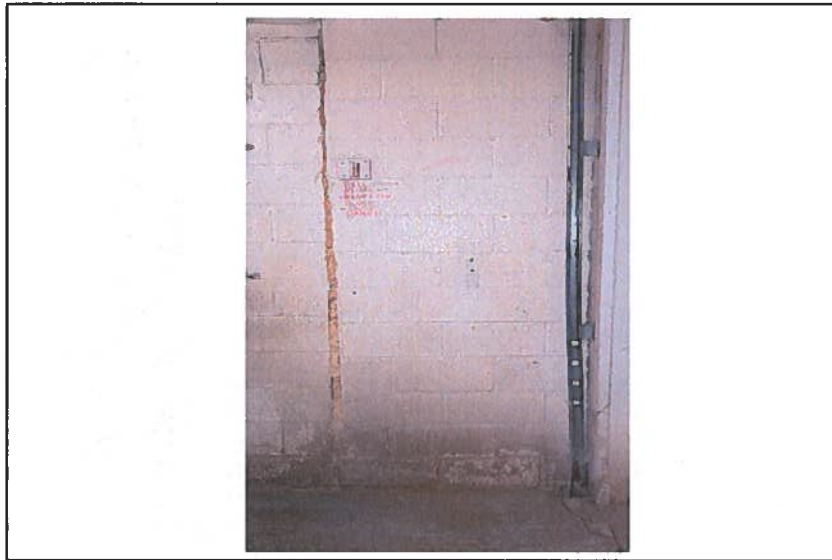


Photo 036 Differential Settlement in Ice-Resurfacing Room



Photo 037 Existing Block Separation Repairs



Photo 038 Block and Joint Damage



Photo 039 Step Cracking and Damage to West-Side Exit



Photo 040 Wall Separation at West-Side Exit

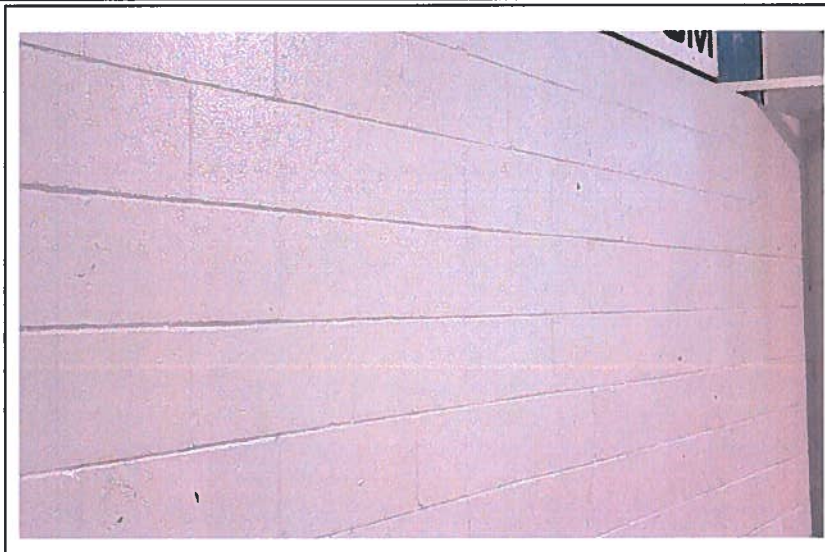


Photo 041 West-Side Wall

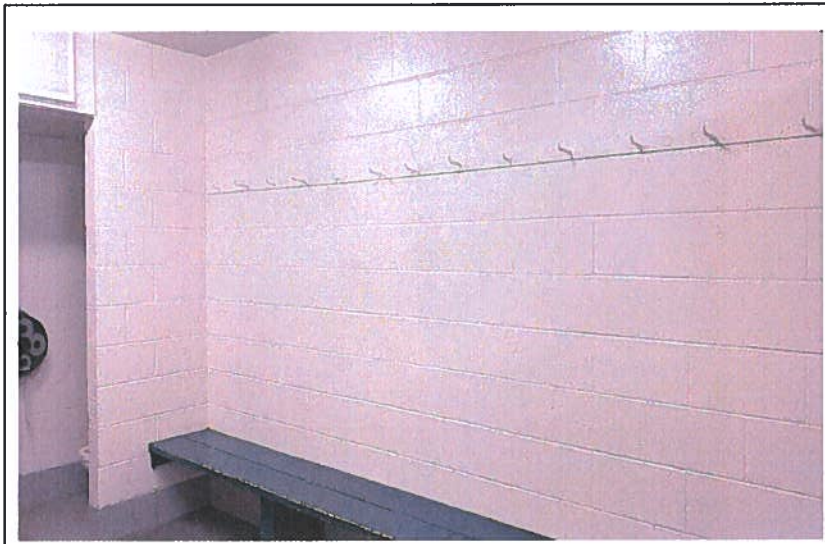


Photo 042 Block Wall Within Changerooms



Photo 043 Localized Damage in Changeroom 3



Photo 044 Columns in Lobby

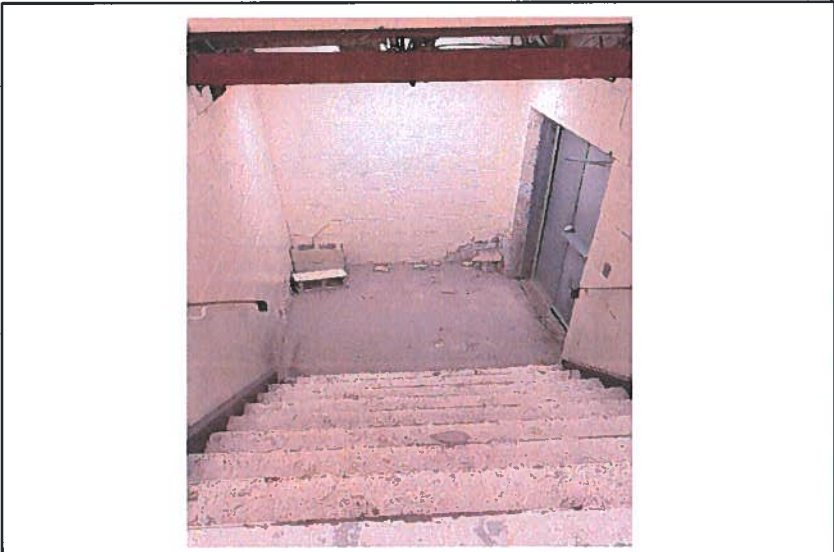


Photo 045 West-Side Stairwell

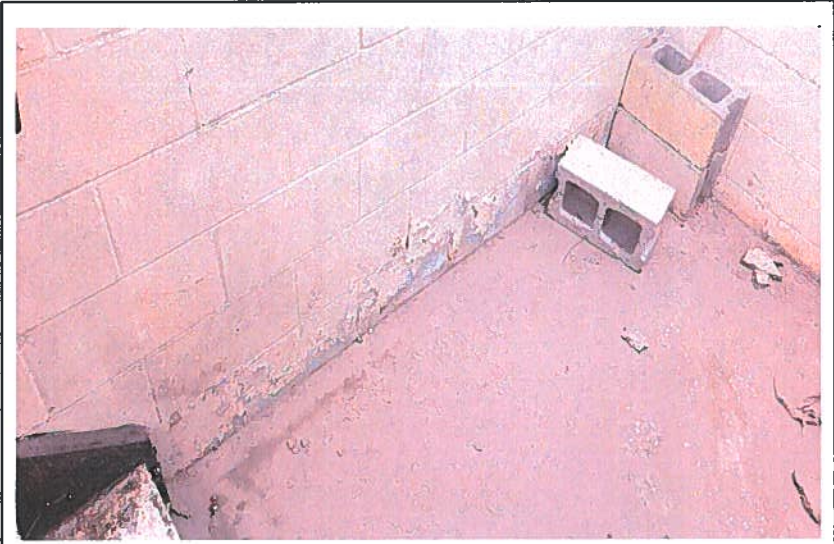


Photo 046 Paint Chipping and Moisture Damage



Photo 047 Localized Block Failure



Photo 048 Localized Block Failure

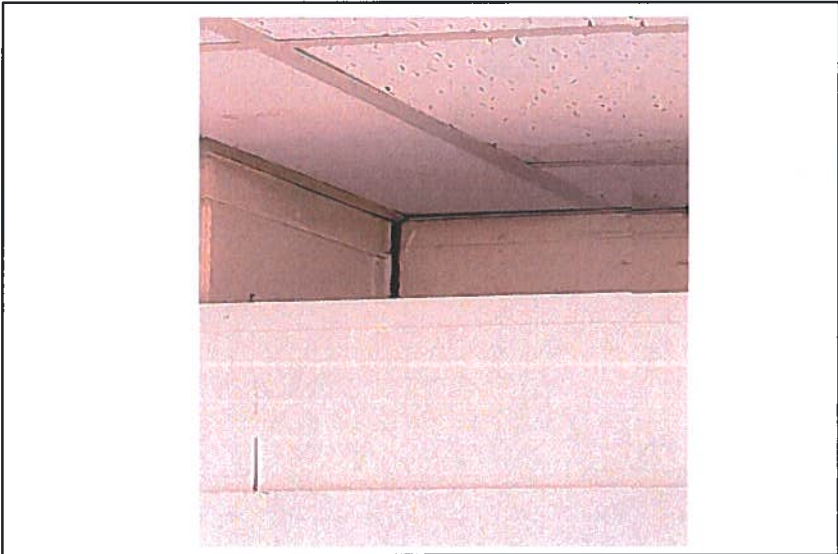


Photo 049 Wall Separation in Second-Floor Storage Room

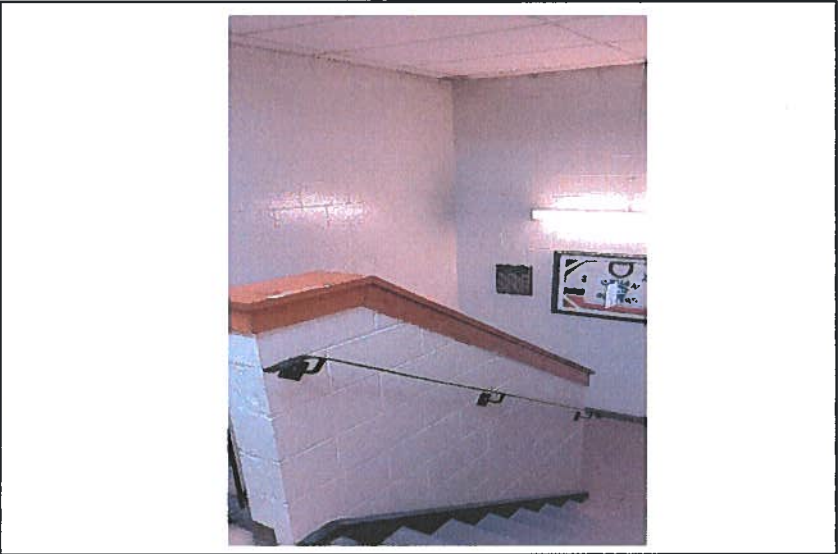


Photo 050 South-Side Stairwell Walls



Photo 051 Slab-On-Grade to Wall Separation in Compressor Room



Photo 052 Concrete Staining in Compressor Room



Photo 053 Concrete Damage at Electrical Equipment in Compressor Room



Photo 054 Slab-On-Grade Damage in West-Side Stairwell

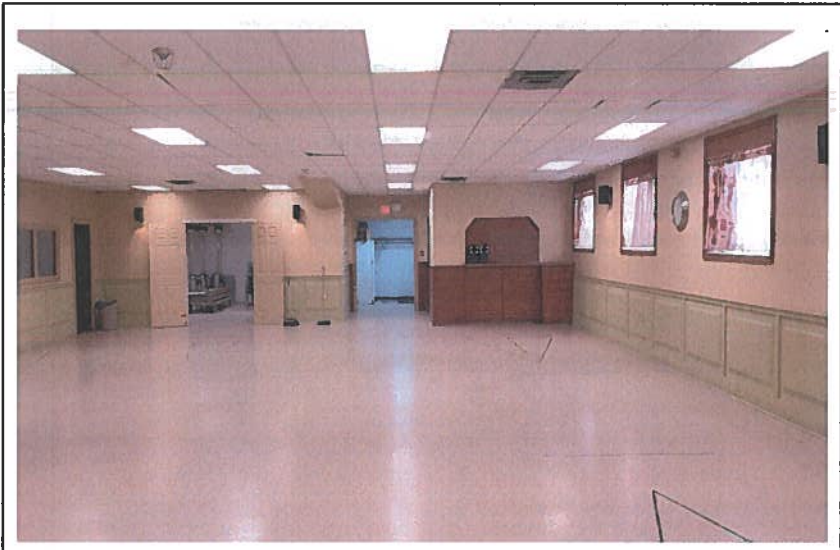


Photo 055 Partial Second Floor Space



Photo 056 Second Floor Kitchen



Photo 057 Partial Second-Floor Roof Framing



Photo 058 Insulation and Plastic Covering



Photo 059 Moisture in Roofing System



Photo 060 Moisture in Roofing System



Photo 061 Signs of Moisture Damage



Photo 062 Signs of Moisture Damage



Photo 063 South-West Corner Foundation

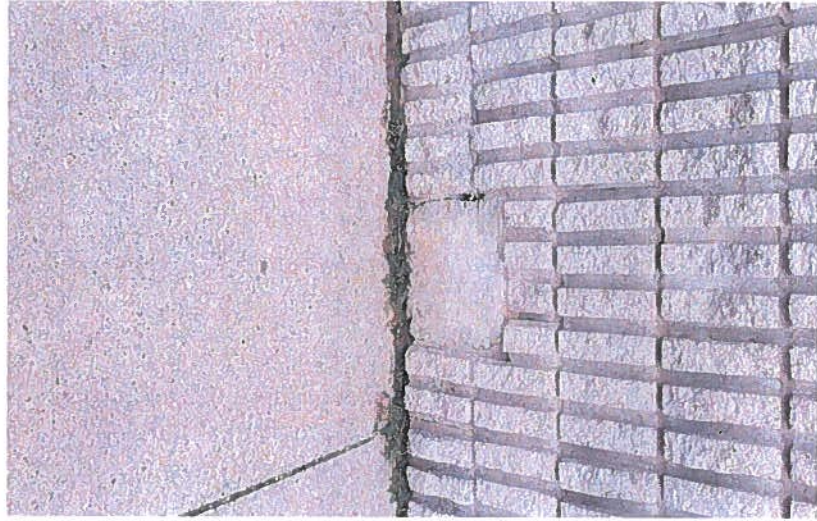


Photo 064 Cracking at Centre Foundation Wall

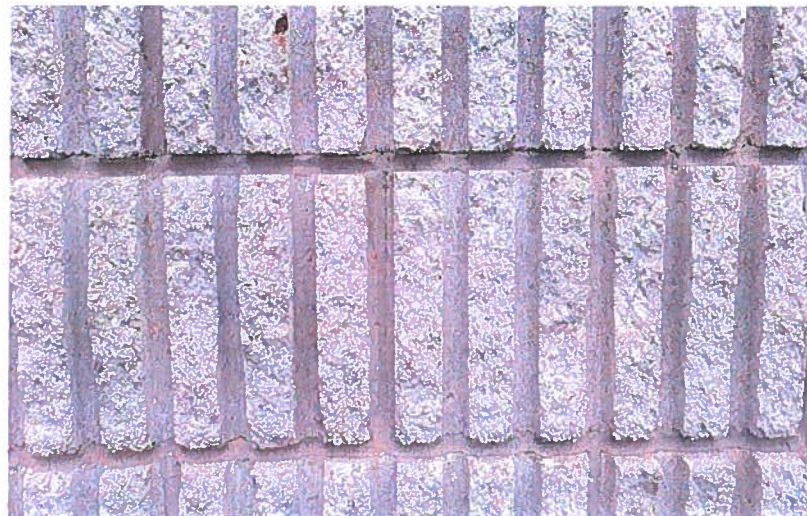


Photo 065 Architectural Block Mortar Cracks



Photo 066 Localized Brick Damage

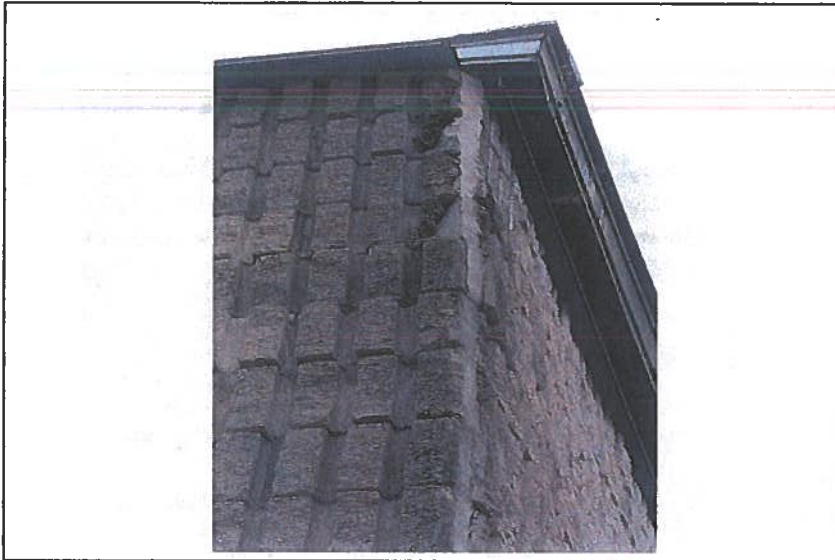


Photo 067 Localized Block Damage at South-East Corner



Photo 068 Architectural Precast Concrete Wall Panels

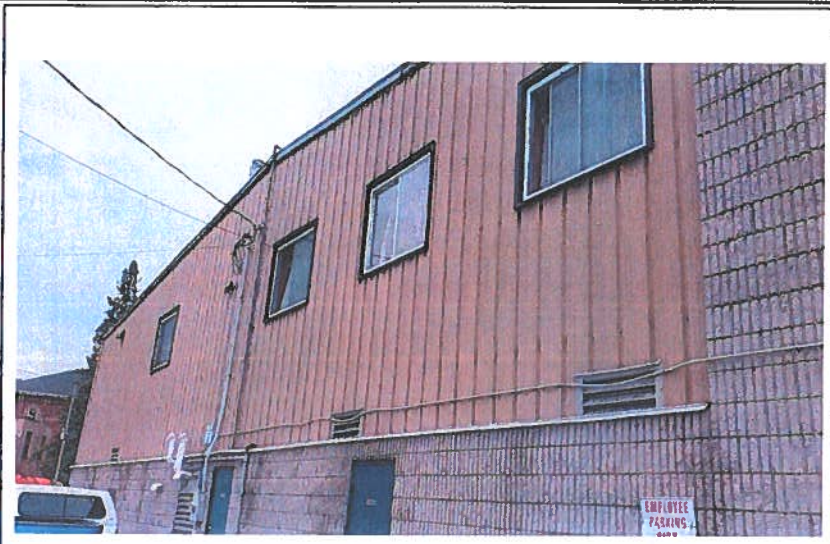


Photo 069 Metal Siding Along South Side

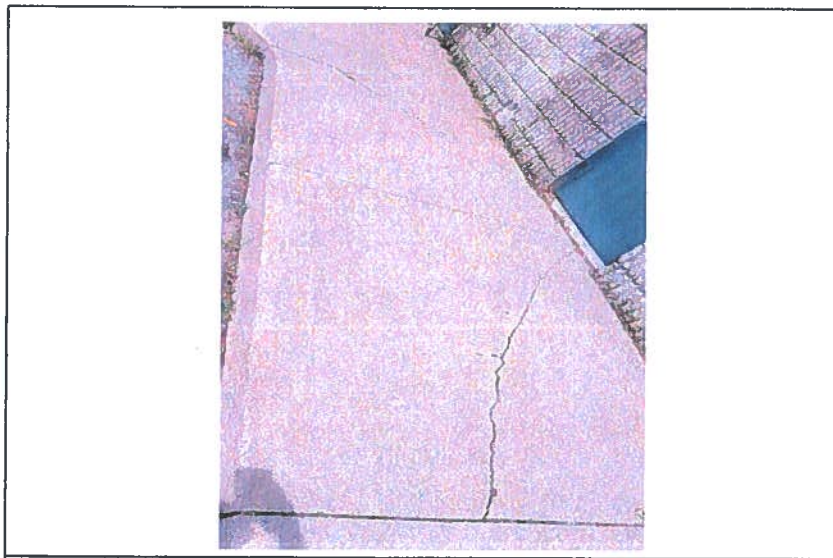


Photo 070 Damage to Sidewalk



Photo 071 Gap in Foundation Wall



Photo 072 Damaged Eaves

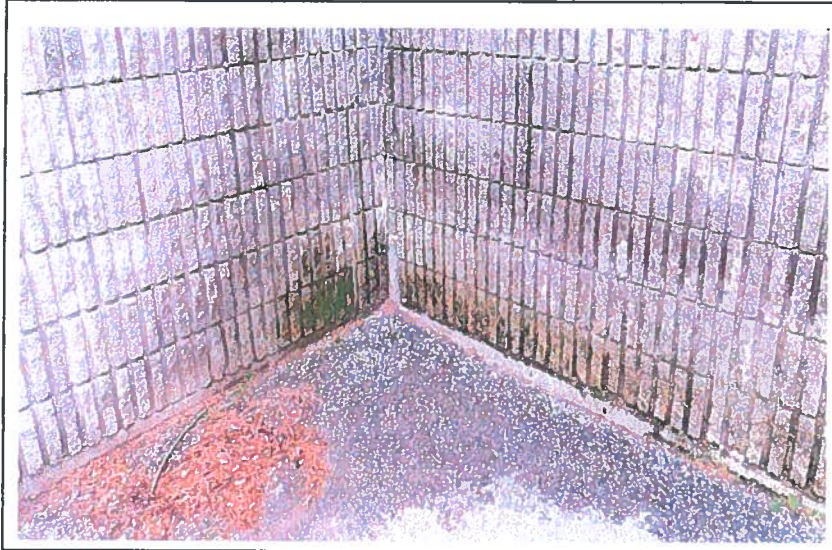


Photo 073 Moss Along East Side Wall

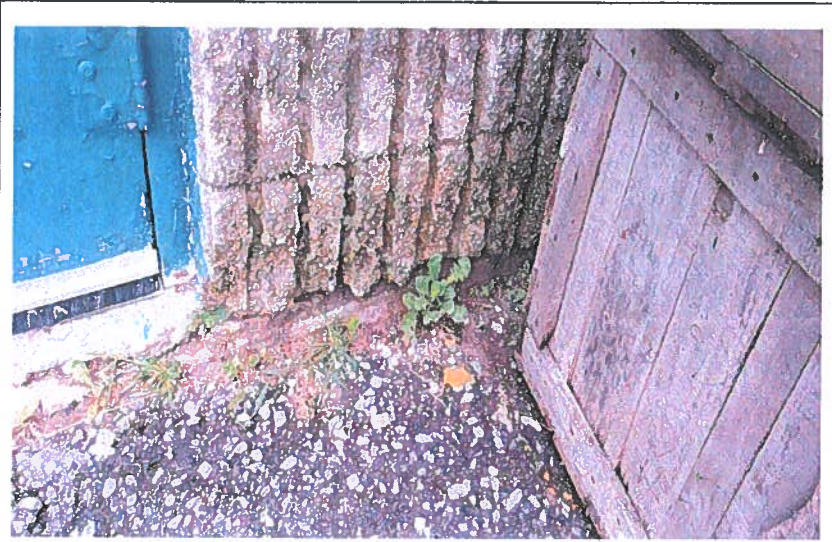


Photo 074 Deterioration of Blocks

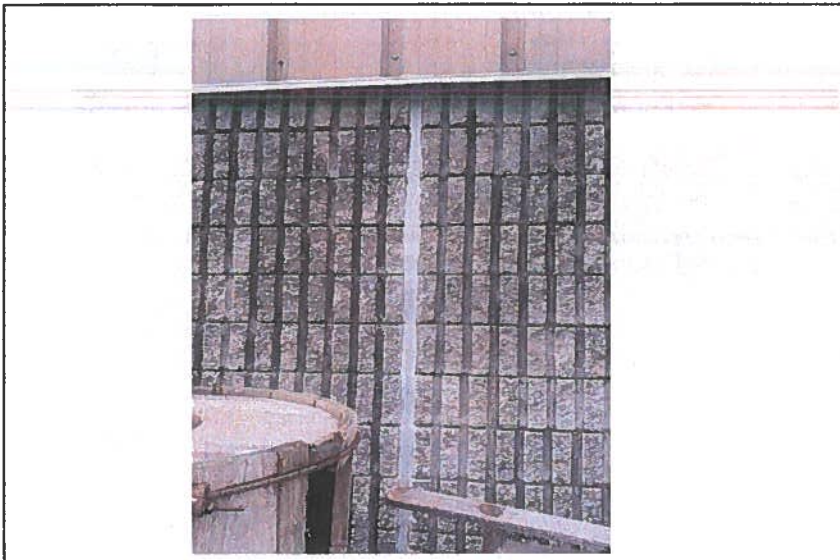


Photo 075 Wall Joint

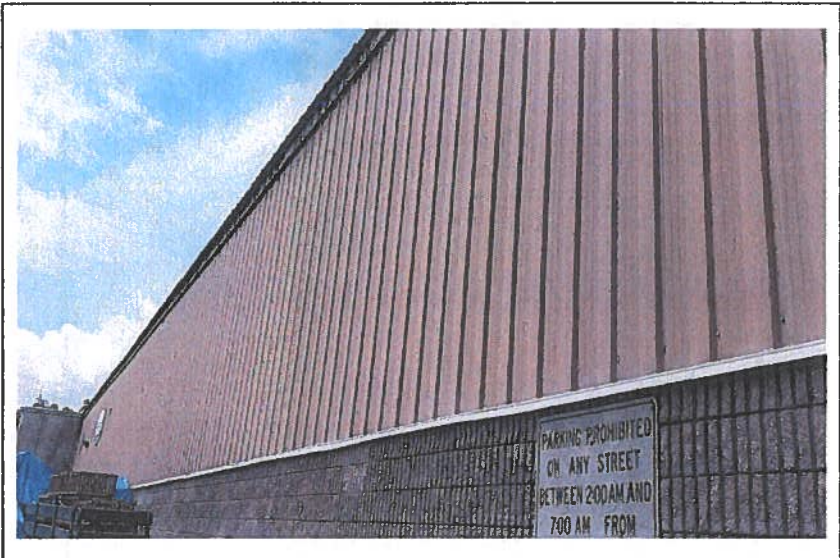


Photo 076 East Side Metal Cladding



Photo 077 Damage to Garage Door Opening



Photo 078 Close Up of Damage Garage Door

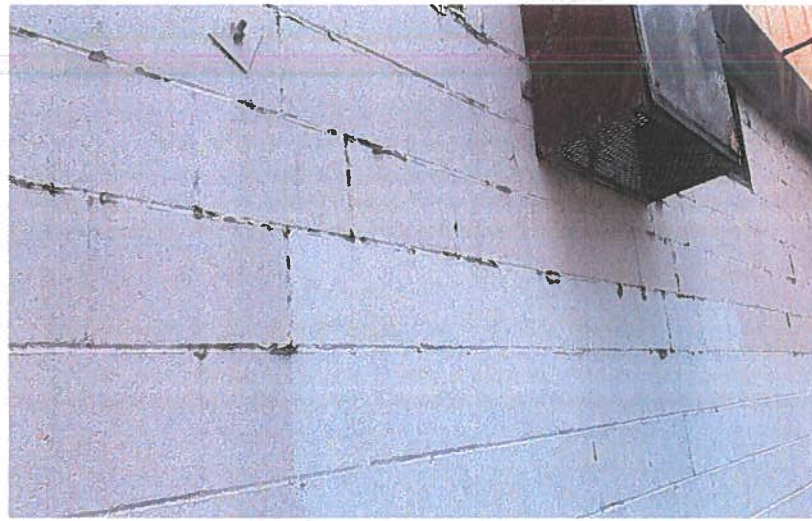


Photo 079 Step Cracking and Paint Peeling

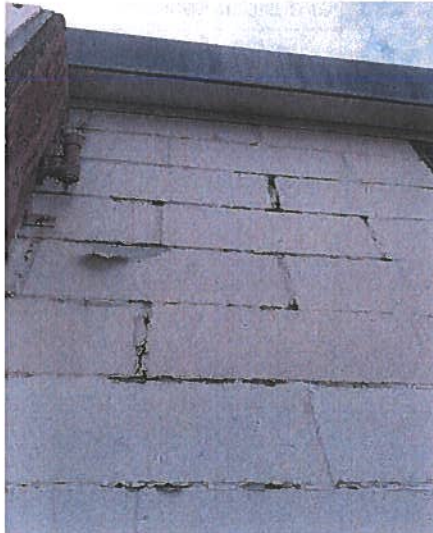


Photo 080 Step Cracking and Paint Peeling

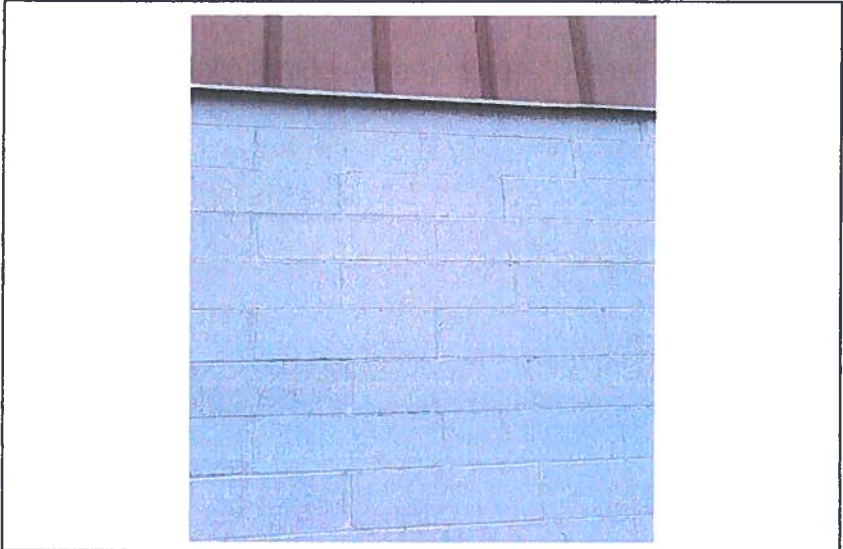


Photo 081 Step Cracking and Block Failure



Photo 082 Honeycombing and Mould Growth

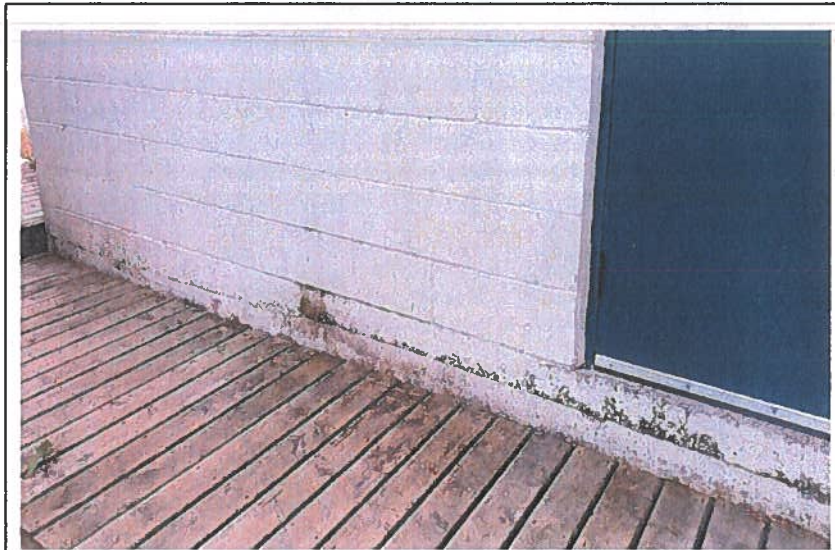


Photo 083 Honeycombing and Mould at Eastside of Ice-resurfacing Room

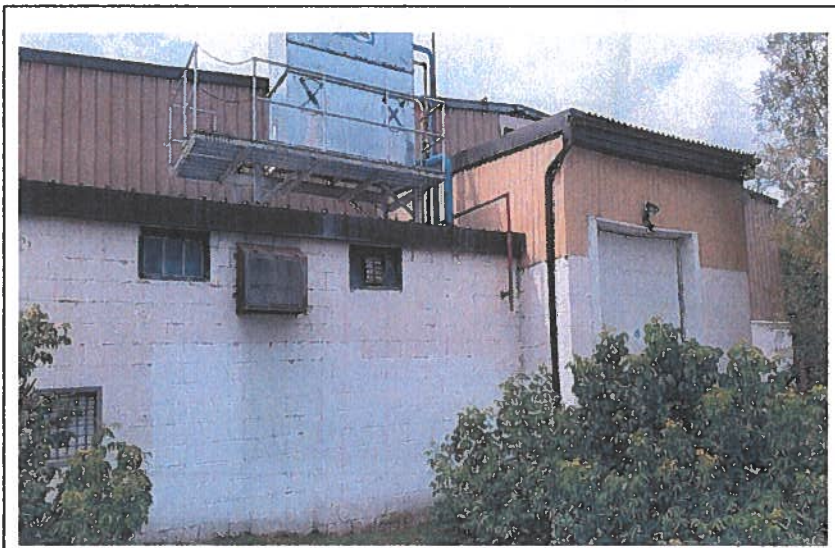


Photo 084 Metal Cladding



Photo 085 Damage to Garage Door Entrance



Photo 086 Damage to Garage Door Entrance

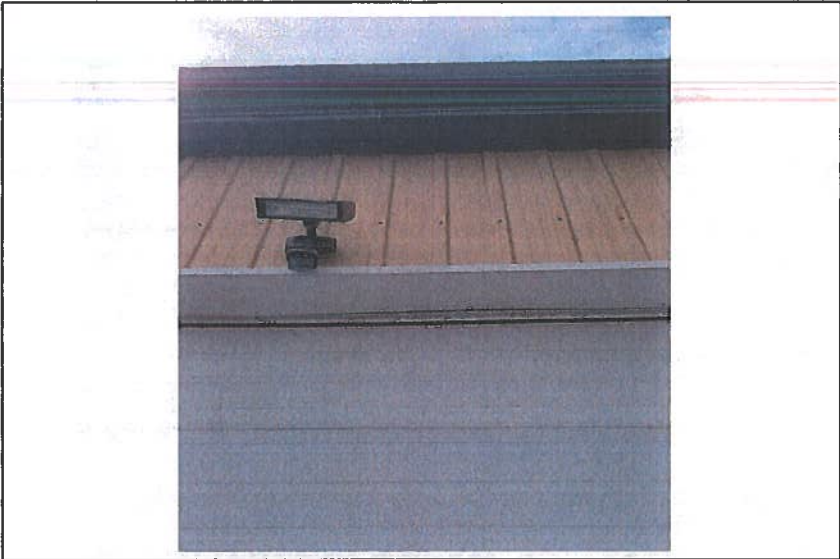


Photo 087 Damage to Garage Door Seal



Photo 088 Mould and Moisture on Block Wal

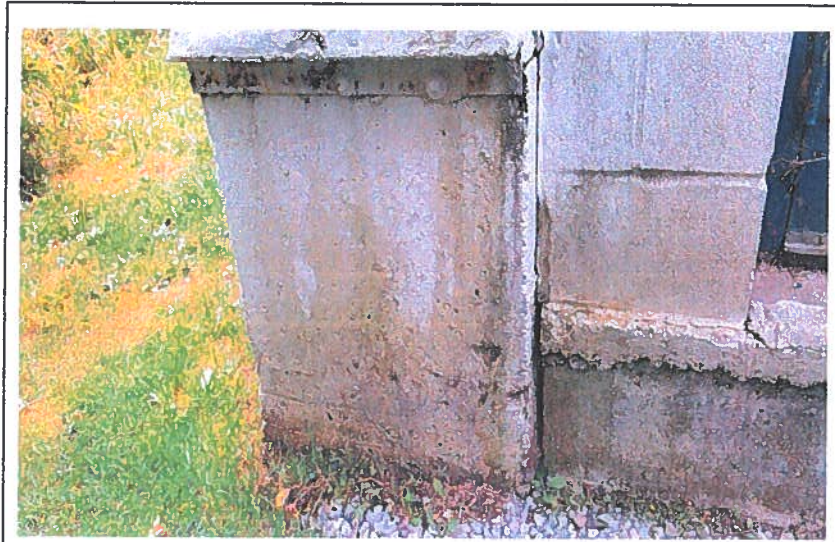


Photo 089 North-West Corner



Photo 090 Mould Along West Side



Photo 091 Damaged Wall Joint



Photo 092 Localized Foundation Wall Damage



Photo 093 Hole in Masonry Block

APPENDIX B

ELECTRICAL SITE CONDITION ASSESSMENT

September 3, 2019
Project: 6461

Township of Cavan Monaghan
988 County Rd. 10,
Millbrook, ON
L0A 1G0

Attention: **Yvette Hurley**
Chief Administrative Officer

Electrical Site Condition Assessment Report

Project: Millbrook Arena
4 Needler's Lane
Millbrook, ON
L0A 1G0

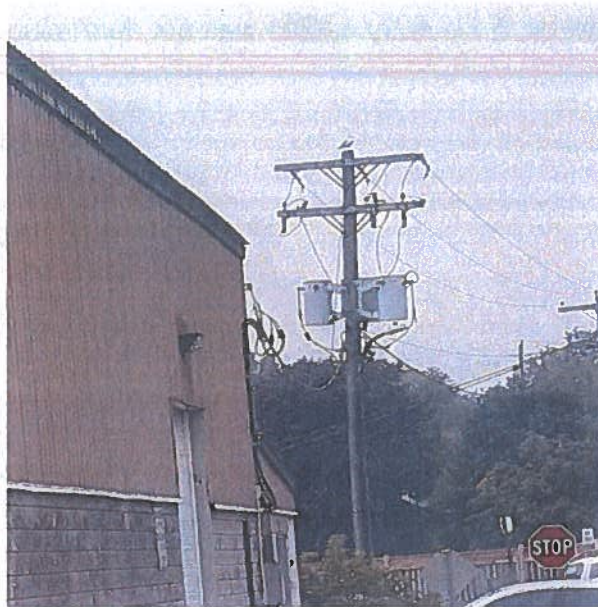
Review Date: Tuesday August 27th, 2019 at 2:00 pm
Reviewed by: David Millen, P.Eng. Electrical

1. General Comments

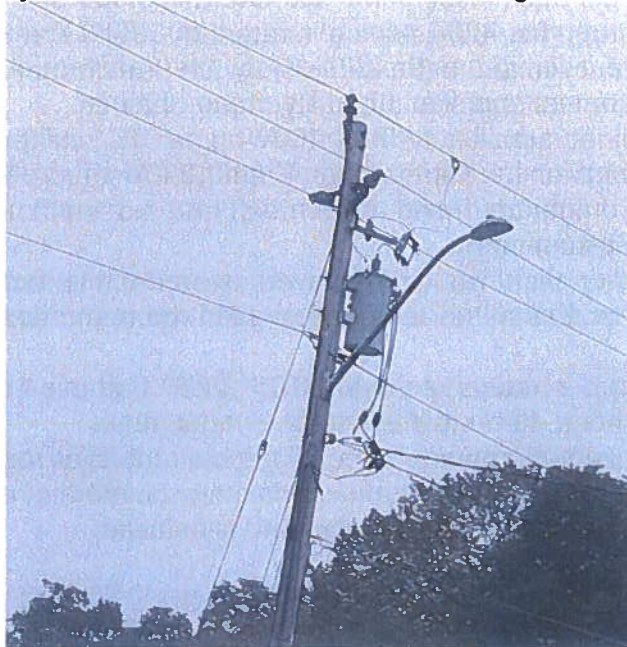
- 1.1 A visual review of the electrical systems at the Millbrook Arena was conducted for inspection of equipment conditional and standards of good practice.
- 1.2 Photographs were taken as part of the site review.

2. Utility Service

- 2.1 The facility is powered by two separate utility services. The 120/240V 200A service that supplies the front of the building (Front Service) and the 600V/347V 400A service that supplies the rear of the building and ice plant (Rear Service).
- 2.2 A set of three pole mounted 75kVA pole mounted transformers supply the Rear Service used primarily for the ice plant. The transformers are configured as a solidly grounded 4 wire 347/600V supply at 225kVA.
 - 2.2.1 The transformers and pole assembly appear in decent condition.
 - 2.2.2 The secondary conductors run overhead individually from the service pole to the arena wall where they transition to core flex and run down the exterior wall and into the rear electrical area and the 600V main disconnect.



- 2.3 A single pole mounted 50kVA pole mounted transformers supply the Front Service used to supply front of the building, including hall, canteen changerooms and washrooms.
- 2.3.1 The transformer appears in good condition. The transformer also supplies the street lighting to the west.
- 2.3.2 The secondary conductors run overhead individually from the service pole to a wall mounted cable termination rack. The cables enter a raceway via a weather-head and drop to the utility meter on the exterior of the building.



2.4 Gauge and material of the entry cables was not determined.



3. Rear Service

- 3.1 The Rear Service main disconnect is a federal pioneer 347/600V rated at 400A.
- 3.2 Note that although the 400A service is rated for 333kVA at 80% de-rating the available power is limited to the 225kVA by the transformer bank
- 3.3 The Main disconnect supplies the utility meter cabinet.
- 3.4 The Meter cabinet supplies a 600V 400A 4 pole BEL splitter.
- 3.5 This splitter supplies the Refrigeration Plant (200A square D fused disconnect), a heater (30A Commander fused disconnect) and a panel board (100A federal pioneer fused disconnect).
- 3.6 The Refrigeration plant was not reviewed as part of this report.
- 3.7 The heater is located in the refrigeration plant room and appears to be in good shape.
- 3.8 The Panel board, a federal pioneer NHDP 225A 3 phase 4 pole model, supplies the ice surface lighting, de-humidifiers and exhaust fans.
- 3.9 The 600V equipment appears to be all original and is all very dated with signs of many years of wear. The splitter is completely covered in rust caused by the high humidity in the area where the equipment is installed.

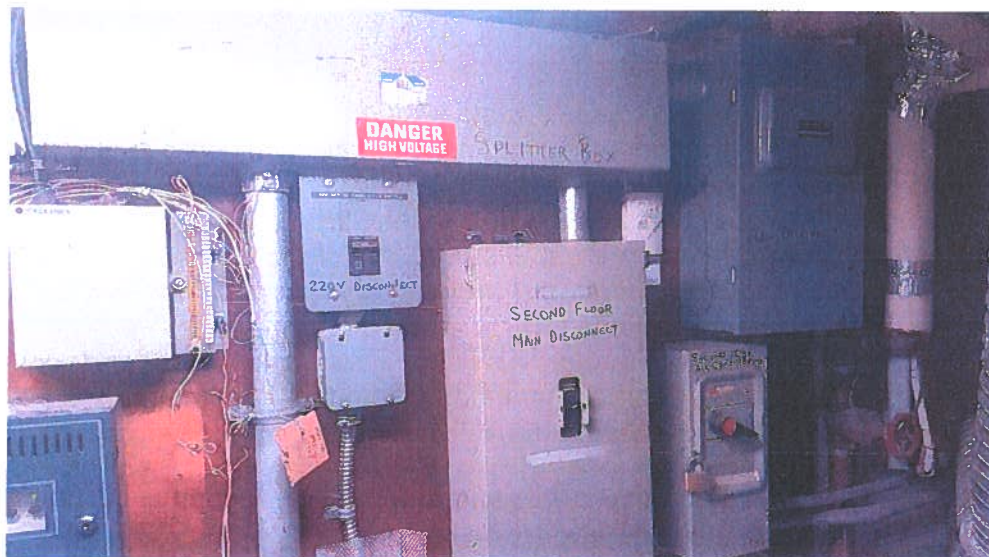
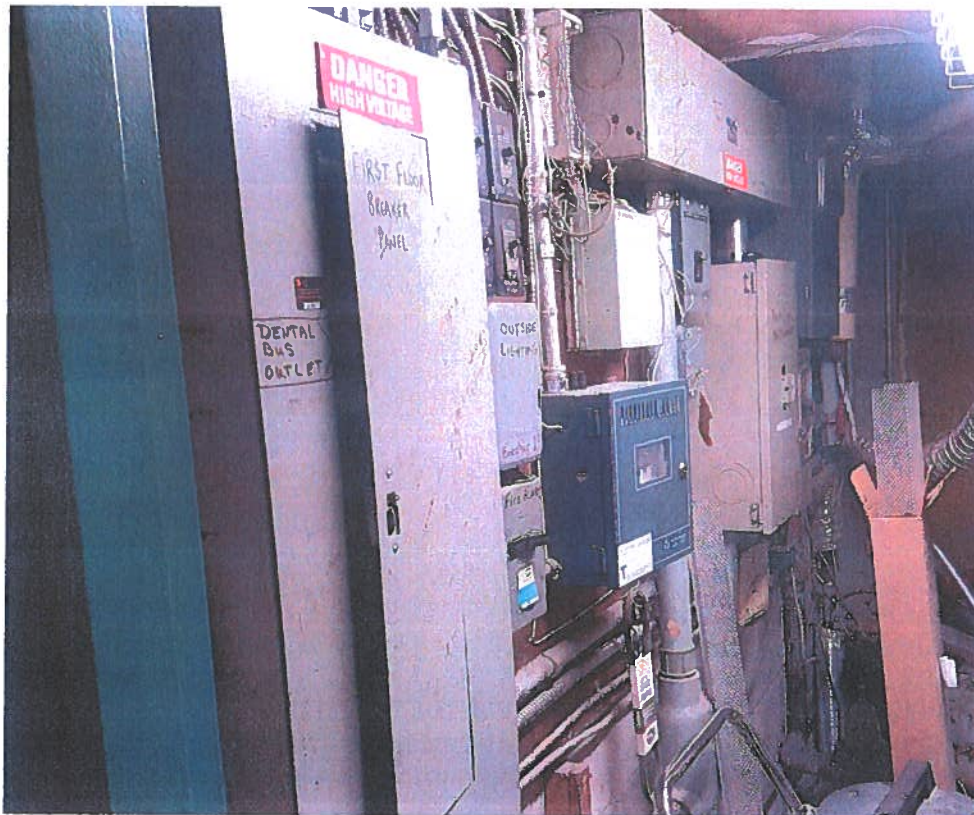


- 3.10 A 100A 120/240V panel is installed at the rear of the facility that is supplied from the Front Service for exit lights, lighting, receptacles, small fans and the timeclock.
- 3.11 It is recommended to conduct an inspection and preventative maintenance of the interior.

4. Front Service

- 4.1 The Front Service main disconnect is rated 120/240V at 200A complete with 200A fuses and is located in the front electrical/mechanical room which is also the location of 4 furnaces and the incoming water service.
- 4.2 The Main disconnect supplies a BEL 600V 3 pole 225A splitter.
- 4.3 This splitter supplies the first-floor panel board, and disconnects for the second-floor panel (125A breaker), office panel (50A breaker) and second floor A/C (30A fused disconnect) that is off and locked shut.
- 4.4 The first-floor panel, Federal Pioneer NBLP-32-3L, supplies power and lighting to the changerooms, offices, washrooms and lobby on the first floor as well as the furnaces and the canteen sub panel (50A 2P). There is a 2P 50A breaker for the Dental Bus outlet.
- 4.5 The Second Floor Panel supplies the power and lighting to the hall, warm up kitchen, laundry room, and washrooms on the second floor.
- 4.6 The office panel was not accessible for review.

- 4.7 The canteen panel, (Square D 16 CCT) supplies the receptacles and equipment in the canteen (refrigerator, coffee makers, popcorn machine, cash register)
- 4.8 The 240V equipment appears to be all original but is in good condition.



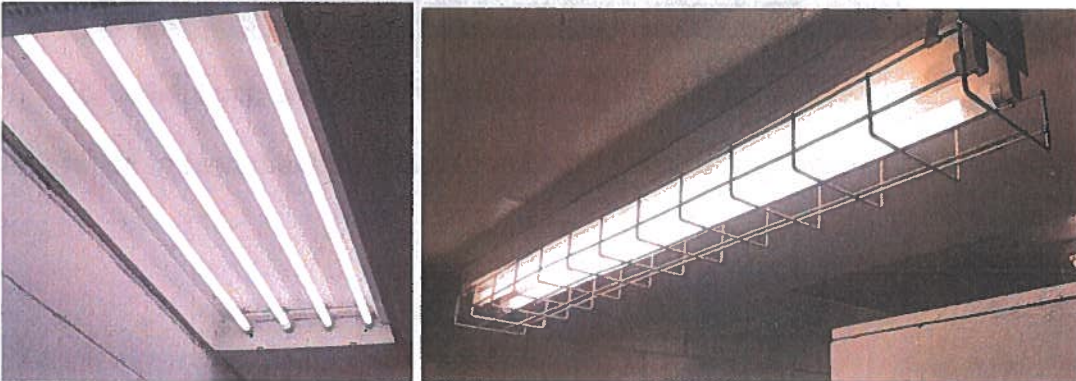
5. Lighting, Emergency Lighting and Egress Signage

5.1 The ice surface lighting is 400W 347V Metal halide.



5.2 It is recommended to replace the existing metal halide fixtures with LED for improved control, instant on capability and longevity.

5.3 Most of the existing 120V lighting fixtures are tubular fluorescent fixtures. Some incandescent fixtures have been upgraded to CFL lamps.



5.4 It is recommended to replace the existing fluorescent fixtures with LED, not just replace the lamps with LED equivalents.

5.5 Existing emergency lights and battery packs appear at end of life. They should be replaced with new battery packs and LED lamps.

5.6 Existing exit signs should be replaced with self-powered green running man signs consistent with current OBC requirements.

6. Fire Alarm system

6.1 The existing fire alarm system is a single zone Notifier CSGL-2000. While it appears to be in good working order it is outdated and should be considered for upgrade.



6.2 The fire alarm devices appear to be original and should be considered for replacement.

6.3 The notification devices are bells. Consider adding strobe coverage for improved notification.

Prepared by:

David Millen, P.Eng.

APPENDIX C

MECHANICAL SITE CONDITION ASSESSMENT



September 3, 2019
Project: 6461

Township of Cavan Monaghan
988 County Rd. 10,
Millbrook, ON
L0A 1G0

Attention: **Yvette Hurley**
Chief Administrative Officer

Mechanical Site Condition Assessment Report

Project: Millbrook Arena
4 Needler's Lane
Millbrook, ON
L0A 1G0

Review Date: Tuesday August 27th, 2019 at 2:00 pm

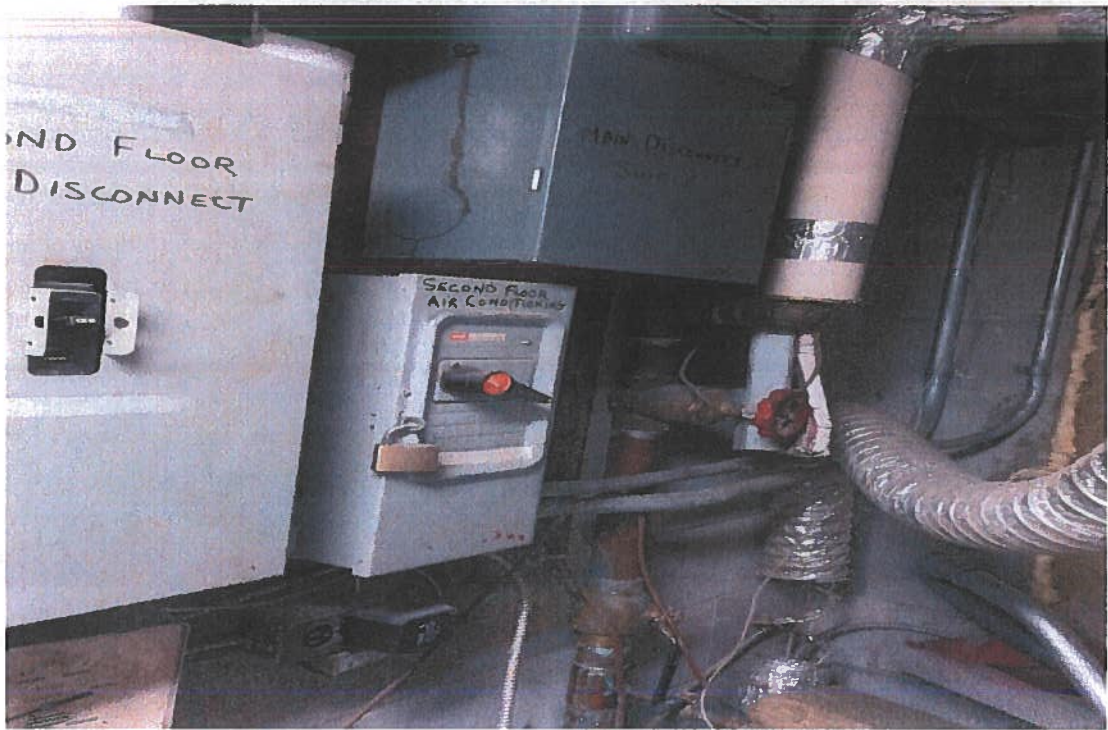
Reviewed by: Abdulfaraj Alyas MSc, P.Eng. Mechanical Engineer

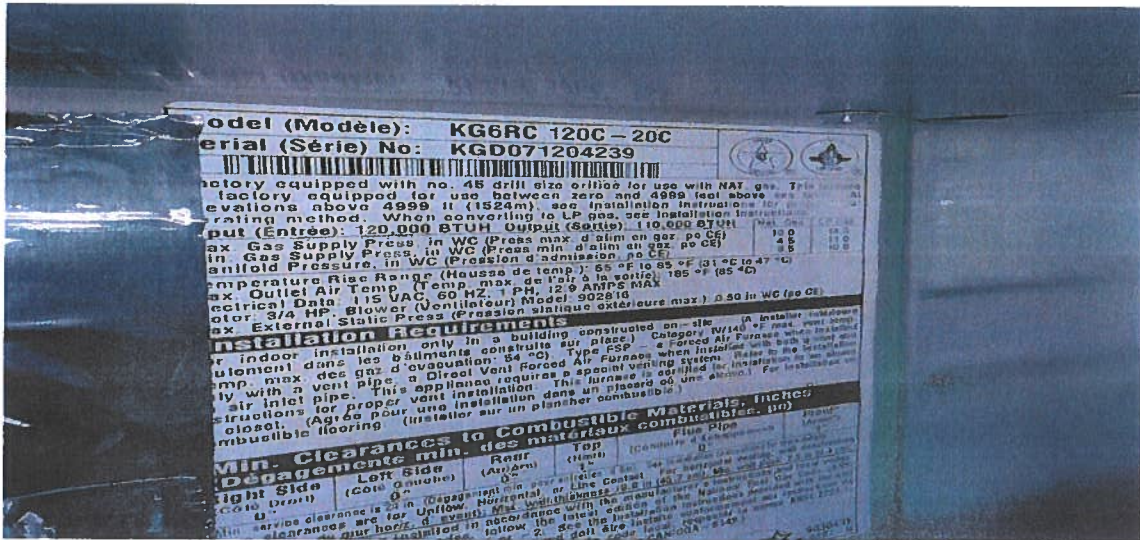
1. General Comments

- 1.1 A visual review of the Mechanical systems at the Millbrook Arena was conducted for inspection of equipment conditional and standards of good practice.
- 1.2 Photographs were taken as part of the site review.

2. Heating / Cooling / Ventilation Systems

- 2.1 The building has four Gibson furnaces for heating only, each has a capacity of 110,000 Btu/hour with efficiency of more than 90%, natural gas fueled.
- 2.2 The building has no cooling as there is no direct expansion coils above the furnaces and a roof top unit could not be verified on the roof.
- 2.3 The building has no ventilation, no heat recovery or energy recovery units, no ventilation ducts and no exhaust duct from the ducting system.
- 2.4 There are no heating, cooling or ventilation calculations to verify if the furnaces are covering the heating load or the cooling capacity required and ventilation or outside fresh air required for the whole building.
- 2.5 The mechanical room is cramped, cluttered and very small for all the equipment in it.



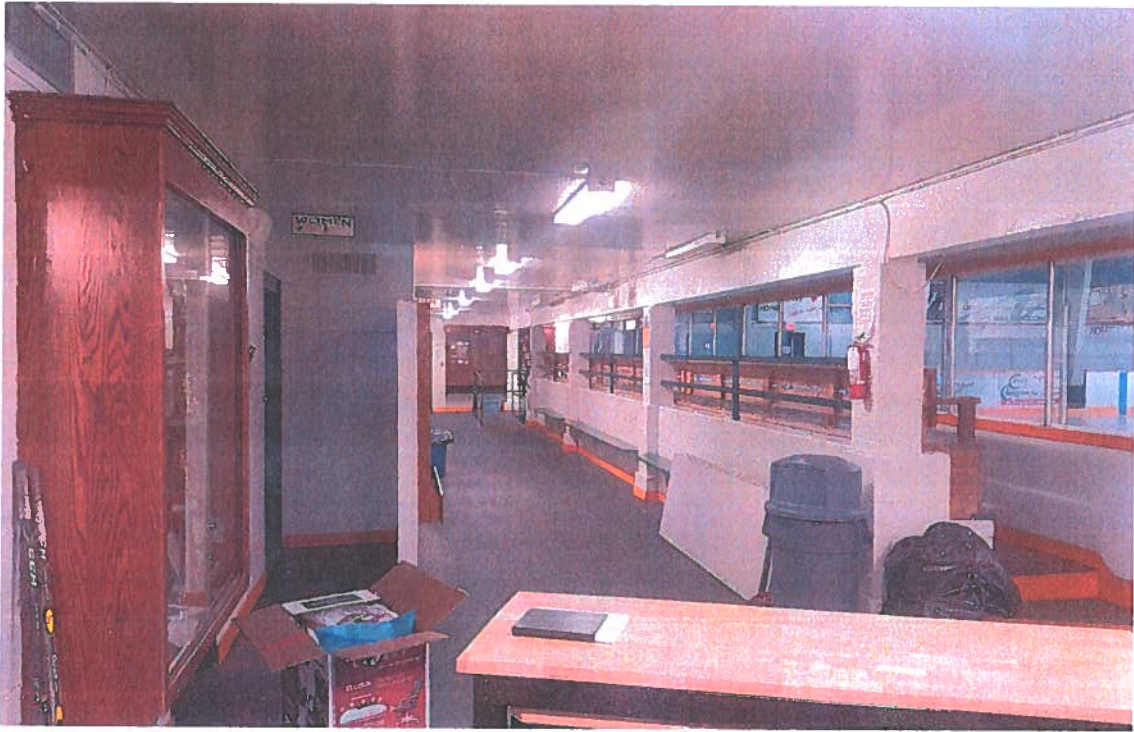


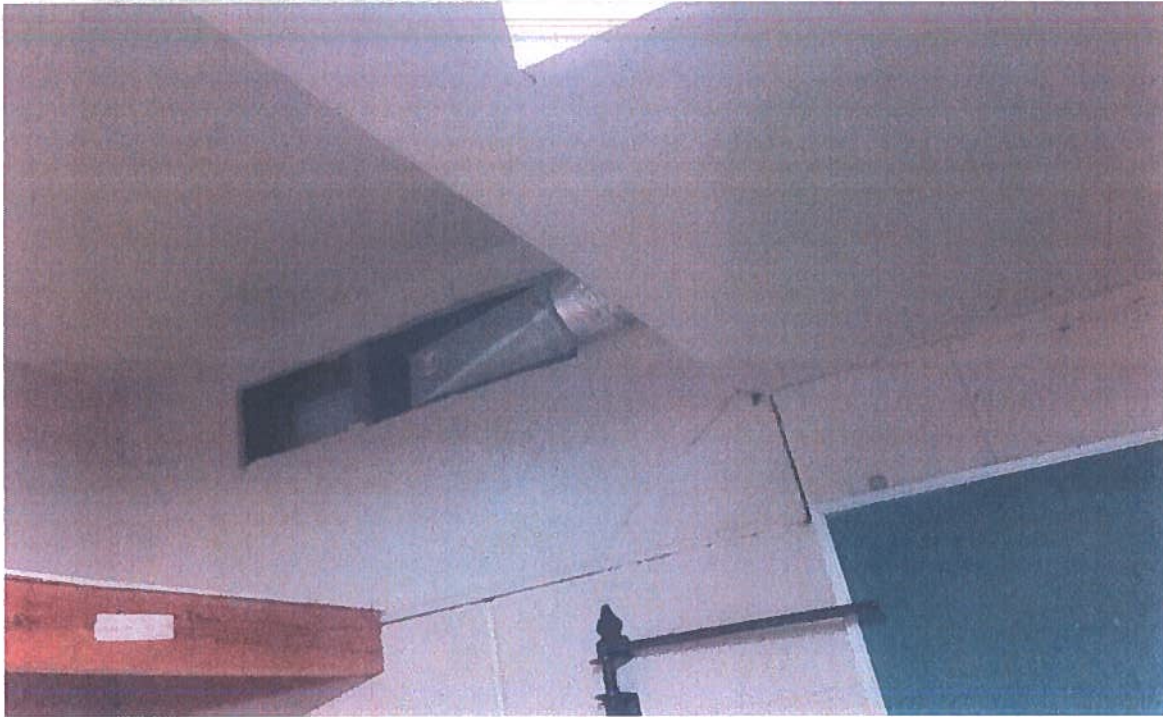
- 2.6 The ducting system had no access panels to verify if there are balancing dampers or any other dampers. The ducting was not accessible to verify how the fittings were done or if they were insulated.
- 2.7 The diffusers are in bad condition; there is very poor air and temperature distribution in the second floor. The diffusers were separated from each other by a long distance without return grills in the same space.





- 2.8 The supply diffusers were in a space and the return grills were in a different space.
- 2.9 Some other spaces had no supply diffusers nor return grills.
- 2.10 There is no heating, ventilation and cooling in the rink lobby as required by codes and standards. The whole corridor in the first floor had no diffusers or grills, which means no heating, cooling or ventilation.





3.0 Sanitary drainage system

3.1 The fixtures as shown in the photos are in bad conditions and old.

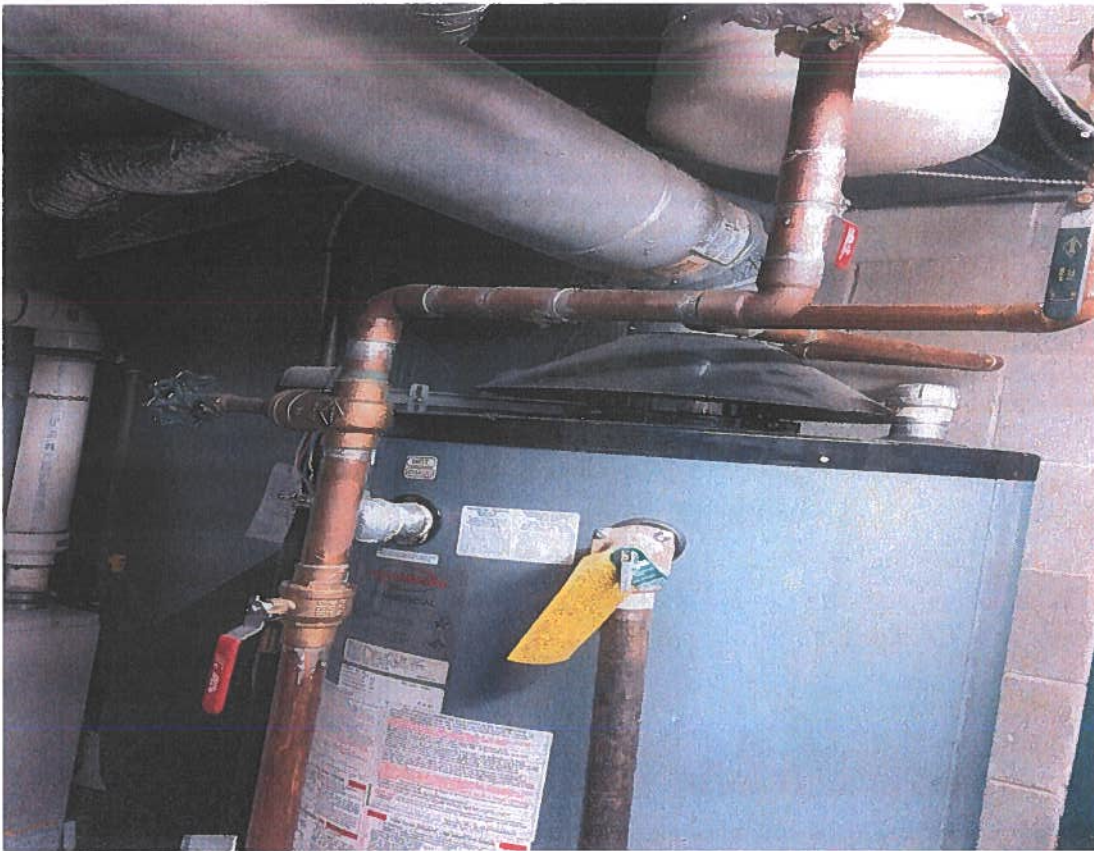




- 3.2 The piping system could not be verified as it is under ground.
- 3.3 The venting piping system for the sanitary piping system could not be verified.
- 3.4 The seal trap primer could not be verified also as it is underground.
- 3.5 The size of the pipes could not be verified as they are under ground.

4.0 Domestic water system

- 4.1 The fixtures are old, low efficiency and at the end of their life.
- 4.2 The pipe system could not be verified as most of it were in the ceiling space or inside walls.
- 4.3 The hot water tank is a good condition and the pipes inside the mechanical room are copper and in a good condition.
- 4.4 The incoming main domestic water pipe, valves and the meter are old, no back-flow meter was noticed.
- 4.5 No insulation on hot water pipes noticed in the whole building except some pipes in the mechanical room.
- 4.6 There was an expansion tank installed above the hot water tank.
- 4.7 No ventilation in the mechanical room and no recirculating pump.
- 4.8 No clearances around all equipment.



5.0 Other mechanical systems

- 5.1** The exhaust air systems from washrooms, change rooms were not provided with exhaust fans or ducts as required by codes.
- 5.2** There is no heat recovery system for ventilation in the mechanical room.
- 5.3** The building roof is in bad condition with many leaks so that the mechanical system cannot work efficiently.
- 5.4** The range hood for the stove is not installed as required by codes and standards.
- 5.5** The Second-Floor room was heated with a base board electrical heater without any ventilation or exhaust fan.
- 5.6** The building has no fire suppression system.
- 5.7** The building has no automated control system for the mechanical or electrical system.
- 5.8** There are many spaces in the building that have no heating, cooling or ventilation.
- 5.9** No water treatment for the water in the mechanical room.





Prepared by:

Abdulfaraj
Abdulfaraj Alyas MSc, P.Eng.

