Township of Muskoka Lakes

Request for Quote

P-2026-18

Port Carling Arena Rehabilitation Project

Site Fit and Design Documents

ADDENDUM # 2
March 20, 2026

The following addendum shall now form part of the contract documents and amends the applicable information contained in the original contract tendering documents.

All other information contained in the original tendering documents remains unchanged.

P-2026-18

ADDENDUM # 2

The RFQ shall be Amended as follows to ensure clarity.

1. 2024 Feasibility Study: Port Carling & Bala Arenas, indicates that the roof structure(s) may not be capable of safely sustaining its own weight and any additional loads to which it may be subjected, snow removal is an ongoing facility requirement and recommends a “full structural analysis” of the roof structure. Can the Township provide clear information (all drawings, past reports, etc.) that would determine the appropriate scope of this work?

   A. Please find the report below. Staff expect this to be updated with a new structural analysis as part of the current scope of work to replace the roof.

2. Regarding the scope and pricing of Phase II and Phase III of the RFP, the scope of these phases and associated costs will be dependent on the outcomes from Phase I, and related alternatives analysis. Therefore, how are consultants providing pricing for Phases II and III with these key unknowns?

   A. Pricing for Phase II and Phase III is just for budgetary purposes at this stage. Upon beginning those phases, the Township will seek revised quotations.

3. The RFP indicates that acoustics and IT engineering is part of the consultant scope - can you confirm that specialist sound/acoustic consultants are required for this project.

   A. Yes, you should include qualified specialist acoustic/sound consultants (and IT engineers) as part of your team.

The Bidder Shall:

1. Sign this Addendum in the space provided below and submit this Addendum as part of the RFQ package.

Signature Date

Buildings & Places

Township of Muskoka Lakes

Visual Review of the Port Carling Arena

Prepared by:

AECOM
55 Cedar Pointe Drive, Suite 620 705 721 9222 tel
Barrie, ON, Canada L4N 5R7 705 734 0764 fax
www.aecom.com

Project Number:

60327553

Date:

August, 2014

Statement of Qualifications and Limitations

The attached Report (the “Report”) has been prepared by AECOM Canada Ltd. (“Consultant”) for the benefit of the client (“Client”) in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the “Agreement”).

The information, data, recommendations and conclusions contained in the Report (collectively, the “Information”):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the “Limitations”);
- represents Consultant’s professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Consultant which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

Consultant shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. Consultant accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

Consultant agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but Consultant makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Without in any way limiting the generality of the foregoing, any estimates or opinions regarding probable construction costs or construction schedule provided by Consultant represent Consultant’s professional judgement in light of its experience and the knowledge and information available to it at the time of preparation. Since Consultant has no control over market or economic conditions, prices for construction labour, equipment or materials or bidding procedures, Consultant, its directors, officers and employees are not able to, nor do they, make any representations, warranties or guarantees whatsoever, whether express or implied, with respect to such estimates or opinions, or their variance from actual construction costs or schedules, and accept no responsibility for any loss or damage arising therefrom or in any way related thereto. Persons relying on such estimates or opinions do so at their own risk.

Except (1) as agreed to in writing by Consultant and Client; (2) as required by-law; or (3) to the extent used by governmental reviewing agencies for the purpose of obtaining permits or approvals, the Report and the Information may be used and relied upon only by Client.

Consultant accepts no responsibility, and denies any liability whatsoever, to parties other than Client who may obtain access to the Report or the Information for any injury, loss or damage suffered by such parties arising from their use of, reliance upon, or decisions or actions based on the Report or any of the Information (“improper use of the Report”), except to the extent those parties have obtained the prior written consent of Consultant to use and rely upon the Report and the Information. Any injury, loss or damages arising from improper use of the Report shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

AECOM: 2012-01-06

AECOM
55 Cedar Pointe Drive, Suite 620
Barrie, ON, Canada L4N 5R7
www.aecom.com

705 721 9222 tel
705 734 0764 fax

August 22, 2014

Mr. Greig Young
Arena Manager
Township of Muskoka lakes
P.O. Box 129
Port Carling ON P0B 1J0

Dear Mr. Young:

Project No: **60327553**

Regarding: **Visual Review of the Port Carling Arena**

We are enclosing our "Visual Review Report for the Port Carling Arena," which outlines the results of our review of the exposed building elements.

It is concluded that the building's structure is in generally good condition. However, we have included several recommendations related to repairs and maintenance which when completed will extend the life expectancy of the structure.

It is recommended that the arena be re-inspected in five (5) years.

In the event that you have any questions or concerns regarding the attached report, please do not hesitate to contact our office.

Sincerely,
AECOM Canada Ltd.

Pete Wills, P. Eng.
Senior Structural Engineer

PW:ls
Encl.

Distribution List

# of Hard Copies	PDF Required	Association / Company Name

Revision Log

Revision #	Revised By	Date	Issue / Revision Description

AECOM Signatures

Report Prepared By:

Pete Wills, P.Eng.
Senior Structural Engineer

Stamp

Report Reviewed By:

Marc Moubarak, P.Eng.
Senior Structural Engineer

Table of Contents

Statement of Qualifications and Limitations
Letter of Transmittal
Distribution List

page

1. Introduction 1

2. Observations 1

2.1 South Side Exterior 2
2.2 East (Rear) Exterior 2
2.3 North Side Exterior 2
2.4 West (Front) Exterior 3
2.5 Front Lobby (Interior) 3
2.6 Dressing Rooms 4
2.7 Olympia Room and Plant Room 4
2.8 Generator Room 4
2.9 Figure Skating Room and Minor Hockey Room 4
2.10 Open Arena Area 4
2.11 Floors 5
2.12 Photos 5

3. Snow Removal 12

4. Summer Ice / Early Plant Start-up 13

5. Conclusion 14

List of Photos

Photo 1 - West (Front) Elevation (South – West Corner) 5
Photo 2 – South Elevation 6
Photo 3 – South Side – Shrinkage Crack & Spalls / Damage 6
Photo 4 – North End of South Side Addition – Vandalism to Stucco Finish 7
Photo 5 – Zambonie Room – Exposed Rigid Insulation 7
Photo 6 – Damaged Block & Erosion Adjacent to Zamboni Room 8
Photo 7 – Stepped Cracking just East of Zamboni Room – South Wall 8
Photo 8 – East Wall – Eroded Block at Downspout 9
Photo 9 – North Side – Deteriorated Retaining Walls 9
Photo 10 – North Side – Stepped Cracking 10
Photo 11 – Interior of Arena with Low E Ceiling below Roof Purlins 10
Photo 12 – Plant Room – Damaged Block Adjacent to Man Door 11
Photo 13 – Rigid Frame Base Plate with Cracked Grout on Pier 11

1. Introduction

As requested, we carried out a structural review of the Port Carling Arena on June 19, 2014, in accordance with our proposal from May 1, 2014.

The Port Carling Arena was constructed in 1973. The last review was carried out in June 2009, also by AECOM. Our scope of work included a review of the previous inspection report (most recent) and a visual review of all exposed structural members and exposed architectural finishes in order to confirm the structural condition of the building and provide appropriate recommendations for maintenance. Our scope of work did not include any removals, materials testing, structural analysis or Code review. As noted above, our visual review was limited to exposed elements, although we did remove a few ceiling tiles in the lobby area and in some of the change rooms to visually review the framing above. Our visual review was completed with the aid of a step ladder provided by the arena staff. The ladder was used to look above some of the ceiling tiles as noted above. However, in and around the ice surface our visual review was completed without the aid of any ladders (i.e. our vantage point was from a standing position on the floor surface and we were unable to get close to the high roof framing).

The main arena building consists of a pre-engineered structural steel building system. The overall dimensions of the arena area are 100 ft. by 184 ft. with a 20’-2” eave height. The ice pad is 80 ft by 180 ft. The structural steel arch frames are supported by conventional cast-in-place concrete foundations. The exterior walls consist of a combination of concrete block masonry and metal siding. New steel roof deck had been previously installed with additional insulation over the old upper roof deck.

A single storey area is located along the north end of the main pre-engineered building area. This area provides mechanical services space for the refrigeration equipment and the ice re-surfacer. The roof consists of single-ply PVC membrane supported by a metal deck that is supported by 14” deep open web steel joists. The open web steel joists are supported by load bearing concrete block masonry walls and conventional cast-in-place concrete foundations.

A single storey area is located at the west end of the main arena portion of the building. The area provides space for the entrance lobby, dressing rooms, concession area and support space. The north roof had a PVC unballasted membrane (EPDM) added in 2001. The membrane is supported by insulation on a metal deck that is supported by open web steel joists. The open web steel joists are supported by load bearing concrete block masonry walls.

An addition for change rooms was added to the south side in 2002 and measures 25 ft. by 118 ft.; the roof consists of a single ply membrane supported by metal deck that is supported by open web steel joists. These joists bear on concrete block masonry walls that are clad with an insulated stucco system on the exterior.

2. Observations

A visual review of the Port Carling Arena was carried out in June 2014. During this review, we were accompanied by the Arena manager, Brian Firth. It is noted that some areas of the arena’s structural components were not accessible for a close-up visual review. It has been assumed that conditions in areas that are not accessible correspond to conditions observed in areas that were accessible for review. The visual review cannot, therefore, ensure that all critical structural deficiencies were noted. The following observations were noted during our site visit.

2.1 South Side Exterior

The south side addition above grade wall has an exterior stucco finish that is supported on a poured concrete foundation wall. The foundation wall contains some minor vertical shrinkage cracks and minor spalls. The stucco appears to have been vandalized, as it contains several small impact dents, many of which appear to have been patched. Also, there are several vertical full height cracks that have been sealed and are in need of re-caulking. Some of these full height cracks may have been control joints or related to shrinkage.

Soil erosion is present below all down spouts. It is recommended to re-grade or repair the erosion and then place concrete splash pads to eliminate further erosion.

There are some damaged blocks at the base of the eavestrough downspout adjacent to the Zamboni room, as well as a significant pot hole from erosion at the outlet of the downspout. All cracked or damaged block should be replaced and any cracked, loose or void mortar joints should be raked out and re-pointed.

The foundation walls at the base of the Zamboni room have been insulated on the exterior face with 2" of rigid insulation that extends above grade by approximately 8" on the west side and approximately 1" or 2" on the south and east side. This insulation is not intended to be exposed to UV solar rays, and if left exposed it will break down over time. It is recommended that this insulation be cut off approximately 8" below grade or covered with an appropriate cladding to protect it against UV deterioration. As well, on the east face of the Zamboni room there is a section of rigid insulation exposed near the top of the wall where it appears that on opening in the wall has been filled in with insulation. This surface should be parged or filled in with block to match the adjacent wall.

The south block wall just east of the Zamboni room contains some minor stepped cracking, some of which has previously been patched and is not re-cracked. All of the open cracks should be routed out and re-pointed.

The joint between the Zamboni room and the perpendicular block wall should be sealed with high quality exterior grade caulking to prevent water infiltration and freeze thaw damage.

The south side parking area is a gravel parking lot that contains some noticeable erosion that could be repaired by re-grading.

2.2 East (Rear) Exterior

The east side is the main arena gable wall, which is comprised of 20 courses of exposed block with steel siding above. There are steel HSS columns built into the block wall, which sit on concrete piers at grade.

There is some minor spalling of some block faces present just above grade. These damaged blocks should be removed and replaced.

At the north east corner, the block wall is eroded around and below the downspout. As well, there is vegetation growing on the base of the wall adjacent to the downspout. The eroded block can be sealed with an appropriate paint or spray on sealer to prevent further water infiltration and erosion.

2.3 North Side Exterior

On the north side at the east end of the building there is a small paved parking area with an old concrete retaining wall on the north end and a timber retaining wall on the east end. Both retaining walls are retaining higher soil from the adjacent properties. These retaining walls are both in poor condition. The concrete wall contains some significant vertical cracking that may or may not be repairable. Please note that we did not sound (i.e. hammer test) this wall for delaminations during our review. As a result we are unsure how extensive the damage / deterioration is. The reinforcing steel in close proximity to any significant cracks is likely severely corroded. As the reinforcing steel corrodes it expands, which results in concrete delaminations around the corroded steel. It may be possible to chip out any delaminated concrete and repair the wall, or alternatively the wall could be replaced. The timber retaining wall appears to contain significant rot and is likely at the end of its service life. The timber wall should be scheduled for replacement in the near future and the concrete wall should either be repaired or replaced.

The asphalt on the north side is cracked and bumpy with some erosion and pot holes at the overhead door. There is some settlement present around the catch basin, which will likely result in ponding water after rainfall (it was dry at the time of our site visit).

The block wall contains some minor stepped cracking as well as some cracks around the doors. Some block erosion is present at the downspouts. As previously noted, eroded blocks can be sealed with an appropriate exterior grade sealer, and all cracked or damaged block should be replaced and loose, void or cracked mortar joints should be raked out and re-pointed.

The wood door frame around the overhead door is broken and likely rotten. It is likely due to be replaced.

The paint on the doors and roof flashing is flaking and in need of re-painting. As well, it appears that some of the roof flashing may be loose.

2.4 West (Front) Exterior

The exterior surface of the west wall has been painted and generally appears to be in good condition. However, there are some minor void mortar joints that require re-pointing.

The grading on the west side / front of the building is not sloping away from the building. It is recommended to add a north – south swale in front of the building to allow the grading to be sloped towards the swale, away from the building.

In the south west corner of the building, some erosion is present and the existing catch basin located in the grassed area isn’t collecting as much water as it could or should be if the grading were corrected.

2.5 Front Lobby (Interior)

In the lobby, we removed four ceiling tiles in an effort to visually review the roof framing above. The low single storey roof above the ceiling tiles is framed with open web steel joists (OWSJ) and steel roof deck. We were told that a new roof top unit was added in 2002, at which time some of the existing OWSJs appear to have been reinforced (i.e. the reinforcing was visible). After looking through the ceiling tiles in four locations to spot check the OWSJs, there was no damage, deterioration or structural distress found / noted.

The interior block walls appear to be generally in good condition in this area.

In the canteen room, which is located off of the lobby, the roof appears to be leaking. This leak should be investigated and repaired immediately to prevent deterioration to the finishes and roof structure.

2.6 Dressing Rooms

All of the dressing rooms have a t-bar dropped ceiling in place. At the time of our site visit, a few ceiling tiles had been removed in dressing rooms # 5 and #6. In these two dressing rooms, the roof appears to be leaking and some of the ceiling tiles are stained (water stains). We were able to visually review the OWSJ framing directly above the removed ceiling tiles, with no signs of structural distress or deterioration noted. However, our visual review was in these rooms without the use of a ladder, so we were only able to review directly above or directly adjacent to the removed ceiling tiles.

No other ceiling tiles were removed in the any of the other dressing rooms during our site visit,

There were no signs of structural distress or deterioration found / noted in any of the dressing rooms. However, the leaking roofs in dressing rooms #5 and #6 should be investigated and repaired immediately to prevent deterioration to the finishes and structure.

2.7 Olympia Room and Plant Room

The roof is framed with OWSJs that are exposed to view (i.e. no ceiling is present). There were no signs of structural distress or deterioration noted in the roof framing.

Adjacent to the man door, there was a damaged / cracked block present that should be removed and replaced.

2.8 Generator Room

The ceiling in the generator room is finished in drywall so we were unable to visually review the roof framing above.

There is some water damage evident in the drywall ceiling as well as a large crack where the tape has come apart between boards and the paint has peeled (likely due to water damage).

2.9 Figure Skating Room and Minor Hockey Room

In these rooms, the block walls were largely covered with cabinets. The ceiling was finished with a t-bar drop ceiling, which was not removed during our site visit (i.e. no ceiling tiles were removed). However, there were no signs of distress noted and no issues or complaints were noted by the arena manager.

2.10 Open Arena Area

As reported in AECOM's site review reports # 1 to 5, prepared by Brad King, P. Eng., ending on May 10th, 2010, the existing pre-engineered steel rigid frames have been reinforced to meet the requirements of the 2006 OBC as per Brad King's design completed in 2009 (Drawing #1, AECOM project #114262).

No signs of deterioration or distress were noted in the roof framing within the open arena area. The Low E insulated ceiling and netting recently installed obscures all of the existing high roof purlins and the upper portions of the rigid frames from view. We are unable to comment on the current condition of these purlins, as they were not exposed to view.

At the base of several of the rigid frame columns, the base plates are starting to rust and the grout below and around the base plates is severely cracked and crumbling. We recommend that all cracked and loose grout be removed and replaced with new dry packed non-shrink grout. As well, all surface rust on the base plates should be removed and the base plates should be painted to slow any future corrosion.

2.11 Floors

The interior floors appear to be all comprised of concrete slabs on grade. However, as is typical in most arenas, most of the concrete slab on grade is covered in rubberized flooring or mats, which obscure it from view. Concrete slabs on grade are supported continuously on the underlying soil and therefore are not structural in nature. The slabs that were exposed appeared to be generally in good condition, with typical shrinkage cracks but no significant cracks or settlement issues.

2.12 Photos

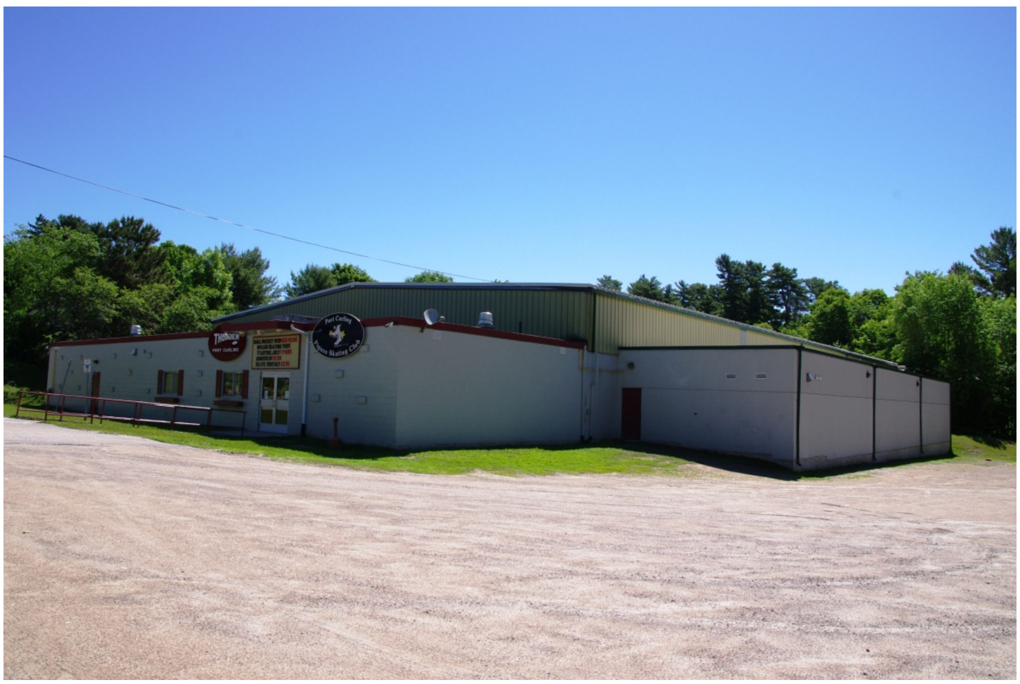

Photo 1 - West (Front) Elevation (South – West Corner)

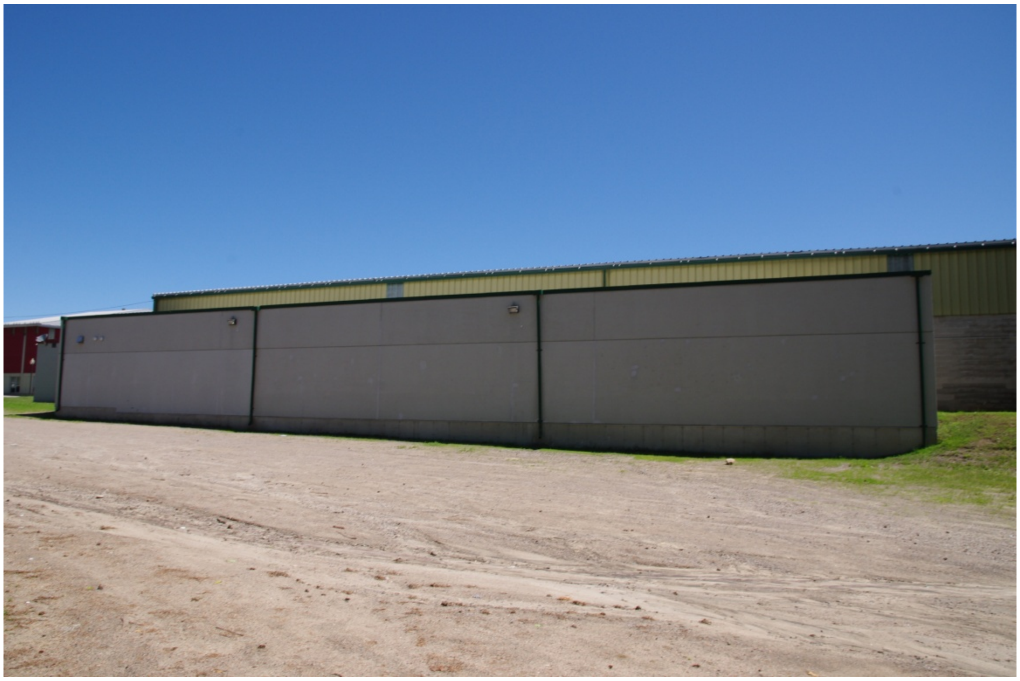

Photo 2 – South Elevation

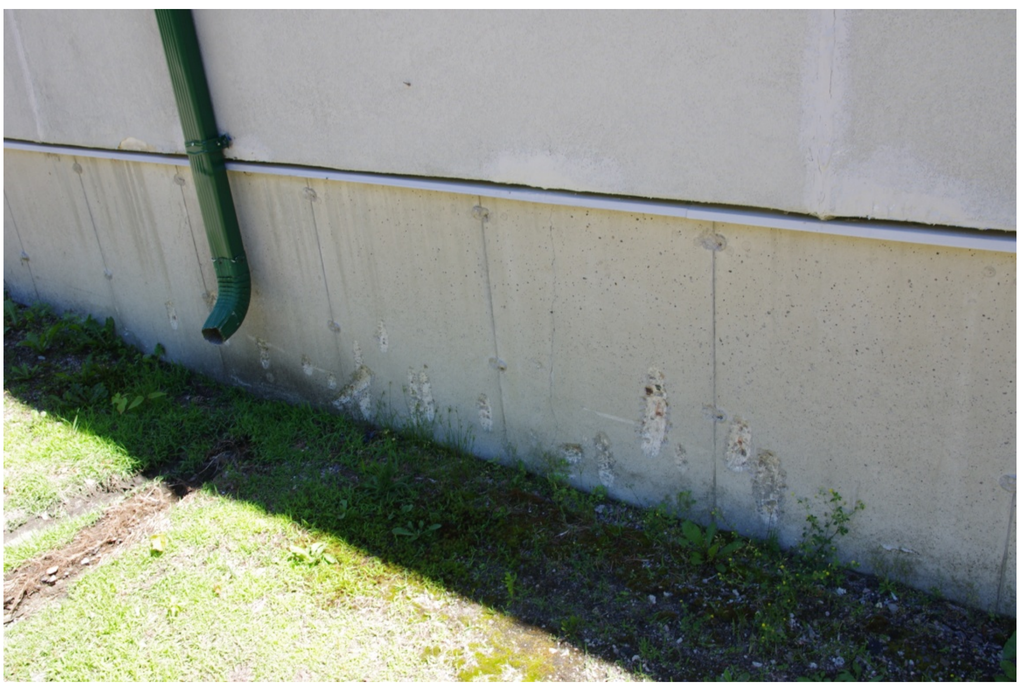

Photo 3 – South Side – Shrinkage Crack & Spalls / Damage

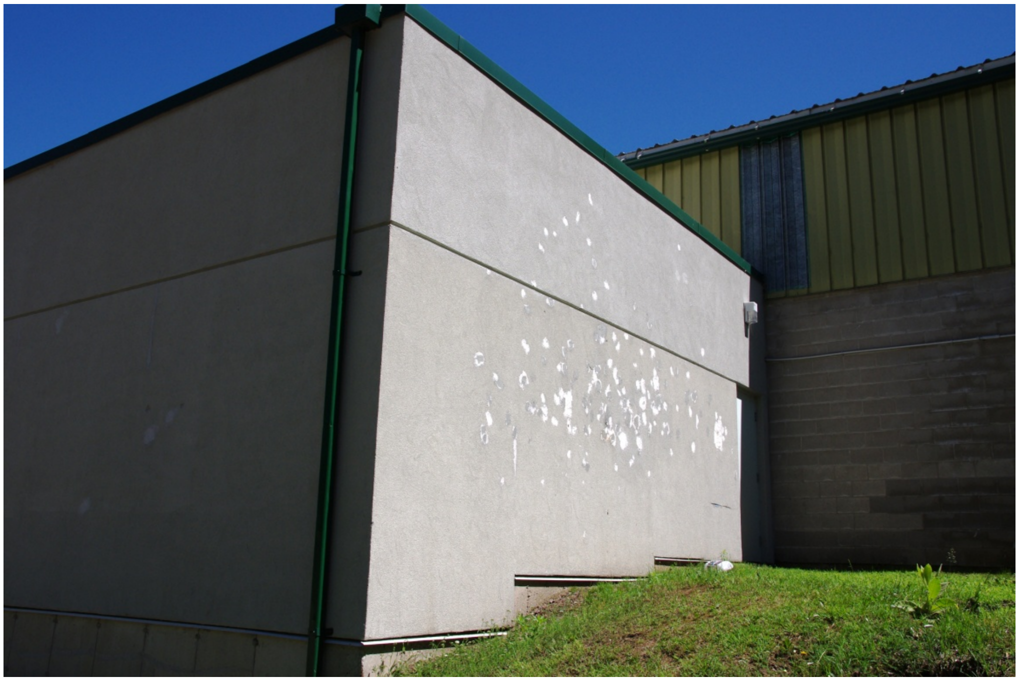

Photo 4 – North End of South Side Addition – Vandalism to Stucco Finish

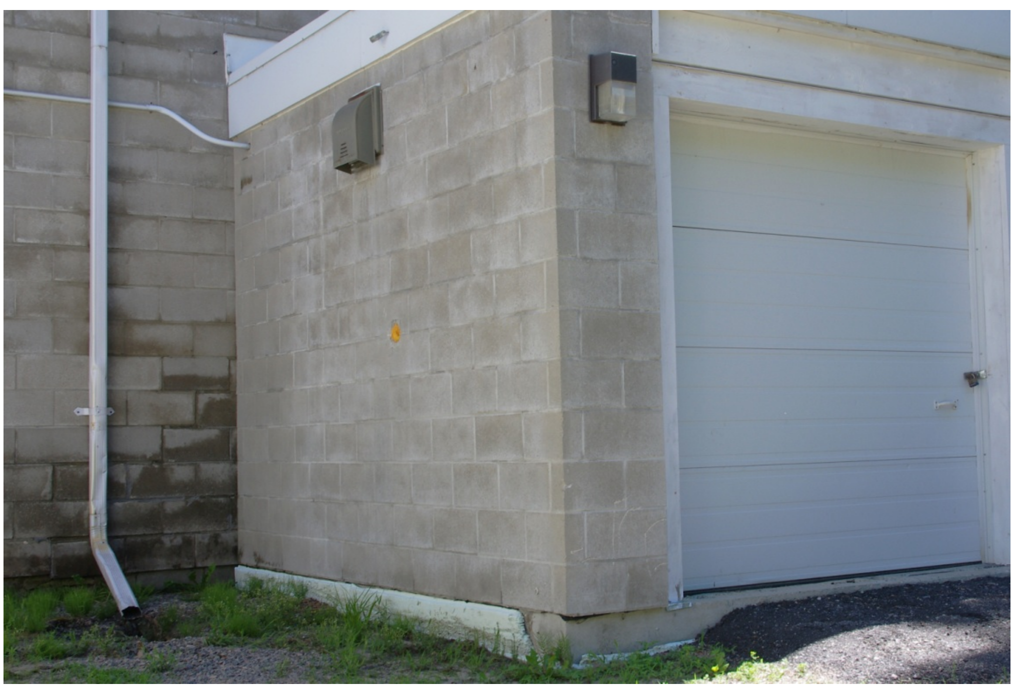

Photo 5 – Zambonie Room – Exposed Rigid Insulation

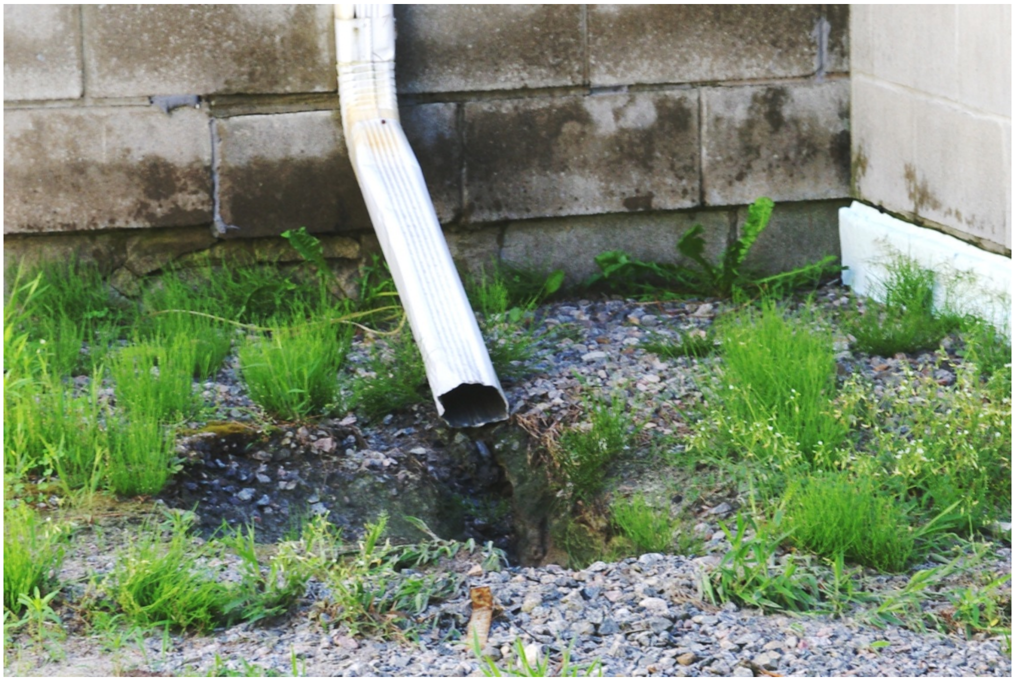

Photo 6 – Damaged Block & Erosion Adjacent to Zamboni Room

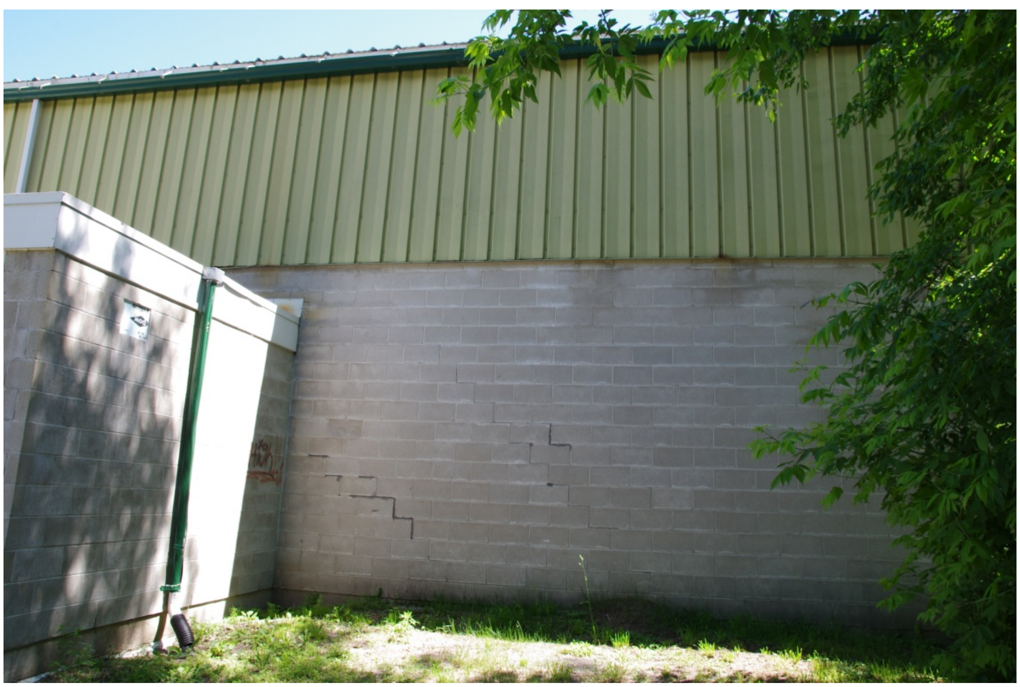

Photo 7 – Stepped Cracking just East of Zamboni Room – South Wall

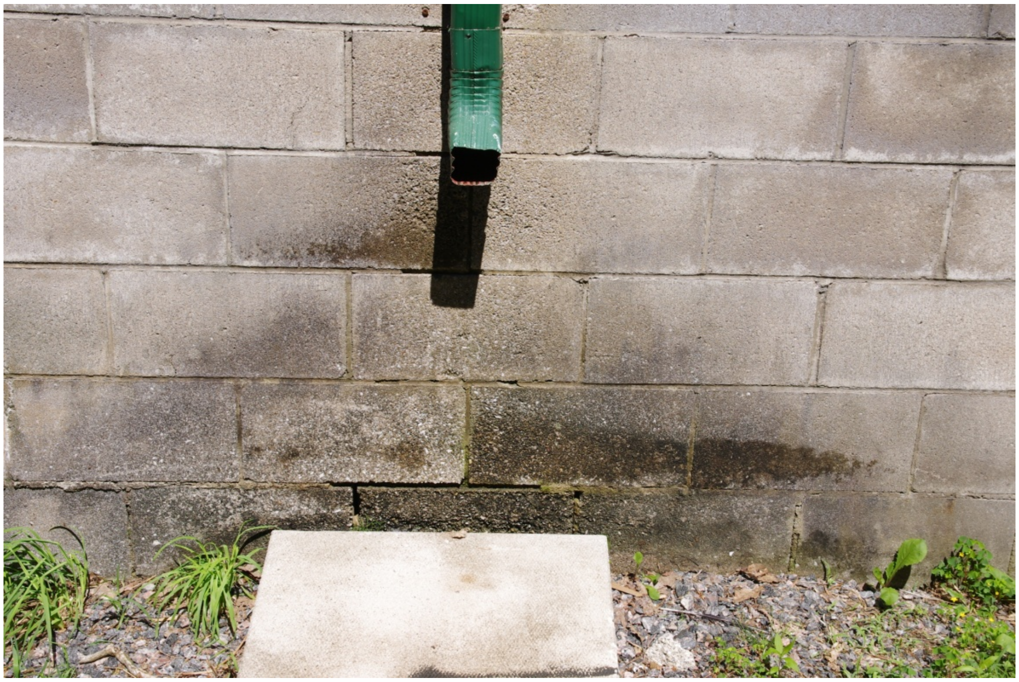

Photo 8 – East Wall – Eroded Block at Downspout

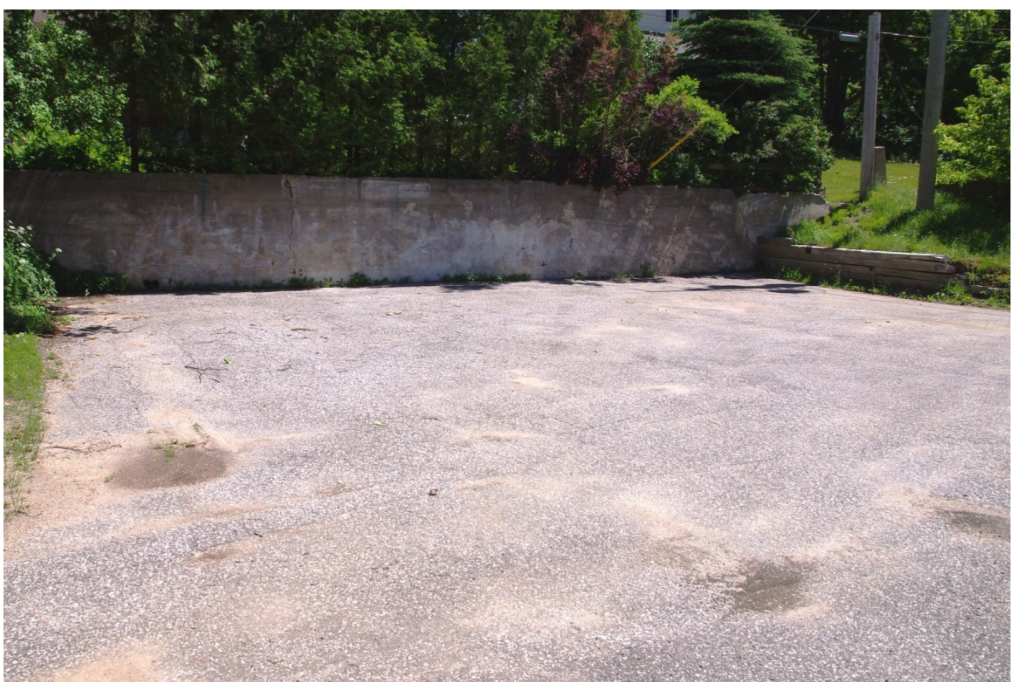

Photo 9 – North Side – Deteriorated Retaining Walls

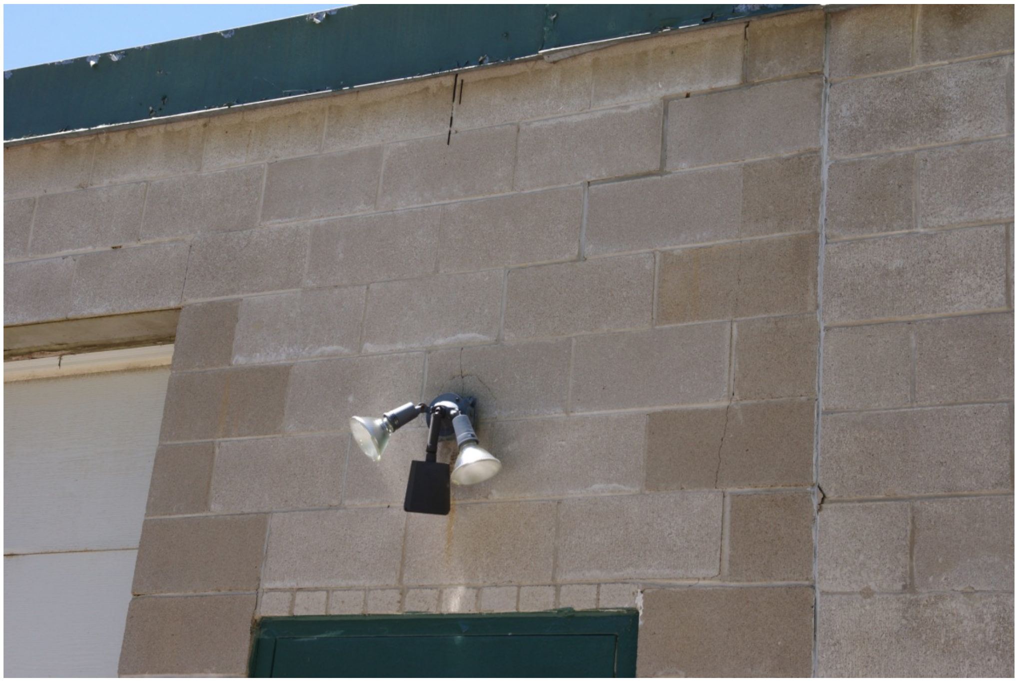

Photo 10 – North Side – Stepped Cracking

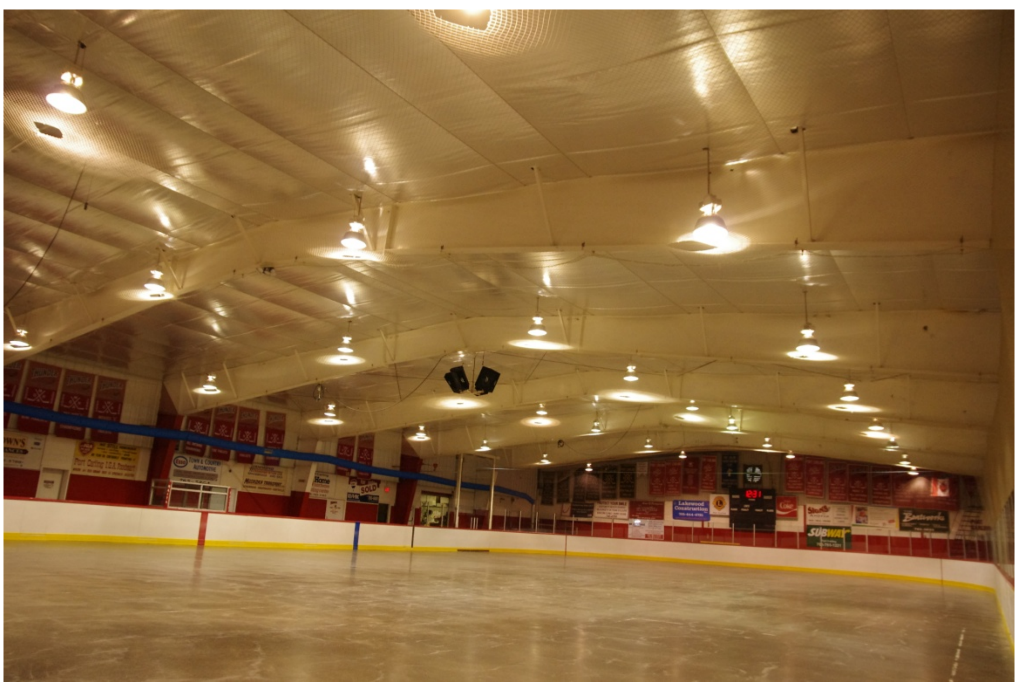

Photo 11 – Interior of Arena with Low E Ceiling below Roof Purlins

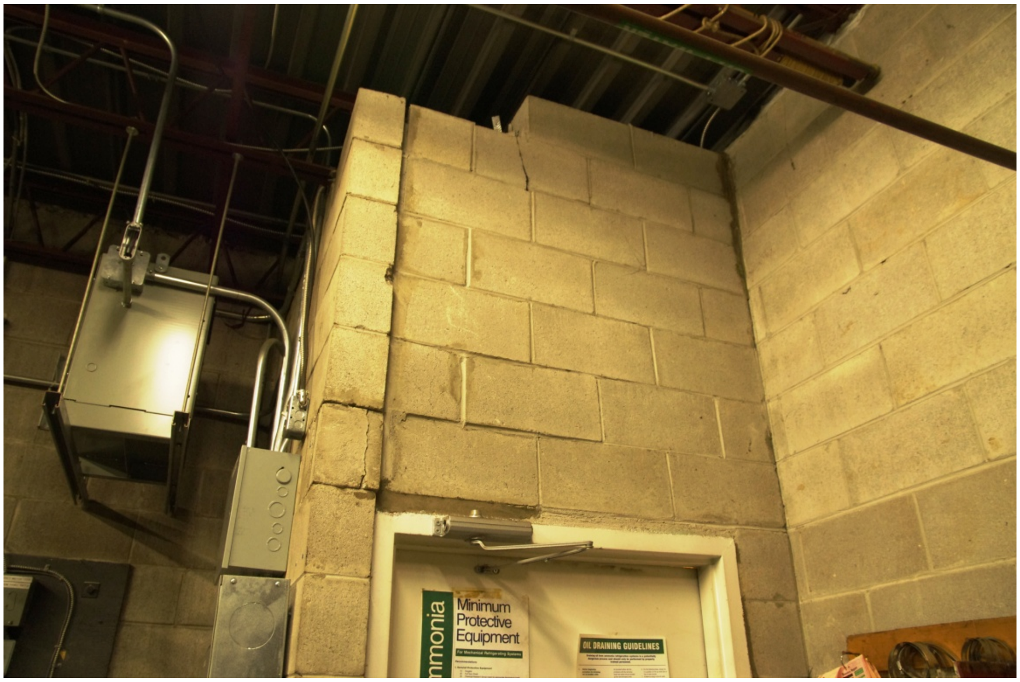

Photo 12 – Plant Room – Damaged Block Adjacent to Man Door

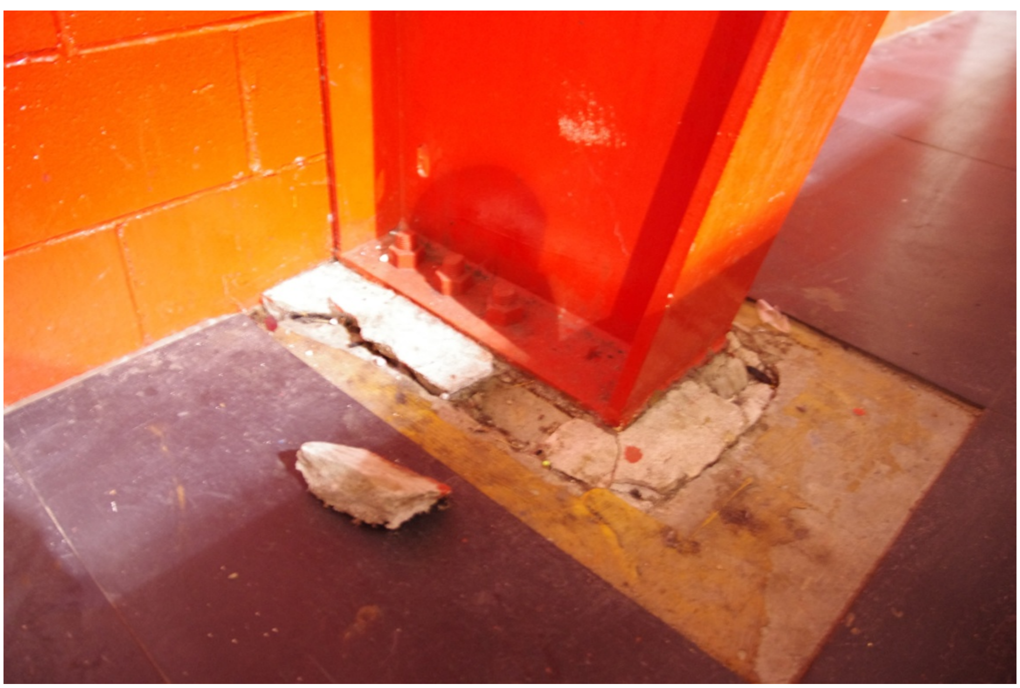

Photo 13 – Rigid Frame Base Plate with Cracked Grout on Pier

3. Snow Removal

As reported in our previous report completed in 2009, the original construction drawings for the building indicate that the original design snow load for the building was 52 psf with the drift load on the low roof peaking at 120 psf. The high roof rigid frames in the arena area were subsequently reinforced in 2009 to safely support a basic roof snow load of 55 psf (2.64 kPa), which is based on a ground snow load of 2.80 kPa. The high roof purlins were also analysed in 2009 and found to be capable of safely supporting the same 55 psf snow load. As reported in AECOM's site review reports of the rigid frame reinforcing (reports 1 to 5 ending on May 10th, 2010), it appears that the rigid frames were upgraded to generally conform to the reinforcing design drawing prepared by AECOM in 2009.

The reason the rigid frames were reinforced was that the high roof had additional dead load added when a new roof and insulation were placed above the existing roofing, and upon analysis the rigid frames were found to be significantly overstressed in the end zones of each frame (i.e. where the beams are attached to the columns). With the additional loading and the resulting overstress, it became necessary to update the structure. Based on our analysis in 2009, the high roof purlins were found to be adequate without reinforcing for the design snow load of 55 psf, with the exception of the east end bay purlins, which lack the continuity to the east. The east end bay purlins were found to be just under 10% overstressed under full snow load, which is often considered to be at the upper bound of acceptable overstress (i.e. 10% overstress is the upper limit). Therefore, it is recommended that these purlins be monitored for excessive deflections. The purlins at each end of the arena (east and west end) lack the continuity of the purlins in the interior bays; however, the west end bay appears to have a 16' long span while the east end bay span is 24' long. As a result, our analysis only resulted in the overstress in the 24' long east end bay (i.e. the 16' span is ok).

As there was no additional load added to the existing low roofs, it was not necessary to analyse/evaluate or upgrade the structures of the low roofs. If no changes to a structure are made, and no additional load is added, the Building Code does not require owners to upgrade their buildings to meet current / new Code requirements. As noted above, the low roofs have only been designed for a snow load of 120 psf according to the original drawings, but because no additional dead load was added to the lower roofs it is not necessary to upgrade them to the current OBC. Based on AECOM's 2009 report, the snow piling on the low roof adjacent to the high roof would be approximately 200 psf peak load based on the 2006 OBC, which is the same as the 2012 OBC. Even though the Building Code doesn't require structural upgrades, it would be prudent to monitor / watch for excessive deflections when snow drifting is high, and to have the snow cleared off of the roof to minimize the snow drifting.

In regards to snow removal, the National Building Code Structural Commentary indicates that the density of roof top snow varies from 6.4 lbs/ft^3 (1 kN/m^3) to 28.7 lbs/ft^3 (4.5 kN/m^3), and to use an average value of 19.1 lbs/ft^3 (3.0 kN/m^3). The lower end of the density range would be considered light and fluffy snow and the higher end of the range is wet, compact, heavy snow. When considering snow removal depths for the Port Carling Arena, the density of snow to consider will likely range from approximately 19 lbs/ft^3 to 25 lbs/ft^3, although this will depend on the ambient temperature and volume of recent rainfall.

On the high roof, which is now designed for 55 lbs/ft^2, lighter snow should not be allowed to accumulate greater than 2'-10" deep (based on a density of 19 $lbs/ft^{3)}$ and heavier compact snow should not be allowed to accumulate deeper than 2'-2" deep (based on a density of 25 $lbs/ft^{3)}$.

On the low roof, the snow piling adjacent to the high roof, which was designed for 120 lbs/ft^2, should not be allowed to accumulate more than 6'-3" deep when light and fluffy, and 4'-8" deep when compact and heavy (based on the same densities noted above). The snow piling will taper down to a uniform depth of snow at a distance from the stepped roof. The low roof was originally designed for a basis uniform snow load of 52 lbs/ft^2, with the exception of the piling area. Therefore the maximum uniform depth on the low roofs should not be allowed to exceed 2'-8" when light and fluffy, and 2'-1" when compact and heavy (based on the same densities noted above).

The above noted snow depth values should be taken as maximums and therefore the snow should be removed from the roof before achieving these depths. Care should also be taken when removing the snow that the piles are not created in excess of the above noted depths. Therefore it will be necessary to remove the snow from the edge of the roof first and subsequently work inwards without piling.

Also it should be noted that based on Code requirements the rigid frames are designed for the following two conditions: case 1 is full snow load on the whole roof area supported by the frame, and case 2 is to have full snow load on the roof area supported by one half of the frame (i.e. on one side of the ridge of the roof) and half the snow on the opposite roof area supported by the other half of the frame (i.e. on the opposite side of the roof's ridge). The frames are not designed to have full snow on one side and zero snow on the opposite side, and this condition could overstress the steel frame. Therefore, on the high arena roof it is important to remove the snow equally from each side, starting with a band of snow at the edge of the roof on one side, and then moving to the opposite side of the roof and completing the same band of snow at the edge of the roof. This will eliminate any significant unbalanced snow loading on the rigid frames in the high roof area.

4. Summer Ice / Early Plant Start-up

We understand that the ice surface is now often started at the Port Carling Arena in mid August, while in the past it had been started in September or even October. There are a few significant issues and/or concerns that the Township should be aware of when starting the ice before the weather cools off in September.

Based on the original drawings, we understand that there is only 2" of rigid insulation present below the ice surface. This was quite typical for arenas of this age in smaller municipalities where they were not intended to have summer ice. One significant issue that should be considered when extending the ice surface season into the summer is the potential for frost heave damage to the ice's concrete slab on grade. When the ice surface is present and the cooling plant is running, frost is driven down into the ground surface below the ice. The longer the ice is present, the deeper the frost will extend into the ground.

If the ice surface was left in all year long, the frost below the ice would become perma-frost and would extend very deep into the ground. Arenas that are designed for ice all year round have more insulation below the slab, they have at least 3' or 4' of free draining granular soil that is not frost susceptible placed below the slab and rigid insulation, and they have ground heaters installed and operating below the insulation (below the slab). This prevents the frost heave from occurring.

In many newer arenas that are not intended to have summer ice, at least 4" of rigid insulation is present below the slab as well as at least 3' of free draining non frost susceptible soil. This helps to minimize the depth that frost will reach, and as a result it takes less time for the frost to melt during the summer months. A typical rule of thumb is that with 4" of insulation and 3' of non frost susceptible soil present below the slab, the frost will melt within 2 ½ to 3 months, depending on ambient temperatures during the summer and depending on the native soil composition. With only 2" of rigid insulation and less than 3' of free draining granular soil present below the slab, the rule of thumb is that 4 to 5 months are necessary for the frost to melt below the slab, depending on ambient temperatures during the summer and depending on the native soil composition.

The presence of frost below the slab may be noticeable by a cold floor slab and possibly the presence of condensation on the surface of the slab. Warm air is capable of holding a lot more humidity without condensation than cooler air. When the humid warm air is in contact with a cold surface such as the slab, it will cause condensation to occur on that surface.

If the frost isn't allowed to completely melt below the slab prior to starting the ice again, it will drive the frost deeper than it would have been otherwise. This will accumulate over the years, with frost advancing deeper and deeper each year that it isn't melted in a row. As frost advances deeper, it may result in frost heave that wasn't present other years as the ice lensing forms in a thicker strata of soil and possibly in soil at depth that is more frost susceptible than the soil closer to the slab. Frost heave is when ice lenses form between soil particles, and as the ice lenses form they expand causing the soil above to lift, which in turn lifts everything above including the slab. In situations like this it is not uncommon for the slab to be badly cracked with vertical elevation changes (i.e. bumps and ledges).

Another issue related to starting the ice before the temperature cools off is that without proper dehumidification the humidity in the warm air within the arena will condense when the air is suddenly cooled by the cooling plant and ice. This will result in significant fog and raining within the arena. The raining is a result of condensation above and below the Low E ceiling. When the moisture in the air above and below the Low E ceiling condenses out as it rapidly cools, it will rain down on the ice surface below. Unfortunately, there will likely be a lot of water trapped above the Low E ceiling that will not likely dry out, but will freeze in place. Similarly, there will be moisture and then ice sitting on the roof framing and likely trapped in the roof insulation. When the outside is still hot and humid, the humid air passing through the insulation towards the interior of the building cools as it gets closer to the cold interior. When this air cools to the dew point temperature, it will condense and leave the moisture in the insulation. Typically the vapour barrier is located on the interior surface of the insulation, but this doesn't help when it is hot outside and cold inside. In that case the vapour barrier should be located on the exterior surface of the insulation, or on both surfaces. However, arenas of this age weren't constructed with vapour barriers on both sides of the insulation when they weren't intended to have ice in the summer. As well, in many cases there were no vapour barriers at all.

When moisture is left sitting on the structural steel for long periods of time, corrosion will begin. If moisture is resting on organic materials such as wood (i.e. speaker boxes, wood frames, etc), mold will grow. Moisture in insulation effectively reduces or eliminates the R-value of the insulation (i.e. the insulative value is reduced).

This building has plain concrete block exterior walls that are not insulated and do not have any vapour or air barriers. As a result, the hot humid exterior air will pass through the walls and condense on the interior surface and add to the fogging inside. The building envelope (i.e. wall and roof assemblies) were not designed to have summer ice, and we anticipate that the existing dehumidification equipment is likely not adequate for summer ice.

5. Conclusion

Based on our visual review of the Port Carling Arena, it appears that the existing structural components are generally in good condition; however, addressing the recommended maintenance items will help to extend the life expectancy of the facility. As well, we recommend ongoing monitoring of the east end bay purlins and low roof framing for excessive deflections under heavy snow loads, and an ongoing snow removal program to prevent the weight of snow from exceeding the design capacity of the different roofs.

As noted in section 4, the design and construction of this facility was not intended to allow for summer ice. When the ice is started in August or earlier, the humidity inside and outside the building is too high, due to the warmer temperatures, to prevent the resulting condensation without building upgrades (i.e. dehumidification equipment and building envelope). As well, it is important that the frost has previously melted below the slab before starting the ice again. If condensation issues continue and the under ice frost isn't completely melted in the summer, the facility will likely require additional maintenance.