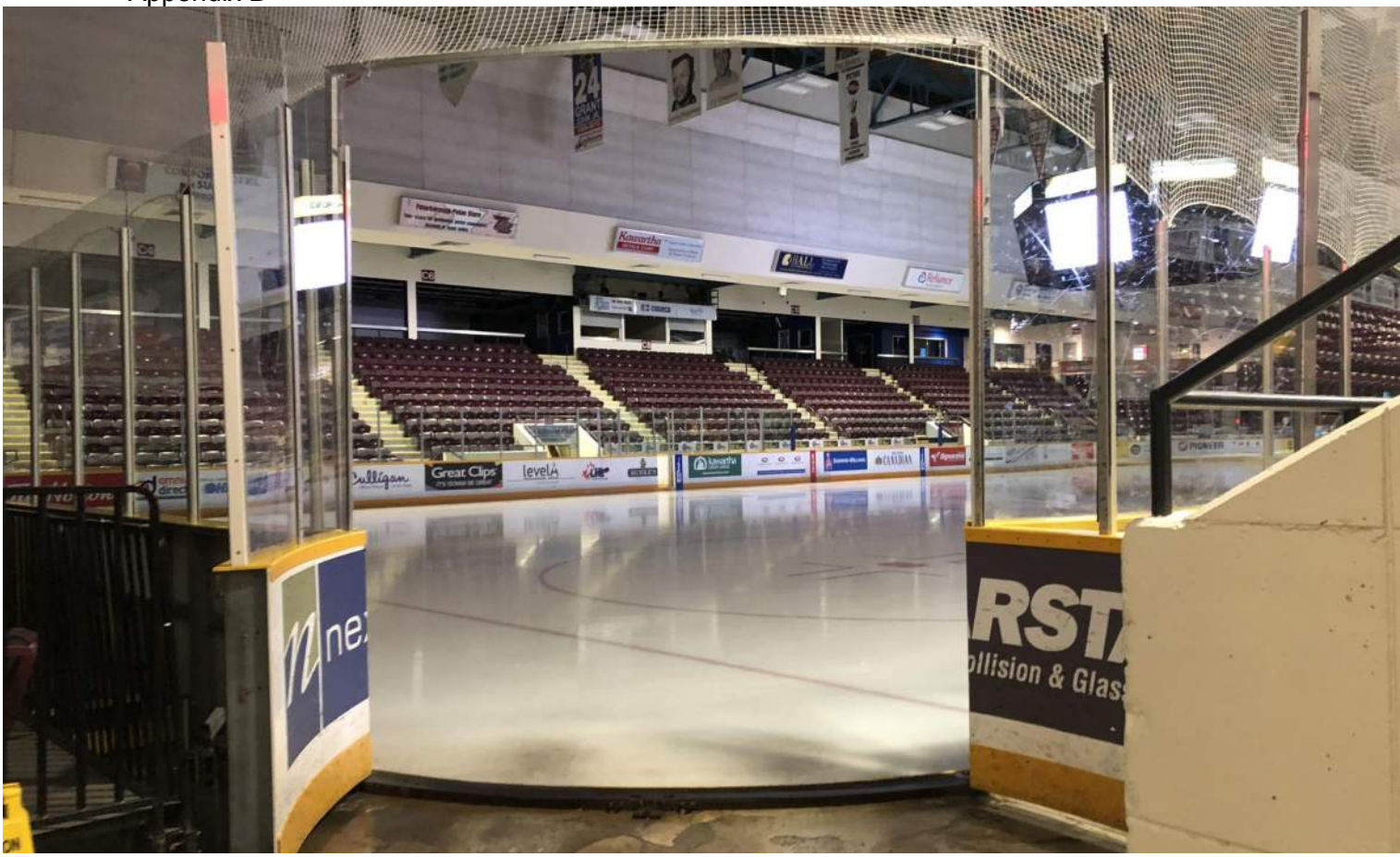
Appendix B



ENTUITIVE

PEER REVIEW REPORT

PETERBOROUGH MEMORIAL CENTRE STRUCTURAL REVIEW

C018.2148

FOR: CITY OF PETERBOROUGH | **DATE:** NOVEMBER 9, 2018

ENTUITIVE

Table of Contents

1 EXECUTIVE SUMMARY

The Peterborough Memorial Centre (PMC) located at 151 Lansdowne Street, in Peterborough, is a 4,329-seat multi-purpose area. The entire building underwent a structural forensic rehabilitation review by Carvajal Structural Engineers Inc. (CSE) in July 2016.

In 2016, the City of Peterborough (COP) contracted CSE to perform an investigation and issued a report establishing their findings, the allowable working load limitation of the existing rink slab and recommendations for the repair of the existing structure. In July 2016, CSE reported that the cause of the concrete deterioration was a result of the age and environment of the structural support elements. CSE classified the risk level of the various conditions of concrete at the underside (soffit) of the original 1955 rink slab and north brine trench foundation wall as structural concerns and requiring immediate repair. In addition, CSE had recommended that, in general, annual monitoring should be performed to report if conditions worsen.

The City of Peterborough has requested that Entuitive assess the conclusions and recommendations made by CSE and confirm whether the conclusions are reasonable and if we have any additional or alternative recommendations for the stabilization or repair to the existing structure. Entuitive was also requested to complete an independent condition assessment and prepare a report summarizing our observations and recommendations of the ice rink structure.

Entuitive performed a review of CSE's report and an in-field investigation of the condition of the concrete structure at the south end of the ice rink. While we generally agree with CSE's comments and recommendations, in our opinion, the infill of the crawl space and current temporary shoring is not a sufficient remedy to extend the serviceable life of the structure by ten years.

We agree with CSE's observations and recommended repair requirements. We have provided additional options for the implementation of the repairs. In our opinion, we recommend that steps be taken as soon as possible to provide additional support to the original rink slab and topping slab within the brine trench for the full extent of the north brine trench foundation wall including the area beneath the ice resurfacer path.

It is recommended that steps be taken as soon as possible to provide localized repairs to the existing deteriorated steel frames supporting the brine header system. It is recommended that repairs to the brine header support system frames take place prior to the installation of the proposed steel frame slab support system.

Based on our independent structural analysis, the 1979 rink topping slab has sufficient capacity to withstand all applied OBC loadings applicable, provided that the topping slab is not materially deteriorated.

Based on the existing structural drawings and investigation reports reviewed, the existing topping slab was determined to have sufficient capacity to restrain the lateral impact loading imposed by the dasher boards system anchored into the slab.

2 INTRODUCTION

The Peterborough Memorial Centre (PMC) is a multi-purpose facility that primarily serves as a hockey and lacrosse arena. The building is located at 151 Lansdowne St., in Peterborough, and it was originally constructed in 1955. The existing ice rink pad (slab) was structurally modified in approximately 1979, and structural upgrades to the seating area, mechanical rooms, and roof were performed in approximately 2002.

2.1 DESCRIPTION OF STRUCTURE

The Peterborough Memorial Centre is an approximate 45,000 square foot multi-purpose facility. The original construction (1955) of the rink slab is a 5" thick suspended reinforced concrete slab cast on a steel deck. The slab is supported along its length by a series of 8" thick concrete block foundation walls, which are spaced at 8'-8" on centre. Crawl spaces are located below the slab between the concrete block foundation walls.

Based on the information contained in the various reports provided and available structural documentation, the existing rink slab was structurally modified in approximately 1979. The structural modifications included the complete removal of all the dasher boards and the installation of a new 4 ½" – 5" thick concrete topping slab with a surface hardener complete with new brine pipes. The new topping was cast on top of the original rink slab. The existing feeder pipes were abandoned in the original rink slab, and new PVC feeder pipes were re-routed into the new topping slab and connected to the brine header pipes. The brine header pipes are located at the south of the rink, to the south of the north brine trench reinforced concrete foundation wall. The PVC feeder pipes run from the south to the north of the ice rink, looping back at the north end of the rink to return to the brine headers at the south end of the rink.

2.2 BACKGROUND

In July 2016, the City of Peterborough (COP) contracted Carvajal Structural Engineers Inc. (CSE) to investigate and establish the allowable working load limitation of the existing rink slab. The purpose of CSE's review was to provide a structural professional opinion on the condition of the existing slab and to determine the allowable working load capacity of the slab. CSE prepared a report dated July 31, 2016 summarizing their structural assessment of the existing rink slab and recommending potential repairs.

After reviewing CSE's initial report, and the recommendations contained within, the COP requested that CSE submit monthly inspection reports starting in June 2017. Per CSE's summary report dated July 3, 2018, CSE was retained to specifically to monitor the condition and structural performance of the north brine trench foundation wall below the existing rink slab over a 12-month period.

A new dasher board and glass system was manufactured by Athletica Sport Systems and was pre-designed and pre-ordered in anticipation of a floor replacement in the summer of 2019. The COP asked Athletica if there were any issues or concerns with changing the scope of work and if it was possible to install the new dasher board system on the existing floor. Athletica submitted a letter to the COP on September 13, 2018 to answer these questions.

A Building Condition Audit was commissioned by the COP to a refrigeration consultant in 2010. The audit assessed a life cycle of 40 years for the floor and brine piping system that is installed in topping slab. The existing brine headers and individual feeder loop pipes were installed in 1979 and are currently 39 years old.

CSE's initial report dated July 31, 2016 noted requirements for structural repairs to the original 1955 rink slab and north brine trench foundation wall. To perform these repairs, it was requested that the brine headers be removed, and all the feeder pipes be cut. Cimco Refrigeration, who is the COP's Refrigeration Preventive Maintenance Contractor at the time of this report, strongly advised against removing the brine header and cutting the brine feeder lines. Cimco Refrigeration provided their professional opinion in a letter dated September 19, 2018.

Due to the conflicting opinions the COP has received on performing the repairs to the ice rink slab, the Owner has requested that Entuitive perform a peer review of the initial investigation and perform an independent structural inspection of the ice rink slab and the foundation wall below the existing rink slab and south dasher boards. The Owner requested that Entuitive review the existing reports and available structural documents, perform a field investigation, perform a structural review of the existing rink slab, formulate a structural opinion on the existing condition of the arena slab, assess the conclusions and recommendations made by the renovation structural consultant, and confirm whether the conclusions are reasonable. The Owner also requested that Entuitive provide any additional or alternative recommendations for the stabilization or repair to the existing structure.

2.3 PROJECT TEAM

The investigation and reporting of the project was conducted under the supervision of Dave Watson, P. Eng., and Mike Hillcoat, P. Eng., CCCA. The investigation and the QA/QC technical review of the report was performed by Scott Wood, B. Eng., and Peter Loudfoot, M.A.Sc. EIT.

2.4 DOCUMENTATION REVIEWED

The following documentation and drawings were provided by the Client and reviewed by Entuitive in preparation of this report:

- PDF scans of the original Peterborough Memorial Centre (1955, 1977, and 2002) drawings,
- Structural Assessment of Existing Ice Rink Pad – by Carvajal Structural Engineers (CSE), dated July 31, 2016;

- Structural Updated Report South Supporting Ice Rink Wall – by Carvajal Structural Engineers, dated July 3, 2018;
- Memorial Arena Wall Monitoring Review Reports No.'s 1-15 – by Carvajal Structural Engineers, dated from August 3, 2017 to September 5, 2018;
- Peterborough Memorial Arena – New Crystaplex 6A dasher board system letter – by Athletica Sport Systems, dated September 13, 2018;
- Header Trench, Header Wall and Rink Floor Letter – by Cimco Refrigeration, dated September 19, 2018;
- Temporary Shoring Drawings – by Carvajal Structural Engineers (CSE), dated June 27, 2016; and
- Various pictures of the header trench wall taken by Carvajal Structural Engineers (CSE).

2.5 SCOPE OF INVESTIGATION

Entuitive performed a preliminary visual investigation of all accessible areas of the existing rink slab, north brine trench foundation wall (south rink slab foundation wall as defined in CSE's reports), and the details for the existing dasher board connections to the topping slab. Entuitive performed acoustic sounding of all accessible areas within the brine trench. The underside (soffit) of the existing slab was accessed via the brine trench to the south of the south rink slab support foundation wall via the mechanical storage room. Acoustic sounding of the concrete was performed by hammer tapping.

At the time of the investigation, Entuitive had limited access to the original 1955 concrete rink slab. The ice rink was in use at the time of the investigation, and as such, the ice made the topside of the existing concrete slabs inaccessible within the boundaries of the dasher boards. The build-up of ice on the brine header and feeder pipes resulted in limited access to the upper portion of the north brine trench foundation wall and some of the underside (soffit) of the rink slabs within the brine trench. The topping slab to the south of the south dasher boards at the ice surface level was made inaccessible by the steel bleachers. The topping slab outside the dasher boards was only accessible in the southeast and northeast corner of the promenade.

Refer to Appendix "B" for a summary of locations where Entuitive performed hands-on investigation to the existing structure.

No destructive testing was conducted in the performance of our investigation.

3 OBSERVATIONS

This section summarizes the results of our field observations. The intent of this report is to summarize our observations regarding the condition of the existing rink slab and associated supporting elements, assess the conclusions and recommendations made by the renovation structural consultant CSE, and confirm whether the conclusions made by CSE are reasonable.

The following observations were made by Entuitive:

3.1 TOPPING SLAB SOUTH OF SOUTH DASHER BOARDS

1. Wide cracks were observed on the topside of the topping slab located at the southeast and southwest corners of the ice rink. See photographs 1 and 2.
2. Areas of localized topping slab repairs were observed adjacent to the dasher board supports at the ice resurfacer doors at the southeast and southwest corners of the ice rink. These existing repairs were observed to be cracked and delaminated. The cracking and delaminating repaired concrete adjacent to the dasher board supports was observed to be the most extensive along the ice resurfacer path at the southeast corner of the ice rink. See photographs 3 and 4.
3. Embedded wire mesh was observed at the top surface of the existing topping slab within the ice resurfacer path at the southeast corner of the ice rink. At this location, the wire mesh was observed to have light to medium surface corrosion. See photograph 5.

3.2 TOP OF ICE RINK SLAB SURROUNDING DASHER BOARDS

1. Wide cracks were observed on the east side of the ice rink and along the ice resurfacer path at the southeast corner of the rink. The most extensive cracking was observed within the ice resurfacer path. See photograph 1.

3.3 UNDERSIDE (SOFFIT) OF ORIGINAL RINK SLAB

1. The majority of the underside (soffit) of the original rink slab structure is not visible since it is located in inaccessible confined spaces, and, where reasonably accessible, the steel deck is covered by cork insulation located beneath the concrete slab.
2. Extensive cracking, honeycombing, delamination and spalling was observed on the underside (soffit) of the original rink slab beneath the ice resurfacer path at the southeast corner of the ice rink. Pieces of fallen concrete and corroded reinforcing steel were observed at this location. Temporary shoring was observed at this location. See photographs 6 and 7.
3. Extensive honeycombing was observed along the underside (soffit) of the original rink slab adjacent to the north face of the south brine trench concrete foundation wall. Exposed reinforcing bars were visible at the time of review and were observed to be lightly corroded. See photographs 11 and 12.
4. The condition of the underside (soffit) of the existing slab directly above the brine header and feeder pipes adjacent to the north brine trench foundation wall was not visible at the time of review. The build-up of ice around the pipes at this location made the underside (soffit) of the slab inaccessible. However, wooden formwork was observed on the underside of the slab at the locations where the feeder pipe penetrated the slab, as per CSE's structural updated report dated July 3, 2018. Where visible, the existing cast-in angle on the underside (soffit) of the suspended slab was observed to be severely

corroded. Honeycombed concrete and exposed corroded reinforcing steel were observed at these locations. See photographs 13 and 14.

3.4 NORTH BRINE TRENCH CONCRETE FOUNDATION WALL

1. The north brine trench concrete foundation wall (Gridline 4x as noted on S-2 in the 2002 drawings) adjacent to the brine header pipes at the south end of the rink (beneath the dasher boards) was observed to be in poor condition. Entuitive's access at the time of review was limited to the south face of the wall since the crawlspace to the north of the wall had backfilled. Concrete deterioration was observed across the full length of the wall. Areas of cracking, freeze-thaw damage, spalling, and deteriorated concrete were observed, in addition to staining from corroding steel and water leaching. The condition of the top of the wall was not visible at the time of review due to the ice build-up around the brine header and feeder pipes. The condition of the concrete at the lower portions of the wall appeared to be sound, as was indicated in CSE's South Supporting Wall Delamination Survey Drawings SK1-01, dated July 12, 2017. See photographs 8 and 9.

3.5 SOUTH BRINE TRENCH CONCRETE FOUNDATION WALL

1. The north face of the south brine trench concrete foundation wall, located approximately 40 inches to the south of the north brine trench concrete foundation wall, was observed to be in fair condition. Concrete delamination and spalling at the bottom of the wall was observed. See photograph 10.

3.6 OTHER OBSERVATIONS

1. Temporary vertical and lateral shoring were observed in the brine trench to the south of the north foundation wall and the space directly beneath the ice resurfacer path as per CSE's Shoring Drawings R1-01 and -02, dated June 27, 2018.
2. What appears to be plywood formwork was observed at the west and east ends of the north foundation wall of the brine trench. Based on CSE's structural updated report dated July 3, 2018, the first bay of the north header trench was believed to have been completely backfilled with blown aggregate material. Due to the backfill, Entuitive was unable to access both the north face of the north brine trench concrete foundation wall and the underside (soffit) of the existing rink slab within the first bay of the crawlspace at the time of review.
3. The existing steel frame support for the brine headers located within the brine trench was observed to have medium to heavy corrosion. Pieces of corroded steel were also observed on the brine trench floor.

4 STRUCTURAL ANALYSIS

4.1 ANALYSIS OF RINK SLAB CAPACITY

Entuitive performed an independent structural assessment of the capacity of the existing rink slab. Since the condition of the original 1955 slab could not be observed from above or below, we analyzed the capacity of the 1979 topping slab alone, neglecting the contribution of the original slab. The capacity of the existing 1979 rink topping slab was analyzed based on the

existing drawings and investigation reports to date to determine if the topping slab could resist the factored applied moments and shear loads safely if the original structural slab (circa 1955) were to fail. The loads imposed on the topping slab were calculated based on current OBC 2012 and NBC 2015 requirements. The structural analysis of the existing topping slab was based on the assumption that the existing concrete and reinforcing bars were installed in conformance with the contract drawings at the time of construction and are in good condition with minimal cracking and concrete delamination.

The following design criteria and assumptions, based on the documentation available to our office, were used for the structural analysis:

- The topping slab (circa 1979) is 4-¾" thick with a trap rock finish,
- The topping slab contains #6 reinforcing mesh in a 6x6 grid, and #3 reinforcing bars at 12" centre-to-centre;
- The topping slab contains 1-¼" diameter feeder pipes at 3-½" and 4" on-centre, and
- A concrete strength of 21 MPa.

Based on our independent structural analysis, the 1979 rink topping slab has sufficient capacity to withstand the following applied loads shown in Table 1 (in addition to its self-weight):

Table 1: Rink Slab Capacity

Load Type	Load
Uniformly Distributed Live Load	4.8 kPA
Uniformly Superimposed Ice Load	0.25 kPA
Concentrated Wheel Live Loads	13 kN

Note that the topping slab is not a structural slab. In the event that the lower slab has lost some structural capacity, we have determined that the topping slab has sufficient structural capacity to resist the applied loads. CSE reported in their July 31, 2016 investigation report that the concrete strength of the existing topping slab was found to be greater than 30 MPa. We have calculated that the 1979 rink topping slab has sufficient capacity to withstand the loads shown in Table 1 (in addition to its self-weight) with an assumed concrete strength of 21 MPa.

4.2 DASHER BOARDS

Based on the existing structural drawings and investigation reports reviewed, the existing topping slab was determined to have sufficient capacity to restrain the lateral impact loading imposed by the dasher boards system anchored into the slab. The capacity of the existing topping slab to restrain the loading is based on the assumption that the existing concrete and reinforcing bars are in good condition with minimum hairline cracking and concrete deterioration. New dasher boards will be installed in 2019 and will be designed and supplied

by Athletica. Athletica's new system will require additional post-installed anchors into the existing structure around the perimeter of the rink. Athletica had specifically raised concerns over the condition of the existing slab and foundation wall at the south end of the rink where deterioration of the structure had previously been reported. In addition, Athletica had also raised concerns over the proximity to the existing brine header and feeder pipe system that is also located at the south end of the rink. At the south end of the rink, Athletica's new dasher board system will be located directly above the brine feeder pipes and will need to be anchored to the existing structure. Entuitive has proposed a connection system for the new dasher board system that will effectively shift the location of the anchors into the existing slab away from the brine system and foundation wall below. A sketch detailing a proposed connection support system is included as drawing SK04 in Appendix B.

5 COMMENTS AND RECOMMENDATIONS

Based on our site investigation, and structural analysis, we have the following comments and recommendations regarding the condition of the items discussed in the previous section.

5.1 TOPPING SLAB SOUTH OF SOUTH DASHER BOARDS

1. Based on our visual observations, the condition of the topping slab generally appeared to be in fair condition, with minor localized cracking and delamination. Deteriorated areas of the topping slab warrant localized repairs to mitigate further deterioration. Localized repairs to the topping slab will provide longevity to the topping slab and to original rink slab beneath. We recommend that localized repairs be performed within 3 to 4 years.

5.2 TOP OF ICE RINK SLAB SURROUNDING DASHER BOARDS

1. Based on our visual observations, where accessible, the condition of the rink slab generally appeared to be in fair condition. Cracks observed should continue to be monitored for growth and deterioration.

5.3 UNDERSIDE (SOFFIT) OF ORIGINAL RINK SLAB

1. Based on our review of the existing drawings and the investigation reports to date, we understand that the condition of the original suspended rink slab is in poor condition. Based on our calculations, however, ongoing deterioration of the original rink slab should not adversely affect the performance of the majority of rink structure for the 10 year period of this study.
2. The localized deterioration of the rink slab along the length of the north brine trench foundation wall and the penetrations created by the new feeder pipes that were installed in approximately 1979, locally reduce the load carrying capacity of the rink slab structure. We recommend that steps be taken as soon as possible to provide additional support to the original rink slab and topping slab within the brine trench for the full extent of the north brine trench foundation wall. It is recommended that a steel frame support system be installed to transfer the loading back to sound concrete. A sketch detailing a proposed steel frame support system is included as drawing SK03 in Appendix B.

3. Based on our visual observations and our review of the existing drawings and the investigation reports to date, the condition of the suspended concrete slab beneath the ice resurfacer path at the southeast corner of the ice rink is in poor structural condition and should be repaired. Extensive cracking, delamination and spalling of the underside (soffit) of the original 1955 rink slab was observed, and wide cracks were observed on the topside of the 1979 topping slab directly above this deteriorated area. We recommend that through slab concrete repairs be completed in this location as soon as possible. Given that this area is outside the ice rink area, the repairs can be done in the hockey offseason while still providing continued access to the rink slab during the lacrosse season. Drawing SK01 & SK02 in Appendix B indicate the area of the recommended through slab repair.

5.4 NORTH BRINE TRENCH CONCRETE FOUNDATION WALL

1. The north concrete foundation wall beneath the dasher boards at the south of the ice rink was observed to be in poor condition and is a structural concern. Based on our field observations and our review of the existing drawings and the investigation reports we recommend that steps be taken as soon as possible to provide additional support to the original rink slab within the brine trench for the full extent of the north brine trench foundation wall.

2. Given the extent of the wall deterioration observed and the limited accessibility to the north side of the foundation wall, it is our opinion, that the wall structure supporting the slabs cannot be effectively repaired with localized concrete wall repairs. A full replacement of the deteriorated foundation wall will come with the risk of damaging the current brine system and impacting the usefulness of the facility for both sports teams.

3. In lieu of a concrete wall repair procedure, it is our recommendation that a steel frame support system be installed to transfer the load from the slab to sound concrete at the bottom portion of the existing foundation wall and footing. A sketch detailing a proposed steel frame support system is included as drawing SK03 in Appendix B. The proposed steel framing will have to be installed during the summer months when ice buildup is not present on the brine header and feeder pipes. The existing slab will bear on steel sections that run perpendicular (north-south) to the trench foundation walls. These steel sections will have a slim profile and will be spaced to accommodate the brine headers and feeder pipes to ensure that the existing brine system is not modified during the work or after the work has been complete

5.5 SOUTH BRINE TRENCH CONCRETE FOUNDATION WALL

1. Based on our visual observations and our review of the existing drawings and the investigation reports to date, the condition of the south foundation wall of the brine trench was observed to be in fair condition. Localized areas of delamination and spalling were observed along the bottom of the wall. We recommend that localized repairs be performed within 3 to 4 years.

5.6 OTHER OBSERVATIONS

1. Based on our visual observation and review of investigation reports completed to date, the temporary shoring beneath the rink slab in the ice resurfacer path should remain in place until repair to the slab is completed.
2. Based on our visual observation and review of investigation reports completed to date, the existing plywood affixed to the underside (soffit) of the rink slab should be removed prior to installing the proposed new steel frame slab support system.
3. It is recommended that steps be taken as soon as possible to provide localized repairs to the existing deteriorated steel frames supporting the brine header system. It is recommended that repairs to the brine header support system frames take place prior to the installation of the proposed steel frame slab support system.

6 REVIEW OF CSE KEY FINDINGS:

6.1 STRUCTURAL ASSESSMENT OF THE EXISTING ICE RINK PAD

We have reviewed CSE's July 31, 2016 "Structural Assessment of the Existing Ice Rink Pad" report, and have the following comments on their key findings:

1. Under the "Summary of Findings" section on Page 7, CSE notes "The top side of the rink topping was in relatively good condition. Some minor spalling around the perimeter edges and concrete delaminations on the to surface of the slab were recorded. The only exception was at the southern limits adjacent to the south foundation wall" and "Delaminated concrete, cracked concrete, and repair areas were observed at the south edge of the topping adjacent to the dasher board. This area has the potential to become a serious structural concern. This condition is most likely due to freeze-thaw damage from the ice pipes and repair work that was performed in the past". This is an important point, and it should be elaborated on further.
    1. At the time of review, both the topside and underside (soffit)of the rink slabs were not visible. However, deteriorated topping slab concrete was observed adjacent to the dasher boards along the outer perimeters of both the southwest and southeast corners of the rink. These locations approximately coincide with where the brine feeder pipes enter the underside of the topping slab.
    2. At the time of review, the underside (soffit) of the original 1955 rink slab adjacent to the north foundation wall of the brine trench was not visible at the time of review due to the build-up of ice around the brine header and feeder pipes. However, based on the observed ice build-up, the observed condition of the north foundation wall of the brine trench, and the photographs in CSE's July 31, 2016 and July 3, 2018 reports, we agree with CSE's assessment that freeze-thaw damage is the reason why the suspended concrete slabs are deteriorated and continue to deteriorate. Furthermore, we agree with CSE's assessment that this area has the potential to become a serious structural concern if nothing is done.

3. Under the "Final Comments & Recommendations" section on page 8, CSE notes that the slab/topping is exposed to "severe freeze-thaw and water penetration exposure" and on page 9, that "significant structural repairs and rehabilitation will be required in this area…within the next 2 to 4 years". We agree with CSE's assessment and recommendation. Entuitive recommends that a steel frame support system be installed to transfer the load back to sound concrete at the bottom portion of the existing foundation wall and footing. A sketch detailing a proposed steel frame support system is included as drawing SK03 in Appendix B.

2. Under the "Summary of Findings" section on Page 7, CSE notes "Concrete spalls along the perimeter of the ice rink slab could be observed at the locations of the dasher board supports. This condition is most likely due to impact loads. At this time there is no structural concern." Entuitive was not able to observer the condition of the slab at the time of our investigation. However, the condition of the underside (soffit) of the original rink slab and foundation wall at this location indicate that CSE's assessment and recommendation is reasonable. "this condition will continue to progress/deteriorate and may pose a structural concern in the future. Regular monitoring of this condition is warranted".

3. Under the "Summary of Findings" section on Page 7, CSE notes that at the south bay, the underside [soffit] of the original concrete slab has been leaking, leading to accelerated corrosion of the steel deck; "the condition was deemed severe (very poor localized conditions). Repairs are warranted." At the time of review, Entuitive did not have access to the underside (soffit) of the original concrete slab below the ice rink. However, based on the existing drawings and investigation reports to date, we agree with CSE's assessment and recommendation.

4. Under the "Summary of Findings" section on Page 7, CSE notes that "the condition of the original slab underside [soffit] is expected to vary from location to location, but in general it is expected to get better as you progress away from the south wall." We agree with CSE's assessment that the condition of the original slab is expected to get better as you progress further away from the south wall.

5. Under the "Summary of Findings" section on Page 7, CSE notes that "During events, maximum assembly occupancy loads shall not exceed 4,000 persons, maximum concentrated wheel loads of 13 kN (3,000 lbs) and maximum operating service loads of 53 kN (12,000 lbs)". CSE should clarify why they have set a limit of 4000 people when they have identified the slab has an assembly occupancy live load capacity of 4.8 kPa.

6. Under the "Summary of Findings" section on Page 8, CSE notes that "During service maintenance, the results of our structural review indicate that maximum wheel load and maximum operating service load for the Ice Rink Slab are 27 kN and 106 kN". CSE should clarify the difference between the event allowable working load conditions and the service allowable working loads conditions.

7. Under the "Description of Structure Reviewed" section on Page 2, CSE notes "This report assumes that the topping is non-structural" and under the "Final Comments &

Recommendations" Section, CSE notes that "the addition of the concrete topping on the slab [original rink slab] has lowered this capacity". Based on Cimco's 1977 New Rink Floor & Brine Header Drawing No. 01616-D1, the concrete topping slab (circa 1979) contained 3/8" reinforcing bars and #6 mesh. We have calculated that the topping slab is capable of resisting all applied OBC loadings applicable, provided that the topping slab is not materially deteriorated.

6.2 STRUCTURAL ASSESSMENT OF THE EXISTING ICE RINK PAD

We have reviewed CSE's July 3, 2018 "Structural Updated Report South Supporting Ice Rink Wall", and have the following comments on their key findings:

1. Under the "Summary of Findings" section on Page 4, CSE notes "The concrete foundation wall at the south end (below the dasher boards) of the rink was observed to be in poor to very poor condition. Concrete deterioration was noted over the full length of the wall. Under the "Comments & Recommendations" section on Page 5, CSE notes "The shoring being recommended is to fill the 1st cavity completely with a self-compacting backfill. Although it will not be possible to attain full bearing with the slab's underside [soffit], the backfill will provide the required shoring to prevent any significant collapse of the rink slab and any associated health & safety concerns." We agree with CSE's assessment of the condition of the north foundation wall of the brine trench, but we question the effectiveness of the self-compacting backfill in the crawlspace. We are concerned that this recommended shoring approach presents too much risk to the client. It is highly probable that there is a void between the self-compacting backfill and the underside (soffit) of the original slab. As a result, little to no bearing is likely transferred to the backfill. We would recommend steel framing in this location, as shown in drawing SK03 in Appendix B.
2. Under the "Summary of Findings" section on Page 4, CSE notes that "the performance of the suspended pathway for the Zamboni is being recommended to be shored for structural safety reasons" and "the extent of deterioration for the south wall and suspended slabs area over the Zamboni path has progressed to a point, w[h]ere in our Professional Opinion, the walls and slab need to be shored before they can be returned to service for the ice rink installation". We strongly agree with CSE's assessment and recommendation. Furthermore, we recommend through-slab repairs for the suspended rink slab pathway for the ice refinisher.
3. Under the "Summary of Findings" section on Page 4, CSE notes that "the results of the vertical crack monitoring have no revealed any significant progression of crack width". We agree with CSE's assessment.

6.3 ADDITIONAL COMMENTS AND RECOMMENDATIONS - ENTUITIVE

In our opinion, based on our observations and our review of the existing drawings and reports to date, the COP should take further steps to stabilize the slab above the brine trench and ice resurfacer path at the south end of the rink to address current and future safety considerations as soon as possible.

There is a risk of concrete that if repairs are not done immediately, deterioration to the existing rink slab and brine trench foundation walls will result in exponential deterioration, and, as such, we recommend that the current shoring system remain in place prior to the proposed repairs discussed in this report. The level of effort to provide a steel frame and through slab repair at the ice resurfacer path, is less than the effort to repair the existing foundation wall, rink slab and topping slab to their original design capacities, so simply providing a steel frame and local through slab repair to the rink slab is the recommended strategy.

Entuitive has not reviewed the condition of the mechanical brine header system. We recommend that a Mechanical (refrigeration) Consultant be contacted to comment on the condition of the system.

7 CLOSING

The information and opinions expressed in this report are solely for the benefit of the City of Peterborough ("the Client"). We request that discretion be exercised when sharing this report, and request that The City of Peterborough notify Entuitive Corporation prior to sharing this report with external parties. Entuitive Corporation authorizes the Client to share this report to the following additional parties (without written notification): CSE, PMC, The Peterborough Pete's, The Peterborough Lakers, and TS Engineering. The report shall not be relied upon for any purposes other than intended for the Client without the expressed written consent of Entuitive Corporation. No portion of this report shall be used as a single entity.

Any use which a third party makes of this report, or any reliance or decisions to be made based on it, are the responsibility of such third parties. Entuitive Corporation accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this report. We expressly waive responsibility for the effects of any action taken as a result of this service unless we are specifically advised and participate in this action, in which case our responsibility will be agreed to at that time. No other warranty, expressed or implied is made.

We trust that this summary of our investigation observations and associated recommendations meets your needs at this time. Should you require field notes, additional photographs or any other documentation supporting our findings, or if you have anything you would like to discuss, please feel free to contact us at any time.

Sincerely,
Entuitive

Mike Hillcoat, P.Eng., CCCA
Principal
mike.hillcoat@entuitive.com
C: 416.670.2855

APPENDIX A
PHOTOGRAPHS

Photograph 1 | Cracking of Existing Concrete Slab along the Ice Resurfacer Path

Photograph 2 | Cracking of Existing Concrete Slab along the Southwest Corner of the Ice Rink

Photograph 3 | Cracking and Delaminating Concrete adjacent to the Dasher Boards along the Ice Resurfacer Path (Southeast Corner of the Ice Rink)

Photograph 4 | Cracking and Delaminating Concrete adjacent to the Dasher Boards at the Alternate Ice Resurfacer Doors (Southwest Corner of the Ice Rink)

Photograph 5 | Exposed and Corroding Wire Mesh in the Topping Slab located along the Ice Resurfacer Path

Photograph 6 | Honeycombing and Exposed Conduit Pipe located on the Underside of the Existing Suspended Concrete Slab Beneath the Ice Resurfacer Path

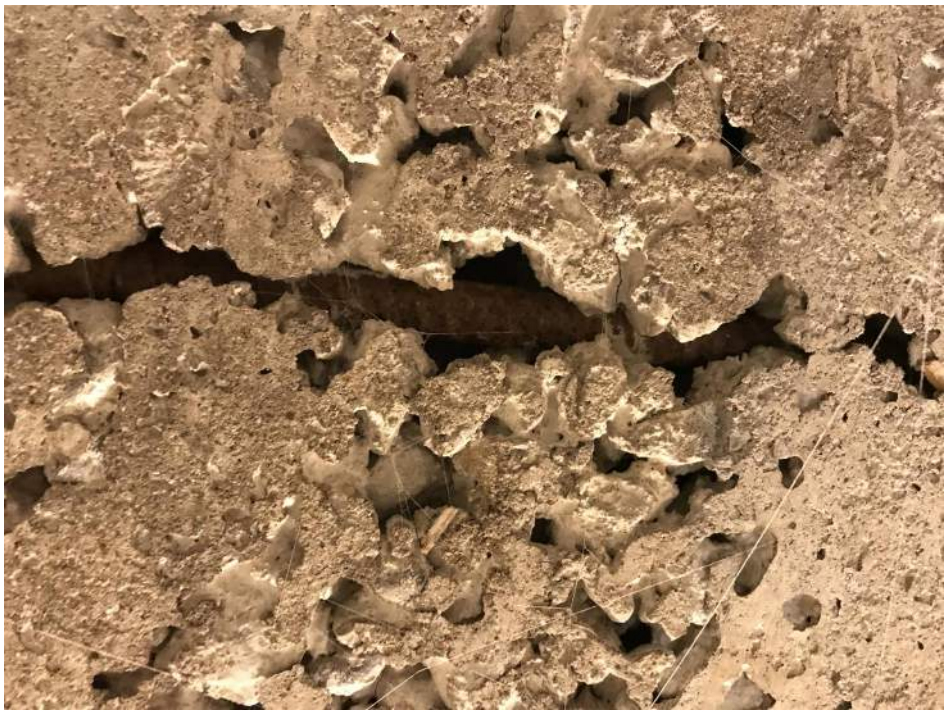
Photograph 7 | Cracking located on the Underside of the Existing Suspended Concrete Slab Beneath the Ice Resurfacer Path

Photograph 8 | Spalled and Delaminated Concrete located towards the Top of the North Foundation Wall in the Brine Trench

Photograph 9 | Spalled and Delaminated Concrete located towards the Top of the North Foundation Wall in the Brine Trench

Photograph 10 | Spalled and Delaminated Concrete located at the bottom of the South Foundation Wall in the Brine Trench

Photograph 11 | Honeycombed Concrete and Exposed Reinforcing Bars along the Underside of the Existing Concrete Slab Adjacent to the South Foundation Wall in the Brine Trench



Photograph 12 | Honeycombed Concrete and Exposed Reinforcing Bars along the Underside of the Existingg Concrete Slab Adjacent to the South Foundation Wall in the Brine Trench

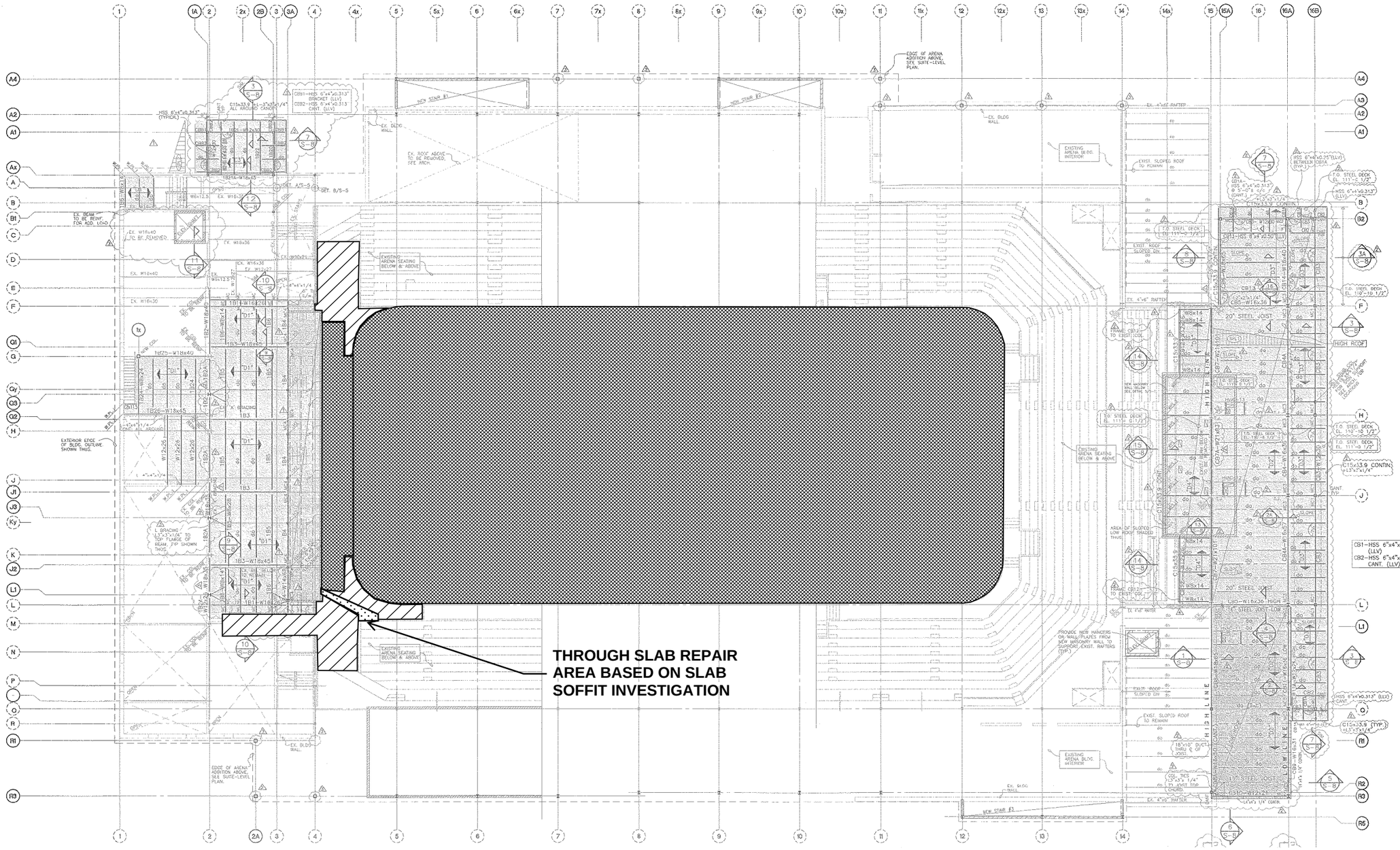
Photograph 13 | Corroded Cast-In Angle on the Underside of the Existing Suspended Slab adjacent to thehe North Foundation Wall in the Brine Trench

Photograph 14 | Corroded Cast-In Angle Observed on the Crawlspace Floor below the Existing Suspended Slab adjacent to the North Foundation Wall in the Brine Trench

APPENDIX B

KEY PLAN OF AREAS INVESTIGATED

SK01 - PMC - TOPSIDE INVESTIGATION PLAN



LEGEND

- THROUGH-SLAB REPAIR
- LOCALIZED TOPSIDE SLAB REPAIR
- INACCESSIBLE AT THE TIME OF REVIEW

NO.	DESCRIPTION	DATE
6	ISSUED FOR CONSTRUCTION	Apr. 17/03
5	STRUCTURAL SITE INSTRUCTION No. 3	Apr. 17/03
4	STRUCTURAL SITE INSTRUCTION No. 2	Mar. 19/03
3	STRUCTURAL SITE INSTRUCTION No. 1	Mar. 13/03
2	Addendum No. 1	Jan. 14/03
1	Issued for Tender and Building Permit	Dec. 19/02

CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DIVISIONS OR DISCREPANCIES TO THE ARCHITECT BEFORE PROCEEDING WITH THE WORK.

DO NOT SCALE THE DRAWINGS

CONSULTANT

Kazmar

KAZMAR ASSOCIATES LIMITED
STRUCTURAL ENGINEERS

7580 MARKHAM AVENUE, STE.210 MARKHAM, ONTARIO L3R 9S5
TELEPHONE (905)415-5455 FAX(905)475-5224

JOB #02132

D.C.CONNOLLY
DEC. 19/02

THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE ENGINEER.

DATE

DRAWN R.C.

DATE NOV. /2002

CHECKED T.B./N.F.

DATE PLOTTED

BRISBIN BROOK BEYNON architects

PROPOSED EXPANSION AND RENOVATION TO

PETERBOROUGH MEMORIAL CENTRE

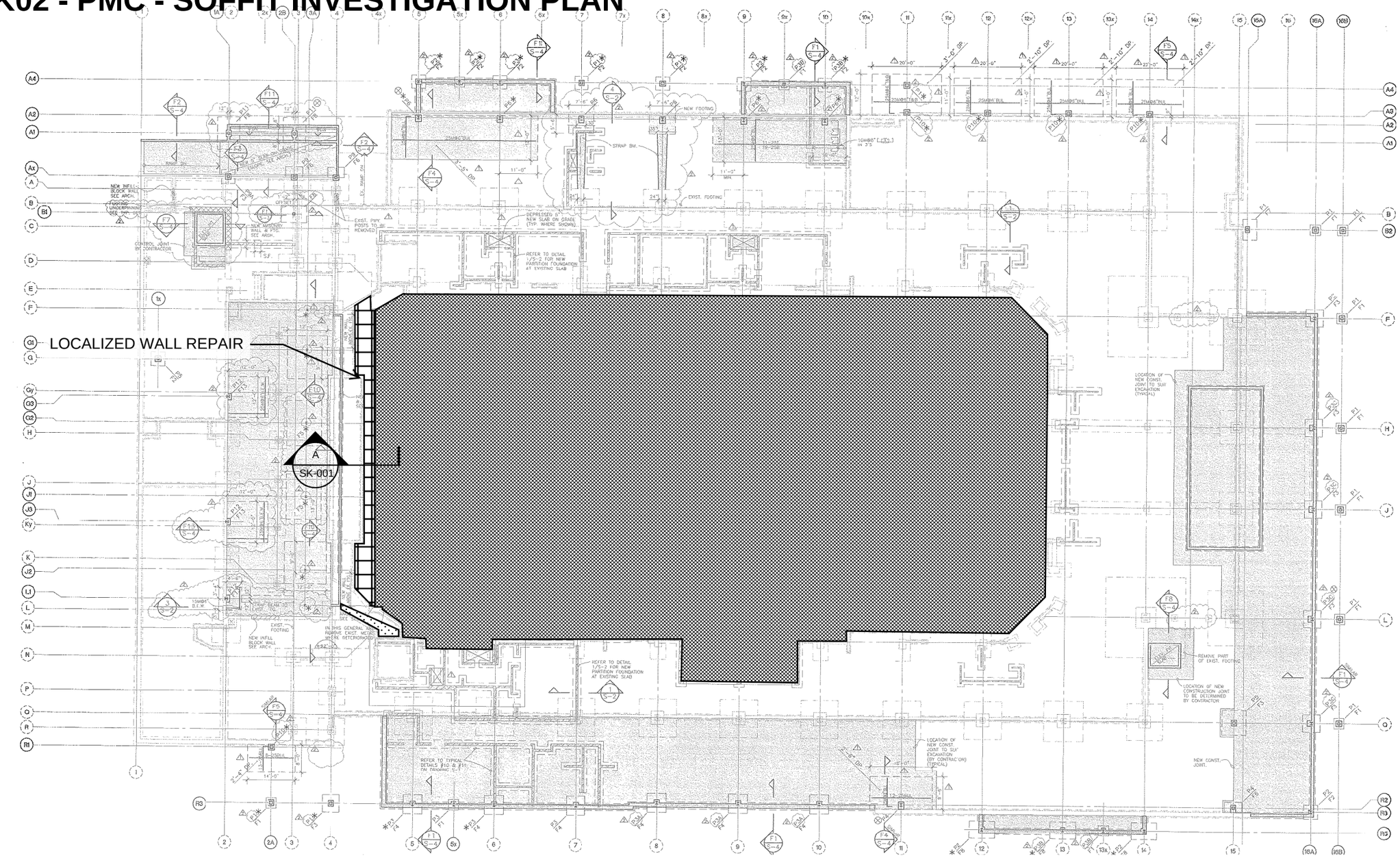
LANSDOWNE STREET, PETERBOROUGH, ONTARIO

DWG. TITLE
RESTAURANT FLOOR AND LOW ROOF FRAMING PLAN

SCALE	DWG. No.	REV.
3/32"=1'-0"	S-5	4

PROJ. NO. 0123

SK02 - PMC - SOFFIT INVESTIGATION PLAN



LEGEND

- THROUGH-SLAB REPAIR
- STEEL FRAME INSTALLATION (A/SK-01)
- INACCESSIBLE AT THE TIME OF REVIEW

NO.	DESCRIPTION	DATE
4	ISSUED FOR CONSTRUCTION	APR. 17/03
3	STRUCTURAL SITE INSTRUCTION No. 3	APR. 17/03
2	Addendum No.	NOV. 14/02
1	Issued for Tender and Building Permit	Dec. 19/02

CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY OMISSIONS OR DISCREPANCIES TO THE ARCHITECT BEFORE PROCEEDING WITH THE WORK.

DO NOT SCALE THE DRAWINGS

CONSULTANT

Kazmar

KAZMAR ASSOCIATES LIMITED
STRUCTURAL ENGINEERS

7305 WARDEN AVENUE, UNIT 202 MARKHAM, ONTARIO L3R 9Z6
TELEPHONE (905)470-0445 FAX(905)470-0447

JOB #02132

D.C.CONNOLLY
REGISTERED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO
DEC. 9/02

THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE ENGINEER.

DATE

DRAWN R.C.
DATE NOV. /2002
CHECKED T.B./N.F.
DATE PLOTTED

BRISBIN BROOK BEYNON architects

PROPOSED EXPANSION AND RENOVATION TO

PETERBOROUGH MEMORIAL CENTRE

LANSDOWNE STREET, PETERBOROUGH, ONTARIO

DWG. TITLE
EVENT LEVEL/ FOUNDATION PLAN

SCALE	DWG. No.	REV.
3/32"=1'-0"	S-2	

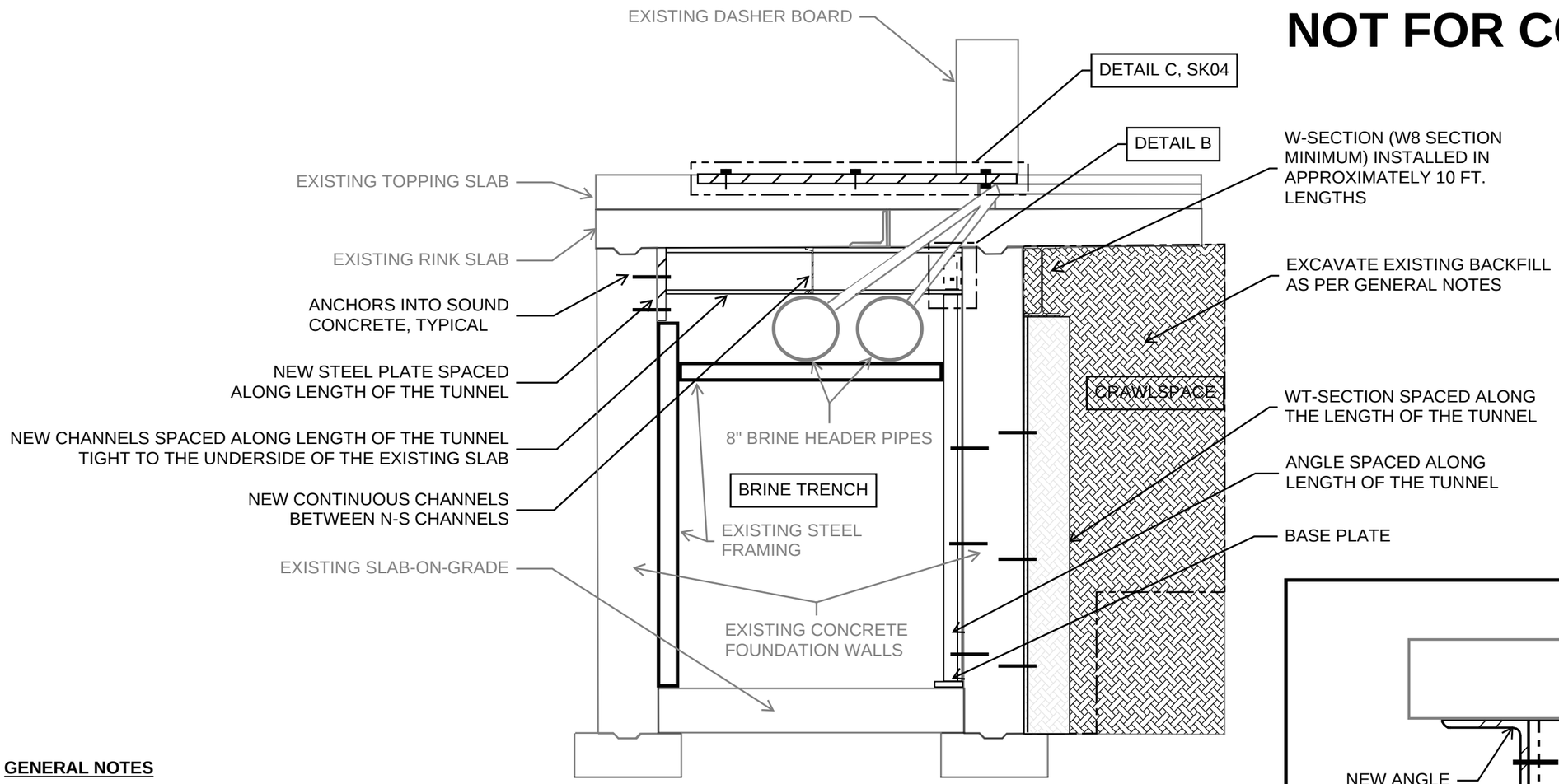
PROJ. NO. 0123

ENTUITIVE

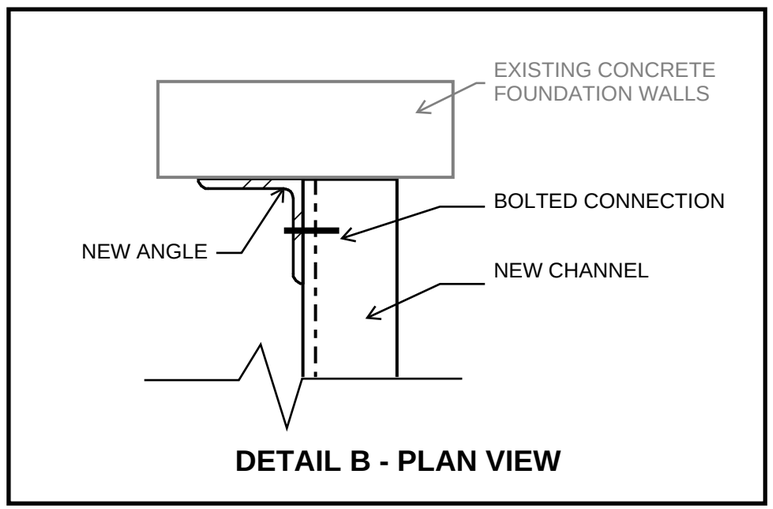
Project: Memorial Centre Structural Review				Project No.: C018-2148	No.: SK03
Design: -	Drawn: -	Checked: -	Date: 09 NOV 2018	Activity No.: -	Scale: N.T.S.
Subject: PRELIMINARY SHORING AT SOUTH FOUNDATION WALL				Reference: SK02	

READ THIS SKETCH IN CONJUNCTION WITH CONTRACT DOCUMENTS

NOT FOR CONSTRUCTION



SECTION A - ELEVATION VIEW



DETAIL B - PLAN VIEW

GENERAL NOTES

1. INSTALL STEEL FRAMING IN THE BRINE TRENCH TO THE SOUTH OF THE NORTH FOUNDATION WALL PRIOR TO COMMENCING WORK TO THE NORTH OF THE NORTH FOUNDATION WALL.

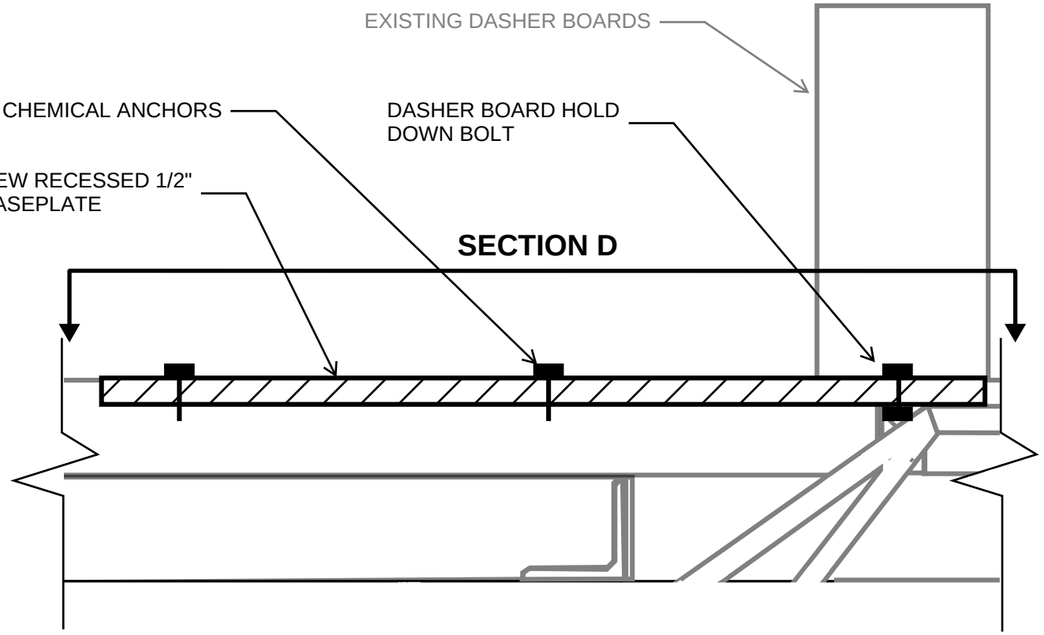
2. IN THE BRINE TRENCH TO THE NORTH OF THE NORTH FOUNDATION WALL, EXCAVATE DOWN TO THE CONCRETE FOOTINGS IN 10 FT SEGMENTS AND INSTALL STEEL NORTH OF FOUNDATION WALL IN SEGMENTS.

ENTUITIVE

Project: Memorial Centre Structural Review				Project No.: C018-2148	No.: SK04
Design: -	Drawn: -	Checked: -	Date: 09 NOV 2018	Activity No.: -	Scale: N.T.S.
Subject: PRELIMINARY DASHER BOARD-SLAB CONNECTION				Reference: SK02	

READ THIS SKETCH IN CONJUNCTION WITH CONTRACT DOCUMENTS

NOT FOR CONSTRUCTION



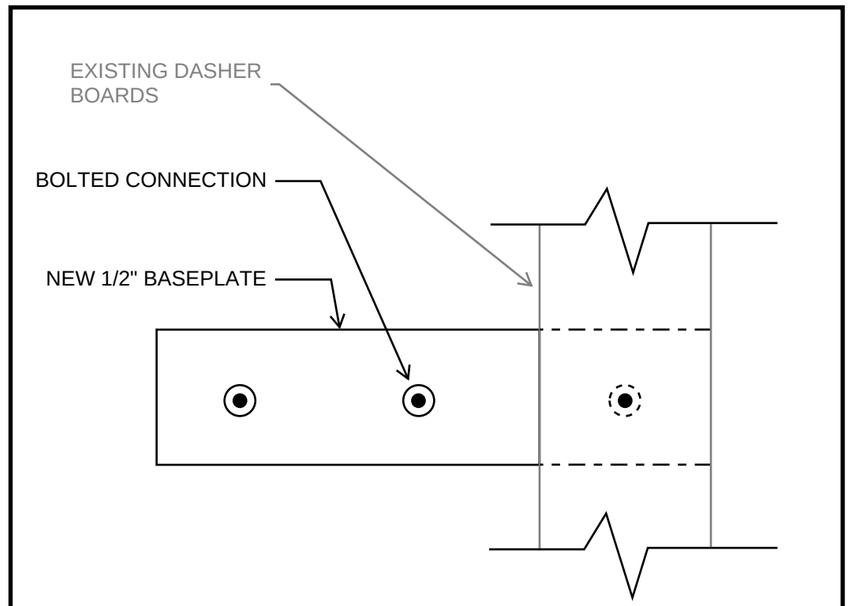
DETAIL C - ELEVATION VIEW

GENERAL NOTES

1. PRIOR TO INSTALLING THE 1/2" BASEPLATE, CHIP DOWN THE EXISTING TOPPING SLAB 3/4" LOCALLY TO ALLOW INSTALLATION OF RECESSED BASEPLATE.

2. INSTALL NEW 1/2" THICK STEEL PLATE WITH TOP OF PLATE FLUSH WITH THE TOP OF EXISTING TOPPING SLAB.

3. TAKE CARE TO AVOID EXISTING FEEDER PIPES WHEN CHIPPING OR DRILLING OF ANCHORS BY SCANNING THE SLAB PRIOR TO INSTALLATION AND AVOIDING FEEDER PIPES WHEN CHIPPING OUT EXISTING TOPPING SLAB AND DRILLING NEW ANCHORS.



SECTION D - PLAN VIEW