**Capacity Engineering Limited**
www.celottawa.ca **- PRELIMINARY REPORT -**

**148 Wharhol Private**
**Ottawa, ON K2H 1G5**
**613·325·7735**

CEL Project # 1078

TKS Holdings Inc.
270 Catherine Street, ON K1R 5T3

6 June 2016
Rev. 2

Attn: Tony Kue Sharashebi
CC: - Leo Nantais, City of Ottawa
Sally Coutts, City of Ottawa

**Re: Somerset House Deterioration, Immediate Repairs & Restoration**
**Location: 352 Somerset Street, Ottawa**

# Evaluation of Existing Structure & Discussion

Site Visit - Date: 24 May 2016
Weather: Mild, Sunny, Warm
Time@Arrival: 8:50am
Time@Depart: 11:25am

**Purpose of Report:**

This is a preliminary, interim report, written within a demanding timeline while maintaining a professional standard, produced in order to inform all parties as to the condition of the structure. It is not definitive. It should be considered an evolving document which we intend to issue monthly throughout the length of our involvement with Somerset House.

**Purpose of Site Visit:**

In accordance with our agreement with the Client (T.K.S. Holdings), and with a representative of the Client, we attended to site in order to conduct non-destructive testing and assess the structure for further restoration and repair.

**Methodology:**

In preparing this report, photos provided are numbered with respect to a concern or observation to which they are thematically linked. Photo numbers are in no way consecutive.

Our site investigations have been conducted in accordance with the following applicable standards and codes:

· CAN/CSA S448.1-10 "Repair of Reinforced Concrete in Buildings and Parking Garage Structures"

· CAN/CSA S304.1-R10 "Design of Masonry Structures"

· MMAH OBC 2012 "Ontario Building Code"

In addition, we have relied upon the industry best practices and guidance as laid out in the following documents:

· ACI 201.1R "Guide for Making a Condition Survey of Concrete in Service"
· ACI 222R-01 "Protection of Metals in Concrete Against Corrosion"

· ACI 364.1R-017 "Guide for Evaluation of Concrete Structures before Rehabilitation"
· ACI 437R-03 "Strength Evaluation of Existing Concrete Buildings"
· ACI 546R-96 "Concrete Repair"
· AS3700: 2001 "Australian Standard – Masonry Structures"
· CBD 230 "Canadian Building Digest – [Modern Code on Existing]"

We further have relied upon information, approaches and techniques as detailed within the following:

· Wiley-Rabun "Structural Analysis of Historic Buildings: Restoration, Preservation, and Adaptive Reuse Applications for Achitects and Engineers." by J. Stanley Rabun, Feb 2000

· PWGSC BIM "Bridge Inspection Manual"

· NZSEE Red Book "Assessment and Improvement of the Structural Performance of Buildings []" inclusive of Corregendum 6

· NEHRP – FEMA 273 "Guidelines for the Seismic Rehabilitation of Buildings"

Note that we have not undertaken any strength evaluation(s) beyond those specifically detailed in this report. In particular we have not undertaken an Earthquake Vulnerability Assessment (EVA) nor any other consideration of the lateral load resisting system (LLRS) for the structure.

## Background/Information Received:

- Structure was subject to a localized collapse of a load bearing wall during construction activities in 2008. The Eastern portion of the structure was thereafter demolished under city order in the interest of public safety.

- The Somerset facing façade was retained and restrained through the addition of a custom steel framing system designed to support the façade during restoration works.

- Water has been permitted to access both front and back of the exposed Somerset-facing façade for several years (we are advised that it has been three years since tarps have been maintained on the back face of the steel propped section.

- Work to selectively demolish sections of the structure began under a City of Ottawa demolition permit in February 2015, but was ordered to stop on the same day work began.

- Structural Drawings are not available for the original construction.

- The temperature in the structure has not been monitored, and as such records for the temperature during winter are not available, however the building has been unheated for at least the past three winters.

## Observations:

See Illustration 1 for the grid line convention adopted in this report. It does not match the gridlines used on drawings and other documents, but rather was adopted specifically for site works. It is the intent of this office to release later versions of this report with a standardized gridline system.

Observations are broken into four categories:
1 – **Immediate Concern**: An issue of imminent danger to the public. These issues cannot await process nor formality, and time is of the essence. All parties are hereby warned that delay may equate to collapse. At a minimum shoring should be placed without further delay. Our office stands ready to assist.
2 – **Serious Concern**: Generally need to be addressed in short order. Each has a specific timeline.
3 – **Of Concern**: Address prior to occupancy or during rehabilitation works.
4 – **Of Note**: May or may not be of concern. Further investigation is required.

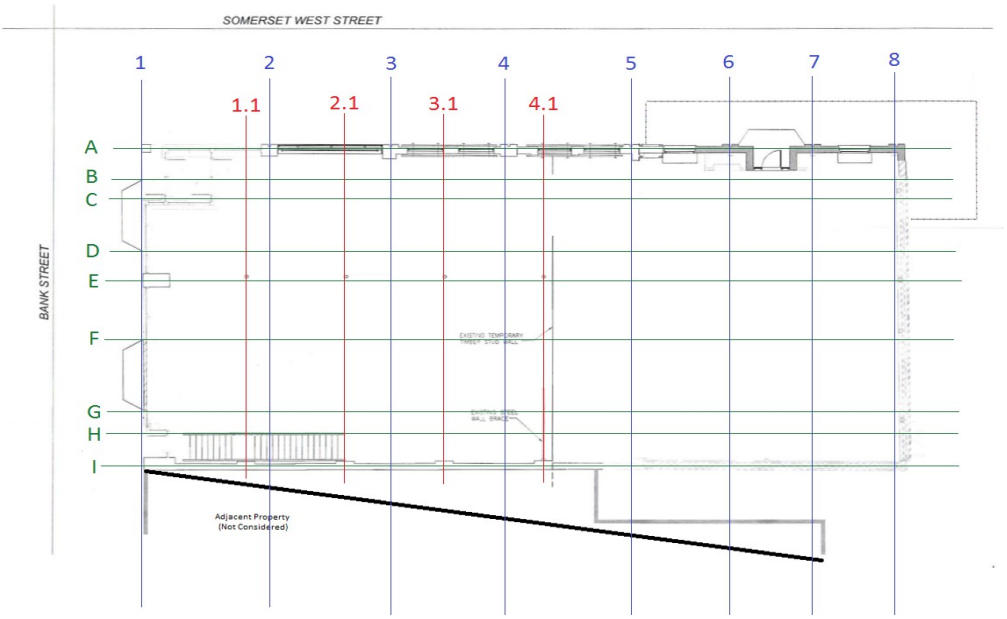



*Illustration 1: Gridlines*

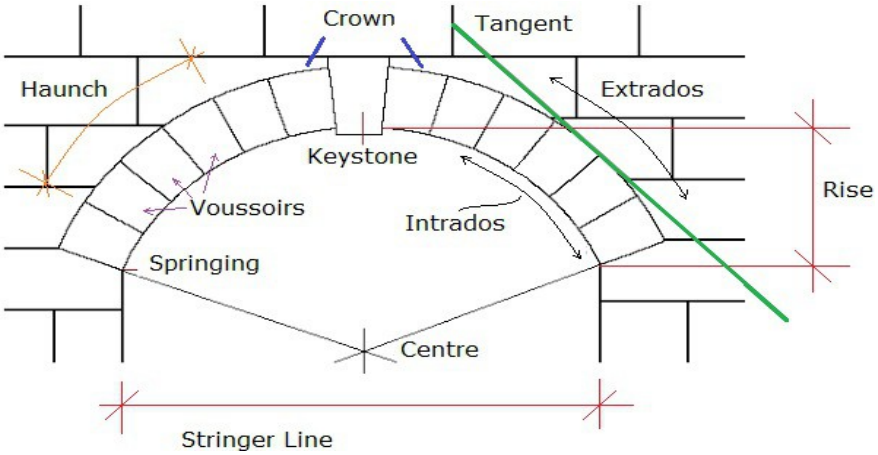



*Illustration 2: Arch Teminology used in this Report*

## Observations of Immediate Concern:

### 1.1 Gridline A from GL 4 to 5 – Restoration or Demolition

**Timeline:** This issue must be rectified within sixty days, or public safety will likely be compromised.

The condition of the multi-whythe load bearing masonry exterior wall in this area is very poor. Large extents of mortar are missing from the interior face of the wall. Mortar, where still present, is deficient and appears to have been subject to both freeze-thaw cycling and wet-dry cycling on both faces. Units are often missing face shell and are generally in very poor condition. The foundation wall in this area is also in very poor condition and requires immediate underpinning or other improvement (refer to Geotechnical report, dated 6 June 2016).

We disagree with the concept that this bay of bricks is definitively unsafe for restoration. It is, however, currently unstable and as such unsafe to allow persons to approach or travel past. While we do believe restoration may be possible, this must be undertaken in a very careful manner and a successful restoration cannot be assured.

**Recommendations**

**Elemental:** Immediately place a stack of ballasted shipping containers to within one foot of the masonry wall along the roadway. Apply two layers of 19mm plywood to the interior vertical surface of the wall, bracing the sheets back to the floor system at two foot intervals. Using whalers and shims, tightly shim the existing masonry wall back to the shipping containers. Install Blok-Lok Spira-Lok 8mm diameter stainless steel ties at 400mm on centre vertically and 600mm horizontally. Where a pilaster or pier would have only two Spira-Lok ties given the 600mm spacing, a third tie shall be installed in between. Where the condition of the inner whythe is poor (refer to Observation 1.4, below), ensure that the Spira-Loks are installed in the best units, or new units are supplemented prior to installing Spira-Loks. Should such operations be judged unsafe at the time of construction, we believe that the GL A wall from GL 4 to 5 cannot be safely repaired.

**Globally:** Where vertical cracks are found in the load bearing masonry façade, 6mm Blok-Lok Spira-Bar sections between 600mm and 900mm should be used at 400mm to 450mm centres vertically (approximately every four courses).

### 1.2 Gridline A from GL 5 to 8 – Urgent Demolition

**Timeline:** This issue must be rectified within thirty days, or public safety will likely be compromised. Where further change is noted, hoarding of the full walkway and the adjacent roadway lane becomes imperitive to protect the public.

The condition of the double-whythe load bearing brick wall along GL A from 5 to 8 warrants ensuring that construction workers are not allowed to work directly on the wall. The lack of vertical confining load and the extended time during which this wall has relied upon exterior backup while being continually washed and exposed to freeze-thaw cycles has resulted in a wall which appears to be unstable and in need of urgent demolition. Refer to Photo 1.2.

**Recommendation:** This section of wall should be subject to standard destructive demolition. The elements of heritage value having already been allowed to deteriorate past a point where they may be safely restored, it would be an irresponsibly dangerous situation to which to expose workers during any attempt at salvage or selective demolition. Shore the stone masonry north foundation wall. Treat with caution and consider partially undermined.

### 1.3 Foundation wall along GL 8

**Timeline:** This issue must be rectified prior to allowing cars to park or other forms of load to be placed within fifteen feet of the foundation wall.

The stone foundation wall along GL 8 is actively failing. The wall has moved in excess of 400mm at peak, the construction site hoarding fence built along GL 8 is sinking into the exposed foundation pit, and changes in the wall are being observed week to week. Note that the cause of this failure would appear to be a combination of lack of vertical load (NB: such walls perform best under moderate vertical confining load), lack of sufficient maintenance (pointing and generally poor mortar condition), as well as exposure to freeze-thaw cycling and weather. Long poles or staves have been installed to support the temporary hoarding fence, whereas maintenance of the wall was required. Refer to Photo 1.3.

**Recommendations**

**Elemental:** This is a critically dangerous situation. The Owner is advised to install new hoarding and fencing to prevent anyone from approaching within fifteen feet (~5m) of the wall. Once the fence is in place, we recommend the

immediate demolition of the top portion of the wall and a new temporary construction ramp be installed both to facilitate further works and to prevent further collapsing of the vertical excavation face along GL 8.

**Global:** Clear all detritus from the excavation, introduce new drains in the base of the excavation and place layers of Granular B in 100mm maximum layer thickness to achieve 400mm of granular fill compacted to 95% standard proctor dry density to OPSS 1010.

*Photo 1.3 - Failing Stone Foundation at adjacent Parking Lot*

### 1.4 Gridline A at Gridline 4 to 5 Masonry Condition

Separately from the overall instability of this section of wall, the condition of the masonry in the URM wall along GL A from GL 4 to 5 is seriously deteriorated. It appears to have been subject to extreme freeze-thaw cycling as well as a great number of wet-dry cycles. Refer to Photo 1.4.

**Recommendations**

**Elemental:** Once the wall section has been stabilized (refer to Observation 1.1), deficient masonry units shall be replaced one at a time, waiting for mortar to achieve sufficient strength to permit further units to be removed prior to undertaking further removals.

*Photo 1.4 - Masonry Wall Deterioration along GL A from GL 4 to 5*

## Observations of Serious Concern:

### 2.1 Removal of below-truss ceiling diaphragm

**Timeline:** This issue must be rectified prior to obtaining an occupancy permit

The original roof structure included a series of timber ceiling joists inserted within the innermost brick whythe and spanning across the bottom chords of trusses. This provided both lateral stability to the roof trusses and an additional diaphragm supporting the top of the walls in the event of a lateral load event (heavy wind, earthquake). The removal of this ceiling diaphragm would have left the trusses without bottom chord stabilization, however this appears to have been addressed through the addition of modern cross bracing elements between the trusses. The issue of the loss of a ceiling diaphragm at the roof level does not appear to have been addressed, other than the addition of a temporary cross bracing system with tension ties. Such a tension tie system by nature requires all four sides to be in serviceable condition, and this structure lacks a structural wall along GL 4. The roof joists require further bracing, and a tension tie system of rods to pattress plates, possibly using cables if preferred, should be introduced to secure the top of the masonry walls to the ceiling level. Refer to Photo 2.1.

### 2.2 Reinforced Brick pilaster at intersection of GL A & 4

**Timeline:** This issue must be rectified during the forthcoming restoration works and prior to allowing further modification to this wall.

This URM pilaster appears to be hinging such that the second storey floor level of the wall is the most proud of the building, with crack hinges having formed and allowing the wall to come away from the static/neutral position. Such movement in a pilaster is never good, and the effects on the structure may cause the sudden and complete collapse of the wall.

**Recommendations**

**Elemental:** Measure the amount by which the pilaster has moved and, if greater than 25mm or observed to change within a one month period, move to effect emergency repairs. Emergency repairs in this case must include the installation of pattress plates as well as tying the pilaster back into the extended and reinforced floor system at each level. Refer to CEL standard pattress plate installation detail in Appendix A. Note that this detail has not yet been revised for use on Somerset House and should be considered not for construction.

*Photo 2.1 - Cut off Ceiling Joists*

### 2.3 Bay Window Supporting System Deficiencies

**Timeline:** This issue must be rectified during the forthcoming restoration works.

A review of the condition of the existing bay windows along bank street fails to show evidence of the presence of either of the two systems commonly used at the time of construction. In the later half of the nineteenth century, carpenters commonly created bay windows by continuing the floor joists out through the wall; if this was the case here in the past, this continuity has been lost through renovations. The second common place system for creating bay windows during the time of construction was to use a system of small pattress on the inside of either masonry spandrels or the window abutments. Again, no evidence of such a tie system is present. Failure to observe a support system, however, does not mean such a system is absent, and no rotation of the bay window system nor separation of the bay window "unit" from the front façade has been observed by CEL Ottawa.

**Recommendations**

**Elemental:** Both window bays should be carefully observed for movement, have their support system(s) identified and analysed, and where found deficient should have a guy wire suspension system installed to provide a modern, if possibly secondary, assured load path.

**Global:** An applied bond beam system should be created towards the top of the masonry walls in order to both tie the walls together as a whole system

and to afford locations to tie suspension systems where existing restraint to fenestrations or other architectural elements of heritage significance require further structural support.

### 2.4 Column Tie Beams Missing

**Timeline:** This issue must be rectified during the forthcoming rehabilitation works.

The top of the columns in the basement are not tied from one numbered gridline to the next. The beams present span only north-south, and as such the floor system is being required to provide the lateral bracing point to the columns, something which the floor system does not appear capable of sustaining.

### 2.5 Floor System Connection (Load Path) Deficiencies

**Timeline:** This issue must be rectified as a priority item during the forthcoming rehabilitation works.

In reviewing the condition of the timber floor systems and their connection to the steel support beams, no sufficient fastenings system to permit reliable diaphragm behaviour of the floors has been found. It is critically important that the floor systems be effectively tied to their supporting beams, and effectively tied to the load bearing masonry walls, in order to produce a reliable, or even minimally safe, structure. Further to the lack of joist to beam connections, the floor sheathing appears to be merely tacked into place throughout and lacks sufficient fastenings to ensure desirable behaviour. Cross bridging has been used in place of blocking, further compromising the ability of the floor system to behave as a diaphragm.

**Recommendations**

**Elemental:** All floors must be reviewed in detail and further fastening installed throughout.

**Global:** The standard of construction must be such that resultant details meet both the letter and intent of the Ontario Building Code 2012, be carried out in accordance with all applicable legislation, and **not** be stopped prior to achieving an acceptable state of repair. A great deal of the conditions found in this structure are of concern primarily due to their having been only half completed. Whether a detail satisfied Heritage requirements or not, once the structure is reliant upon said detail, the construction must be brought to completion in order

to protect both the heritage characteristics and value remaining as well as the public.

## 2.6 Temporary wall and adjacent floor

**Timeline:** This issue must be rectified during the forthcoming rehabilitation works.

The temporary walls built along GL 4, as well as the flooring materials within a 600mm to 1200mm distance of the inside of the temporary timber wall show visible signs of deterioration (discolouration, particularly greying). In various locations probed by staff from CEL Ottawa these timbers were also showing softness and as such are not believed to be in serviceable condition.

The construction of the temporary timber walls is also deficient, having no dwangs (blocking), single side sheathing only, and fastenings appear to be at irregular spacing and not to a standard required to produce reliable diaphragm behaviour.

**Recommendations**

**Elemental:** The temporary walls need to be deconstructed, the materials therefrom separated into reusable and disposal sets, and the walls reconstructed to a standard which will permit reliance upon them in the event of a lateral load event.

**Global:** It is essential that the building be made weather tight.

**Observations of Concern:**

### 3.1 Original Iron Roof Truss – Exposure to Elements

**Timeline:** Must be addressed before the structure is permitted to weather another winter.

The existing conditions leave one side of the easternmost original iron truss (roof level, along GL 4) exposed to the environment. This is an unacceptable condition which may lead to irreversible deterioration and the loss of another Heritage Element. See Photo 3.1.

*Photo 3.1 - Heritage Roof Truss Exposed to Elements*

**Recommendations:**
**Elemental:** Extend moisture barrier to encapsulate the truss and prevent further exposure to the elements.

**Global:** Ensure heritage elements are not exposed to weather, with particular attention needing to be paid to preventing wet-dry cycling.

### 3.2 Bank Street facing wall – Segmental arch overstress

**Timeline:** Monitoring works must begin by the end of June 2016.

Both segmental arches at the third floor of the bank street façade appear to be in an overstress condition. The reason for this overstress would appear to be the deterioration of the arch and not an overload condition, however this cannot be definitively determined without a more detailed history.

The shape of both arches is indicative of past settlements, and the condition is indicative of recent repointing. While this maintenance work appears to have restored the strength of the arch itself, it has not prevented the overstress condition of the springer. Further, it appears that the repointing was carried out with an incompatible mortar; where these arches naturally settle small amounts both immediately following completion and in service, the modern cementitious mortar used has not permitted any movement of the joints, further causing tensile stresses within the matrix, and resulting in the cracking of the brick units (which are now being subject to accross-width tension loads they have heretofore been protected against by the use of weak mortars). Thus while the mechanism of the arch behaviour has changed from weak mortar strong brick to strong mortar, weak brick, the condition is not easily reversed. Once installed, cementitious mortars bond very well to the masonry units and create a condition wherein, like most systems, the most likely element to be damaged in removal works are the weakest elements, unfortunately this is now the bricks themselves. Refer to Appendix B "Masonry Behaviour – Soft Brick/Hard Mortar versus Hard Brick/Soft Mortar" and Photo 3.2. See Illustration 2 for arch terminology used in this report.

**Recommendations:**

**Elemental:** Start high accuracy recording of the length of the stringer line and install crack gauges on the cracks which have occurred in the bricks at and about the springer.

**Global:** Ensure the correct, materials compatible, mortar is used in all repairs.

### 3.3 Relocation of 2nd Elevated Floor Level

The second elevated floor has been cut and lifted, with original cast iron columns apparently replaced with longer steel facsimiles. Note that modern steel columns offer none of the character and social value of the original cast iron columns, and this modification was further undertaken without additional pattress installation nor iron bar strapping or links being placed to assist the multi-whythe brick wall

in being able to sustain the additional unbraced compression length.

While requiring specialised knowledge and careful planning, nearly all cast iron elements used in construction may be repaired rather than replaced. CEL Ottawa has the required expertise in house and can facilitate the repair of further elements; the client is strongly encouraged not to permit the removal of cast iron columns nor elements found elsewhere in the structure.


*Photo 3.2 - Segmental Arch Abutment Cracking*


*Photo 3.2 - Segmental Arch Abutment Cracking*

**Recommendations**

**Elemental:** The ideal solution would be to restore the floors, however with the original material gone and the overall building's structural condition being poor, we feel we must recommend that the insitu condition be made safe rather than corrected. Pattress plates need to be installed at the mid-height of the (new) pilaster and wall heights in order to provide some stability to the column and load bearing wall behaviours of the structure, and where analysis shows that such are warranted, knee braces, iron strong backs, or sway braces shall be

installed to permit the load bearing walls to achieve the required capacity under their new unbraced lengths.

**Global:** Where an existing system is performing well and has been proven to be sound through long years of service, it can arguably be declared as having been field tested. Note that a useful reference for this principle is CBD-230. Given a field tested system, particularly one in a heritage building, we strongly recommend not modifying the system without express need. Modifications intended solely to produce higher (or lower) ceiling heights rather than improve durability or correct deteriorating function are, in our opinion, not wise nor warranted in the case of a Heritage Building.

### 3.4 Exposure of roof joists & wet-dry cycling

The temporary protection used above the 2nd elevated floor's temporary wall is not placed so as to protect the timber of the roof joists. Given the condition of the temporarily wall and adjacent floor sheathing, refer to 2.6, it is important that these timbers be protected from wet-dry cycling.

**Recommendations**

**Elemental:** Install a weatherproofing system to protect the edge of the roof and prevent exposure of the roof joists to further deleterious conditions.

**Global:** The building must be made weather-tight.

### 3.5 Restraint of front wall - Loose guy wires

The reinforcement installed at the north bay window and about the north bay window as well as masonry strong-backs installed vertically appear designed to provide restraint to the multiple floor vertical spanning URM walls. Unfortunately the installation of the guy wires intended to restrain the wall from moving outward towards Bank Street is deficient, having been installed lose, and no back-prop struts were included in the installation. Refer to Photo 3.5.

**Recommendations**

**Elemental:** Introduce acro prop struts or similar to provide a compressive restraint to the walls at the locations where the floors have been cut away. Once these are in place, tighten the guy wires to provide tension restraint.

**Global:** Where cutting through an existing floor system to introduce a

mechanical chase (an elevator carway being in effect a very large mechanical chase), all necessary structural upgrade works should be undertaken in advance of removing the floor system.

**Observations:**

### 4.1 Existing S shape modified during previous works

Note that the existing 2nd elevated floor's support framing consists of new timber infill flooring upon existing S shape steel sections. The S shape adjacent to the staircase has been modified by drilling holes in the top flange to permit the installation of a modern strong-back to the brick wall above. Refer to Photo 4.1.

**Recommendations**

**Elemental:** The use of a modern bolt and washer, rather than a mild steel bolt and bevelled washer, have resulted in a compromised installation with less strength than a correct installation. We recommend the anchor bolts be removed, one at a time, and replaced with new A325 bolts using the correct bevelled washers, if possible given the installation.

**Global:** Avoidable structural modifications to a heritage element, such as drilling into a late 19th century steel beam, should be avoided. The modern strong-back would have been best installed using a grouted base plate with a clamp tie, so as to avoid drilling the heritage element. Future works should respect the original construction materials and character, with additions made in such a manner as to be clearly additions when viewed in the distant future.

### 4.2 Acceptable Fireproofing not present

While this is a construction site and a building not yet furnished with expected finishes, etc, it should be noted that the existing beams and columns are exposed and not protected from the effects of fire.


*Photo 4.1 - Flat washer and resultant twisted bolt on S shape*

### 4.3 Unauthorised activities

Clear evidence of unauthorized access and unacceptable activities may be observed on both the 1st elevated and 2nd elevated floors. Fire pits built directly upon the plywood flooring and burning construction materials are present in addition to graffiti, discarded alcohol containers and various human waste and detritus.

**Recommendations**

**Global:** This site is not suitable for human occupation in its current condition, and is not suitable for uncontrolled or ad-hoc heating. The Owner is strongly advised to further secure the site and prevent unauthorized access. A fire in this structure could easily spread to adjacent buildings and or result in the loss of life through collapse or the action of fire.

### 4.4 Anchoring of new elevator shaft column

The steel framing for the new elevator shaft appears to rely upon a T-shaped fish plate into the existing stone masonry foundation wall. Such a connection can be made to function reliably when the condition of the foundation wall is excellent, the wall will be in a visible, highly likely to be maintained, location and the wall has been provided with a reliable waterproofing or water removal (weeping tile, etc) system. Refer to Photo 4.4

*Photo 4.4 - New Elevator Shaft*

**Recommendations**

**Elemental:** The connection design should be confirmed during future works. The wall should be provided with a reliable durability solution prior to being relied upon to carry vertical transportation system loads. The new elevator shaft should be provided with an independent deep foundation.

**Global:** The building should be subject to a detailed review for durability and to ensure that preventable deterioration is avoided.

### 4.5 Steel Frame in Outer wall at Ground Floor

At some point in the past a steel frame, which shows detailing typical of both a modern moment resisting and knee connections more commonly associated with a braced frame, was installed in the ground floor. This frame is an anachronism in a building of this age, and in fact weakens the structure significantly and further magnifies the torsional loads which typically occur within URM structures in the event of an earthquake. In something of a structural irony, this large opening was later infilled with two smaller doors and timber framing.

**Recommendations**

**Elemental:** The steel frame should be removed and replaced with suitable structure to provide suitable access and egress for future use.

**Global:** The Owner is advised to consult with an Architectural Historian regarding suitable repairs to heritage elements which will both respect the character of the building and restore the structure while not concealing the fact of newer construction. At all times members of the public should be able to discern where new construction has been added to, or allowed to modify, the original.

### 4.6 Parapet restraint lacking or absent

One of the most dangerous aspects of a URM structure being subject to cyclical lateral loading (typically earthquakes) is that of cantilevered load bearing elements. The classic example of this condition for most structures is the chimneys and parapets. In the case of Somerset house, the chimneys are already gone, however the remaining three perimeter walls are all parapet walls. These parapets need to be restrained back to the rehabilitated roof system.

**Recommendations**

**Elemental:** Restraining brackets need to be fitted to the structure such

that the parapet walls have a second point of lateral support in the even of an earthquake.

### 4.7 Adjacent structure built composite – Possible Party wall

Where one structure has been built to rely upon the presence of another, the condition may be termed a Party Wall. Whereas party walls were originally load bearing walls shared between two buildings, the term has expanded to include areas of walls in contact between two buildings which effectively results in a similar condition with respect to lateral loads. The adjacent property at Bank Street is built tight to our structure from the 1st elevated floor framing to the 2nd elevated floor framing; the reason for this is not yet clear. Refer to Photo 4.7.

**Recommendations**

**Elemental:** Restore the party wall area, if possible. Review the supporting condition and supplement the bearing if required.

**Global:** Request and obtain access to the adjacent property, as well as the adjacent property records. Confirmation that modification to Somerset House will not affect the adjacent property is needed prior to removing the party wall condition.

*Photo 4.7 - Adjacent Building Built Composite with Somerset House*

### 4.8 Weeping tile poured into slab without granular sheath

Evidence of a weeping tile system can be seen adjacent to the existing slab in the basement, between the slab and the old underpinning efforts. Weeping tiles only perform well when they are protected by a geosynthetic fibre wrap and a granular bed. Exposed as they are, the weeping tile are unlikely to remove water from low enough to improve the behaviour of the foundation wall, and are likely to become clogged and damaged, if they are indeed currently functional.

### 4.9 Bars Bent - Incorrect Shape at Foundation & Underpinning

A great number of reinforcing bars in the basement have been bent to a shape not conducive to continuing the works. The Owner is strongly advised not to attempt rebending in absence of Engineering specifications detailing how to do so.

### 4.10 Masonry Strong-backs and Supplementary Bracing

External reinforcement to the masonry walls has been added to the first and

second elevated storeys, but not to the ground floor masonry walls. Further, the supplementary bracing system added is present only on the 2nd elevated floor for the north-south axis, and only on the 1st and 2nd elevated floors for the east-west axis of the structure. The supplementary braces are localized in the south-east corner of the building, but should be distributed throughout in order to provide supplemental structure in the event of a lateral load event and the formation of hinges and cracks in the multi-whythe URM walls.

## System Deficiencies, Global Issues and Concerns

### A) Lateral Load Resisting System (LLRS)

The missing return wall along Gridline 5 and other various absent or compromised elements will cause the structure to function poorly in the event that it becomes subject to a moderate to high lateral load. The structure must be reviewed in detail for load paths and made subject to construction to reinforce, restore, and or introduce competent load paths throughout for both vertical and lateral loads.

### B) Fire Engineering

The structure is severely lacking in fire resistant assemblies, fire detection systems, and fire suppression systems. These deficiencies should be addressed in short order for the protection of the public. It is not reasonable to treat the structure as a perenial construction site; construction site conditions are tolerated for practical purposes while working to produce a safe and functional structure. They are not reasonable when there is no timeline to completion in play.

### C) Temporary Conditions vs. Extended Construction Timeline

With respect to the condition of the structure, there are many sections and elements which are of a capacity and condition which could be justified given an active construction site. The return periods and loads demanded of a structure under construction are less than those of a completed structure, for the practical purpose of allowing construction to be carried out. It is unreasonable to continue to apply the test of construction site loadings to a structure which has been at a state of rest for many years. All parties are to be urged to take whatever steps are necessary to complete the emergency repairs and restoration. The continued deterioration of this structure can only result in collapse and day by day becomes

a greater threat to the public at large. It is not possible, nor reasonable, to demand an engineer advise as to when a structure is of imminent danger. Such a condition is a guess at best, however should this structure not be subject to detailed bracing and repair in short order, it is clear that the statistical safety of the structure will continue to fall, and thereafter – at some unknown future point – so once again will portions of the structure.

**Causal Factors:**

Following on site observations, our firm has undertaken a review of the available documentation and can report further findings.

(a) Design Deficiencies: We believe that the underpinning and some attempted repair works have resulted in minor overstresses and some localized instability in or affecting some of the original elements, further complicated by (b)

Recommendation: We recommend that the affected areas be subject to detailed corrective maintenance, restoration, and in the case of foundation elements be given underpinning, piling or be burried in accordance with the Geotechnical Recommendations for each area or element. Suitable details are being prepared by our firm.

(b) Construction Deficiencies: Areas of the masonry walls have been repointed using incorrect materials, further timber works are not built in accordance with best nor standard practice, and areas of construction appear to have deteriorated faster than anticipated due to original design deficiencies.

Recommendation: We recommend that an effort be made to review past documentation to confirm whether or not the CMU columns were an approved omission, or are in fact construction deficiencies. Where these are believed to be deficiencies, new columns of like construction should be introduced to complete the original repair works, or as an alterative, a review of the necessity of such columns may be undertaken. Such a review is currently outside of our scope of work, however we would be happy to assist with such a review should this be of interest to the client.

(c) Material Deficiencies: We have not found cause to suspect sub-standard materials within the structure. Upon the Client's direction, testing of selected materials may be undertaken as a further level of certainty with respect to our

findings and recommendations, however we are not recommending further action at this time.

Recommendation: Do nothing.

(d) Material Degradation: Discussed in detail in "Observations".

Recommendation: Refer to Repair Plans and remainder of this report.

(e) Foundation Movement: Evidence of advancing movement in the foundations has been noted. Review of such conditions is now underway through our subconsultant Geotechnical Engineer, GeoSeismic.

Recommendation: Engage a suitably trained and qualified Geotechnical Engineer registered in the Province of Ontario to review the overall geotechnical conditions for the structures at this location. **NB: Owner has now done so. 4 June 2016**

(g) Fire Exposure: No evidence of sustained fire was noted during our site visits.

Recommendation: Not applicable.

**Course of Works:**

This report is accompanied by a preliminary set of drawings suitable for submission to the Authority Having Jurisdiction to begin repair, selective demolition, and demolition works. We recommend that these drawings be reviewed in detail by the client, commented upon and changed as appropriate, and approved in principle in order for our firm to move forward and complete the process of bringing them to a constructible standard.

We further recommend that a field technician be employed during the course of works to ensure that the contractor does not use excessively heavy equipment, and ceases operations where any excessively soft materials or other deterioration(s) is found. We would be pleased to provide such a technician at the client's request, or assist in the engagement of a third party site review technologist (Civil Engineering Technologist). The work of the CET would be an extension of the site visits already envisioned under our agreement with the client, and would offer further assurance that no issues arise during construction

and go unnoticed. With respect to demolition works, there is no option and field representation from our office is required if we are to continue on the project.

**As a matter of course:**

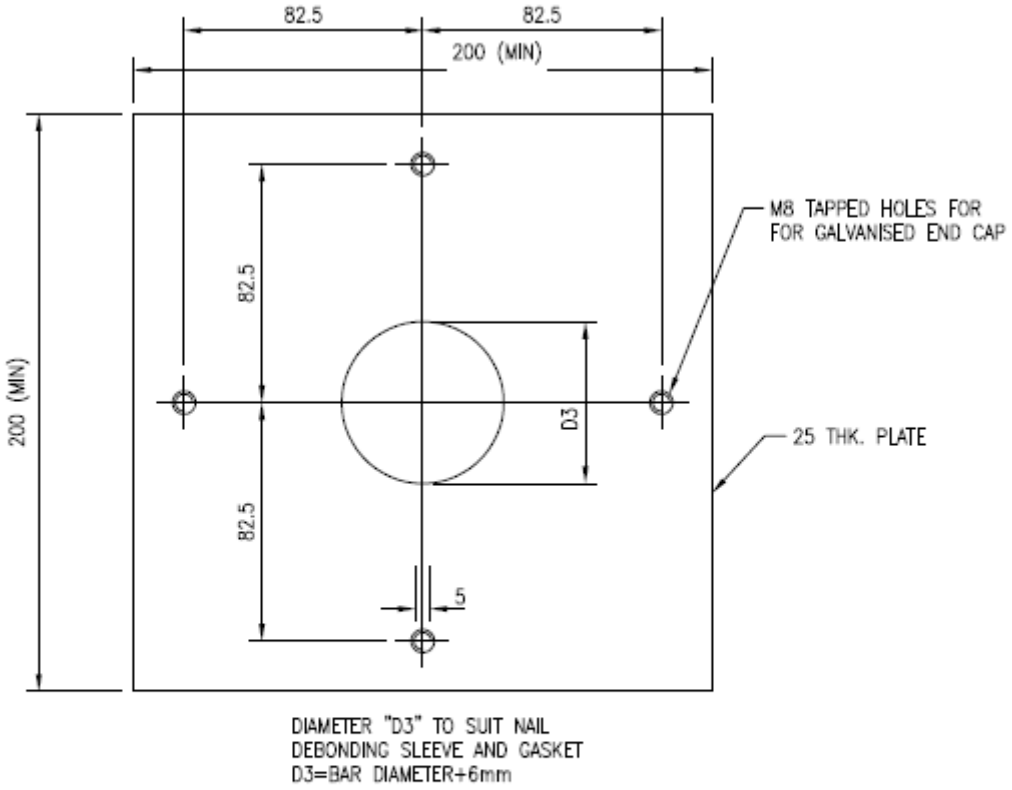
▪ Make no assumptions in your interpretation of this field report and the site instruction(s) contained herein. Our engineers are happy to assist you with the proper dispatch of work. Direct all queries to the undersigned.
▪ Our work on site to date has not been sufficient to be able to offer a client or any other party a professional opinion as to the issues at hand. As such the engineering content and all discussions within this document are offered entirely without responsibility. They are provided solely in an effort to move the project forward and enable our firm to obtain sufficient information with which to be able to provide a professional opinion.

Sincerely,

M.W.Quinn, P.Eng., MIPENZ(Structural), PMP

**Note:**
**- This report was prepared for the account of T.K.S. Holdings Ltd. and represents the best judgement of Capacity Engineering Limited given the information available at the time of writing. Any use which a third party makes of this report, or any reliance upon, decisions made in response to or in any way influenced by this report are the responsibility of such third party.**
**- This report is both confidential and copyright. Should you have received this in error, please return to Capacity Engineering Limited.**
**- The use of an asterix (*) indicates information which has changed fundamentally from a previous issue of documentation, and is so placed in order to draw attention and highlight the change to a reader.**

## Appendix A – Standard Pattress Plate




GALVANISED STEEL PATTRESS PLATE

NOTE: DIMENSIONS MAY BE ALTERED
TO SUIT PARTICULAR DESIGN

## Appendix B - Masonry – Soft Brick/Hard Mortar versus Hard Brick/Soft Mortar

## Appendix C - Glossary

**CMU =** A Concrete Masonry Unit.

**GL =** Gridline.

**Rehabilitation =** Providing a space which may be considered fit for use/habitation

**Restoration =** Maintenance and construction aimed at improving the condition of an element or assembly with minimal, and without significant, impact to character defining elements of a structure.

**Repair =** Returning an element or assembly to specified, design or require strenght.

> ***Mimimal* Repair =** Works to meet the least strength improvement required so as to ensure public safety and minimum durability requirements.
>
> ***Standard* Repair =** Works to carried out to provide as much strength and durability improvements as possible without resorting to extra-ordinary methods and/or uneconomical costs.
>
> **Extra-ordinary Repair =** Works carried out without regard for cost, but solely to achieve the best possible result.
>
> ***NB:** For heritage elements, minimal repairs are generally more invasive and detailed than for a regular structure. In no case may a repair be permitted to compromise the Heritage Defining Elements or overall Character of the structure.

**Multi-Whythe =** Load bearing masonry built with tie brick courses (bricks laid accross the whythes)

**Pattress =** Stress reducing plate, typically of ductile iron or mild steel, used to allow for the tying together of an Unreinforced Masonry Structure (URM).

**URM =** UnReinforced Masonry.

**Whythes =** A vertical layer of bricks.