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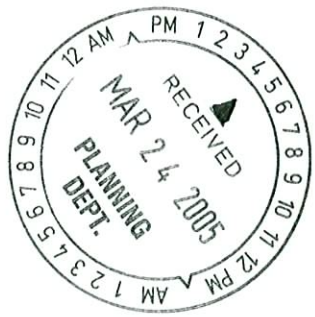
STRUCTURAL STABILIZATION REPORT FOR 66 MOHAWK STREET BRANTFORD, ONTARIO



PROJECT NO. 05020

MARCH, 2005

Prepared By: E. H. Chapman, P. Eng.

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March 1, 2005

The Corporation of the City of Brantford
100 Wellington Square
Brantford, Ontario
N3T 2M3

Attention: **Ms. Hoda Kayal**
Director of Property Management

Subject: Structural Stabilization Report
66 Mohawk Street
Brantford, Ontario
Our Project No. 05020

Dear Madam:

Please find enclosed herewith, our report on 66 Mohawk Street, Brantford, Ontario.

We have completed our site reviews. The observations from our site reviews have been analyzed and examined and the deficiency areas and their associated repair costs noted in the text of this report.

Since our conclusions are based on visual examinations only, we cannot guarantee the total extent of deficiencies have been determined. However, our recommendations are based on the observations, as well as our considerable experience in the assessment of these types of building problems.

Furthermore, the construction estimates are our opinion of probable construction costs based on our experience and knowledge of costs of work of this nature. This does not rule out the possibility of the final construction costs being higher or lower. The cost is very dependent on determining the exact amount of work required, and our visual inspection will not have included all possible damaged areas. Costs also depend on the types and methods of repair chosen. In addition, these costs will be dependent on the workload in the market place, additional inflationary pressures and your business relationships that may exist with potential contractors.

We trust this report is self-explanatory and meets with your requirements.

If there are any questions regarding the contents of the report, please contact the writer.

Yours truly,

Group Eight Engineering Limited

E. H. Chapman, P.Eng.

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SYNOPSIS

An assessment and review was completed of the building structures at 66 Mohawk Street, Brantford, Ontario. The assessment and review were completed to establish the following:

- Estimated costs to replace/stabilize building structural fabric
- Estimated costs for roof replacement and repairs
- Estimated costs for stabilizing the exterior building fabric
- Costs associated with the prevention of moisture intrusion into the building
- Costs associated with increasing the bearing capacity of the floor structure to accommodate a warehouse function dead and live loads

The exact date of construction for the two (2) buildings is not known.

The buildings need to be upgraded to prevent water ingress. Various other repairs are required, including removal of a portion of the Second Floor.

To prevent additional timber decay, the wood members have to be dried out to less that 20% moisture content. Artificial means will likely be required to dry out the timber. A number of timber structural elements are inadequate for the proposed loading and will require reinforcing. With this reinforcing, the office floors can support a 50 psf live load and the warehouse floors can support a 100 psf live load.

Further review of the structural members is required to determine the extent of decay and the extent of deterioration to the load capacity of the members.

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1.0 INTRODUCTION

Group Eight Engineering Limited was retained by the City of Brantford to examine and comment on the condition of the building envelope and structural components and to analyse the structural components of the two (2) buildings at 66 Mohawk Street, Brantford, Ontario.

The purpose of the review and analysis is to determine the following:

- Estimated costs to replace/stabilize building structural fabric
- Estimated costs for roof replacement and repairs
- Estimated costs for stabilizing the exterior building fabric
- Costs associated with the prevention of moisture intrusion into the building
- Costs associated with increasing the bearing capacity of the floor structure to accommodate a warehouse function dead and live loads

The review was visual. No testing of existing materials or structural members was completed.

Not all areas of the buildings were reviewed, and not all structural components were reviewed due to the wall and ceiling finishes still in place. Our recommendations and comments are based on this limited review, as well as our experience in the assessment of these types of buildings. But, we cannot guarantee the total extent of the structural deficiencies have been determined.

The on-site reviews were completed February 15 and 16, 2005.

This report, prepared by Group Eight Engineering Limited, is intended for the exclusive use of the City of Brantford. Neither Group Eight Engineering Limited nor the City of Brantford assume any liability for the use of this report, or for the use of any information disclosed in the report, or for damages resulting from the use of this report, by other parties.

2.0 BACKGROUND

The site consists of two (2) buildings (Photograph No. 1).

One (1) building is a three-storey structure with a basement. The front area of the building was originally office space and the back area was originally warehouse or production space (Photograph No. 2). There is a small entrance structure on the west side of the office. Within the warehouse is a lift which extends from the basement to the third floor. The lift structure extends above the warehouse roof.

The other building is a single-storey structure. This structure was the original timekeepers building (Photograph No. 3).

The date of construction of either building is unknown. Dates cast in the front of the office area are 1877 and 1903. The significance of these years is not known.

There are no architectural or structural drawings of the buildings available for review.

3.0 EXISTING BUILDINGS DESCRIPTION

3.1 General

Floor framing plans and building sections, created from field observations and measurements are detailed in Appendix A.

The First Floor of the office and warehouse are at the same elevation. The Second and Third Floors of the office are 20" and 24" higher than the warehouse floors. The office roof is approximately 12" higher than the warehouse, at the low corner.

3.2 Office/Warehouse Building

.1 Office Structure

Roof Construction:

- timber sheathing
- timber joists (2" x 8" @ 16" C/C)
- timber beams (6" x 8") and columns (8"∅ nominal)

Floor Construction

- timber sheathing
- timber joists (2 x 12 @ 16" C/C (typical))
- timber beams (11-1/2" x 15-1/2") and columns (8"∅ nominal)

The timber joists bear on the timber beams on the interior and bear on the brick masonry on the exterior. The timber beams span to timber columns on the interior and span to brick masonry pilasters on the exterior.

The bay spacings, parallel to the joist spans, are 13'-1", 12'-6" and 14'-4" (approximately). The bay spacings, perpendicular to the joist spans (column centrelines) are 20'-8", 16'-0', 10'-6" and 10'-4" (approximately).

At the First Floor level, there is a concrete slab, between the Stairwell and the masonry wall of the warehouse.

Foundation walls are multi-wythe brick masonry to grade and cast-in-place concrete below grade. Interior columns are supported by brick masonry piers in the Basement. The Basement Floor slab is cast-in-place concrete.

Existing foundations were not exposed. No information on the foundations is available.

.2 *Warehouse Structure*

Roof Construction:

- timber sheathing (unknown size)
- timber beams (6" x 10") and columns (5-1/2" x 9-1/2")

Floor Construction

- timber sheathing
- timber joists (2" x 4" @ 2" C/C, solid back-to-back joists)
- timber beams (size varies) and columns (size varies)

The floor framing is solid (2 x 4's). The floor joists are back-to-back.

Roof sheathing spans between beams with an intermediate stiffener at mid-span between beams.

The roof beams in the centre bay are reinforced with (approximately) 5/8"∅ rods (Photograph No. 4). It is not known whether these rods were part of the original structure or were added at a later date. In various locations, the floor structure has been reinforced with steel beams or the steel beams were added for hoisting purposes (Photograph No. 5). Locations are detailed on the floor framing plan.

The bay spacing is 12'-6" . There are twelve (12) bays. Column centrelines are 17'-6", 23'-2" and 17'-6" (approximately).

Foundation walls are multi-wythe brick masonry to grade and cast-in-place concrete below grade. Interior columns are supported by brick masonry piers in the Basement. The Basement Floor slab is cast-in-place concrete.

Existing foundations were not exposed. No information on the foundations is available.

.3 Envelope

The existing exterior walls of the office and warehouse are multi-wythe brick masonry (minimum three wythes).

The roof of the office and warehouse was a built-up system. The exact roofing composition is unknown. The roof of the warehouse slopes north to south. The roof of the office slopes to the south-east corner, draining onto the warehouse roof.

There is no insulation on the walls or the roof of the office and warehouse.

3.3 Timekeepers Building

.1 Structure

The roof structure consists of wood sheathing and 2" x 8" joists at 16" C/C. The roof is pitched.

Exterior walls are multi-wythe brick masonry.

A small timber framed area is attached to the south side (Photograph No. 6).

.2 *Envelope*

The roof is shingled. A small area of the roof on the south side is covered with a plastic sheet (Photograph No. 7).

The exterior walls are multi-wythe brick masonry. The wall area on the south side is timber cladded.

The walls and roof are uninsulated.

4.0 OBSERVATIONS

4.1 General

As previously noted, not all areas were reviewed, The roof was covered by a recent snowfall. This limited observations on the roof.

4.2 Office/Warehouse Building

.1 Office

.1 Roof:

The parapet requires cap replacement and brick replacement. The mortar joints need to be pointed (Photographs No. 8, 9).

Due to the existing ceiling finishes, it was not possible to view the condition of the roof sheathing.

The exposed roof joints, beams and columns appear to be in good shape (Photographs No. 10, 11).

On the north side, there are two diagonal members from the roof beam to the exterior wall and to the first interior column (2 locations). See Drawing S-6 and Photograph No. 12. It is not known whether these diagonal members are required to shorten the beam span because of additional roof loads and/or were used to resist lateral loads. They only occur between the Third Floor and the roof.

.2 Third Floor

Floor sheathing, which spans perpendicular to the floor joists, has lifted in various locations (Photograph No. 13).

Two (2) columns, adjacent the Stairwell, supporting the Third Floor have been removed. Currently, the studs of the Stairwell walls are supporting the Third Floor beams in this area (Photographs No. 14, 15).

Exposed floor joists, beams and columns appear to be in good shape (Photographs No. 16, 17). The majority of the existing structure is not exposed. Floor joists are notched at the beams for bearing.

.3 Second Floor

The majority of the floor is covered above by floor finish (tile) and below by two (2) different ceilings. Joists are exposed in one small location. In this location, joists appear to be in good shape. The upper portion of the joists in this area have been notched for piping (Photograph No. 18).

.4 First Floor

The floor is covered by carpet. Floor sheathing is not visible and its condition cannot be determined.

Floor joists and beams visible in the Basement appear to be in good shape. Joists are typically 2 x 12 @ 16" C/C (Photographs No. 19, 20). In the north-east corner, joists are 3 x 12 @ 12" C/C.

The concrete slab between the stairwell and the masonry wall, at the warehouse, is in good condition. The area above the First Floor at the concrete slab would have appeared to have been a vault.

Masonry piers support the First Floor beams, and the columns for the Second and Third Floor and the roof. An additional pier has been added on both column lines on the north side of the building (Drawing No. S-1). These piers are in good condition.

.5 Basement

Foundation walls do not show any signs of distress.

Pointing of mortar joints is required (Photograph No. 21).

In one location, bricks have been removed under a floor joist. This joist has no bearing (Photograph No. 22).

The cast-in-place concrete floor slab appears in good condition.

.6 Envelope

The existing roof membrane requires replacement. The roof leaks in various locations.

From the First Floor level to grade, the exterior face of the office is stone Photograph No. 9). The stone and its mortar joints appear to be in good condition.

There are some bricks missing on the exterior face of the parapet.

Mortar pointing is required on all three exposed building faces.

None of the windows are fully glazed. First Floor windows and a few windows on the Second and Third Floors are hoarded (Photographs No. 9, 23, 24).

.2 *Warehouse*

.1 Roof

There is very little granular material on the roof (Photographs No. 25, 26). In various areas, plastic sheets have been installed below the roof to transport water, which has leaked through the roof, to the exterior through window openings (Photograph No. 27).

White coloured fungus is visible on the underside of the roof sheathing and on some beams (Photographs No. 28, 29, 30).

The roof sheathing in visible areas, appears to be in relatively good condition when viewed from the underside. Roof sheathing, over areas covered by the plastic sheets, is not visible.

The beams and columns generally appear to be in good condition. Beams are split in a number of locations. Columns at this level are not plumb.

The interior wythe of the exterior masonry walls require pointing. There are holes in the exterior walls in a few locations (Photograph No. 31, 32). There are cracks in the masonry walls (Photograph No. 33).

.2 Third Floor

Floor sheathing, which spans diagonally over the solid 2 x 4 joists, has lifted in various locations throughout the floor area (Photograph No. 34).

There is one soft spot, north-west corner, in the floor.

Five bays of the warehouse, at the underside of the Third Floor, are covered by ceiling finish. A few locations in this area are exposed. The white fungus is visible is these areas.

In the remaining seven bays, the white fungus is visible in various locations throughout on the underside (Photographs No. 35, 36, 37, 38).

There are a number of holes through the exterior masonry walls (Photograph No. 39).

The centre span of the three east bays have additional steel beams which span to steel beams which, in turn, span to the wood columns reinforced with steel channels. This steel is rusting (Photograph No. 40).

.3 Second Floor

The five bays at the west end are inaccessible at this time. The floor in this area is covered with tile flooring plus a significant amount of debris from the ceiling above. There are two distinct areas within these five bays where the floor has collapsed (Photographs No. 41, 42, 43, 44, 45, 46).

In the remaining seven bays, the floor sheathing has lifted in various locations.

Five bays at the west end, plus the south side of the next two bays, have a ceiling in place. In exposed areas, the white fungus is visible. In the remaining exposed ceilings areas, the white fungus is visible in various areas.

In the four west bays, the column braces have been removed (six columns in total).

In at least one location, there is a pile of frass or sawdust. This is a probable indication of carpenter ant infestation (Photograph No. 47).

.4 First Floor

The five bays at the west end of the warehouse are covered by floor finishes (Photographs No. 48, 49). In the remaining seven bays, the floor sheathing has lifted in various locations.

Floor joists and beams visible in the Basement, appear to be in good shape (Photographs No. 50, 51).

In one location, an opening was cut in the floor at sometime in the past. This area has additional framing. The opening has been infilled.

In another location, 4th bay from the west end on the south side, the solid floor system is shored.

In the three bays at the east end and the 5th bay from the east end, areas have additional steel framing. This framing is rusting.

The white fungus is visible in a number of areas on the floor and beam members (Photographs No. 52, 53, 54).

Masonry piers support the columns from the Second and Third Floors and the roof and the First Floor beams. Additional piers are added on the north and south sides supporting the First Floor beams (Drawing No. S-1). Masonry piers are generally in good condition. One pier has cracked masonry (Photograph No. 55).

.5 Basement

Foundation walls do not show any signs of distress. Mortar pointing is required in various locations.

The cast-in-place concrete floor appears in good condition.

.6 Envelope

The existing roof membrane requires replacement. The roof leaks in a number of locations (minimum 12 locations).

Pointing of the mortar joints is required throughout the exterior walls of the warehouse. There are areas of loose bricks (Photographs No. 56, 57, 58, 59, 60, 61, 62, 63).

In various locations the bricks in the outer wythe are spalling. There are cracks in the walls at various locations. In other locations, bricks are missing (Photographs No. 60, 61, 62, 63).

Not all windows on the north and south sides are hoarded (Photographs No. 56, 57).

4.3 Timekeepers Building

.1 Structure

The roof structure is only visible though a small opening in the ceiling. The wood joists appear to be in good condition (Photograph No. 64).

Masonry loadbearing walls require pointing.

Loadbearing members of the wood structure on the south side are not visible.

.2 *Envelope*

The wood siding on the south side of the building is in poor shape.

As previously noted, masonry walls require pointing.

The parapet on the east side is cracked. Bricks are missing or are spalled (Photograph No. 65).

The parapet on the west side of the building is leaning to the west (Photographs No. 6, 7, 66).

The shingled roof appears to be in fairly good condition. The lower portion of the roof over the small area to the south is covered by some type of plastic sheet (Photograph No. 7).

5.0 DISCUSSION

5.1 Wood Decay

Wood does not decay simply because it is wet. It decays because it has been attacked by fungi under special conditions of moisture and temperature.

The conditions for fungal growth are, as follows:

- Source of infection
- Suitable substrate (food)
- Moisture
- Oxygen
- Suitable temperature

Suitable temperature for fungi growth is between 65°F and 70°F. There is no growth of fungi at freezing temperatures, but the fungi are not killed at these temperatures.

Fungi can be classified, as follows:

- moulds and staining fungi
- soft-rot fungi
- wood-rotting basidiomycetes (WRB) - white rot fungi
  - brown rot fungi

Moulds and staining fungi generally cause little damage. Soft-rot fungi typically attack wood in permanently moist conditions. WRB cause the most damage in buildings. These fungi typically produce large fruiting structures (toadstools, brackets or conks). WRB decays wood at a much faster rate than soft-rot fungi.

Without completing testing of the fungi, it is not possible to determine which type(s) of fungi are present.

Drying wood to below 15% moisture content will stop the decay process but will not necessarily kill the decay fungus (unless a sufficiently high temperature has been used in the drying process). WRB can survive up to nine years in wood at moisture contents around 12%. If the wood wets up again, then the decay process can start again.

Wood-rotting fungi break down the carbohydrates in the wood into carbon dioxide and water. The moisture content of the wood will increase as decay progresses. This process makes it more difficult to stop the decay process by drying out the wood. Some form of accelerated drying is normally required.

Once established, decay can progress at moisture contents as low as 25%, so it can be maintained by a moist atmosphere.

All sources of moisture must be removed.

It is critical infected wood, not only that which is obviously decayed, but that which is beyond the end of the visible decay be removed.

Visibly rotted wood is the last stage of the decay process, thus WRB may be present in wood which is not apparently affected.

5.2 Carpenter Ant Damage

Carpenter ants are 7 to 20 mm long, black to red-brown in colour. They can cause severe structural damage to wood in service. They do not eat wood, they merely excavate it to live in.

Carpenter ant damage is usually not seen on the surface of the wood. The ants generally gain access to the member through checks or other openings which result in large galleries close to the surface that are smooth walled and contain frass (wood debris). This wood material is not digested by the ants, but is deposited outside the entrance of the nest. The discovery of these wood particles is the best indication of an ant infestation.

Carpenter ants prefer softer woods (low-density) or moist or wet wood softened by decay.

5.3 Design Loads

The dead and live loads used to design the roofs, the office and warehouse floors are unknown.

Today's live load requirements would be as follows:

Roof Snow Load	-	1.36 kPa (28.4 psf) + drift
Office Floor Loads	-	First Floor - 4.8 kPa (100 psf)
	-	Second, Third Floors - 2.4 kPa (50 psf)
Warehouse	-	4.8 kPa (100 psf) (minimum design load)

The proposed loadings for the possible uses are, as follows:

Museums	-	4.8 kPa (100 psf)
Retail Areas	-	4.8 kPa (100 psf)
Library (Stack Rooms)	-	7.2 kPa (150 psf)

Other current load requirements per the Ontario Building Code are, as follows:

Wind	-	cladding .31 kPa (6.5 psf) (1/10 return)
	-	structure .37 kPa (7.7 psf) (1/30 return)

Seismic	-	Z_a	-	1.0
	-	Z_v	-	0.0
		v	-	0.05

Within the existing warehouse area, there is a posted sign limiting the live load on the Third Floor to 125 psf.

5.4 Structural Analysis

The strict application of current codes to existing structures can have a devastating effect on heritage buildings. Contemporary code requirements were developed to ensure safety at a reasonable cost but, when applied to existing structures, the cost will likely be prohibitive.

Since 1985, the Canadian National Building Code allows for the performance of a structure to be a key factor in determining the bearing capacity of a structure. The focus is on meeting the objective of the Code, as opposed to meeting the requirements of the Code.

As referenced in CBD-230, *Applying Codes to Existing Buildings*:

> *Where a building has been standing for many years, and its condition or its relationship to adjacent buildings has not changed significantly, one may consider the building to be field tested. If a roof has withstood the effect or snow and wind for 50 or 60 years and shows no signs of distress, one may reasonably assume that it will continue to provide adequate service. The same may be assumed for walls in relation to wind loads. Earthquake loads are more difficult to assess because of their irregular occurrence. Nevertheless some assessment can be made in light of the recorded seismic activity of the area where the building is located.*

If the structural calculation indicated underdesign results the engineer does not have to condemn the structure. The structural assessment results based on the lifetime performance of a structure can even overrule the theoretical assessment.

Historic structures, their components and joints, must be analysed in the context of the loads which they carry and the forces they must resist.

Since stresses have a lasting effect on building materials, the engineer must investigate the magnitudes of loads which were carried by the structure in the past and also the length of time the loads were acting on the structure.

Loading conditions should be based on the user requirements and the selected function of the structure. If the selected function remains unchanged or results in a decrease in the loading, and if the performance of the structure is satisfactory through a period, the structural systems should be adequate.

Evidence of fire, excessive moisture content, infestation and other signs of material deterioration should be noticed and their effects on materials' properties evaluated.

Because of the current condition of the building's structural elements it is not known if there is significant distress in the elements which remain. The capacity of the members will be ultimately determined by their condition after the timber dries out. Therefore, basing the building evaluation on past performance is not justified at this time.

Using the method presented in Commentary K of the NBC Structural Commentaries, the reliability level and the load factors for the structural analysis are, as follows:

		Load Factor	
	Reliability Level	**Dead**	**Live**
Office	2	1.11	1.2
Warehouse	3	1.15	1.3

For the analysis, the following assumptions were made:

- Joist material - Select Structural, Spruce-Pine-Fir
- Beams and Columns - Select Structural, Douglas Fir

Current allowable strengths for these materials are used for the analysis.

The analysis of the Warehouse floors does not include the additional steel beams. Our analysis includes only the original building structural members.

The results of our analysis are, as follows:

.1 Office

.1 Roof

Because of the future possibility of adding insulation to the roof membrane and that snow drift loads created by the parapet are now applicable, no reduction was taken in the current applied loads.

The existing joists can support current roof loads.

The beams are capable of supporting current roof loads except the beams which span 16-'0" (Drawing No. S-4).

.2 Floors

Floor joists are capable of supporting a 100 psf live load using reduced load factors.

The floor beams are capable of supporting a 50 psf live load using reduced load factors, except for the 20'-8" spans (Drawings No. S-2, S-3).

It is not possible, based on current information, to determine the capacity of the concrete slab at the First Floor Level.

.3 Columns

Columns can support the actual roof load plus a live load of 50 psf using reduced load factors on the Second and Third Floors.

.2 *Warehouse*

.1 Roof

The roof beams are capable of supporting imposed loads (i.e. snow). The centre beam is each bay is marginal.

An exact thickness of the roof sheathing could not be established. The only area where the sheathing could be measured was at the elevator shaft. Based on this measurement, the sheathing is not adequate. It cannot be determined if the measurement taken is accurate and therefore, no conclusion was reached on the structural capability of the roof sheathing.

.2 Floors

The floor joists and beams are capable of supporting a live load of 100 psf at each floor using the reduced load factors, except as noted. This analysis did not include a partition load (1 kPa) on the floors. The floors will need to remain open (i.e. no partitions).

The beams which span 9'-0" and 11'-6" at the First Floor require shear reinforcing (Drawing S-1).

.3 Columns

Columns are capable of supporting the roof loads and a live load of 100 psf at each floor.

.3 Timekeepers Building

.1 Roof

The 2 x 8 joists are adequate for the imposed snow loads.

The wind loads on the building were not analysed. Based on the history and condition of the building, with respect to lateral wind loads, the building can adequately carry the load.

A seismic evaluation/analysis was not completed. This is a more detailed analysis which is not within our scope of work. This analysis will need to be performed prior to occupancy.

5.5 Office/Warehouse Building

.1 Office

.1 Structure

Where the joist, beams and columns are visible, these members appear to be in good condition. The floor and ceiling finishes need to be removed to determine the condition of each individual member. These finishes also need to be removed to determine the condition of the floor sheathing.

Because of the number of roof leaks and the poor condition of the roof membrane, we are assuming that a large portion of the roof sheathing will need to be replaced.

The two columns that were removed, which support the Third Floor, need to be replaced if the Third Floor is to be used. The existing 2 x 4 wall studs are not adequate.

Masonry walls must be repaired, where noted, for joist and beam bearing.

.2 Envelope

Pointing of the existing mortar joints is necessary to make the building water-tight.

In addition, the roof membrane has to be replaced and the windows have to be hoarded to make the building water-tight.

The existing parapet walls at the roof level and the existing corbels must be repaired to maintain their integrity.

.2 Warehouse

.1 Structure

Roof sheathing, where damaged, will need to be replaced.

The beams and columns, where visible, appear to be generally in good condition. Beams and columns that are covered will need to be reviewed when this material is removed. Beams, at areas of floor damage which will be removed, will need to be reviewed once the floor is removed.

Floor sheathing, diagonal boards, will need to be removed to view solid wood floor framing and then reinstalled.

The five bays at the west end of the second floor will require removal of the solid wood floor members. The exact amount of removal will be determined after the floor and ceiling finishes are removed.

The missing diagonal members at the column/beam interface need to be reinstalled.

Masonry piers in the Basement require repair.

.2 Envelope

The existing roof membrane requires replacement to make the building water-tight. The extent of roof sheathing replacement will need to be determined when the existing membrane is removed. From our visual review we are assuming approximately 40% of the roof sheathing will need to be replaced.

Pointing of the existing masonry walls is necessary to make the building water-tight. In addition, the holes in the exterior masonry walls need to be infilled.

The existing parapet walls at the roof level and the existing corbels must be repaired to maintain their integrity.

Window hoarding is required to make the building water-tight.

5.6 Timekeepers Building

.1 Structure

The existing east and west parapets must be rebuilt to maintain their integrity.

The crack in the east masonry wall over the door must be repaired.

.2 Envelope

Mortar pointing of all exterior walls is required.

If the timber-sided area on the south side is to remain, the timber siding needs to be replaced.

The area of the roof covered by the plastic sheet requires further review. We have assumed this area of roof will be re-shingled.

5.7 Required Procedures

The required repairs, etc., to make the buildings water-tight (i.e. new roof, hoarding, masonry repairs) have been previously detailed. Making the building water-tight is the first step in limiting further damage.

The existing ceilings and floor finishes have to be removed to remove a potential source of moisture in order to prevent further decay and to allow further review of the structural elements to determine the total extent of the decay.

Areas of decay have to be removed to prevent further decay. The structural components removed will need to be replaced to maintain the use and integrity of the buildings.

Further structural reviews are required during the steps noted above and after the work is completed to determine if all areas of decay or deficient structural members have been established. At this time the extent of the damage from the carpenter ants can also be determined.

These further structural reviews will, most likely, incur some testing, including sounding, drilling, etc.

Once the building is made water-tight, areas where the mould and fungi are visible but do not appear to have yet damaged the structural members will need to be cleaned up. These areas should then be reviewed again to determine if any decay has occurred.

6.0 REPAIRS AND OPINION OF PROBABLE COST

6.1 General

The probable costs for each repair or replacement are detailed on the following pages.

The costs presented are February 2005 values. Increased costs due to inflation, etc., have not been included. The costs are our opinion of probable repair/replacement/ construction costs based on our experience and knowledge for work of this nature.

Engineering costs, if required, are not included. Also, costs to remove any asbestos or mould are not included

6.2 Office/Warehouse Opinion of Probable Cost

.1 Office

.1	Removal of Existing Floor and Ceiling Finishes	$18,500.00
.2	Removal and Replacement of Roof Membrane	$36,500.00
.3	Masonry Mortar Pointing[1]	$57,600.00
.4	Parapet and Corbel Repairs[2]	$4,500.00
.5	Window Hoarding	$9,500.00
.6	Column Replacement	$4,500.00
.7	Miscellaneous Masonry Repairs[2]	$2,000.00
Sub-Total		*$133,100.00*

[1]Mortar pointing necessary to maintain building integrity. Mortar pointing to limit moisture ingress only will be less.
[2]Necessary scaffolding included under masonry mortar pointing

.2 *Warehouse*

.1	Removal of Existing Floor and Ceiling Finishes	$24,000.00
.2	Removal and Reinstallation of Diagonal Floor Sheathing	$13,200.00
.3	Second Floor Removal and Reconstruction	$75,000.00
.4	Reinstallation of Diagonal Members	$6,000.00
.5	Repair of Masonry Columns	$1,000.00
.6	Removal and Replacement of Roof Membrane	$125,000.00
.7	Masonry Mortar Pointing[1]	$145,400.00
.8	Miscellaneous Masonry Repairs[2]	$5,000.00
.9	Parapet and Corbel Repairs[2]	$7,900.00
.10	Window Hoarding	$14,600.00
Sub-Total		*$417,100.00*

6.3 Timekeepers Building

.1	Rebuild Parapets/Crack Repair	$22,300.00
.2	Masonry Mortar Pointing[1]	$5,000.00
.3	Timber Siding Replacement	$1,100.00
.4	Roof Replacement	$1,500.00
Sub-Total		*$29,900.00*

6.4 Structural Upgrades

.1	Office Floor Beams	$2,000.00
.2	Office Roof Beams	$1,000.00
.3	Warehouse Floor Beams	$4,000.00
Sub-Total		*$7,000.00*

[1]Mortar pointing necessary to maintain building integrity. Mortar pointing to limit moisture ingress only will be less.
[2]Necessary scaffolding included under masonry mortar pointing

7.0 SUMMARY

The existing buildings at 66 Mohawk Street are in need of significant work to make them water-tight to prevent further decay of the interior structural members.

The existing wood structural members need to dry out to prevent further decay. Sealing the building from water ingress does not prevent further decay in the wood members. Artificial means of drying out the timber will likely be required.

Based on our structural analysis, using reduced load factors, a number of structural members need to be reinforced to carry the imposed loads. The office floors are capable of supporting a 50 psf live load and the warehouse floors are capable of supporting a 100 psf live load with the required reinforcing.

Deficiencies which required attention to make the buildings water-tight include:

- roof membrane replacement
- masonry pointing and repairs
- window hoarding

Our Opinion of Probable Cost for the repairs/replacements, etc., noted above is **Three Hundred and Ninety-Five Thousand, One Hundred Dollars ($395,100.00).**

Deficiencies which require attention to prevent further decay of structural members include:

- removal of ceiling and floor finishes
- floor removal and replacement

Our Opinion of Probable Cost for the repairs/replacements, etc., noted above is **One Hundred and Thirty Thousand, Seven Hundred Dollars ($130,700.00).**

Deficiencies which require attention to maintain the existing integrity of the buildings include:

- masonry parapet and corbel repairs
- timber siding replacement, shingle repairs
- column replacement and repairs
- masonry column repairs

Our Opinion of Probable Cost for the repairs/replacements, etc., noted above is **Fifty-Four Thousand, Three Hundred Dollars ($54,300.00).**

Areas which require structural upgrading to meet current proposed loading conditions include:

- office floor beams
- office roof beams
- warehouse First Floor beams

Our Opinion of Probable Cost for the repairs/replacements, etc., noted above is **Seven Thousand Dollars ($7,000.00).**

The structural elements of the buildings will need to be reviewed during the repair work to determine the exact extent of the decay in the structural members or, if there is decay in the structural members in other currently unexposed areas.

In addition, areas which currently have mould or fungi but do not appear damaged will need to be cleaned up after the building is sealed. At that time, the extent of any additional decay can be determined.

After the wood structural members dry out, the moisture content below 20%, these members will need to be reviewed to determine whether there is any deterioration and if the material strengths used in our analysis are applicable.

8.0 APPENDICES

8.1 Appendix 'A' - Framing Plans and Sections

S-1 First Floor Framing Plan
S-2 Second Floor Framing Plan
S-3 Third Floor Framing Plan
S-4 Roof Framing Plan
S-5 Roof Plan
S-6 Building Section - Office Area
S-7 Building Section - Warehouse Area

8.2 Appendix 'B' - Photographs

9.0 BIBLIOGRAPHY

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Appendix 'A' - Framing Plans and Sections

S-1 First Floor Framing Plan

S-2 Second Floor Framing Plan

S-3 Third Floor Framing Plan

S-4 Roof Framing Plan

S-5 Roof Plan

S-6 Building Section - Office Area

S-7 Building Section - Warehouse Area