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November 14, 2014

City of Stratford
Building and Planning Department
P.O. Box 818
Stratford, ON N5A 6W1

Attn: Mr. David Carroll, C.E.T., C.B.C.O.
Chief Building Official

Dear Mr. Carroll:

RE: Cooper Site Building
350 Downie Street, Stratford, ON
Roofing Components – Visual Review **RJC No.: TOR.103282.0008**

1.0 Introduction

Read Jones Christoffersen Ltd. was authorized by Mr. David M. Carroll, Chief Building Official for the City of Stratford to undertake a visual review of the roofing components of the Cooper Site Building located at 350 Downie Street in Stratford, Ontario as per our proposal dated October 27, 2014 (RJC No. TOR.099521.0001).

The purpose of this review was to determine the present condition of the roofing components with respect to the age related deterioration and the hazards associated with potential falling debris throughout the structure. Immediate course of action and repair strategies, complete with our opinion of the probable construction costs are presented in our report.

As part of our review, the following work, briefly described below, was carried out:

.1 Review of available drawings and documents describing the structure and the roofing components to re-familiarize ourselves with the construction of the building.

.2 A comprehensive visual review of the roofing components from the ground to detect areas of apparent deterioration.

.3 A visual review of the roofing components at the random locations from the boom lift in order to obtain better understanding of the degree of roofing component deterioration.

The review of structural components of the roofing system (i.e. steel bracing) for structural adequacy is beyond the scope of our work and as such was not performed as part of this evaluation.

The review of the structure for presence of hazardous materials is beyond the scope of our work and as such was not performed as part of this evaluation.

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2.0 Brief Building Description

2.1 Building Description

The main building located at 350 Downie Street is an abandoned industrial building constructed circa 1871 generally of riveted steel construction currently covering a footprint of approximately 160,000 square feet *(Refer to Photograph #1 in Appendix A).* The building has undergone various iterations of additions and demolition over its history prior to and following abandonment in 1989.

It is our understanding that the building located at 350 Downie Street was originally constructed in 1871 as a locomotive repair shop with expansions in 1889 and 1907, and an addition in 1940. Currently, only the 1907 expansion and 1940 addition exist on site, with the original building and 1889 expansion having been demolished in 2004. The property is bound by a community centre on Downie Street to the east, a municipal parking lot and a university campus building on St. Patrick Street to the north, the Festival Hydro yard on Wellington Street to the west, and the rail lines to the south.

The remaining building is generally arranged with four (4) bays, all of which are open from the ground to the roof structure with the exception of the north-most bay, which includes a mezzanine level *(refer to Figure #1 below)*. From north to south, the north-most bay (herein referred to as the "mezzanine bay") is approximately 615-ft long by 40-ft wide and 50-ft high to its peak. The next bay south (herein referred to as the "low bay") is approximately 770-ft long by 65-ft wide at a similar height of 50-ft to its peak. The 3rd bay south (herein referred to as the "high bay") is approximately 780-ft long by 70-ft wide and 67-ft high to its peak. Finally, the south-most bay (herein referred to as the "addition bay") is approximately 580-ft long by 50-ft wide and 38-ft high to the roof surface.

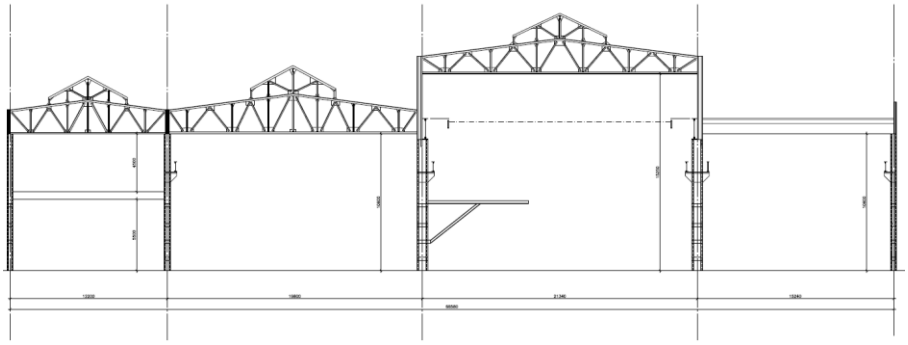

FIGURE #1: TYPICAL BUILDING SECTION

In plan, the main bays are denoted by lettered gridlines As, Cs, Ds, Es, and Fs, spaced in the north-south direction as per the bay width noted above. The transverse gridlines are numbered and identify the column spacing in the east-west direction, generally at 22' centres.

Access to the building is achieved from a municipal surface parking lot at the north side of the building, where the main entrance can be accessed near the centre of the north side of the building.

2.2 Structure Description

The building structure ranges from approximately 38-ft to 67-ft tall with the main portion of the building constructed of riveted built-up steel construction and the addition constructed of rolled structural steel sections. The building, in general, is constructed above grade with several pits of unknown depths present throughout the footprint of the building.

The steel structure utilizes cross-bracing in the vertical plane along gridlines As, Cs, and Ds and horizontal plane at the roof levels to provide lateral stability. The main building area constructed in 1907 consists of riveted steel with main roof trusses spanning in the north-south direction across each bay (varying from 40' to 70') supported by built-up steel column sections. The columns are spaced approximately 22' apart along the length of the facility. Rolled steel 'C' and 'I' section purlins span between trusses to support the roof deck. Large plate girders are also present within the structure, formerly utilized to support mobile crane loads carrying locomotives.

2.3 Roof Components

Having undergone various phases of expansions, additions, modifications, repairs, and demolition, the building utilizes several forms of roofing systems.

In general, the main building is constructed similarly for each of its three bays, with a higher, sloped roof with a central peak at the central half of each bay (herein referred to as the "apex") elevated by short walls from the low sloped roof on either side. The apex roof areas are generally constructed of sheet metal supported by wood strapping and metal U-channel grid. The walls at the edges of the apexes were generally constructed with wood studs sheathed with plywood, and in some cases cement board, and coated with asphalt felt, similar to the low-slope roof areas below. The assembly of the low-slope roof areas at the outer bands of each bay was typically constructed with mopped multi-ply asphalt roof membrane on solid 2" thick tongue-and-groove wooden roof deck spanning over the steel purlins *(Refer to Photograph #2 in Appendix A)*.

The roof of the 1949 addition is a flat roof (with mild slope towards the exterior south parapet wall) constructed with a multi-ply roofing system with pea gravel and copper flashing. The membrane was applied to the underlying solid 2" thick tongue-and-groove wooden roof deck.

2.4 History & Background

The building was constructed by Grand Trunk Railway (GTR) as a locomotive shop to accommodate their growing steam locomotive market, with the site in Stratford being selected as it was located at the crossroads of the main line from Quebec to Chicago and the east-west line from Buffalo to Goderich on Lake Huron. The original shops were completed in 1871. After acquiring Great Western Railway (Hamilton to Detroit), GTR expanded the Stratford facility in 1889 to accommodate the influx of staff and equipment relocated from Hamilton. Another major expansion was constructed in 1907 to provide more space to the increasing size of the locomotive, and a final addition was constructed in 1949 to accommodate even larger locomotives. During that time, GTR was absorbed by Canadian National Railway (CNR) in 1923. Due to the takeover by diesel engines, CNR no longer required the locomotive repair shops and sought offers for the fully equipped facility in 1953. In 1959, the U.S.-based Cooper-Bessemer Corporation (later named Cooper Energy Services) leased the facility from CNR for its manufacturing purposes. By 1989, due to the turnaround in fortunes for Cooper Energy Services, the building became, and remains, vacant.

Since becoming vacant, the property has seen a few changes in ownership with several proposals and plans put forth for redevelopment of the facility, none of which ever came to fruition. In 2002, a major fire occurred in the west end of the building causing extensive damage. Another smaller fire occurred in 2008, with only minor damages noted. In 2004 and 2010, respective demolition of the 1871 and 1889 portions of the building were completed, leaving the 1907 expansion and 1949 addition as the building currently existing on the site.

3.0 Description and Results of Field Work

The field work associated with the visual review of the roofing components was performed on October 29, 2014. The following summarizes the fieldwork and results obtained as part of this evaluation:

3.1 Visual Review of the Roofing Components

The condition of the roofing components (i.e. wooden and metal decking, roofing membrane etc.) was visually reviewed from ground and from the boom lift to identify the extents of deterioration and damage to the building. In general, given the exposed and abandoned condition of the building, the roofing components are experiencing varying degrees of deterioration.

In general, the roofing was observed to be in poor condition, which was particularly evident upon observing the varying degrees of deterioration at the underside of the roof deck in all areas of the building. Flaking paint, damp and rotting wood, and corroded sheet metal were observed throughout the building in both the main building and the addition *(Refer to Photographs #3 to #7in Appendix A)*. Extensive roofing and roof deck deterioration was predominantly noted within the west section of the structure between gridlines 1 – 10 and Cs – Es adjacent to the area of the building burnt down during the major fire in 2002 as noted previously in this report. Sections of the roofing material and the roof decking were noted to be deteriorated to the point where they either have been blown off or are in danger of being blown off the building's roof. Generally speaking, at this time, the observed deterioration of the roofing assembly appears to be predominately related to the deterioration of the wooden roof decking and roofing membrane.

Since the condition and stability of the roof deck material was questionable, only a cursory review of the roof surfaces could be performed through the skylights and the burnout sections of the roof from a boom lift. From the cursory review of the roof surface performed, it was obvious that the roofing materials had well exceeded their useful service life, were in a state of complete disrepair, and were no longer functioning as intended. Fallen roofing debris was noted throughout the interior of the building and around the perimeter of the exterior of the building *(Refer to Photograph #8 in Appendix A)*.

4.0 Conclusions/Discussions

In general, the findings of this review suggest that the primary concern with respect to the condition of the roof (i.e. wood roof decking and roofing membrane) relates to the observed age related deterioration and the potential safety hazards arising as a result of falling roofing debris from high levels. As previously noted in this report, the wooden roof decking and roofing membrane are in poor condition and are in an obvious state of disrepair as the moisture penetrating through the membrane has caused some significant levels of deterioration and failure of the decking materials, particularly along the west section of the building. Although evaluation of the structural components of the roof structure (i.e. steel framing systems) was not included in the scope of our review, based on our cursory review and the findings of structural evaluation undertaken by RJC in the past, it appears that the structural integrity of the framing system is not a concern at this time.

The observed deterioration of the roofing membrane and decking can be attributed to several factors, including but not limited to prolonged exposure to the elements as a result of a lack of repair and maintenance over an extended period of time (due to the derelict nature of the building). In our opinion the deterioration is expected to increase at an accelerated rate if left unattended resulting in increased frequency of the failure of the wooden roof decking and increased potential for the safety hazards associated with falling roofing debris.

Further, corrosion related deterioration of the structural framing system (i.e. trusses, beams, etc.) is an increasing concern given their exposure to the elements. The corrosion related deterioration of the structural framing system can be expected to occur at an accelerated rate if left unattended for the extended period of time resulting in potential risks associated with the reduction of the load carrying capacity and potential structural integrity concerns for the remaining building structure.

5.0 Possible Courses of Action

The action plan provided below is based on the findings of our review with respect to the present condition of the roofing components and our observations during the walkthrough of the structure's exterior perimeter. Our analysis of this information has allowed us to extrapolate and predict future expenditures that may be needed on this structure based on its present condition.

Given the uncertainty with the future redevelopment plans of the structure, the rehabilitation of the roofing for the building was not considered as an option.

Based on the findings of the evaluation, the following courses of action are available to address the potential safety hazards as they related to the deterioration observed at the time of our review.

5.1 Option #1 - Removal of the Loose Roofing Components and Annual Monitoring

The purpose of this strategy is to address the current potential safety hazards observed at the time of our review associated with the falling roofing components (i.e. roofing membrane and wooden decking). This work involves retaining the services of contractor to remove all the areas of deteriorated roofing components that are in danger of falling and/or being blow off the roof. Direction would be provided by RJC at the Owner's request.

It should be noted that the observed deterioration of the roofing components is likely to continue at an accelerated rate and additional engineering assessments as well as removal of the loose roofing components is recommended on an annual basis until full scale restoration is implemented or demolition is required to mitigate a large scale collapse due to advancing levels of deterioration. Based on the expected accelerated rate of deterioration, it is anticipated that the observed deterioration may progress to a point where complete demolition of the roofing components may be required within 3 to 5 year period unless measures are taken to rehabilitate the observed deterioration and protect the structure from future moisture degradation.

This option recognizes that the proximity of adjacent properties and buildings cannot be adequately protected against falling roofing debris, which could otherwise be contained by the perimeter fencing.

It should be noted that the removal of the roofing components will further expose the buildings structural framing components (i.e. steel frame, perimeter concrete and masonry walls, etc.) to the elements which in turn will accelerate the rate of corrosion related deterioration resulting in potential risks associated with the reduction of the load carrying capacity and potential structural integrity concerns.

5.2 Option #2 – Complete Demolition of the Roofing Components

This strategy is relatively self-explanatory, essentially involving the complete demolition of all roofing components of the building (i.e. roofing membrane, wooden and metal decking, etc.). The purpose of this strategy is to mitigate from potential costs associated with annual evaluation and need for additional removals of the roofing components as the structure continues to deteriorate. It should be noted that exposing the structural components to the elements will accelerate the rate of corrosion related deterioration of these components resulting in potential risks associated with the reduction of the load carrying capacity and potential structural integrity concerns.

The following scope of work is the minimum recommended work required to demolish the west end wall:

1. Protection of the site for the duration of the demolition work to restrict access only to contractor and consultants as well as maintain site safety.

2. Demolition of the roofing components (i.e. roofing membrane, wooden and metal decking, etc.).

5.3 Perimeter Fencing and Site Protection

Provided the potential risk associated with the falling debris along the exterior of the building resulting from the ongoing deterioration of the roofing components, barrier fencing should be installed around the perimeter of the building. Two possible options should be considered and are presented below:

.1 Option #1 - Permanent Perimeter Fencing

1. Installation of an 8'-0" high security fencing around the perimeter of the building with permanent post footings buried below the frost line in accordance with the Ontario Building Code.

2. Installation of access gates to provide vehicular and pedestrian access to the municipal maintenance staff.

3. Installation of signage on the barrier fencing advising general public of potential risks associated with trespassing and entering the property.

.2 Option #2 – Temporary Perimeter Fencing (i.e. fast fencing)

.1 Installation of an 8'-0" high fast fencing around the perimeter of the building.

.2 Installation of signage on the barrier fencing advising general public of potential risks associated with trespassing and entering the property.

Using concrete post footings for the perimeter fencing (as oppose to temporary "fast fencing") is recommended given the need to mitigate security breaches in the fence and the unknown duration that the fencing will need to be in place.

6.0 Opinion of Probable Construction Costs

The following cost estimates represents our opinion of the probable construction costs and are based on the information obtained during this condition survey. The following cost estimates should be treated as "ball park" figures only and cannot be guaranteed accurate.

Based on the construction review experience we have in the repair and rehabilitation of existing structures and buildings, we advise that it is reasonable to assume that the repair quantities - as compared to those deteriorated quantities observed during the condition survey - will be larger. Different items for repair characteristically have exhibited different increases in size during the repair program. Our summary to follow, which outlines the estimated construction costs, has considered this increase from the observed deteriorated quantities.

6.1 Option #1 - Removal of the Loose Roofing Components and Annual Monitoring

The construction cost estimate for the removal and disposal of the loose roofing components, as described in Section 5.1 of this report assuming all work is performed in one year in 2014 dollars, is approximately $105,000.00 plus and H.S.T. and breaks down as follows:

Table 6.1 – Option #1 Opinion of Cost Breakdown

Item	Description	Report Value
1	Mobilization, General Accounts, Overheads	$ 35,000.00
2	Removal and Disposal of Loose Roofing Components	$ 55,000.00
3	Engineering Fees *	$ 15,000.00
	Total ("Class D" - Cost Estimate)**	**$ 105,000.00**

*Engineering Fees include preparation of technical documentation, tendering of the project, site review and contract administration.

** The cost associated with the abatement of hazardous materials (if present) was not included in our cost estimates.

6.2 Option #2 –Complete Demolition of the Roofing Components

The construction cost estimate for complete demolition of the roofing components, as described in Section 5.2 of this report assuming all work is performed in one year in 2014 dollars, is approximately $315,000.00 plus H.S.T. and breaks down as follows:

Table 6.2 – Option #2 Opinion of Cost Breakdown

Item	Description	Report Value
1	Site Protection	$ 35,000.00
2	Bonding, Mobilization, General Accounts, Overheads	$ 75,000.00
3	Demolition and Disposal/Recycling of Roofing Components	$ 150,000.00
4	Contingency Allowance	$ 20,000.00
5	Soft Costs *	$ 35,000.00
	Total ("Class D" - Cost Estimate) **	**$ 315,000.00**

*Soft Costs include engineering fees, cost of building permit and material testing fees and are estimated to be approximately 15% of the total construction budget.

** The cost associated with the abatement of hazardous materials (if present) was not included in our cost estimates.

6.3 Perimeter Fencing and Site Protection

.1 Option #1 - Permanent Perimeter Fencing (i.e. security fencing)

The construction cost estimate for the installation of perimeter fencing and site protection, as described in Section 5.3.1 of this report assuming all work is performed in one year in 2014 dollars, is approximately $250,000.00 plus H.S.T. and breaks down as follows:

Table 6.3.1 – Option #1: Permanent Fencing

Item	Description	Report Value
1	Mobilization, General Accounts, Overheads	$ 25,000.00
2	Supply and Installation of New Fencing	$ 210,000.00
3	Engineering Fees *	$ 15,000.00
	Total ("Class D" - Cost Estimate)	**$ 250,000.00**

*Engineering Fees include preparation of technical documentation, tendering of the project, site review and contract administration.

.2 Option #2 – Temporary Perimeter Fencing (i.e. fast fencing)

The construction cost estimate for the installation of perimeter fencing and site protection, as described in Section 5.3.2 of this report assuming all work is performed in one year in 2014 dollars, is approximately $155,000.00 plus H.S.T. and breaks down as follows.

Table 6.3.2 – Option #2: Temporary Fencing

Item	Description	Report Value
1	Mobilization, General Accounts, Overheads	$ 20,000.00
2	Supply and Installation of New Fencing	$ 125,000.00
3	Engineering Fees *	$ 10,000.00
	Total ("Class D" - Cost Estimate)	**$ 155,000.00**

*Engineering Fees include preparation of technical documentation, tendering of the project, site review and contract administration.

7.0 Recommendations

Based on the findings of this evaluation, we recommend the following course of action to address the potential safety hazards as they related to the deterioration of the roofing components observed at the time of our review.

7.1 Roofing Components

With respect to the deterioration of the roofing components observed during our visual review, we are of the opinion that the observed deterioration has progressed to a point where integrity of the wooden roof decking and roofing membrane has been compromised and fallen roofing debris was noted throughout the site.

As a result, in the short term, we recommend implementing Option No. 1 as discussed in Section 6.1 of this report and retaining the services of contractor to remove all the areas of loose and deteriorated wooden roof decking and roofing membrane and implementing annual update reviews of the roof structure. Annual reviews will monitor the structure for future deterioration and identify the need for additional removals and/or site protection or structural shoring based on the increased level of deterioration. It should be noted that implementation of this option should not be delayed due to the safety concerns associated with the falling roofing debris and/or debris blown off the building noted at the time of our review.

Alternatively, if the redevelopment of the site is not planned to be completed within next 3-5 years it may be more cost effective to implement Option No. 2 as discussed in Section 6.2. This option becomes the more cost effective approach due to the accelerated rate of deterioration that is expected to occur as long as the roofing components remain unprotected in its current state. It should be noted that implementation of this option will result in exposing the main structural components of the building to the elements and may accelerated the corrosion related deterioration of the superstructure.

7.2 Perimeter Fencing and Site Protection

With respect to the perimeter fencing and site protection, we recommend implementing Option No.1 as discussed in Section 6.3.1 of this report given the need to mitigate security breaches in the fence and the unknown duration that the fencing will need to be in place.

8.0 Closing Remarks

Thank you for selecting Read Jones Christoffersen Ltd. for this project. We would be pleased to assist you with the implementation of our recommendations. Should you have any questions or concerns, please do not hesitate to contact this office.

Sincerely,
Read Jones Christoffersen Ltd.

Reviewed by:

Sohrab Baba Karkhel, P.Eng.
Project Engineer
Building Science and Restoration

Jeremy Horst, C.E.T., LEED AP
Principal
Building Science and Restoration

Appendix 'A'
Photos

Photo #1: General Overview of the Structure

Photo #2: General Overview of the Roof

Photo #3: Typical Roof Deterioration

Photo #4: Typical Roof Deterioration

Photo #5: Typical Roof Deterioration

Photo #6: Typical Roof Deterioration

Photo #7: Typical Roof Deterioration

Photo #8: Roofing Debris Scattered Throughout the Site