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Staff Report

Community Services

Report To: **Committee of the Whole**
Meeting Date: April 3, 2017
Report Number: CSPW.17.042
Subject: L.E. Shore Memorial Library Steel Roof Repair Investigation
Prepared by: Aaron McMullen, Facility Manager/Building Maintenance Coordinator

A. Recommendations

THAT Council receive Staff Report CSPW.17.042 entitled "L.E. Shore Memorial Library Steel Roof Repair Investigation";

AND THAT Council approve the completion of the steel roof repair investigation as an unbudgeted capital project in 2017 as outlined in this report to an upset limit of $8,000;

AND THAT Council approve funding the steel roof repair investigation from the Library Asset Management Reserve Fund;

AND THAT Council direct Staff to develop a Capital Replacement Strategy for facilities utilized by the Blue Mountains Public Library Services.

B. Overview

This report outlines the details and costing for the investigation process of the curved steel roofing structures at the L.E. Shore Memorial Library (Library).

With the approval of Council to move forward with the recommendation from Staff, C.C. Tatham and Associates (C.C. Tatham) will provide a detailed report outlining their recommendation for a remedial fix or a complete renovation along with a timeline for project completion.

C. Background

In late March of 2016, Town Staff began providing Facility Maintenance Services at the Library. After reviewing a health and safety inspection and undertaking discussions with Library Staff, Facility Maintenance Staff deemed the air quality concerns to be of the highest priority and began the process of determining the appropriate steps required to rectify the concerns.

It was deemed that the root cause to the air quality issues was the flat roof sections and the compromised insulation and failing membranes. Staff completed the tendering process for the mold abatement and restoration and roof replacement.

Throughout the course of the project, several leaks in the replaced flat roof were identified which were repaired by Northeast Roofing. However, two leaks were persistent and a site meeting was convened on February 10, 2017 to investigate these leaks. The leaks were located in the gallery and the main hallway within the area of the skylight.

During the site meeting, observations were made at both leak locations. A portion of the metal roofing was lifted and water was observed on the underside of the roofing and the insulation was found to be saturated. Water was present well above the location of the flat roof tie-in detail. Therefore, the flat roof project was not the cause of the new leaks from the steel roof.

Staff requested C.C. Tatham to provide a report (Attachment 1) outlining the findings from the February 10, 2017.

D. Analysis

Through this review, C.C. Tatham could not definitively determine the cause of the metal roof leakage, however, C.C. Tatham has provided the following information regarding the possible causes:

1. It is likely that condensation is forming on the underside of the roofing, due to heat loss contacting the cold metal roof. Moist warm air inside the building will rise into the highest interior spaces which would be in the metal roof areas, and the roof assembly does not have provisions for ventilation. In addition, C.C. Tatham noted that during a construction review for the flat roof replacement project, they had observed regularly spaced horizontal linear melt lines in the snow covering the metal roof. This indicates that moist warm air may be escaping between joints in the insulation batts/panels and this could lead to condensation forming on the underside of the metal.

2. It is possible that the metal roof seams have shifted and no longer provide adequate protection against rainwater and snow melt penetration. C.C. Tatham observed that the metal roof panels are corroded along the seams in several locations indicating water was present and this water could be entering the roofing assembly through the seam, especially wind driven rain.

3. The flat roof replacement project required the lifting/removal of the lower 24 inches of the steel roofing materials at the location where the flat roof and sloped metal roof meet. It is suggested that the flat roof project did not cause this leaking.

E. The Blue Mountains Strategic Plan

Goal #1: Create Opportunities for Sustainability

Goal #4: Promote a Culture of Organizational & Operational Excellence

Goal #5: Ensure Our Infrastructure is Sustainable

F. Environmental Impacts

All efforts will be made to ensure the works completed use best practices for protection of the environment.

G. Financial Impact

The chart below outlines the expected costs for the curved steel roof investigation at the Library:

Investigation Breakdown	**Cost**
Condition of Metal Roof Report (February 10, 2017 site visit findings)	$1,200
Initial Investigation	$3,200
Roofing Contractor (cost to remove steel panels and insulation and replace all components)	$3,600
Total Cost	**$8,000**

Staff are recommending that the $8,000 unbudgeted investigation be funded from the L.E. Shore Memorial Library Asset Management Reserve Fund as this reserve fund is under the care and control of Town Council and does not require Library Board approval.

H. In consultation with

Deputy Treasurer/Manager of Accounting and Budgets

Director of Finance/IT Services/Treasurer

Director of Community Services

Manager of Purchasing and Risk Management

I. Attached

1. Report from C.C. Tatham and Associates – Condition of Metal Roofing

Respectfully submitted,

Aaron McMullen
Facility Manager, Building Maintenance Coordinator

Shawn Everitt
Director of Community Services

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March 8, 2017

via email (amcmullen@thebluemountains.com) & mail
CCTA File 116195-2

Aaron McMullen
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32 Mill Street, P.O. Box 310
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Re: L. E. Shore Library - 173 Bruce Street South, Thornbury
Condition of Metal Roofing

Dear Mr. McMullen:

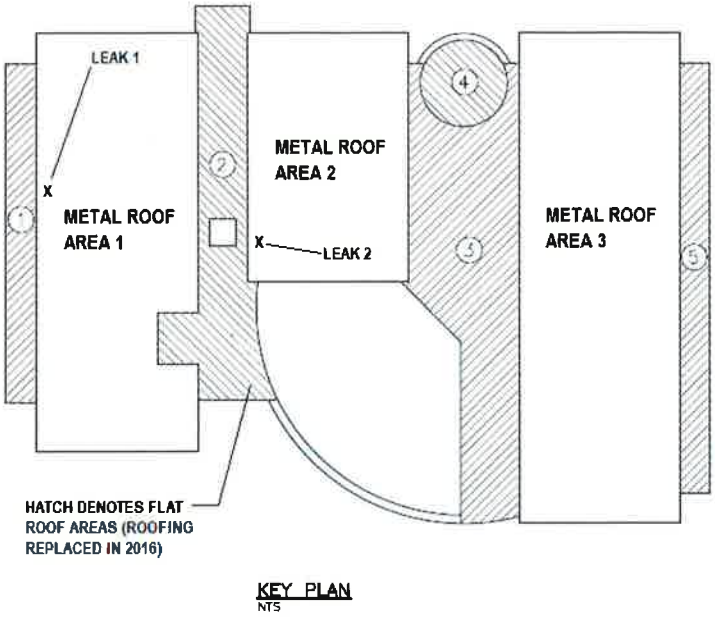
While investigating the cause of two leaks during the construction phase of the flat roof replacement project at the L. E. Shore Library, the contractor discovered water, wet insulation, and corrosion under portions of the metal roofing (above the limit of the flat roof replacement work). The same discovery was made at both locations where leaks continue to occur. As per your request, we have prepared this report to document the observations, present our opinion on the cause, and provide recommendations for addressing the issue.

Building Description & Background

The L. E. Shore Library was originally constructed in 1994. The building is approximately 10,500 square feet in plan area and one storey in height. The structure consists of a variety of materials including wood framing, masonry walls, concrete beams, and steel framing. The entire structure is supported on concrete foundations. The metal roof areas comprise approximately 7,200 square feet combined and the flat roof areas comprise approximately 3,300 square feet. The superstructure construction is generally described as follows (refer to figure 1 below for building section designations):

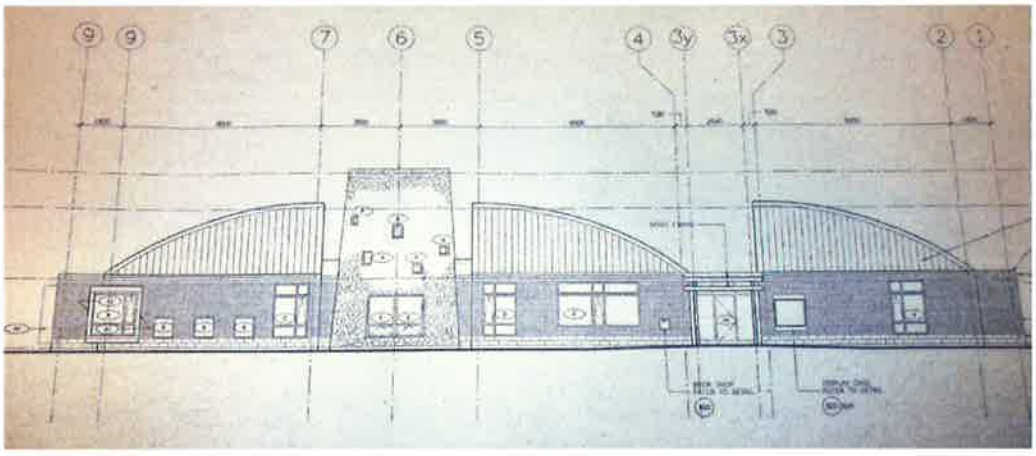
- at metal roof areas 1, 2, and 3, and flat roof area 2, the structure consists of wood plank decking supported on wood beams which are then supported on reinforced concrete beams and columns;
- at flat roof area 3, the structure consists of steel roof decking supported on wood beams which are then supported on concrete beams and concrete or steel columns; and
- at flat roof areas 1 and 5, the structure consists of steel roof decking spanning between an exterior masonry wall and a line of beams (concrete beams at roof area 1 and glulam beams at roof area 5) which are then supported on concrete or steel columns.

Figure 1: L. E. Shore Library Key Plan



The metal roof areas consist of high curved roof profiles which slope down to flat roof areas 1, 2, and 5 (see figure 2 below). On site, the roof assembly was found to consist of metal roofing, horizontal z-girts, 15 lb felt paper, and insulation. The roof assembly components observed on site generally match the original design, which we verified in the original design documents and details provided by the Town and by the architect (Shore Tilby Irwin). The original design also shows vapour barrier and wood sheathing below the insulation (on top of the wood plank decking) however these materials were not accessible for review on site.

Figure 2: Elevation View of L. E. Shore Library (excerpt from drawing A-5 by Shore-Tilby-Irwin)



In 2016, the Town proceeded with the replacement of roofing on flat roof areas to address moisture penetration and leakage. The majority of this work took place between November 2016 and January 2017. The metal roofs were not to be replaced therefore a detail was developed to tie the new flat roofing into the base of the metal roof. The contractor cut back the metal, lapped the flat roofing materials onto the upper roof, and finished with metal flashing that laps underneath the metal roofing.

During the course of the project, several leaks presented which were repaired by the contractor however two leaks were persistent and a site meeting was convened on February 10, 2017 to investigate these leaks. The leaks presented on the interior at approximately the following locations:

- at the location where flat roof area 1 meets metal roof area 1, at approximately the intersection of gridlines 2 and L (see mark on figure 1); and
- at the location where flat roof area 2 meets metal roof area 2, at approximately the intersection of gridlines 4 and K (see mark on figure 1).

Observations

During the site meeting, observations were made as detailed below.

- At both leak locations, the metal roofing was lifted and water was observed on the underside of the roofing and the insulation was found to be saturated (Photograph 1). Water was present well above the location of the flat roof tie-in detail.
- Water was observed running along the surface of the felt paper, coming from above the location where the roofing was lifted (Photograph 2).
- Corrosion was observed on the underside of the metal roofing indicating that moisture has been present for an extended period of time (Photograph 3).
- Water staining was observed on the underside of the wood decking inside the library indicating that the metal roofing has leaked in the past (Photograph 4).

Conclusions & Recommendations

Through this limited review, we cannot definitively determine the cause of the metal roof leakage, however, it is most likely due to one or all of the following:

- It is likely that condensation is forming on the underside of the roofing, due to heat loss contacting the cold metal roof. Moist warm air inside the building would rise into the highest interior spaces which would be in the metal roof areas, and the roof assembly does not have provisions for ventilation. In addition, we note that during a construction review for the flat roof replacement project, we had observed regularly spaced horizontal linear melt lines in the snow covering the metal roof. This indicates that moist warm air may be escaping between joints in the insulation batts/panels, and this could lead to condensation forming on the underside of the metal.
- It is possible that the metal roof seams have shifted and no longer provide adequate protection against rainwater and snow melt penetration. We observed that the metal roof panels are corroded along the seams in several locations indicating water was present and this water could be entering the roofing assembly through the seam, especially wind driven rain.
- The flat roof replacement project disturbed the roofing materials at the location where the flat roof and sloped metal roof meet. A detail was provided to the contractor to seal these locations from water penetrating from the exterior (i.e. rain and snow). If water/condensation is present above the joint in the roofing and beneath the metal roofing, water could flow down the sloped roof and enter the building

at this location. This would not occur if water was not present below the metal roofing, above the level of the flat roof.

To address these leakage issues, we recommend the following:

- conduct leakage tests on the metal roofing and observe whether additional leaks present themselves;
- remove metal panels to further investigate the extent of moisture penetration in the insulation;
- if the investigations above conclude that little additional leakage and/or condensation/corrosion is observed, then the Town could locally repair the leaks and observe whether further leakage occurs, or proceed with full replacement of the metal roofing; and
- if the investigations conclude that the leakage and/or condensation is widespread, then we recommend the metal roofing be replaced.

Estimate of Replacement Cost

With the information that is currently available, we estimate the cost of replacing the metal roofing to be in the range of $250,000 to $350,000. We anticipate this would include removal and disposal of the metal roofing and insulation, replacement of the insulation, the addition of a roof sheathing and ice/water shield on top of the existing z-girts, and placement of new metal roofing. We note that a more accurate cost estimate could be provided after additional investigations and preliminary design work is completed.

As previously noted, we recommend that an investigation be completed to determine if localized repairs will be sufficient or if total replacement is warranted.

We trust that this is satisfactory for your purposes at this time. We would be pleased to provide you with a fee estimate and work plan to prepare contract documents for the roofing replacement project, should you decide to proceed. If you have any questions, or require any additional information, please don't hesitate to contact our office.

Yours truly,
C.C. Tatham & Associates Ltd.

Michael Sanfilippo, B.Sc.Eng., M.PL., P.Eng.
Senior Engineer, Project Manager
MAS:mw

copy: Ryan Gibbons, Town of The Blue Mountains (rgibbons@thebluemountains.ca)

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Photograph 1: Moisture present on the underside of the metal roofing

Photograph 2: Water running along the felt paper

Photograph 3: Corrosion present on the underside of the metal roofing

Photograph 4: Example of past wood staining on underside of wood planks