cocoon

Insulation • Performance Testing • Radon

MINNEOPA STATE PARK EVALUATION

Client: Minnesota Department of Natural Resources

Location: Minneopa State Park
54479 Gadwall Road
Mankato, MN 56001

Phone: (507) 389-5464

Email: Minneopa.statepark@state.mn.us

Date of Testing: October 21, 2014

Objective

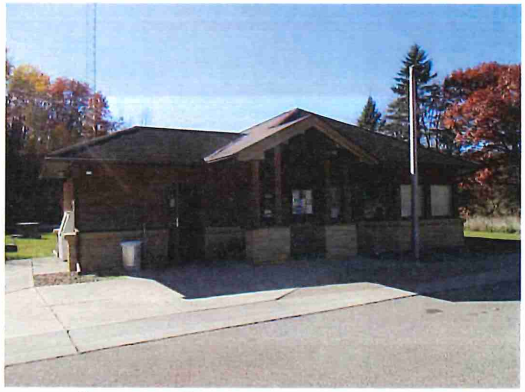
Project Description: Analyze current building performance of Contact Station and Heated Storage/Shop to determine most effective way of reducing overall energy usage of the park by 15%.

Consultant's Report

Overview

Cocoon conducted performance testing and inspections on the Contact Station and the Heated Storage / Shop Building for Minneopa State Park. These two buildings were identified as having the most potential for energy improvements since they were heated and semi-occupied.
The client's goal: Identify ways to reduce the overall energy usage by 15% by 2015.

Results for the diagnostic testing and inspection can be seen on the following pages.


Contact Station


Heated Storage / Shop

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Contact Station

Blower Door

Air leakage and lack of insulation are major contributing factors to heat loss and high energy consumption. The largest potential for improving building performance and increasing energy efficiency usually comes from improving the performance of the building envelope and more specifically, air sealing and insulating. Many times the attic is the area that holds the most potential for drastic air sealing and increased R-value.

A blower door test was conducted to measure the total air leakage of the building envelope. Examples of common air leakage are windows, doors, and penetrations through the ceiling into attic areas.

MEASUREMENT	PRE TEST
Air Leakage (CFM50)	1299 CFM
Air Changes (ACH50)	7.18 ACH

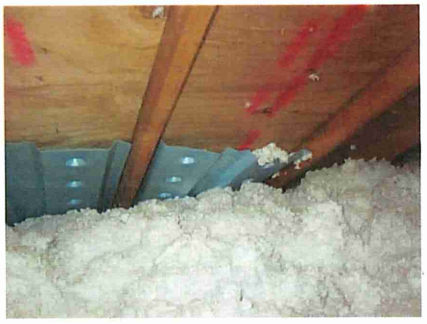
Attic Inspection

The attic was inspected to assess the amount of insulation (R-value) present. Around 14-20" of blown fiberglass insulation was used. A poly vapor barrier was present under the existing insulation.

CONTACT STATION ATTIC	
Insulation Type	Blown Fiberglass
Existing Insulation Depth	14 – 20"
Average R-value Present	*R-50

**Note: Minnesota Rules (MR) 1323 Commercial Energy Code requires an R-30 in the attic (1323.055). Current MN Residential Energy Code requires R-38.*

These results indicate that the R-value in the attic of the contact station is well above the minimum code requirements for commercial buildings and residential buildings.



Contact Station

Records of heating costs for the contact station were used to calculate the average cost per gallon of propane from 2/15/13 – 3/27/14. This calculated cost was used in conjunction with the air leakage rate and annual fuel utilization efficiency (AFUE) of the existing heating system, to calculate the estimated cost per year of air leakage for heating. Results from the blower door test can be seen below.

BUILDING LEAKAGE TEST

Date of Test: 12/12/2014
Customer: DNR - Minneopa State Park

Test File: Contact Station Pre BD
Technician: TM / CC
Project Number:

Building Address: Contact Station
54479 Gadwall Rd
Mankato, MN 56001

Test Results

1.	Airflow at 50 Pascals: (50 Pa = 0.2 w.c.)	1299 CFM50 7.18 ACH50 1.0873 CFM50/ft2 floor area
2.	Leakage Areas:	134.1 in2 Canadian EqLA @ 10 Pa 71.4 in2 LBL ELA @ 4 Pa
3.	Building Leakage Curve:	Flow Coefficient (C) = 102.2 Exponent (n) = 0.650 (Assumed)
4.	Test Settings:	Test Standard: CGSB Test Mode: Depressurization

Infiltration Estimates

1.	Estimated Average Annual Infiltration Rate:		70.5 CFM 0.39 ACH		
2.	Estimated Design Infiltration Rate:	Winter:	119.1 CFM 0.66 ACH	Summer:	106.3 CFM 0.59 ACH

Cost Estimates

1. Estimated Cost of Air Leakage for Heating: $ 215 per year heating
2. Estimated Cost of Air Leakage for Cooling:

Estimated Cost of Air Leakage

The total cost of heating for the contact station from 2/15/13 – 3/27/14 was $1,094.26. This data shows that $215.00 or 19.6% of that cost was due to air leakage through the building envelope. It is unknown what portion of that air leakage is through the ceiling/attic and what portion is through the exterior walls.

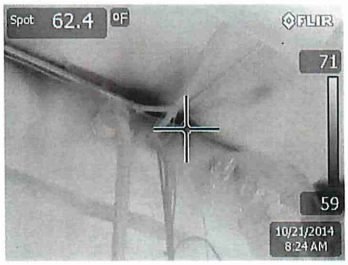
Infrared Images – Contact Station (continued)

An infrared camera was used in conjunction with the blower door to visually identify locations of thermal anomalies that indicate air leakage and deficiencies in insulation. The most prevalent and problematic locations can be seen in the photos on the following page.

1

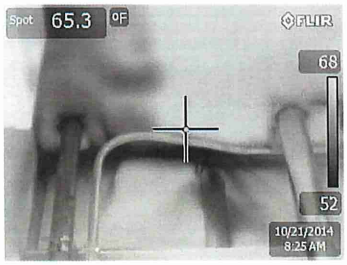
Location: Rear Entry

2



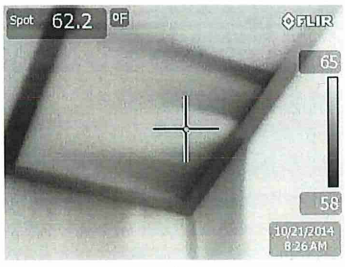
Location: Mechanical Room

3



Location: Mechanical Room

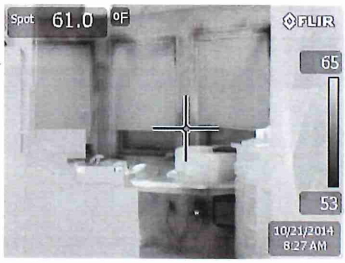
4



Location: Hall

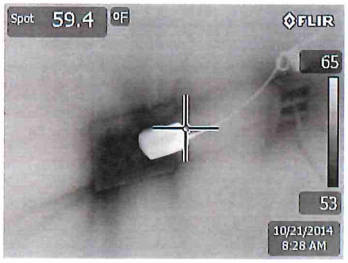
Infrared Images – Contact Station (continued)

5



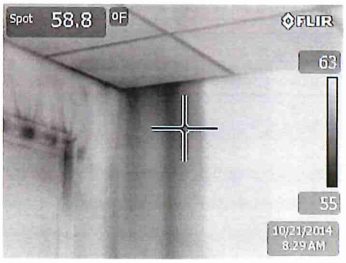
Location: Hall / Office

6



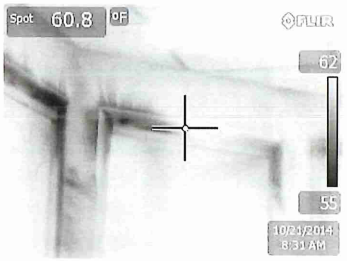
Location: Office

7



Location: Office

10



Location: Front Office

Infrared Images – Contact Station (continued)

11

Location: Hall

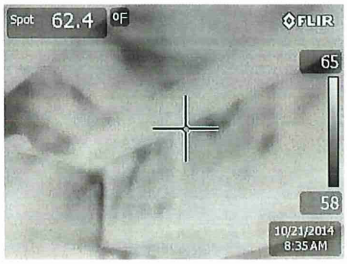
12

Location: Front Entry

13

Location: Front Entry

14



Location: Front Entry

Contact Station

Summary

- Improving the building envelope through air sealing and insulation is not the "lowest hanging fruit" for achieving 15% energy reduction.
  - Existing attic R-value (R-50) is currently much greater than required minimum R-value (R-30).
  - Total air leakage through the building envelope only accounts for an estimated $215.00 of annual heating costs.
- Upgrading the existing 95.5% AFUE high efficiency furnace and electric water heater also leave little room for gaining any major energy reduction.

Recommendations

- Investigate other viable options to decrease overall energy consumption through the use of renewable energies such as solar or wind power.

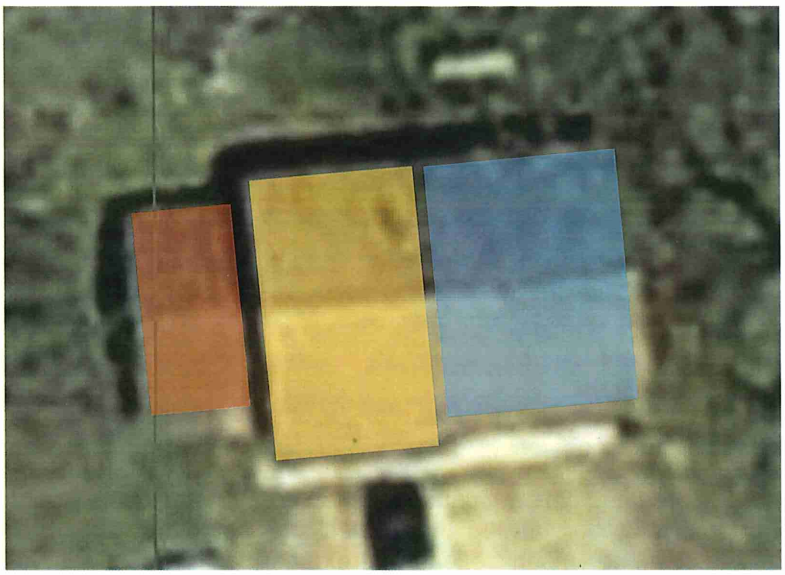
Miscellaneous

Potential structural issues were noted in the attic on the south side (see below). Further investigation from a structural engineer is recommended.



Storage / Shop Building

Parts of the storage and shop building are heated to around 50 degrees during the winter and it is only semi-occupied. It was also a candidate for assessing building performance to determine opportunities for increased energy efficiency through building envelope or HVAC improvements.



Break Room

Heated Shop

Typically Unheated Shop

Storage / Shop Building

Break Room Attic Inspection

The attic above the break room is separate from the attic above the shop. It currently has around 6-8 inches of blown cellulose. A vapor barrier was also identified under the insulation

BREAK ROOM ATTIC	
Insulation Type	Blown Cellulose
Existing Insulation Depth	6 – 8"
Average R-value Present	R-26



Shop Attic Inspection

The shop attic spanned over the heated and typically unheated shop area. Areas of material degradation were identified around the chimney due to improper flashing and roof leaks. A combination of vermiculite, blown cellulose and fiberglass batt were identified. Varying amounts of each were dependent on location. No vapor barrier was observed.

SHOP ATTIC	
Insulation Type	*Vermiculite, blown cellulose, fiberglass batt
Existing Insulation Depth	0 – 8"
R-value Present	R-0 – R-20

**Note: The vermiculite was tested and 0% asbestos was found present in the samples.*



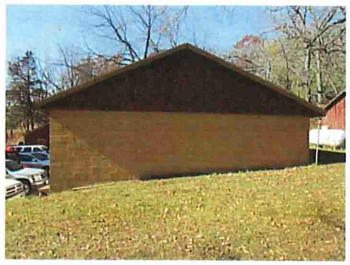



Storage / Shop Building

Building Inspection

The majority of the south shop wall is garage door, making the potential for increasing overall R-value is limited. Additionally, air sealing that area is not applicable and impractical. Only a portion of the north, east and west walls are above grade.






Storage / Shop Building

Summary

- Improving the building envelope through air sealing and insulation is not the "lowest hanging fruit" for achieving 15% energy reduction.
    - Attic insulation is minimal, however areas are only semi-occupied and partially heated.

Recommendations

- Explore other opportunities for decreasing overall energy consumption other than making improvements to the building envelope or heating system of the storage / shop building.