SWIFT COUNTY COURTHOUSE

Benson, Minnesota
Exterior Envelope Assessment

PREPARED BY

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Project Number 13061.00

July 13, 2013

COLLABORATIVE DesignGroup, inc.

Architecture
Engineering
Interiors
Planning

July 12, 2013

Mike Pogge-Weaver
Swift County Administrator
County Courthouse
301 14th Street N
Benson, MN 56215

Re: County Courthouse Exterior Envelope Condition Assessment
CDG Project 13061.00

Mike -

We have completed this Condition Assessment as a supplementary part of the HVAC replacement study, in our role supporting EDI's team. This report summarizes our evaluation procedures along with our observations, conclusions regarding reasonable strategies to resolve the window infiltration issues, and recommendations for repairs.

The services performed in evaluating the windows and walls and in preparing this report have been in accordance with the level of skill and care normally used for this type of project. The conclusions and recommendations discussed in this report are our best professional opinions based on our knowledge of current design and repair of this type of building. No warranties are expressed or implied.

It has been a pleasure to perform this service for you. If you have any questions, or if we can be of further assistance, please feel free to call.

Very truly yours,
Collaborative Design Group

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EXECUTIVE SUMMARY

This condition assessment was originally undertaken to evaluate the condition of the exterior walls of the Swift County Courthouse, discuss their impact on mechanical (HVAC) service, and to discuss appropriate repairs. Preliminary observations of the Courthouse revealed significant concerns regarding the performance of the windows. Evaluation of the windows was, therefore, a prime focus of our assessment.

A building is a working system comprised of many components. Repairing selected elements of the envelope without addressing other parts of the building that may contribute to the condition being evaluated may result unsatisfactory resolution of the original problem being addressed.

Overall, the condition of the windows and window sills is considered acceptable. However, there are significant issues with poor fit of sashes in openings, gaps at material joints, and widespread air infiltration issues. The wood window stops, sealant and trim are themselves generally intact, but the way they come together to form a system is poor. The principal effect of this poor fit is on the comfort of the occupants (drafts, cold spots, etc.). The air infiltration occurring at the assemblies has an effect on the efficiency (and operating cost) of the HVAC system as well.

Options and requirements for envelope assembly improvements include the following:

1. Improve the windows. The two window options are:
    a. Reconstruct the existing system, replacing damaged and ill-fitting components. Augment sashes with additional weatherstripping and sealants. Determine which windows will likely be operated and repair / improve function. Consider more aggressive sealing of non-operating units (e.g. courtrooms).
    b. Replace the windows with new aluminum clad wood sash windows, with thermal pane insulated panes of glass.
2. New through-wall flashings should be installed as part of any window replacement.
3. Cleaning and re-pointing selected areas of the exterior should be planned as an asset preservation-level project. Sealing of existing penetrations and joints in materials to prevent air and water infiltration should proceed as part of the HVAC work.

Not part of the exterior envelope *per se* but critical to the improved function and efficiency of a new HVAC system is the construction of an insulated space in the existing attic to house the new gear. This area would not be a “room” in the conventional sense, but rather a framework to hold insulation that would form a space around the equipment. It is important that the existing historic roof structure and decking not be insulated directly, as this would create a “hot roof” unvented condition under the slate, leading to condensation, rot, and deterioration and eventual failure of the roof.

A detail of this suggested assembly is provided as part of the larger HVAC report. However, a line item for this work is included in the budget discussion section at the conclusion of this document.

The return-on-investment period for any work should be evaluated in more detail as plans progress. Any work planned should be performed in conjunction with the HVAC work presently under consideration to maximize economies of scale.

INTRODUCTION

The historic Swift County Courthouse was constructed in 1897. The entire structure is built of masonry mass walls with timber roof framing. The use of the building remains much as when first occupied, with county offices, courts, and other public services still occupying their original spaces. The building's original windows have been replaced with metal-clad wood sashed replacement units. Dropped ceilings have been installed in most offices, with the now-blocked upper window transom glass changed out for panels, forming a plenum space.

The purpose of this study is to understand the condition of the exterior envelope of the building, as it affects the HVAC performance of the facility. Particular attention was paid to the window assemblies, which are known to have fit and performance issues. Other exterior conditions needing maintenance-level attention were noted and are included in this discussion.

The Law Enforcement Center (LEC) was constructed as a relatively recent addition to the west side of the historic Courthouse, with a one-story connecting link. Review of this portion of the complex was not included as part of this study.

SCOPE OF REPORT

Review of Documents

No original design drawings of the Courthouse were available for review. Re-roofing documents of recent vintage were used to develop background drawings for this report.

Observations

Two site visits were performed to observe the condition of the building, in May and July of 2013. The following rating system was used in assessing the condition of the building components:

- Excellent: The building component is new, with no apparent defects.
- Good: The building component is able to perform its originally intended function in its current condition. Any defects are minor and do not affect the performance of the building component.
- Poor: The building component is unable to perform its originally intended function in its current condition. The component has major defects, but is repairable.
- Unacceptable: The building component is unable to perform its originally intended function in its current condition, and cannot be economically repaired. Replacement of the building component is required.

Visual observations of the building are recorded below.

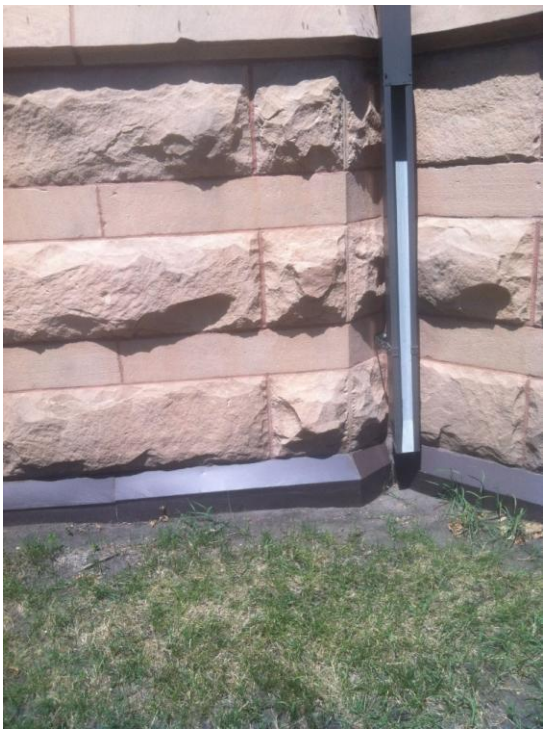
EXTERIOR OBSERVATIONS

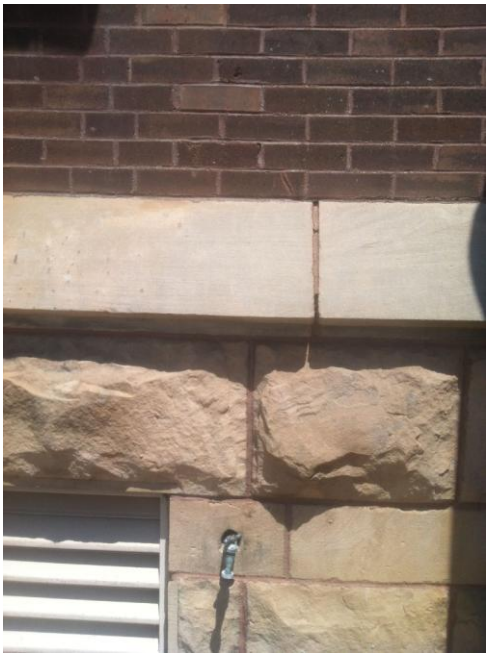
OBSERVATIONS	REFERENCE PHOTO
View of the south and east walls of the courthouse. The building is in excellent shape and has been very well maintained. The building has been repointed at least once, and original windows were replaced with clad wood sash single hung units. Slate roof is recent. Note panel infill at former transom windows (above canopies). Significant historic construction from several eras is present and in good condition.	 

OBSERVATIONS	REFERENCE PHOTO
Previous repair work has been effective, though not always discrete.	
The leaking roof of the porch is a serious concern. The original wood ceiling and brick walls are deteriorating due to the volume of water passing through the roof assembly.	

OBSERVATIONS	REFERENCE PHOTO
The perimeter sill flashing, covering the stone base of the wall, is in need of isolated patching and replacement of joint covers.	
Sill Plashing has been displaced due to lawnmower action, and should be replaced.	

OBSERVATIONS	REFERENCE PHOTO
The water-table stone coursing and the rusticated base stone are in need of repointing with appropriate mortar.	
Along the west elevation, where the base course is not covered by flashing, the limestone foundation has deteriorated. This condition should be repaired..	

OBSERVATIONS	REFERENCE PHOTO
Many rain downspouts do not have kickers / diverters to move the water away from the building. Scouring is visible at base of wall where water is percolating into soil immediately adjacent to walls, potentially entering the building,	
Normal micro-erosion of brick was observed in some locations at top of belt course, where water vapor exits the wall assembly. This is normal for a 100+ year old building, and is not a concern unless it starts to accelerate.	

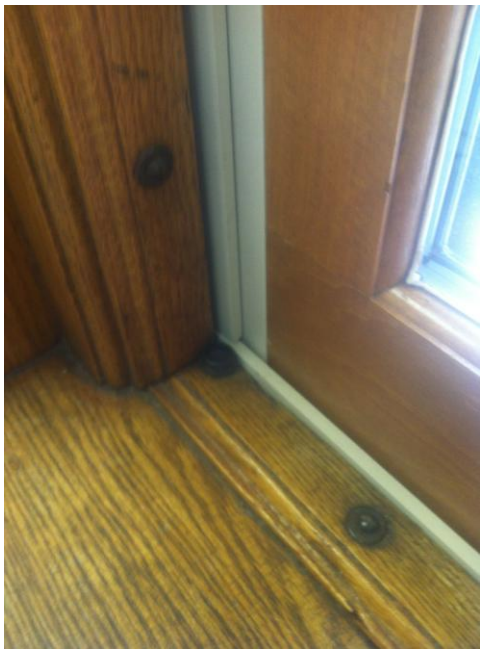
OBSERVATIONS	REFERENCE PHOTO
Note open penetration at hose bib. This opening should be sealed. Open joints at water-table should be repointed.	
Openings through wall at outlet boxes and conduits should be resealed.	

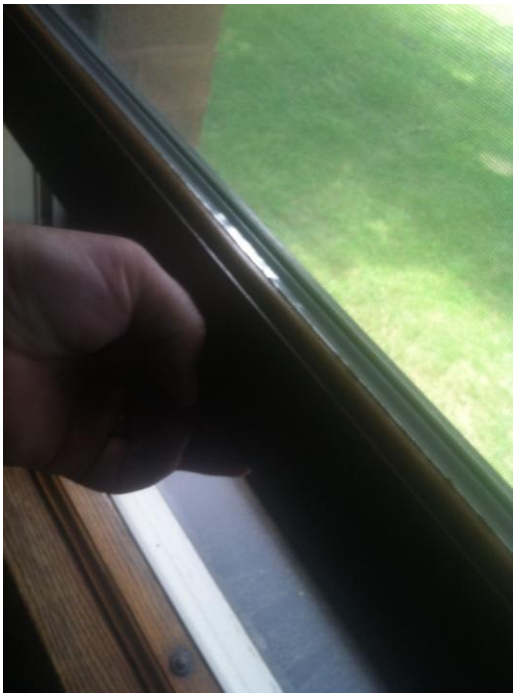
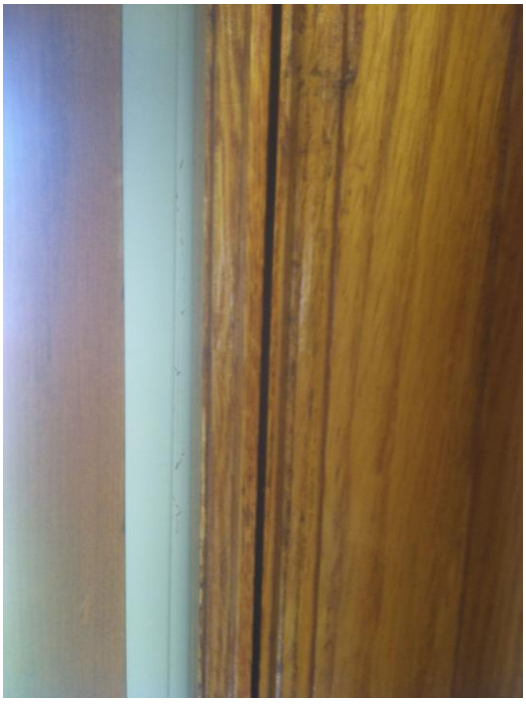
OBSERVATIONS	REFERENCE PHOTO
Previous repair work under lip of water-table was well done, but is near life expectancy and should be redone at time of water-table repointing.	
Stone steps should be reset and repointed. Step stone slabs are in excellent condition.	

OBSERVATIONS	REFERENCE PHOTO
Efflorescence on porch columns is due to water flow from roof leaks on porch. This should be cleaned off after roof repairs.	
View of porch roof, showing significant displacement of ballast due to forceful water flow. Roof is beyond life expectancy and leaking in several places.	

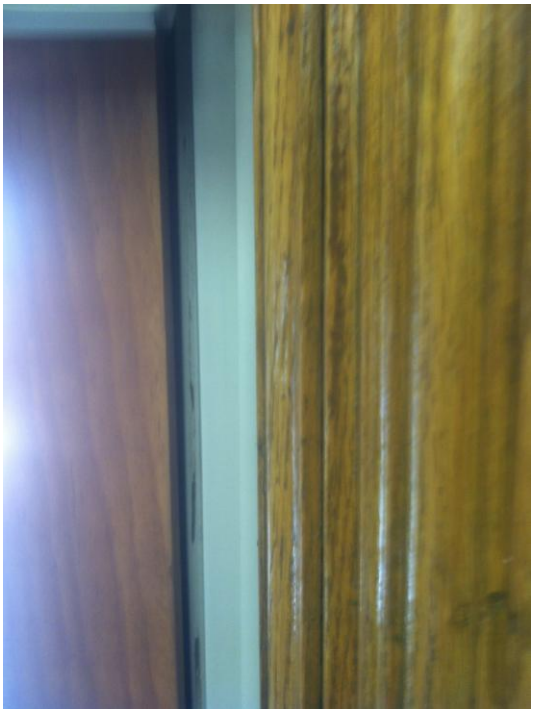
OBSERVATIONS	REFERENCE PHOTO
Roofs of bays at County Board room and Registrar's office are metal of recent vintage, and in excellent condition.	

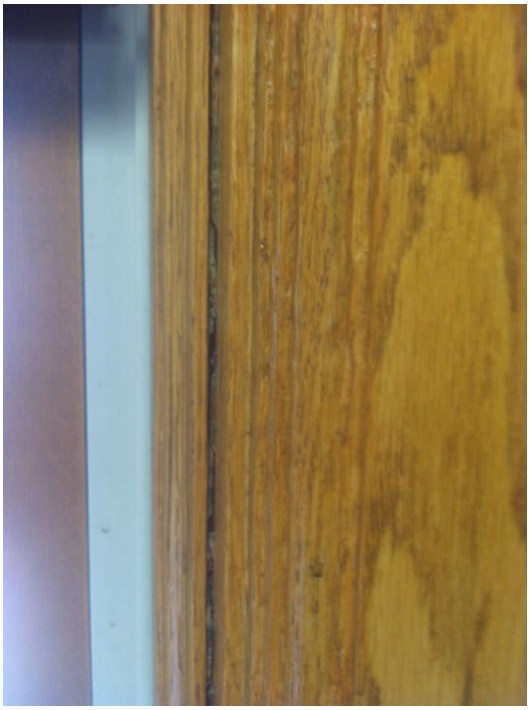
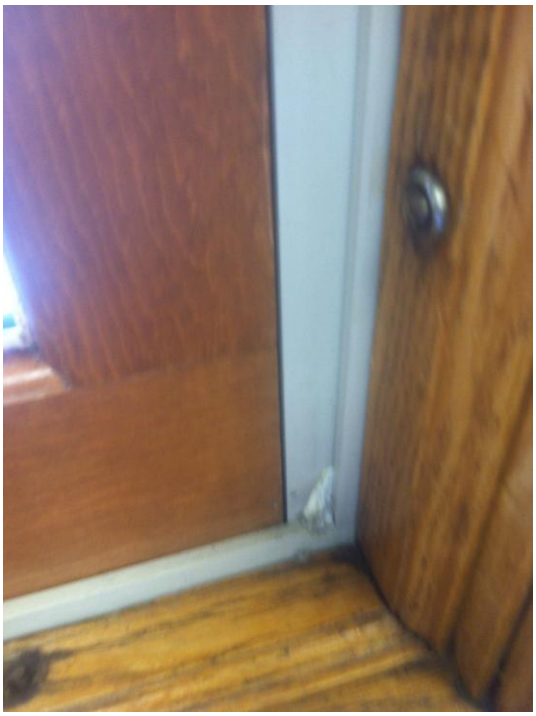
WINDOW OBSERVATIONS

OBSERVATIONS	REFERENCE PHOTO
Replacement window units were installed with minimal disruption to historic wood trim. However, gaps between new windows and original construction are very common.	

OBSERVATIONS	REFERENCE PHOTO
Many sashes do not hold position when opened, and require blocking or other materials to be used. Staff stated a general preference for operable windows, though a relatively low frequency of use.	
Gaps at existing assemblies are common. Many stops are loose and can be finger-tightened.	

OBSERVATIONS	REFERENCE PHOTO
Coverstock paper can be inserted into gaps in most window assemblies.	
In some cases the Coverstock can be inserted entirely though the assembly to the outside.	

OBSERVATIONS	REFERENCE PHOTO
Gaps at sash / track / frames are typical.	
Gaps at sashes often reach one quarter inch.	

OBSERVATIONS	REFERENCE PHOTO
Typical loose assembly – historic woodwork in need of re-setting.	
In some instances staff members have attempted to seal windows with paper or other materials.	

OBSERVATIONS	REFERENCE PHOTO
Windows in vaults have original steel shutters in place. Shutters are still routinely operated. Where infiltration at windows is significant when shutters are closed, temperature swings and moisture have caused deterioration of finish on historic millwork.	
Some locations on the second floor have aluminum replacement windows that do not match typical wood sash units. These units appeared to be in good condition. Some units have become more difficult to operate but are otherwise intact.	

OBSERVATIONS

Replacement windows on third floor at main stairway are modern awning-style units. Exterior patching indicates significant reconfiguration was done to windows in this area at some time in the past. These windows are in excellent condition.

REFERENCE PHOTO

Non-Destructive Testing: Thermal Imaging

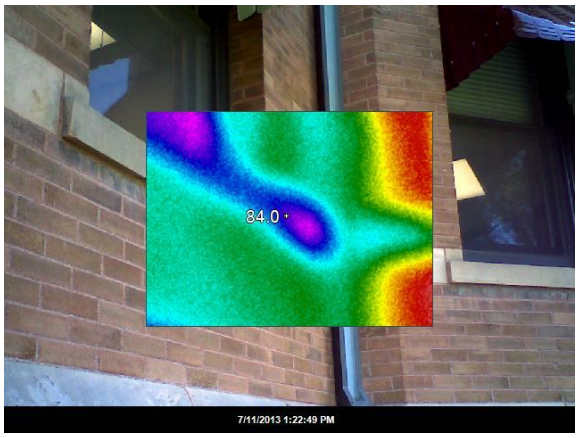
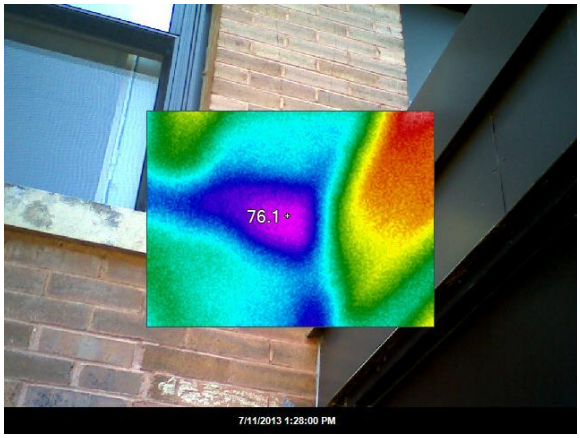
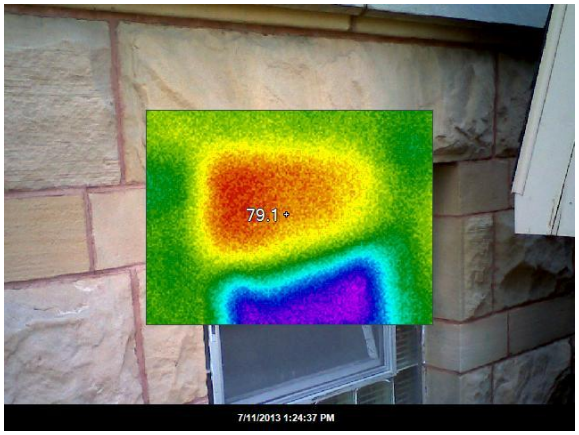
Thermal imaging was performed on the exterior of the building to determine if cold air or water vapor is condensing within the wall assembly of the Courthouse during air-conditioning season. Condensation and/or artificially cooled materials within this assembly would show up as a lower temperature reading than the surrounding material temperature.

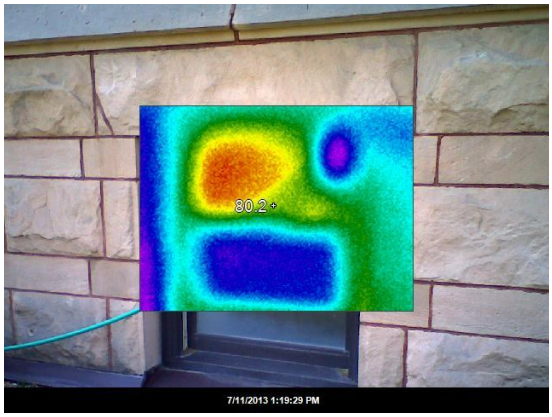
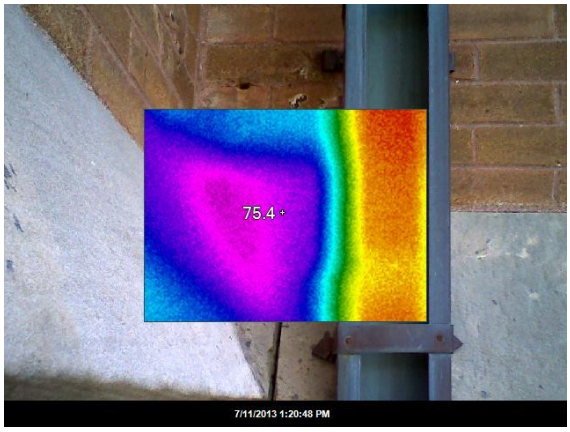
The imaging did reveal isolated anomalies that suggested cold air is escaping from the air-conditioned interior into the exterior walls, principally at windows. It is anticipated that this infiltration / leaking occurs year-round, with warm air exfiltrating / cold air infiltrating the building during the winter.

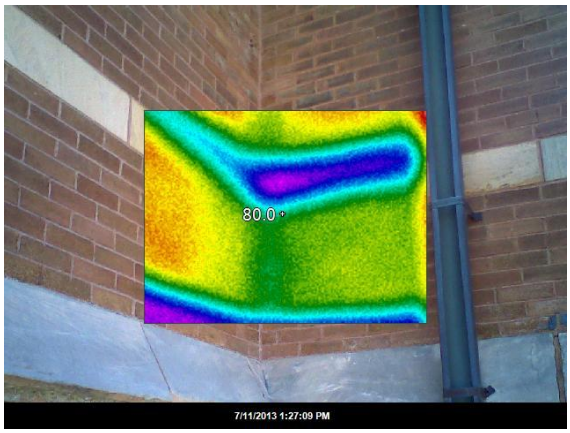
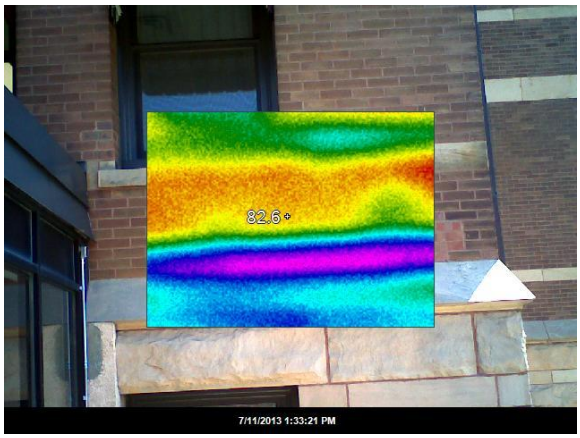
The plenum spaces created by the addition of dropped ceilings exhibited a significant temperature differential from the spaces adjacent. As these are unconditioned spaces, this is not surprising. Consideration should be given to better venting or conditioning these spaces to the interior rooms, and installing insulation at the transom panels, to improve the thermal inertia of the building as a whole.

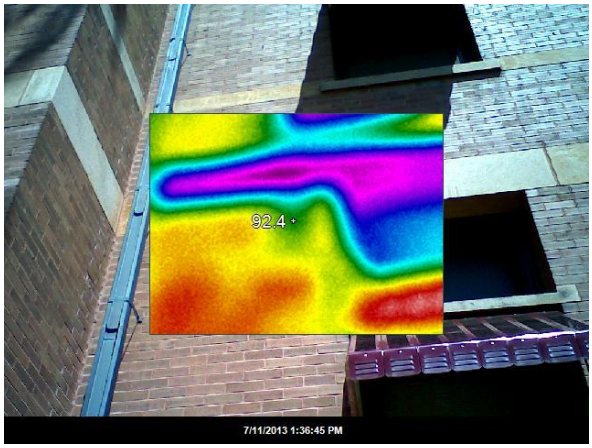
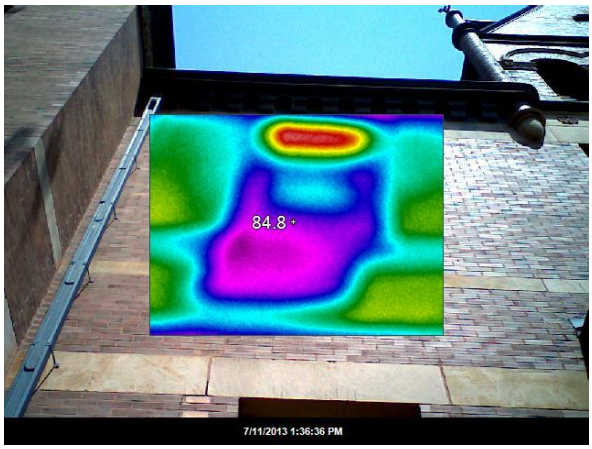
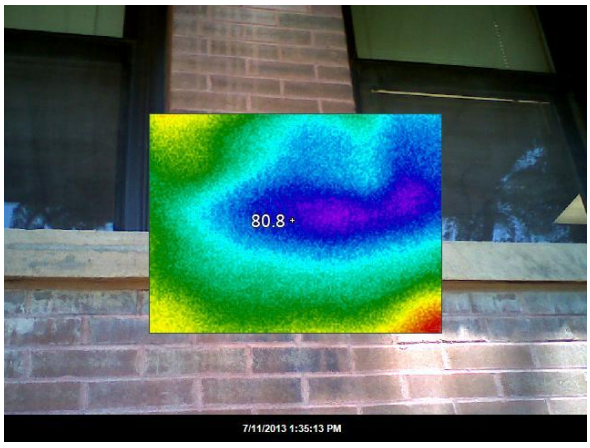
Anomalies showing temperature differentials at windows, roof vents, lights, etc. were observed; all were typical of what was expected at the locations and are not generally a source of concern. Isolated instances of potential moisture in the mass walls were observed. These cases were generally associated with the building's sandstone belt course and water-table course, locations where it is normal for environmental moisture to work its way down and out of the brick courses above.

Note regarding interpretation: Colors in thermal images indicate relative temperature differential. Cooler areas are illustrated in blues and magentas, with warmer areas showing as yellow and red.

THERMAL IMAGE	OBSERVATIONS
	Wall at NE corner of Registrar's office. Note cool spot trailing away from first floor window into wall mass, indicating exfiltration.
	Wall adjacent to County Board Room. Detail view of cold spot in wall adjacent to first floor window.
	Lower Lever window, north elevation. Note "hot" plenum showing at transom panel location.

THERMAL IMAGE	OBSERVATIONS
	Typical window assembly, north elevation. Note “hot” plenum showing at transom panels against relative coolness of sandstone.
	Northeast corner, Lower Level Men’s Room window: Note “hot” plenum, and cold air leaving the building at unsealed hose bib penetration through window sash. 
	Northwest corner. Cold area indicating likely air / water infiltration at penetrations.

THERMAL IMAGE	OBSERVATIONS
	Northwest corner. Note cool area of sandstone caused by moisture migration out of wall.
	Southwest corner. Typical wall assembly showing cool belt course.
	Typical wall assembly (South elevation). Note cool window and cool belt course.

THERMAL IMAGE	OBSERVATIONS
	Typical wall assembly (South elevation). Note cool window and cool belt course.
	Typical wall assembly (South elevation). Note cool window with hot transom panel.
	Typical window (South elevation). Note cold spot associated with exfiltration of cold air.

DISCUSSION AND CONCLUSIONS

General Discussion

This study focused on a general observation of the condition of the exterior walls and windows of the Courthouse. The unsatisfactory condition of the window assemblies was investigated in more detail.

Our assessment included a creation of background elevation drawings, visual observations, and an infrared scan of the building exterior.

Conclusion

The exterior brick walls are in admirable condition for their age. It is clear that the County has performed timely maintenance and kept the building in good order. Normal maintenance tasks should continue on a regular, scheduled basis.

The windows, as a system, are in marginal condition. The sashes and other components were well made and as isolated parts are in excellent physical condition, but the way they are put together, with gaps and ill-fitting or non-functioning mechanisms, creates an inadequate assembly. This poor fit is the source of the personal comfort-oriented issues that building occupants experience due to drafts and infiltration.

A contributing factor to the draft issues may be the nature of the building itself. On windy days, an air pressure differential between inside and outside is created due to the impervious mass walls. This puts additional stress on the windows as a "path of least resistance" for air infiltrating or exfiltrating to equalize the pressure.

Of interest in our findings was the "hot" plenum condition evident in the thermography. This situation causes a loss of HVAC efficiency, as it allows a temperature differential path from exterior into the heart of the spaces.

Recommendations

The windows should be repaired and retrofitted with sealant and weatherstripping. Gaps at sashes should be minimized. Windows that will not be operated (e.g. courtrooms) can be more securely sealed. Additional sealing and repair should be done at the original window casings, which in many cases have worked loss and now allow additional drafts.

We recommend repairing the existing masonry walls, where necessary. Most immediately, the water-table course should be repointed along with overall spot repointing as required. Penetrations at pipes and conduits should be sealed, and the metal base flashing should be repaired as necessary.

The HVAC renovation should include provisions for pressure equalization interior / exterior in any new system. This is a minor aspect of the normal fresh air intake system.

Note: another option is to replace the windows entirely. This strategy would result in much improved window performance and human comfort; however, the very significant expense of this option would result in a very long "payback" period that would exceed the likely life of the new window units themselves. At this time we do not recommend pursuing this option,

Priorities and Estimated Costs

The study of the Swift County Courthouse was initiated to help understand the apparent condition of the exterior and windows, any deficiencies and their sources, and to prioritize repairs. We believe that retrofitting the windows will greatly reduce the human comfort issues, though not completely eliminate them. The following are the most immediate priorities and include the insulation work previously discussed in relation to the largest priority at this time, the HVAC system:

1. Construction of attic insulation shelter for HVAC equipment.
2. Retrofit the windows.
3. Insulate the plenum transom panels at windows with rigid insulation panels.
4. Seal existing penetrations and repair flashings.
5. Clean and re-point exterior brick veneer areas such as the water-table.

The following cost estimates are for budget purposes. The estimate for the windows assumes retrofitting in place, without significant reconstruction. The work should be considered overall as one project if possible, for mobilization and overhead-related cost efficiencies, but each project could be implemented independently.

Description	**Estimated Cost**
Construction of insulated shelter in attic for HVAC equipment	$ 45,000
Window retrofitting ($150/window allowance)	$ 16,800
Insulation of transom panels	$ 6,000
Exterior sealant and repairs	$ 2,500
Masonry repairs and tuckpointing	$ 25,000
Sub Total	$ 95,300
Contingency, 20%	$ 19,060
Fees, 8%	$ 9,500
Total	$ 123,860