IN THE COURT OF CLAIMS OF OHIO

GRAND VALLEY LOCAL SCHOOL DISTRICT BOARD OF EDUCATION, et al.,	)	
Plaintiffs,	)	
vs.	)	Case No. 2014-00469-PR
BUEHRER GROUP ARCHITECTURE & ENGINEERING. INC. et al.	)	Judge Patrick M. McGrath
Defendants,	)	

AFFIDAVIT OF ERIC MOSER

STATE OF OHIO)
) ss
COUNTY OF FRANKLIN)

Now comes, Eric Moser, first being duly cautioned and sworn, says and deposes the following:

1. I have personal knowledge of all the matters set forth in this Affidavit.

2. I am employed by the Ohio Facilities Construction Commission, ("OFCC") as a Post Construction Administrator.

3. I am the Post Construction Administrator for OFCC assigned to the remediation work at the Grand Valley Local School District K-12 new school ("Project"). The remediation work on the Project involves a re-roof, masonry work and parking lot work.

4. As the Post Construction Administrator assigned to the Project, I am responsible, on behalf of the OFCC, for the oversight and implementation of the remedial Project on behalf of the OFCC.

5. The Grand Valley K-12 Project was originally completed and occupied in late

2005. The parking lot remediation was completed subsequent to the occupation date.

6. The original architect with design responsibilities for the building and the parking lot was Buehrer Group Architecture & Engineering, Inc. ("Buehrer").

7. Subsequent to occupation, the Project began experiencing water infiltration and roof issues which were handled under the roof warranty. The Project also began to experience issues with the failure of the pavement in the parking lots.

8. The roof issues which were observable at the time included water infiltration and buckling of shingles throughout the roof.

9. The Co-owners retained a roofing consultant, Construction Resources Inc. ("CRI") to examine and evaluate the roofing system.

10. CRI issued its report on July 19, 2011. Attached to this Affidavit as Exhibit 2 is a copy of the CRI Report. Among other things, the CRI Report recommended the Co-owners retain an engineer to evaluate the design of the Project.

11. As the Post Construction Administrator responsible for the files of the Grand Valley remedial Project, I certify that Exhibit 2 attached to this Affidavit is a true and accurate copy of the CRI Report issued July 19, 2011, taken from the public files of the OFCC.

12. Based on the recommendation of CRI, the Co-owners retained I A Lewin PE & Associates ("Lewin") to evaluate the design. Attached as Exhibit 3 to this Affidavit is the Report of Lewin issued October 17, 2011. The Lewin Report found a number of design errors or omissions in the design work of Buehrer.

13. As the Post Construction Administrator responsible for the files of the Grand Valley remedial Project, I certify that Exhibit 3 attached to this Affidavit is a true and accurate copy of the Lewin Report issued October 17, 2011, taken from the public files of the OFCC.

14. The successor company to the construction manager on the Project engaged EDP Geosciences ("EDP") to evaluate the distressed pavement at the Project. EDP issued a report on June 13, 2011, with respect to the causes of the distressed pavement. The EDP Report found that one of the causes of the pavement distress was the lack of underdrains included in the design of the parking lots.

15. As the Post Construction Administrator responsible for the files of the Grand Valley remedial Project, I certify that Exhibit 4 attached to this Affidavit is a true and accurate copy of the EDP Report issued June 13, 2011, taken from the public files of the OFCC.

Further Affiant sayeth naught.

Eric Moser

Sworn and subscribed before me on this 10 day of June 2014.

Notary Public

NOTARIAL SEAL STATE OF OHIO

PAMELA A. MORTIMER (schaal)
Attorney at Law
Notary Public, State of Ohio
My Commission Has No Expiration
Section 147.03 R.C.

Date: July, 19, 2011

To: William Nye
Superintendent
Grand Valley Local Schools

From: Bud Griffith
President
Construction Resources, Inc.

Re: Grand Valley Local Schools Roof Study

Grand Valley Local Schools is located at 111 Grand Valley Avenue West in Orwell, Ohio. The new K-12 School Building began construction in 2004, based on drawings created by the Buehrer Group Architecture & Engineering Inc. This study was performed to examine the existing components of the roof system, the condition of those components, and investigate what may be causing the reported leaks. As part of this investigation a partial set of the original drawings set was reviewed, as supplied by the Client. Based on this information the summary and recommendations in this report have been developed.

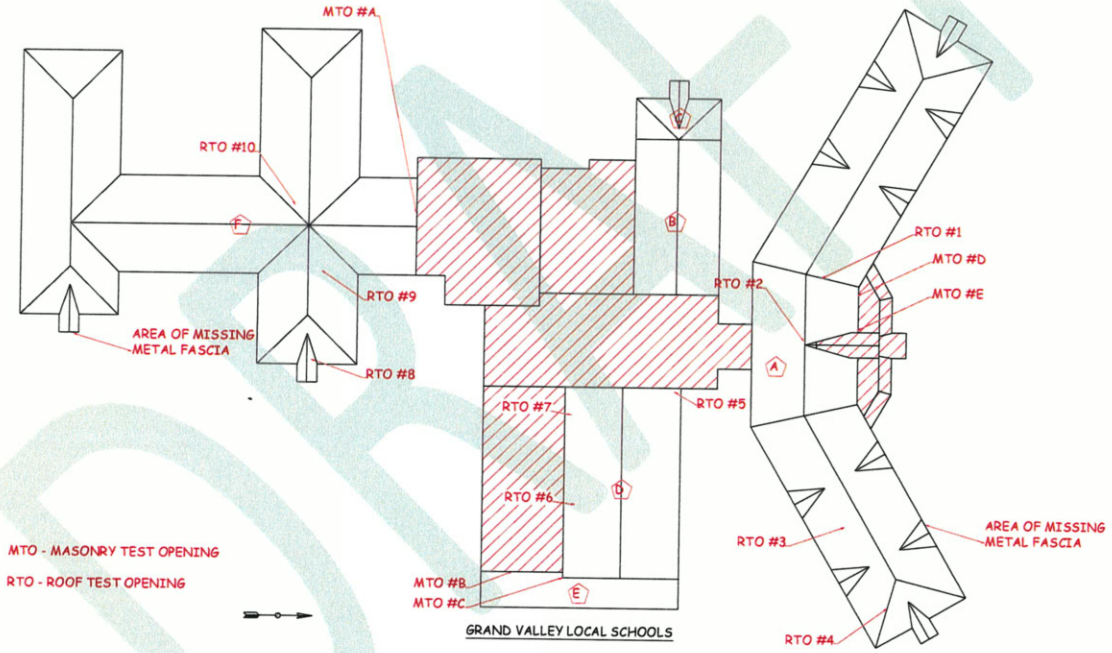
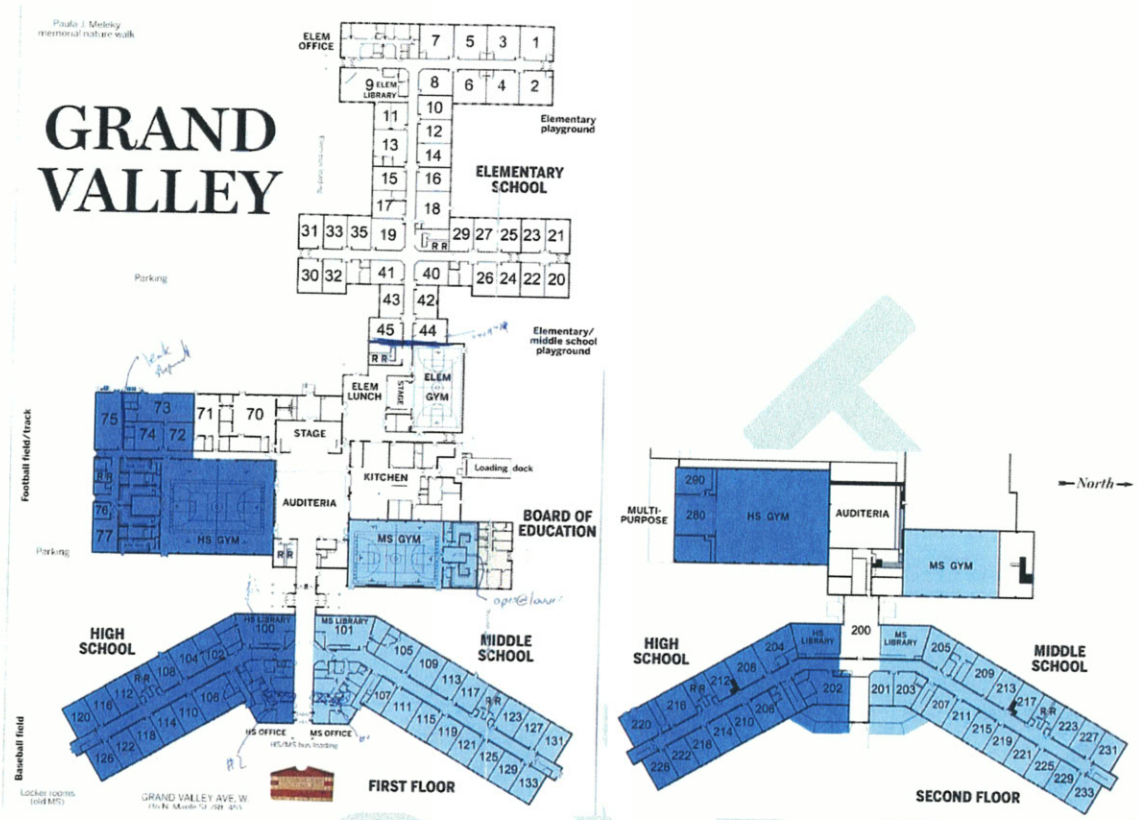


EXHIBIT 2

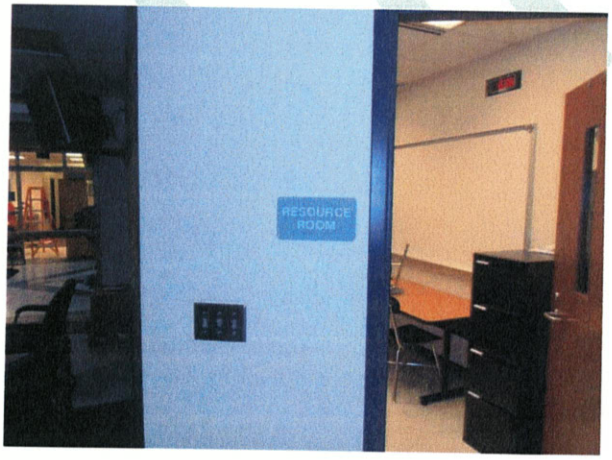
Following is a floor plan supplied to us by the Client:



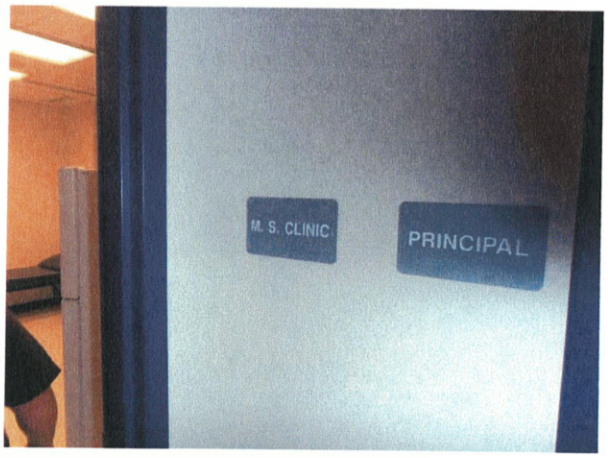
Areas of Leaks

Below are interior photos of a partial list of locations supplied by the Client of what are believed to be roof leaks:

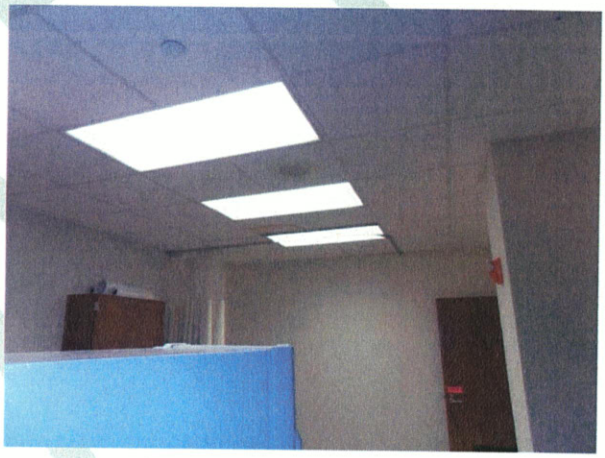
Middle School Office Resource Room



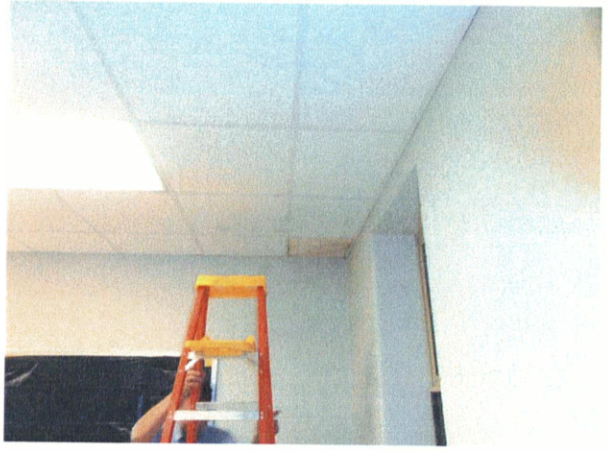
Middle School Clinic



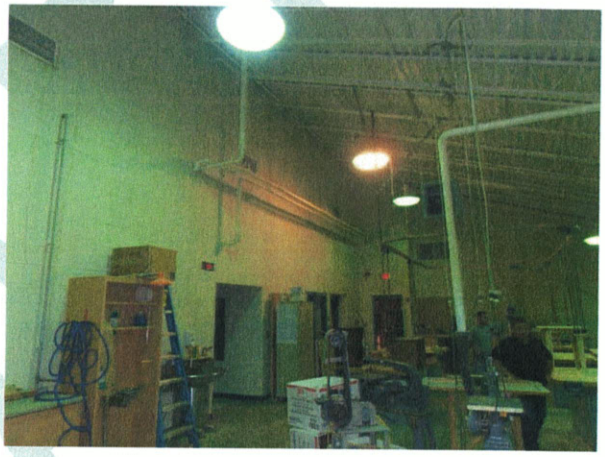
High School Clinic

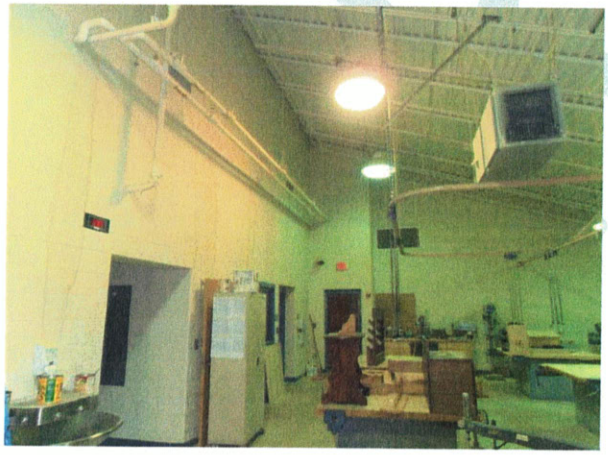


Room 215



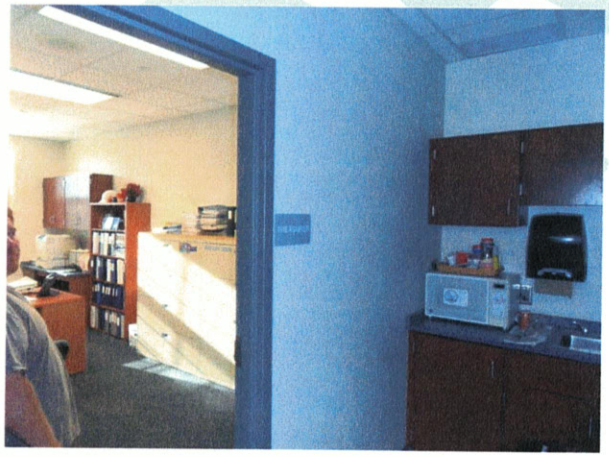
Room 75

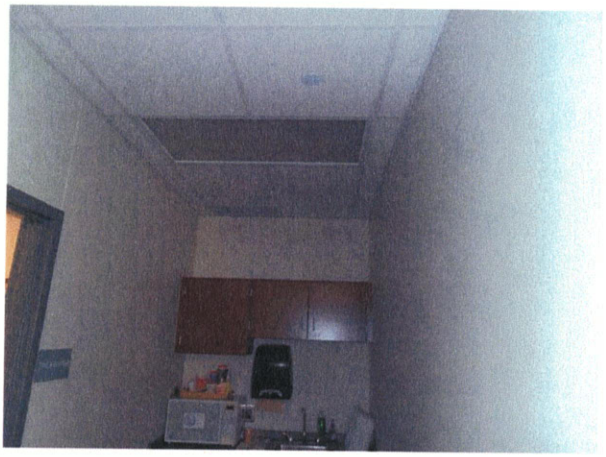


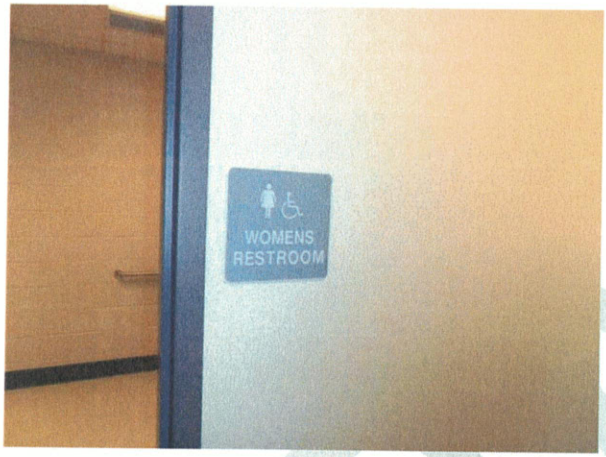


Room 44

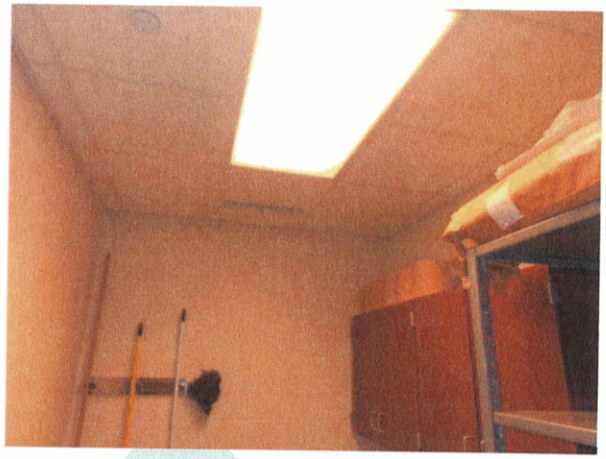
Rooms below Roof C





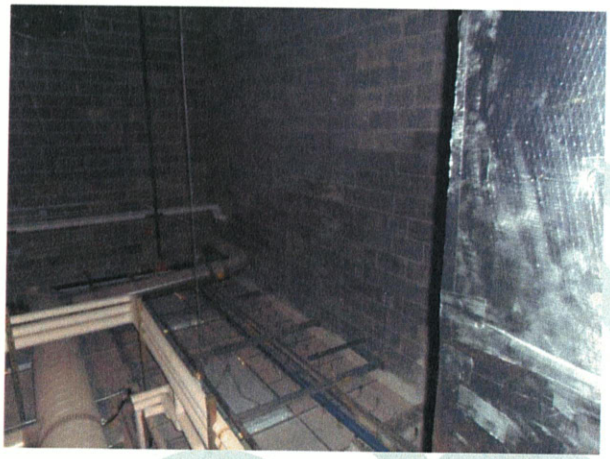

WOMENS
RESTROOM

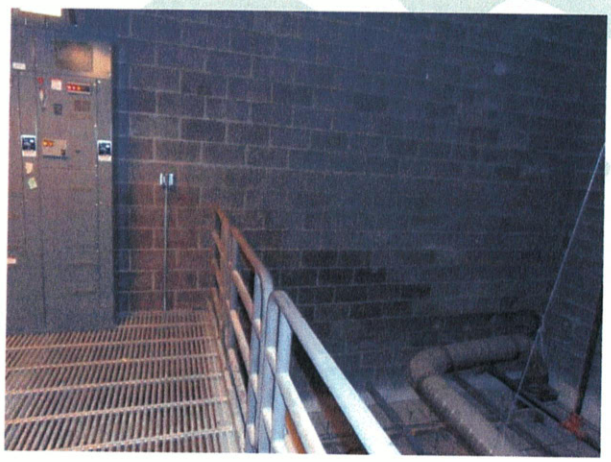

MENS
RESTROOM



Wall below Roof B and above Roof C –

Note that this moisture entry follows the roof line of Roof C where open mortar joints were observed.





Roof Test Openings

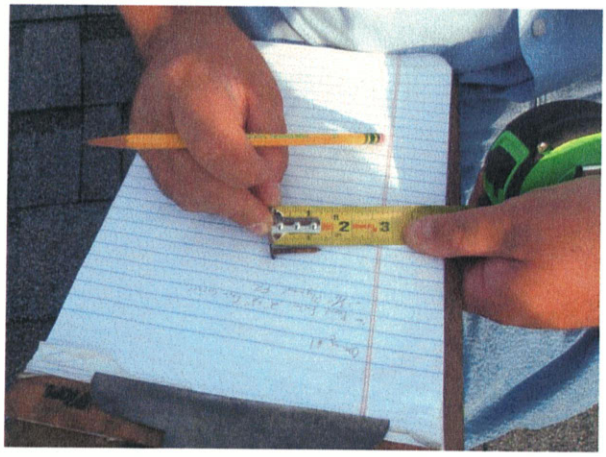
On July 6, 2011, with the assistance of Terik Roofing, roof openings were made as part of the investigation.

Roof Test Opening #1

RTO #1 was located the east face of the eastern most building section, at the closed valley north of the skylight. This area was chosen to view the construction of the closed valley and also due to the deflection present in the surface of the shingles.

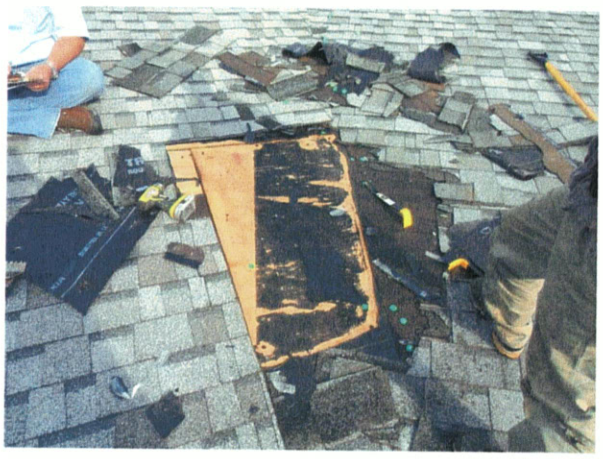
Once the shingles and underlayments were removed it was observed that the plywood of the vent board was curling and bowed.

The nails used to secure the shingle at the site of the opening were measured to be 1.25" long and appeared to be chromium coated and rusting. Note that Ohio Building Code requires fasteners to be made of galvanized steel, stainless steel, or copper.



The fasteners used to secure the vent insulation board and underlying insulation were measure to be 6" long which was adequate to penetrate the upper rib of the steel deck

The shingles were then removed to expose the valley adjoining the area. Once the shingles were removed it was observed that a layer of bituthene was centered over the valley extending approximately 18" to either side of the valley. This condition meets Ohio Building Code requirements.



Over the plywood substrate, a combination of #30 felt and synthetic underlayment was present. The felt was observed to have been installed on the north side of the valley and the synthetic underlayment was present on the south side. The synthetic underlayment was observed to be Tri-Flex 30 Roof Underlayment. Both underlayments were secured in place with plastic cap nails.

Once the underlyaments were removed the fasteners were backed out of the plywood and it was observed to be no longer attached to the EPS blocking. Note that evidence of past moisture was present on the facer of the polyisocyanurate insulation of the vent board.

The removed plywood was viewed and it appears to be Hoover Pyro-Guard fire treated ¾", 4-ply plywood.

The plywood was observed to be tightly abutted at the valley. The Vent Board manufacturer requires a ¼" gap to be present between the plywood to allow for expansion. This does not appear to have been created and may be contributing to the deflection observed in the plywood substrate.

An approximate one gap was present in the valley between insulation boards creating a point of excess heat loss. In this system, the insulation board is meant to be tightly abutted in all details to create a complete insulation system. This gap in the insulation board could be contributing to the formation of ice damming.

Once the polyisocyanurate board portion of the vent board was removed it was observed that an apparent biological growth on the facers of insulation.

Past moisture stains were also observed on the underside of the bottom layer of insulation.

The bottom layer of insulation was removed and it observed that there was evidence of past moisture present in the low ribs of the deck.

The fasteners securing the sheet metal valley between sections of deck had pulled out and were displaced. This could be a sign that excessive movement is occurring. It is recommended that a Structural Engineer evaluate this Building and its roof system in relation to this apparent lack of expansion capability.

The valley closure was cut back on the north side of the valley. It was observed that there was a 1.5" gap between the decks on either side of the valley. In addition, a ¾" gap was present between the trusses at the valley.

Roof Test Opening #2

At RTO #2, located on the north wing of eastern building, the ridge was opened. First the cap shingles were removed and then the ridge vent was removed.

The opening present at the plywood of the vented R-board was approximately 2.5". It was noted that the insulation was not mitered at the ridge. Again, this reduction in insulation at the ridge is an improper installation and will contribute to heat loss.

The ridge vent appears to have been originally secured with nails that measured approximately 1.25" long. These appear to be the same nails used to secure the shingles and are not long enough to secure the vent to the deck and penetrate a minimum ¾". Areas of replacement shingles were observed to have been secured with 2.5" nails.

Roof Test Opening #3

RTO #3 was created on the west side on the southern wing of Roof A. The location was chosen due to the pronounce bowing present below the shingles.

At the site of test area it was observed that nails securing the shingles were exposed in areas and that they were also rusted.

In addition, a shingle was observed to be torn at the test area, which may have been caused from the lack of expansion capability in the roof system.

Once, the torn shingle and the underlying synthetic underlayment was removed the plywood was exposed. At this test opening the underlayment was the synthetic Tri-Flex 30 underlayment.

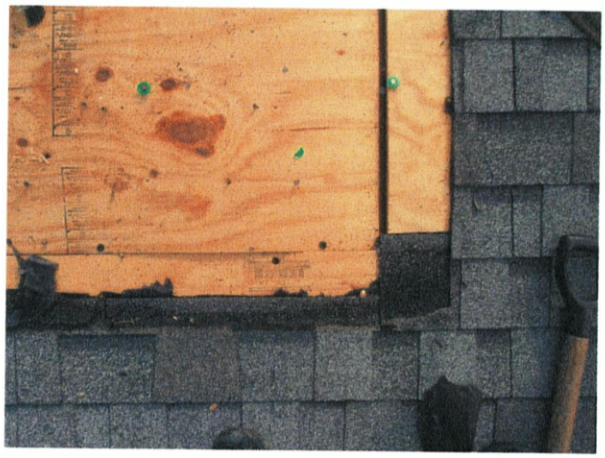
At this location the plywood was cracked and plates and fasteners were installed through the deck in an apparent attempt to flatten out the plywood. It is unknown when the fastener and plate was installed, since it was installed through an underlying shingle.

The shingles and underlayment were removed to expose a 4'x8' vent board that was installed with the 8' side of the board parallel with the gutter.

This board was secured with 18 fasteners. The fasteners were installed in 3 equal horizontal rows of 5 with 3 additional fasteners installed at the crack in the plywood. Based on the Manufacturer literature reviewed 15 fasteners would be adequate to secure the board.



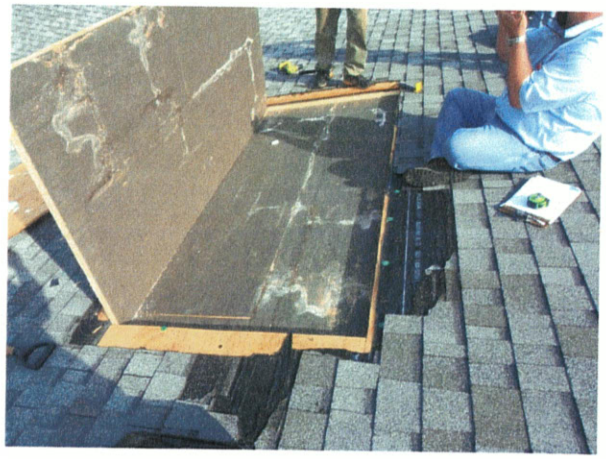

It was observed that a ¼" gap was present along the top of the board and no gap was present along the bottom of the board. Approximately 1/8" to ¼" gaps were present along the sides of the board, but these gaps appeared to be due to the warping of the board. A 1/8" gap should be consistent around the perimeter of the board based on the literature reviewed from Atlas.

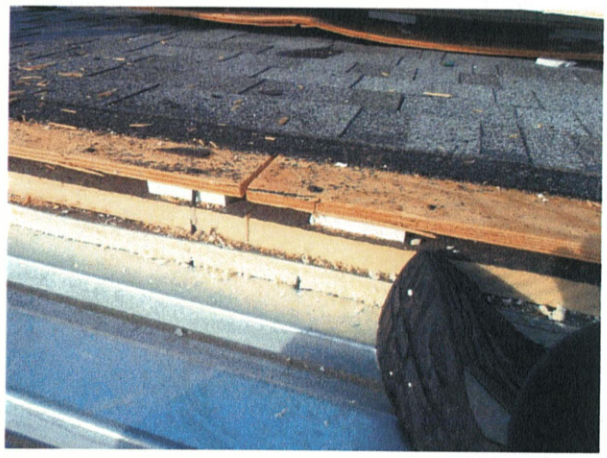
Once the fasteners were removed the plywood warp of the board was more pronounced.




Significant staining was present on the facers between the vented board and the underlying 1.5" polyisocyanurate insulation board.

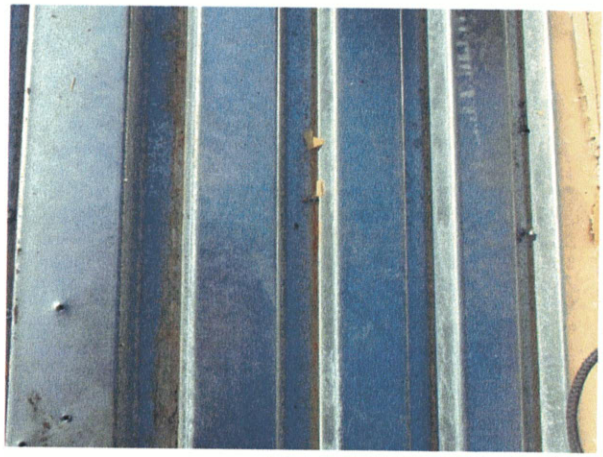



It was observed that the NTB fasteners were installed near the edge of the plywood and also installed at an angle. This appears to have been done to ensure that the fastener would catch the upper rib of the metal deck. This placement of the fasteners is not in accordance with the Manufacturer, who states that the perimeter fasteners should be placed 3" to 6" from the edge of the board. A diagram of proper placement has been included later in this report.



Minor surface rust was observed to be developing in the low ribs of the deck. This could have been present during construction of the building.

It was also observed that the fasteners used to secure the deck to the structure were backing out in areas, again possibly due to roof movement and the lack of expansion provision in the design of the roof system. This condition may be compromising the wind attachment of the roof assembly and deck. A Structural Engineer should investigate this condition and determine proper remediation.



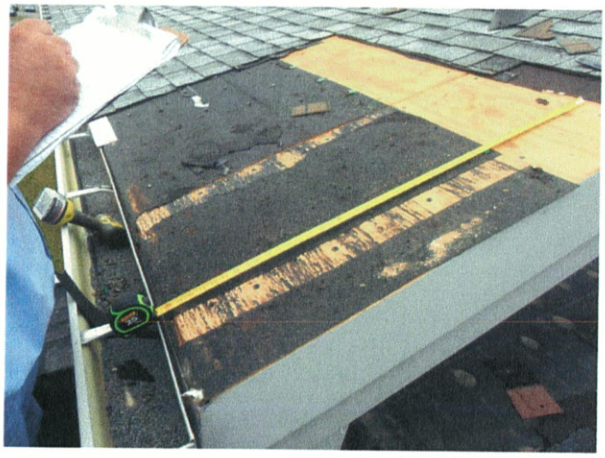
Roof Test Opening #4

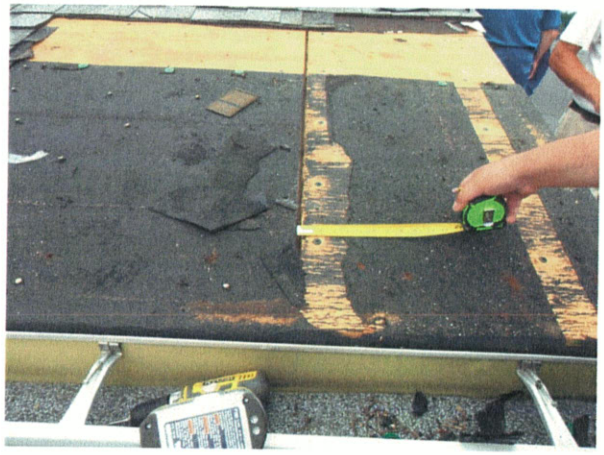
A ridge cap was removed from the western hip on the southern wing of Roof A. It was once again observed that 1.25" chromium coated nails were used to secure the ridge caps, and as stated earlier these fasteners are too short to properly secure the ridge cap.

Roof Test Opening #5

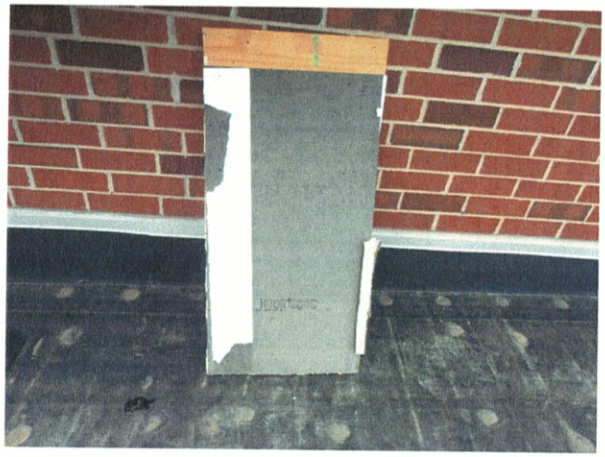
The northeast corner of the Varsity Gym was the location of RTO #5. This area was chosen to view the components at a soffit at a fall hazard safe condition.

As the shingles were removed it was observed that while a starter shingle was installed up the rake, but no bituthene was present. In addition, the bituthene present at the gutter was installed to a distance 34" up from the gutter and 28" from the exterior face of the exterior wall. Ohio Building Code requires the underlayment to be installed a minimum of 24" inches from the interior of the exterior wall. This installation does not comply with this requirement.

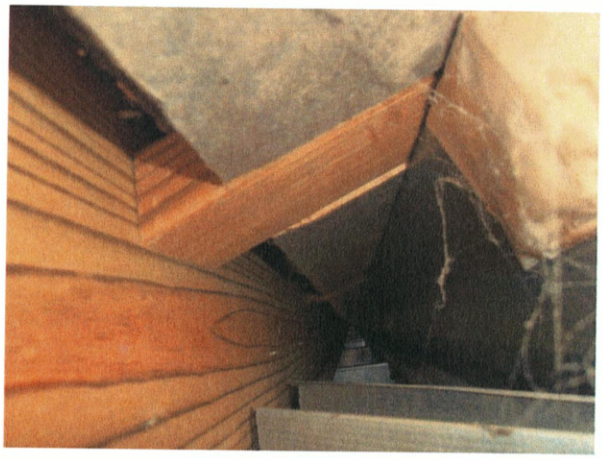




No signs of deterioration were observed on the plywood or the facers on the insulation.



It was observed that the bottom layer of insulation was set back from the lumber at the gutter edge to allow for air movement; however, the insulation for the vent board was tightly abutted to the wood inhibiting air flow from the soffit into the air space of the vent board.



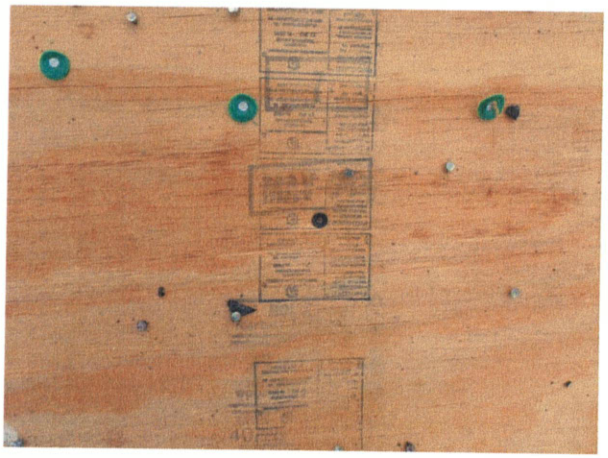
Roof Test Opening #6

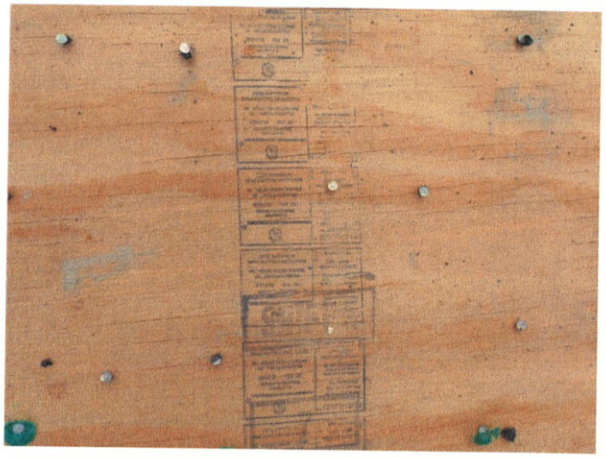
RTO #6 was located near the center of the west face of Roof D. This area was chosen due to the displacement observed in the shingle surface.

The shingles were removed from the area to expose a full 4x8 section of vent board.

It was determine that the Tri-Flex 30 synthetic underlayment was installed at this location and secured with plastic cap nails.

Once exposed the plywood deck was observed to be fire treated.



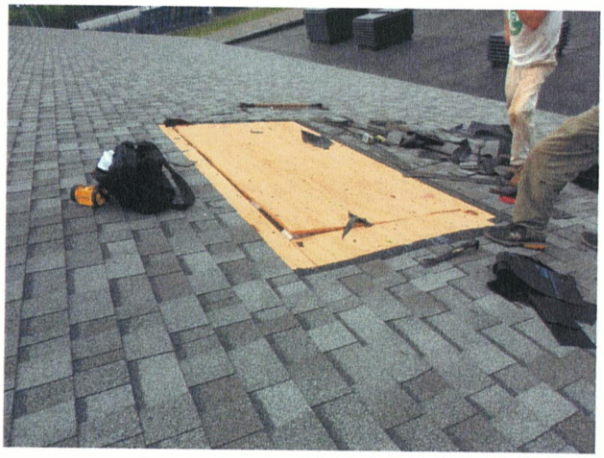


It was observed that a 5/8" gap was present along the top of the board, a 3/8" gap was present on the left hand side of the board, and 1/8" gaps were present on the bottom and right hand side of the board. This appeared to be sufficient gapping.




On the right hand side of the board, it was observed that three additional fasteners with plates were installed in an apparent attempt to pull down the curled end of the board. It was observed that the board was bowed in-between the fasteners.


When the three rows of five fasteners and the additional fasteners and plates were removed the loose board exhibited a more pronounced bow. Note that the top row of fasteners were approximately one inch from the edge of the board and were located approximately 2" from the board of the board. The numbers of fasteners was sufficient based on the Manufacturer's literature; however, the perimeter spacing was not proper.

Evidence of apparent biological growth was observed on the bottom of the insulation of the vent board and on the top of the bottom layer of insulation.


Minor water staining was observed on the bottom of the bottom layer of insulation.

Roof Test Opening #7

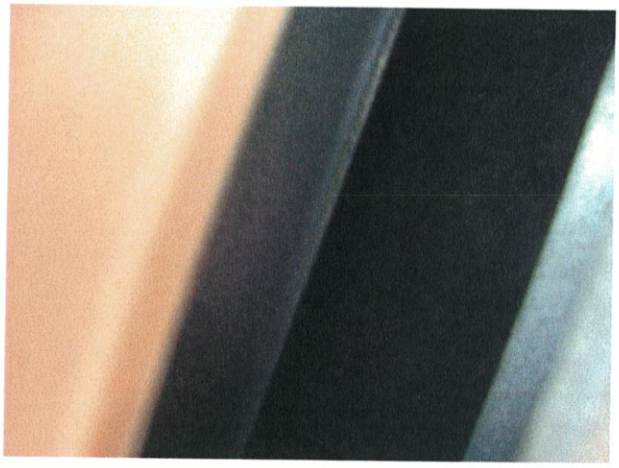
RTO was located at the north end of the west face of Roof D. The shingles were removed at this location to investigate the soffit intake and roof ventilation components in a safe location.

It was observed that the vent openings in the soffit metal are not continuous. The perforated soffit sections are 12" long and are spaced 5' on center.

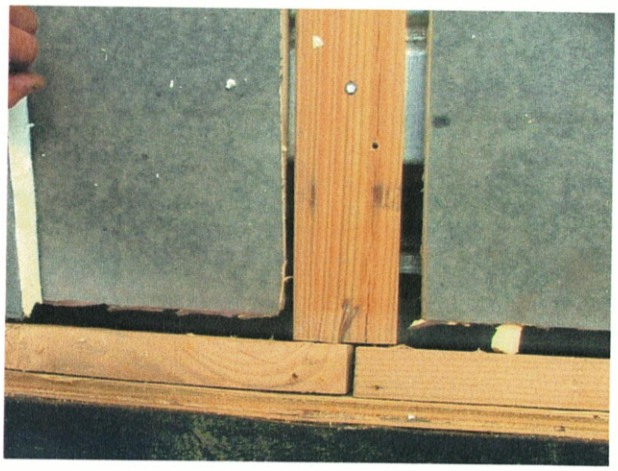
Once the shingles were removed the bituthene was again present, extending up the roof 34" from the gutter edge and 28" from the exterior face of the exterior wall. Again, this was not sufficient; the bituthene is required to extend 24" in from the interior of the exterior wall per Ohio Building Code.

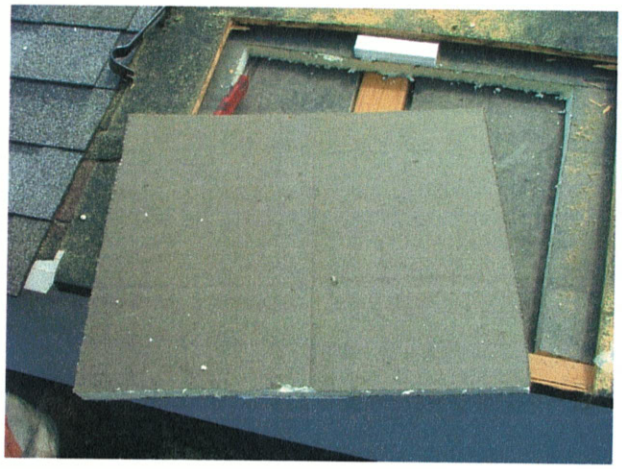
The air space opening behing the wood fascia varies from a maximum of 1" to -0-". This condition will inihbit adequate air from ventilating through the roof assembly.

When viewed from beneath the soffit, the opening was block by the bottom layer of insulation.



Gaps were present adjoining the sleeper wood present at the soffit. These larger gaps may allow excess heat loss and contribute to the reported ice damming.





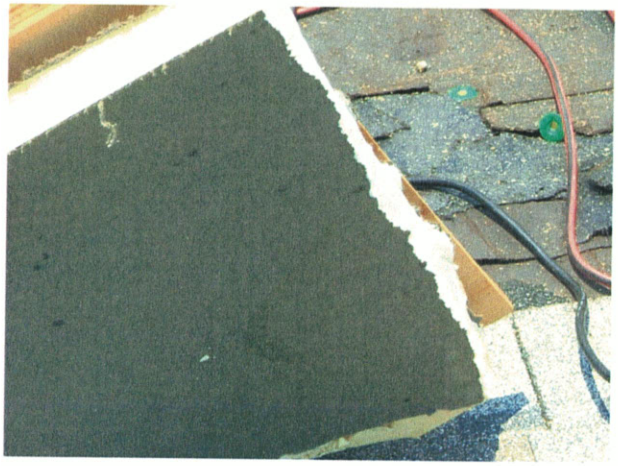
With the removal of all the insulation it was observed that an approximate 1.5" opening is present between the framing to allow air passage at the soffit.

Roof Test Opening #8

RTO # 8 was located on Roof F at the eastern most dormer, on the southern side of the roof. The roof was opened to expose the transition between the main roof and the dormer roof.

The ridge was opened and it was observed that an approximate 2" opening was present. Further it was observed that the insulation was not mitered at the peak creating a point of heat loss.

On the bottom facer of the insulation board of the vent board staining was observed. This could likely be from condensation.



Once the vent board and insulation was removed it was observed that the copper lightning rod cable was mounted to the galvanized steel deck. A galvanic reaction appears to have already developed were the two dissimilar metals have been in contact.

As part of the removal of the insulation from the dormer it was observed that the plywood from the main field of the roof tightly abuts the base layer of insulation on the dormer, preventing air transfer from between the two venting board. In addition, no gap was left for expansion of the plywood.

Roof Test Opening #9

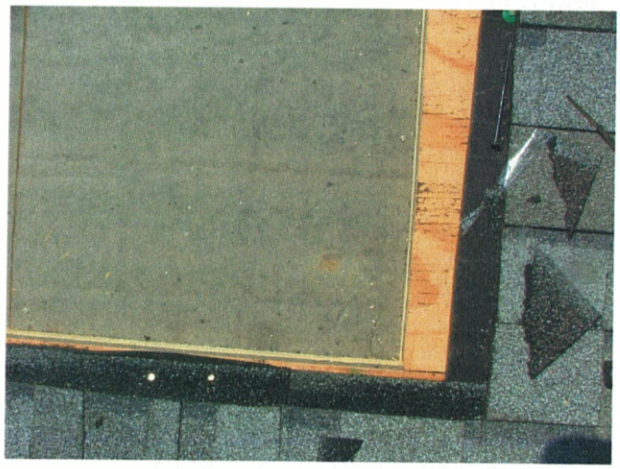
RTO #9 was created on the northern end west face of Roof Face at the location of a buckle in the shingles.

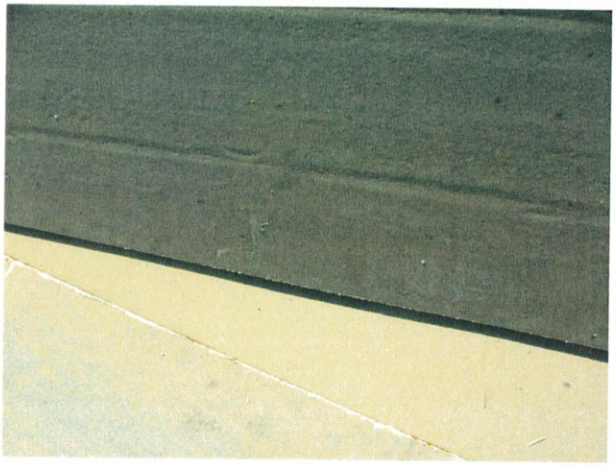
Once the shingles and #30 felt was removed from the plywood a full 4x8 board was exposed. It was determined that 15 fasteners were installed securing the board to the deck, matching the Manufacturer's requirements.

The gap present around the perimeter of the board was inconsistent. It ranged from 3/8" on two sides to nothing on the other two sides. The lack of a 1/8" on two sides may have contributed to the bowing of the plywood.

It was also observed that plywood had become warped and bowed.

Once the plywood and insulation was removed it was observed that an apparent biological growth and past moisture stains were present on the facers between the layers of insulation.





Roof Test Opening #10

RTO #10 was created around a soil stack on Roof F as shown on the drawing. This was created to determine if the roof assembly was sealed around the stack penetration.

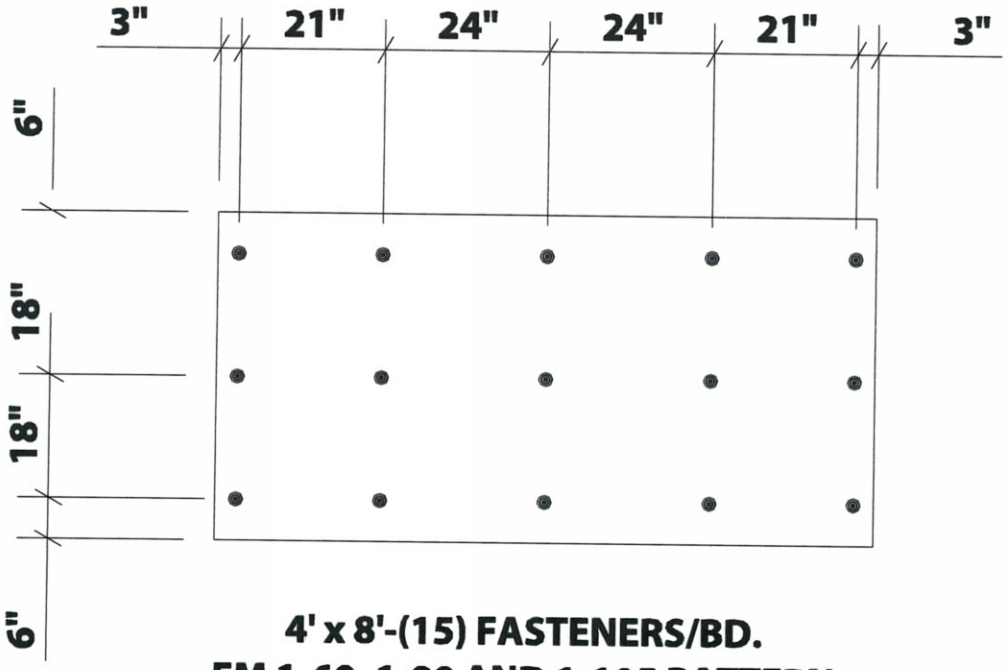
After the shingles, flashing boot, and underlayment were removed a large gap was observed between the soil stack pipe and the surrounding plywood, insulation, and deck. As a result, interior conditioned air can readily escape into the roof assemblies vent space.

This gapped condition may cause ice damming to form in cold weather conditions. In addition, it allows conditioned air to readily escape which is energy inefficient.

GENERAL INFORMATION

Based on supplied information from the Client, Atlas was the manufacturer of the ventilation board and flat stock polyisocyanurate insulation. Based on field gathered data the vent board consisted of ¾" fire treated plywood, a 7/9" air gap, and 1.5" polyisocyanurate insulation. Below the vent board a second layer of 1.5" polyisocyanurate insulation was present. This was consistent at each opening created.

The manufacturer data supply by Atlas on their website was reviewed since no submittals or specifications were supplied for review. It was determined that the Atlas AC-Foam CrossVent was not secured per the recommended pattern supplied by Atlas that follows:



4' x 8'-(15) FASTENERS/BD.
FM 1-60, 1-90 AND 1-105 PATTERN

The boards were typically secured in three rows of five fasteners, however, at each of the test openings the perimeter spacing of the fasteners was observed to be between ½" to 2" from the edge of the board. It appeared that this may have been done by the Contractor when they were problems aligning the board with the upper ribs of the deck. It was also noted that the fasteners were installed at an angle in areas to allow the fasteners to catch the underlying deck upper flute.

Atlas literature also recommends the use of a vapor retarder when necessary, especially when construction related moisture is present. The following was copied from Atlas literature:

Vapor/Air Retarders

Moisture vapor tends to migrate from warmer to cooler areas. In building construction, vapor/air retarders are used to inhibit or block the passage of warm, moisture-laden air into walls or roofing assemblies. To determine whether a vapor/air retarder is necessary, calculations based on interior relative humidity, interior temperature, and the outside design temperature must be performed. Consult the NRCA Roofing Manual, Membrane Roof Systems 2007 for more information regarding vapor/air retarders and dew point calculations.

Special consideration should be given to construction-generated moisture as well. For example, construction-generated moisture will be released when concrete floor slabs are placed after the roof has been installed, which can drive large quantities of moisture into the roof system. Therefore, Atlas is not

responsible for damage to the insulation when exposed to construction-generated moisture. Refer to the NRCA Roofing Manual, Membrane Roof Systems 2007 for recommendations for the use of a vapor retarder when construction-generated moisture is present (5th Edition, Volume 3, p. 813). Refer to Atlas Technical Bulletin #00-01. Consult vapor/air retarder manufacturer for recommended applications and details.

It was reported that torpedo blast heaters were used during construction of the school. These types of heaters produce significant amounts of moisture. For example one 400,000 BTU set on high would produce approximately 30 pounds of water in an hour. Depending of the type, quantity, and time frame of use, a large amount of moisture may have been introduced into the environment beneath the roof assembly during construction. Since the building was under construction and the HVAC systems were most likely not yet operational, the Contractor would have needed to control humidity so that the roof system was not damaged during construction, especially since the Contractor was aware that the roof system did not have a vapor retardant.

Another possibility is that moisture generated by activities such as installing concrete or painting may also have caused higher humidity conditions to develop on the interior during colder exterior temperatures when the interior was being heated, after the roof was installed. These conditions can also cause condensation to develop in the roof system with no vapor retardant in the assembly. If conditions like this existed during construction and the vent board was installed, it is predictable that moisture may have damaged the fire treated plywood and contributed to the bowing of the plywood currently present in the roof assembly. This would also explain the moisture evidence between and on the bottom of the insulation boards, where the dew point would have likely occurred.

Ventilation

Ohio Building Code states in Section 1503.5 Roof ventilation.

Intake and exhaust vents shall be provided in accordance with Section 1203.2 and the manufacturer's installation instructions.

1203.2 Attic spaces. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof framing members shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain and snow. Blocking and bridging shall be arranged so as not to interfere with the movement of air. A minimum of 1 inch (25 mm) of airspace shall be provided between the insulation and the roof sheathing. The net free ventilating area shall not be less than 1/150 of the area of the space ventilated, with 50 percent of the required ventilating area provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents. Exception: The minimum required net free ventilating area shall be 1/300 of the area of the space ventilated, provided a vapor retarder having a transmission rate not exceeding 1 perm in accordance with ASTM E 96 is installed on the warm side of the attic insulation and provided 50 percent of the required ventilating area provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents, with the balance of the required ventilation provided by eave or cornice vents.

Based on the wording of Ohio Building Code this building should have net free ventilating area of 1/150 of the area of the space to be ventilated properly since no vapor retarder is present. Based on the supplied drawings the approximately square footage per roof area is as follows:

Roof Designation	Equivalent Attic Area	Required Intake	Required Exhaust	Existing Intake	Existing Exhaust (assuming 2" opening)
A	50,390 sf	24,187 in^2	24,187 in^2	21,660 in^2	18,240 in^2
B	9,737 sf	4,674 in^2	4,674 in^2	3,990 in^2	3,192 in^2
C	2,877 sf	1,381 in^2	1,381 in^2	2,385 in^2	576 in^2
D	16,598 sf	7,967 in^2	7,967 in^2	3,960 in^2	3,094 in^2
E	4,830 sf	2,319 in^2	2,319 in^2	2,565 in^2	4,104 in^2
F	58,765 sf	30,548 in^2	30,548 in^2	24,090 in^2	11,760 in^2

The net free ventilating area should be evenly divided between ridge and eave. Based on field observation the effective intake is less than needed since a majority of the eave openings are not open and air is prevented from entering the ventilation system. The exhaust was observed to be approximately 2" opening at the ridge. For a system to function properly the minimum requirements for net free area must be met and the system must also be evenly balanced between intake and exhaust. This system does not appear to have adequate capacity and it is also not balanced due to the dysfunctional intake components.

Ice Damming and Icicle Formation

The lack of a vapor retarder and the gaps found between insulation boards maybe contributing to the warm roof condition that appears present. Where observed, like at Roof Test Opening #10, penetrations in the roof appear to allow conditioned air to enter the roof assembly. It is reported that significant ice damming and icicles form during cold weather conditions. In cold weather conditions, the warm interior air would enter the vent board where the interior air is not contained. This would then warm the shingles causing snow to melt. When the water flows to areas of the roof where the warm interior air is not present to warm the surface of the shingles the water would then freeze and ice would develop.

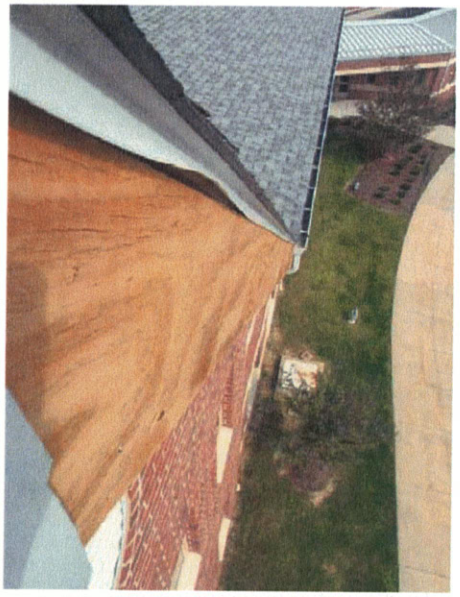
Nails

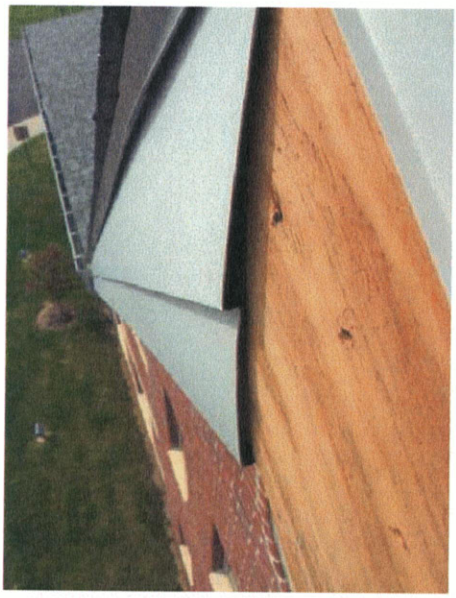
The nails used for securing the shingles were cadmium coated nails which are not an approved nail per Table 1507.2 that requires galvanized, stainless steel, aluminum, or copper nails be used.

The specifications and submittals for the project were not reviewed therefore it is uncertain what nails were specified or approved. The fasteners present have begun to rust in areas and will continue to deteriorate, especially at the locations of ice damming and leaks. In addition, throughout the roof areas nails have backed out and created holes in the overlying shingles. Each of these "nail pops" are potential points of moisture entry.

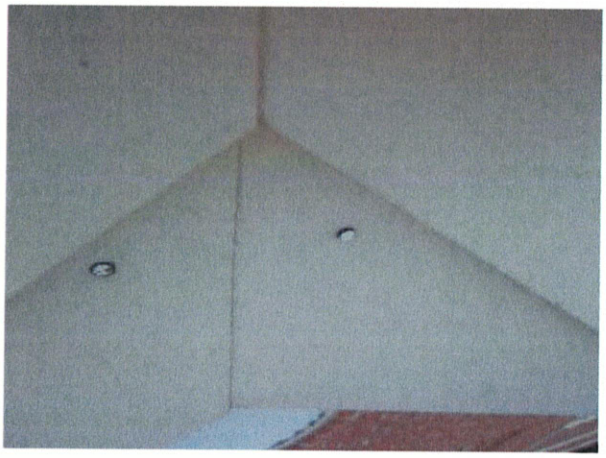
Sheet metal Components

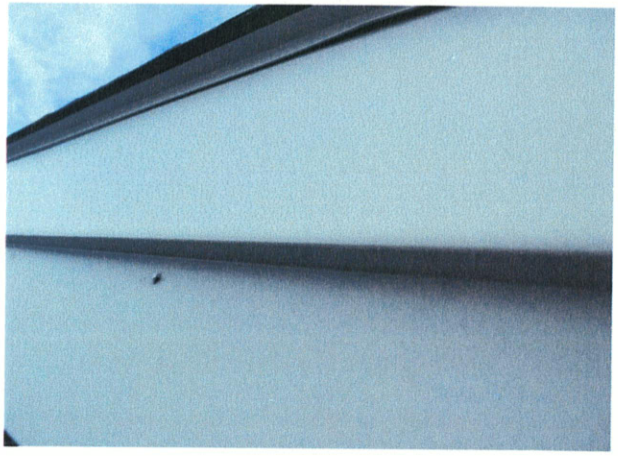
The sheet metal fascia was poorly installed. Two areas of metal were missing at the time of the site visits and the underlying wood fascia is exposed. They are marked on the drawing. It appears that no underlayment was installed over the wood at the numerous location checked during the field activities.





Areas were observed where exposed nails were installed to secure the fascia metal. These nails are backing out. Exposed nails should not be present in fascia since they create points of entry for moisture.





Expansion Joints

It was observed that no visible expansion joints are present in the shingled roof assemblies. Several of the roofs are very long in dimension. The ridge of Roof A is approximately 480 LF. A Structural engineer should review the structure and determine if expansion joints are required for this building.

Mold Testing

Four samples were collected and sent to U.S. Micro-Solutions, Inc. for testing. The results of the testing follow. Several types of mold were present on the samples tested. They include:

Alternaria conidia
Aspergillus/Penicillium-like conidia
Conidia resembling Acremonium
Fruiting structure resembling Acremonium
Hyphal Fragments

The following are description of the particles found in the samples

Conidia are an asexual, non-motile spores of a fungus.

Alternaria is a genus of ascomycete fungi. *Alternaria* species are known as major plant pathogens. They are also common allergens in humans, growing indoors and causing hay fever or hypersensitivity reactions that sometimes lead to asthma.

Aspergillus is a genus consisting of several hundred mold species.

Penicillium is a genus of ascomycetous fungi.

Acremonium is a species are usually slow growing and are initially compact and moist. Acremonium hyphae are fine and hyaline and produce mostly simple phialides. Their conidia are usually one-celled (i.e. ameroconidia), hyaline or pigmented, globose to cylindrical, and mostly aggregated in slimy heads at the apex of each phialide.

Hyphal fragments are components of fungal growth (similar to the roots and branches of a tree); it is common to find small hyphal fragments in outdoor air and possibly in indoor dust. But their presence in indoor air samples, if in quantity or in large segments, suggests an active fungal colony in the building. Their presence in a surface sample in quantity or in large segments indicates that active fungal growth is present or nearby, or that fungal material has been disturbed in the building. May be allergenic.

Based on the presence of mold it is recommended that indoor air quality tests be performed to ensure that a problem does not exist. Regardless, the roof components should be removed in a timely manner to inhibit the condition from worsening.

U.S. Micro-Solutions, Inc. * 475-C Willow Crossing Road * Greensburg, PA 15601
Phone: (724) 853-4047 Fax: (724) 853-4049 AIHA EMLAP # 103009
www.usmicro-solutions.com

AIHA LAP, LLC ACCREDITED LABORATORY

Customer Name:	Construction Resources, Inc.	**Sample Date:**	July 6, 2011
Customer Address:	33900 Station Street Solon, OH 44223	**Date Received:**	July 8, 2011
		Date of Report:	July 11, 2011
Customer Phone:	(440) 248-9800	**Fax:**	(440) 248-9939
PO Number:		**Attention:**	Brian Smole
Project Name/Number:	Grand Valley Local Schools		

Customer sample numbers below are uniquely identified by prefixing Laboratory # 72014-11

Direct Microscopic Examination - Bulk
Analytical Method: USMS-T017

Customer Sample Number	1					2					3				
Sample Description/ Location	Test Opening #3 Bottom					Test Opening #3 Top					Test Opening #8 Top				
Particle ID	Rare Amt	Few	Mod	Many	Num	Rare Amt	Few	Mod	Many	Num	Rare Amt	Few	Mod	Many	Num
Alternaria conidia						X									
Ascospores															
Aspergillus fruiting structures															
Aspergillus/Penicillium- like conidia												X			
Basidiospores															
Bipolaris/Drechslera conidia															
Chaetomium ascospores															
Cladosporium conidia															
Conidia resembling Acremonium					X					X					
Curvularia conidia															
Epicoccum conidia															
Fruiting structure resembling Acremonium				X			X								
Hyphal Fragments				X				X			X				
Insect fragments															
Penicillium fruiting structures															
Pithomyces/Ulocladium conidia															
Plant fragments															
Pollen (unidentified)															
Rusts															
Smuts/ Myxomycetes															
Stachybotrys conidia															
Stachybotrys fruiting structures															
Torula conidia															
Unidentified dematiaceous conidia															
Unidentified hyaline conidia															
Skin Cell Fragments	1					1					1				
Debris	1					1					2				
No fungal conidia/hyphal fragments noted															
Analyst Initials	SG					SG					SG				
Date Analyzed	7/8/11					7/8/11					7/8/11				

Note: The Aspergillus/Penicillium-like category represents spores that are small, round, and with few distinguishing characteristics that cannot be differentiated by non-viable sampling methods. Results relate only to the items tested.
Num = Numerous

Technical Manager: Herbert Layman

Herbert Layman, BS, SM, CIEC

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PO Number:		**Attention:**	Brian Smole
Project Name/Number:	Grand Valley Local Schools		

Customer sample numbers below are uniquely identified by prefixing Laboratory # 72014-11

Direct Microscopic Examination - Bulk
Analytical Method: USMS-T017

Customer Sample Number	4														
Sample Description/ Location	Test Opening #9 Bottom														
Particle ID	Rare Amt	Few	Mod	Many	Num	Rare Amt	Few	Mod	Many	Num	Rare Amt	Few	Mod	Many	Num
Alternaria conidia															
Ascospores															
Aspergillus fruiting structures															
Aspergillus/Penicillium- like conidia															
Basidiospores															
Bipolaris/Drechslera conidia															
Chaetomium ascospores															
Cladosporium conidia															
Curvularia conidia															
Epicoccum conidia															
Hyphal Fragments															
Insect fragments															
Penicillium fruiting structures															
Pithomyces/Ulocladium conidia															
Plant fragments															
Pollen (unidentified)															
Rusts															
Smuts/ Myxomycetes															
Stachybotrys conidia															
Stachybotrys fruiting structures															
Torula conidia															
Unidentified dematiaceous conidia															
Unidentified hyaline conidia															
Skin Cell Fragments	1														
Debris	1														
No fungal conidia/hyphal fragments noted	X														
Analyst Initials	SG/BM														
Date Analyzed	7/8/11														

Note: The Aspergillus/Penicillium-like category represents spores that are small, round, and with few distinguishing characteristics that cannot be differentiated by non-viable sampling methods. Results relate only to the items tested.
Num = Numerous

Technical Manager: Herbert Layman

Herbert Layman, BS, SM, CIEC

Page 2 of 2 plus COC

Masonry Test Openings

On July 8, 2011, masonry wall openings were made in walls above roofline as a continuation of the investigation. These openings were made with the assistance of Masonry Restoration and Maintenance.

Masonry Test Opening A

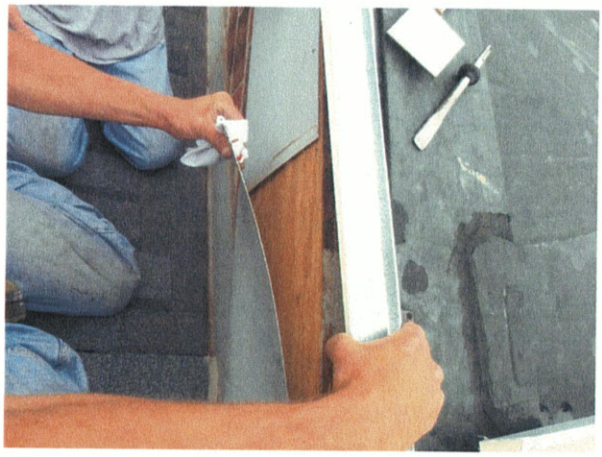
MTO A was located on the north face of the eastern most location on Roof F at the masonry to roof transition. A water test was first performed on the area to attempt to determine the source of the moisture entry. Water was first applied to the field of the roof and the transitioned to the roof to wall transition. Once water hit the transition it entered the building.

As a result of the moisture entry the sheet metal flashing was removed from the masonry wall. Once partially removed it revealed that the step tins present only had an approximate 2" up turned leg.

It was observed that sealant was applied to the transition of the reglet counter flashing and shingles. This is an improper repair and would have a limited lifespan.

At this same location, efflorescence was observed on the masonry wall below the fascia and drip edge at the top of the parapet for the adjoining roof area. Therefore a section of the fascia and drip edge was partially removed.

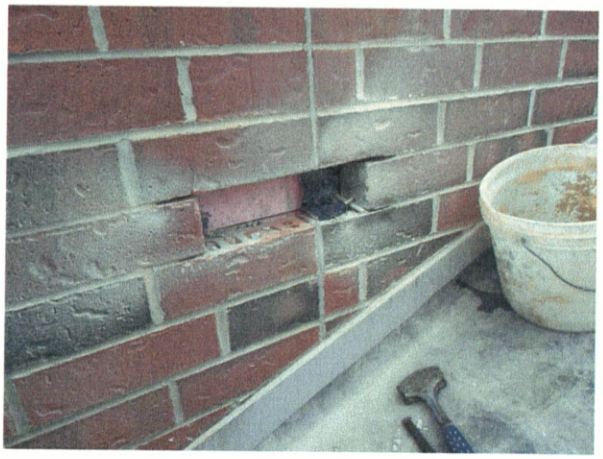
Once removed, it was observed that the EPDM membrane was cut short in areas exposing the top of the fascia metal. In addition, no protection was installed over the wood fascia prior to the installation of the metal fascia.



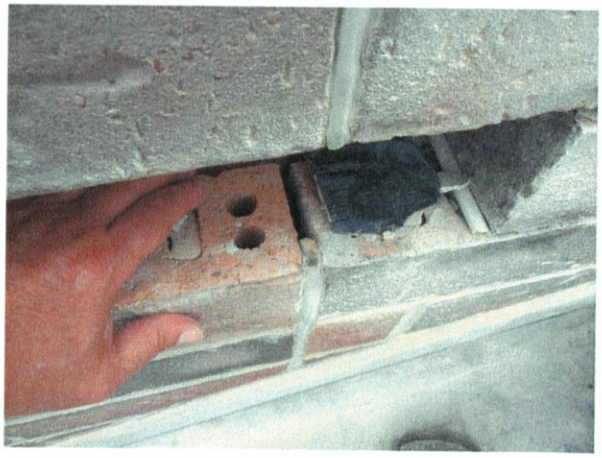
It was also observed that efflorescence was present on the southern end of the same wall. Throughout all the masonry walls, cellular head joint weeps were installed horizontally in the bed joints. The location of the weeps corresponds with some of the efflorescence observed.

A test opening was created at the expansion joint on the northern side of the wall.

Once the opening was created, it was determined that the flashing was not continuous through the expansion joint. In addition, end dams were not present at the expansion joint. This allows any water present on the flashing the ability to drain off the ends.



With the sealant exposed, it was determined that backing material was not installed. Without backing material, the depth of the sealant cannot be controlled. For sealant to perform properly the depth of the sealant should be twice the width.



Masonry Test Opening B

An ongoing leak was reported to be present along the wall North wall of Room 75. A water test was performed to attempt to determine the source of the moisture entry. Water was initially applied to the roofs surface with no moisture entry. Water was then directed at the roof to wall vent and moisture immediately entered.

The roof to wall vent detail was dismantled. It was confirmed to be a shop formed detail that consisted of sections of apparent Cor-A-Vent PS-400, perforated metal, and a sheet metal cover. The Cor-A-Vent PS-400 is designed for vertical installation and has no means of preventing drawing rain from entering in this horizontal type of installation. As a result when the hose was directed on the vent water entered immediately.

The detail to be installed at this location was U46/A21 which states that a shingle vent is to be installed at this location. No documentation was supplied for review which clarifies what was specified, if anything, for a shingle vent; therefore, it is uncertain if this was the designed detail or not.

Masonry Test Opening C

MTO C was located at the southwest corner of Roof D above Roof E. A crack had developed on the southern face of adjoining this corner.

After the masonry was removed it was determined that the wall ties were spaced 16" o.c. both horizontally and vertically. In addition, a 1" air gap was present between the back of the clay brick and in front of the 3" extruded polystyrene insulation.

One brick course up from the split face block at the base of the wall, the through wall flashing was observed to be present. It was noted that the flashing stop approximately 1" from the face of the masonry allowing water to drain in to holes in the underlying brick unit.

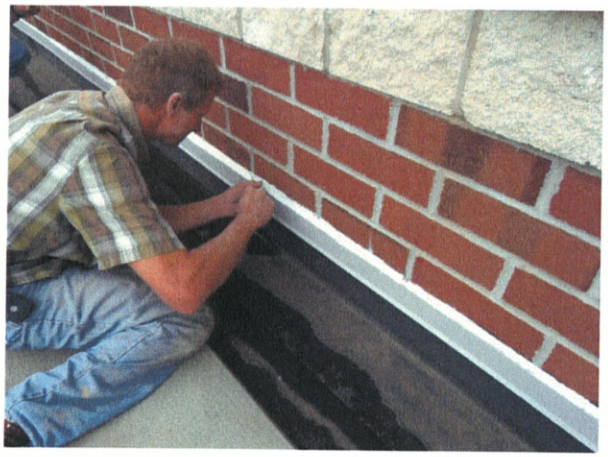
Masonry Test Opening D

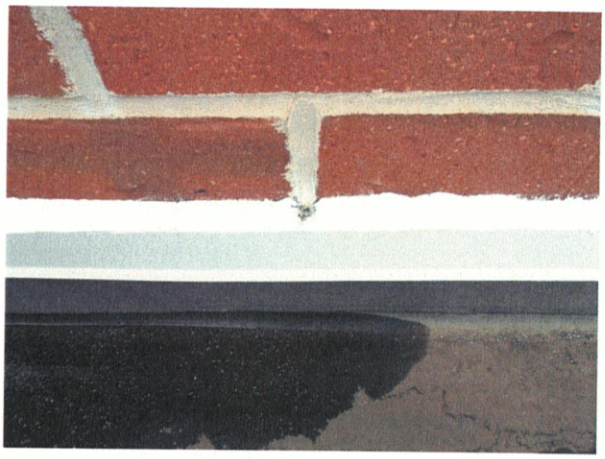
At this location, over the Middle School Office Nurses Station, a water test was performed first at the northern end of the roof area. Water was first applied to the roof and flashing with no moisture entry.

Water was then applied to the base of the masonry wall, once water was applied to the hole for the lightning protection cable water immediately entered. Based on the interior staining this was a long term point of moisture entry.

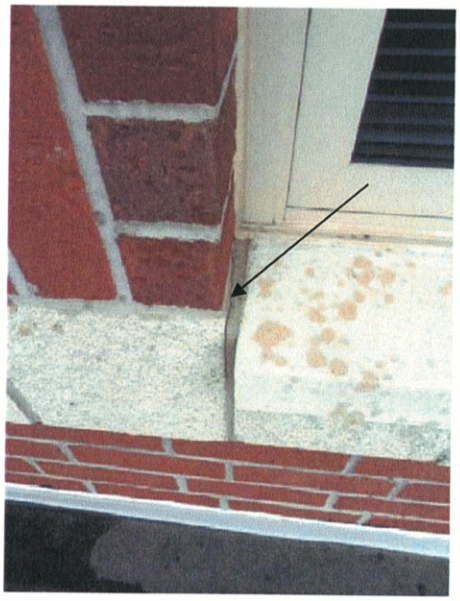
The water test was continued up the wall until the split face block ban in the masonry was reached. Once this component was reached moisture again entered. It was determined that mortar was never installed in the joint between split face block and the inside corner.

The water test was then moved further to the south on the wall and moisture was found to enter once water was applied to the wall at an elevation approximately at the window sill. Multiple items were observed in these areas that may have been contributing to the moisture entry. At some point someone installed sealant over the weeps present at the base of the wall. With the weeps closed moisture that is absorbed by the wall has no means of exiting.

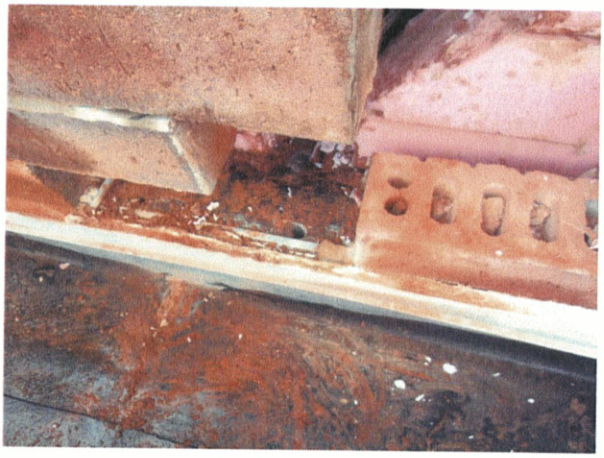




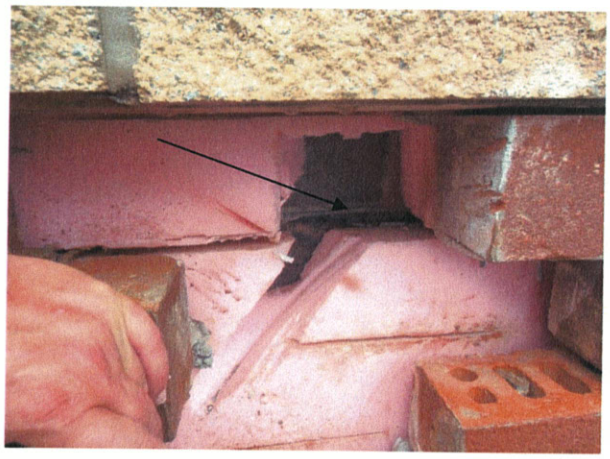
In addition, at either end of the precast sills the mortar joints are open.



An opening was created directly beneath northern end of the second window north of the skylight. When the bricks were removed it was determined that the flashing stopped approximately 1" short of the face of the brick units leaving the cores of the brick units exposed. This allows water that is being forced out by the flashing to drain into the cores of the underlying brick units.



With the brick and extruded polystyrene removed it was observed that the flashing was installed in the mortar joint of the backup CMU.

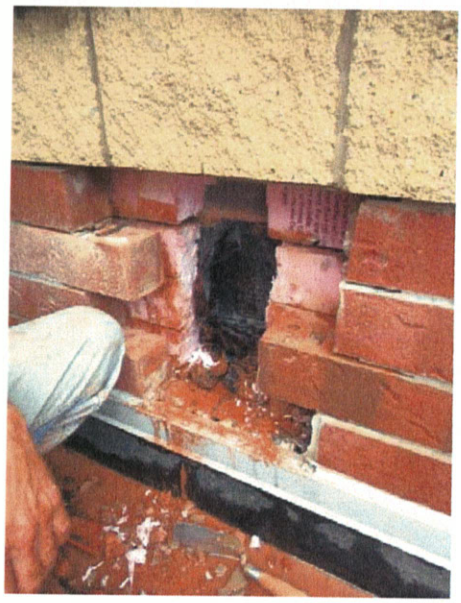


When the flashing was cut open it was determined that two pieces of flashing were used to create the detail. With the large amount of overlap observed it appears that the contractor could have easily moved the bottom piece of flashing down to allow it to be exposed and cover the underlying brick.

Masonry Test Opening E

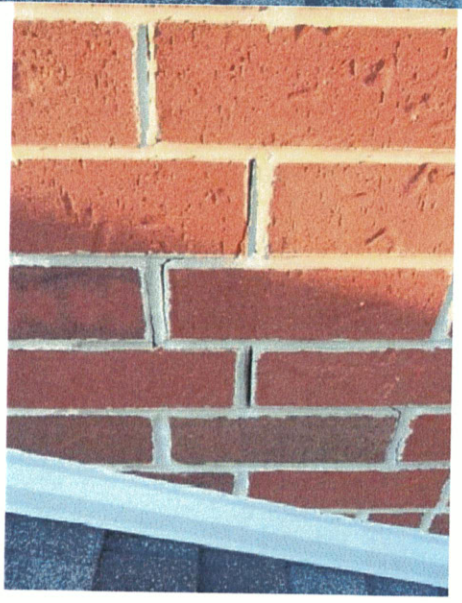
MTO E was located above the Middle School Main Office storage room. A water test was also performed in this area. Moisture eventually entered after the wall became saturated. A test opening was created below the first window north of the skylight.

With the masonry and extruded polystyrene removed, the through wall flashing was exposed. The condition of the flashing matched that at MTO D, the flashing stops short of the exterior masonry wall exposing the cores of the underlying masonry units. In addition, the end laps in the flashing were not adhered.

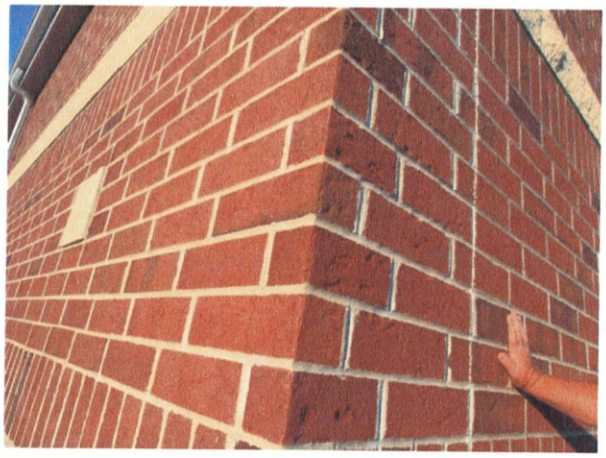


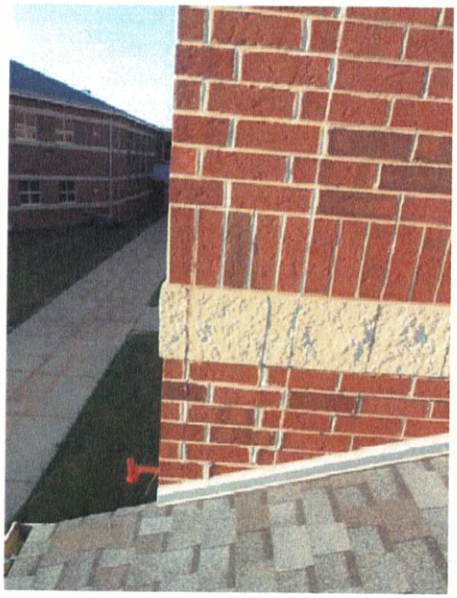
Wall above Roof C

On July 21, 2011, an additional site visit was made to view the conditions of Roof C and the adjoining masonry wall components above Roof C. Numerous step cracks are present directly above the through wall flashing in the masonry.



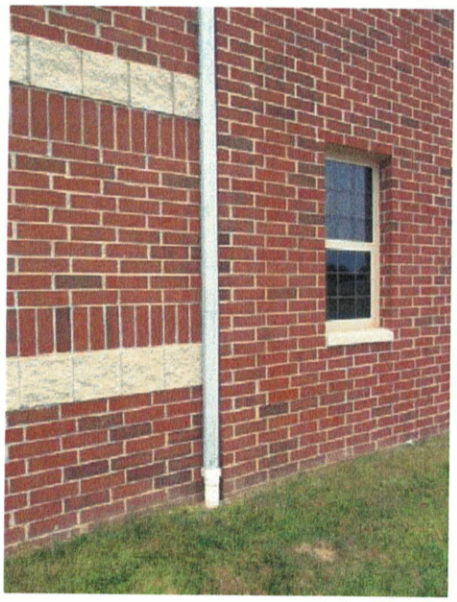
In addition, apparent expansion relief cracks have developed at the corners.

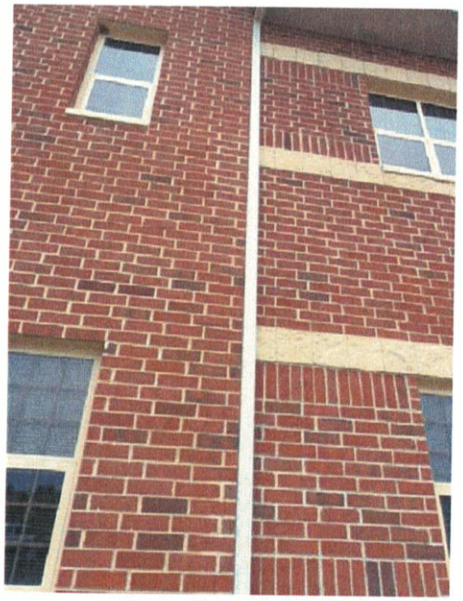




Control Joints and Vertical Cracks

When the perimeter of the building was viewed, numerous vertical cracks were present, especially at the masonry present below the dormers on the east side of the building. The presence of these cracks implies that this building needs additional capacity to absorb movement. These cracks will continue to deteriorate and further masonry deterioration may develop if this situation is not further investigated and properly resolved.





Summary and Recommendations

Numerous defects are present within the roof assembly at the time of this study. They include the following:

- Ohio Building Code requires that nails penetrate a minimum of ¾" into the deck or penetrate through the thickness of the sheathing per Table 1507.2. The thickness of the existing deck is 3/4" which means that nails should just penetrate the deck since the deck is ¾" thick. The removed nails were measured to be 1.25" long and during the walkthrough in the attic it was also observed that the nails penetrated approximately ¼" in most areas which appears to satisfy the Building Code requirement of penetrating the deck. The fastening requirement was further reviewed based on the requirements of three shingle manufacturer's, CertainTeed, GAF, and Owens Corning. The manufacturer's had similar requirements to that found in Building Code, with the additional requirement of penetration of a minimum 1/8".
- Improper nail ridge caps. The nails used were 1.25" long which is too short to ensure proper ¾" penetration into the deck due to the multiple layers of shingles and ridge vent present.
- The nails used for securing the shingles were cadmium coated nails which are not an approved nail per Table 1507.2 that requires galvanized, stainless steel, aluminum, or copper nails be used. The specifications and submittals for the project were not reviewed therefore it is uncertain what nails were specified or approved. The fasteners present have begun to rust in areas and will continue to deteriorate, especially at the locations of ice damming and leaks. In addition, throughout the roof areas nails have backed out and created holes in the overlying shingles. Each of these "nail pops" are potential points of moisture entry.
- The use of fire retardant plywood that is highly susceptible to moisture and is unstable. With the lack of a vapor retardant, it is likely that condensation may occur within the roof system from humidity and colder exterior conditions, likely to have occurred during building construction but may also occur from moisture drive from many human beings in rooms during winter conditions.
- The vent board was not installed properly. Fasteners were spaced too close to the edge of the board. In addition, proper 1/8" gaps were not present between adjoining boards.
- Based on a letter from Atlas Roofing Corporation dated April 4, 2006, 52 areas had been identified on the steep sloped roof areas that required additional fastener installation in order to flatten out the insulation boards. This implies that the deterioration of the vented board assembly manifested during the first year of the shingle roof assembly.
- Mold growth was present on the facer of the polyisocyanurate insulation at multiple roof openings.
- Galvanic reaction appears to have developed at the locations were the copper lightning protection cable rests on the galvanized steel deck.
- The air intake functionality is questionable due to numerous areas where the insulation was installed blocking the opening. In addition, even if the air intakes functioned properly the system is unbalanced and inadequate ventilation is present.
- The fascia metal was installed over wood without first installing underlayment. In addition, the metal was secured with nails that were exposed in areas. Two sections were observed to be missing during the site visits and numerous backed out nails were observed.
- Reported ice damming and icicle formation in numerous areas during cold weather conditions.

During the study it was observed that portions of the building have long lengths present without apparent expansion joints visible. **A Structural Engineer should be hired to determine if adequate expansion joints are present in the construction of the building and its roof systems. In addition, the Engineer should determine if the movement observed has affected the attachment of the roof system and deck components.**

A possible source of deterioration observed was the reported use of natural gas fueled blast heaters during construction of the building. These types of heaters produce large amounts of moisture as the result of combustion. This moisture would have been able to come into contact with the roof system components and during cold exterior temperatures may have caused condensation in the roof components, including the plywood substrate that may have contributed to the plywood become unstable and warping.

It is recommended that the existing roof assembly be removed down to the existing steel deck. Areas of deterioration will need to be restored or replaced at this time. All copper lightning protection cables should be removed and replaced with aluminum components. Galvanic damaged roof deck would need replaced. A new roof assembly should consist of a receiver board and vapor retarder. This could also serve a temporary roof system. Over the vapor retarder, insulation, vented insulation board, underlayments, and shingles should then be installed. In addition, all new sheet metal components should be installed. As part of the sheet metal installation, new ventilation intake and exhaust components will need to be installed to ensure that adequate intake and exhaust exists.

The through wall flashing at the base of the masonry wall above roof line was installed improperly. Currently the flashing is too short and appears to be allowing moisture entry into the underlying wall components. In addition, weeps were observed to have been caulked. The head joints at the ends of windows sills are open. The sealant throughout the walls has begun to deteriorate. It appears some of the wall control joints sealant was incorrectly installed. As a result of these defects it is recommended that a new through wall flashing be installed at a proper height above roof line. This flashing should incorporate weeps. At restoration time all open or deteriorated mortar joints should be repaired. In addition, the walls should be cleaned and have a water repellent applied. A further masonry studied should be done to examine why some many cracks in the exterior masonry walls are developing.

Budgets

We have estimated the budget costs of a portion of the proposed restoration, as outlined in the summary and recommendations section of this report, as follows:

Designations	Roof Area	Estimated Budgets
Roof A	54,572 sf	$ 1,800,000.00 to $ 2,185,000.00
Roof B	10,545 sf	$ 348,000.00 to $ 422,000.00
Roof C	3,116 sf	$ 109,000.00 to $ 131,000.00
Roof D	17,976 sf	$ 594,000.00 to $ 719,000.00
Roof E	5,231 sf	$ 183,000.00 to $ 220,000.00
Through Wall Flashing in Masonry Above Roof E		$ 25,000.00 to $ 30,000.00
Roof F	63,642 sf	$ 2,100,000.00 to $ 2,546,000.00
Through Wall Flashing in Masonry Above Roof F		$ 13,000.00 to $ 18,000.00
Through Wall Flashing over Office Roofs		$ 20,000.00 to $ 25,000.00
Combined Estimated Budget		$ 5,192,000.00 to $ 6,296,000.00

The above cost budget amounts have been made by comparing this project to similar projects on a square foot/linear foot cost comparison and are for the restoration/replacement of in today's dollars. They will need to be revised prior to a restoration project occurring in the future. These figures are not as inclusive as a Contractor's means and methods bid. Note that when work is performed under multiple contracts, the cost escalates. In addition, costs are affected by the time the project is bid, material costs, inflation factors, and the economy.

This report is based on a limited examination of an existing, finished structure. No warranty is made or implied that all defects were observed and reported. Due to the finished construction, concealed conditions may exist that would affect this report; CRI assumes no liability for concealed conditions that may affect the extent or costs of any repair work needed. If additional drawings of the existing construction become available or conditions assumed by CRI are found to be different from those described in this report, CRI should be notified. CRI reserves the right to adjust the information presented in this report should additional information become available. CRI does not assume any responsibility for any defects in design or construction, whether observed or not, since CRI was not involved in the original design and construction of this building. The opinions, conclusions, and recommendations contained in this letter are based on CRI's judgment and are not to be construed as representations of fact.