

W E T H E R H O L T A N D A S S O C I A T E S , I N C .

Preliminary Roof Infrared Survey Report

Lynnwood Recreation Center
18900 44th Avenue West
Lynnwood, Washington

SITE VISITS – September 4 and 11, 2013



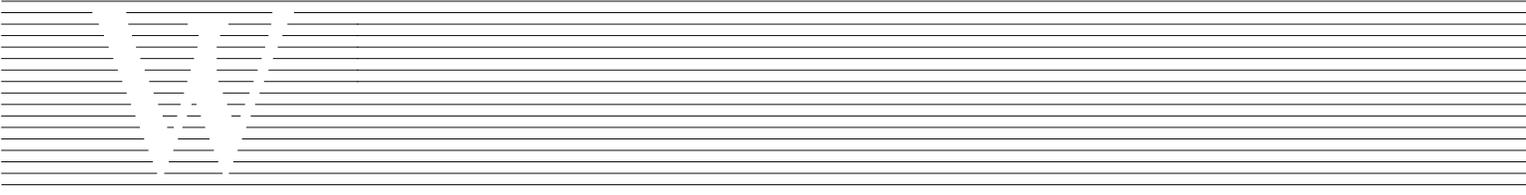
for

City of Lynnwood
Parks, Recreation and Cultural Arts
PO Box 5008
Lynnwood, WA 98046-5008

Attn: Lynn Sordel
Cc: Keith Skore

Project No. 1006-22B1
October 18, 2013

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October 18, 2013
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PO Box 5008
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Phone: 425-670-5240

Attn: Lynn Sordel
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Ref: Preliminary Roof Infrared Survey
Lynnwood Recreation Center
18900 44th Avenue West
Lynnwood, WA

Greetings,

At the request of Keith Skore, this writer, Jose Laurean of Wetherholt and Associates, Inc., accompanied by Ray Wetherholt, visited the above mentioned site on September 4, 2013 to meet with Mr. Skore and perform an initial review of existing roof conditions. While on-site, contact was made with Anton Woody, Holmberg.

On September 11, 2013 this writer performed a preliminary infrared (IR) survey of the roof areas which excluded the entry canopy, the steep sloped metal roofs over the Cardio/Weight room and Lobby, and the roof areas currently scheduled for demolition as part of the natatorium air handling system upgrade. The infrared survey was performed to help determine whether the existing roof system showed signs of moisture infiltration. No destructive testing was authorized or performed to check anomalies (potential areas of moisture) indicated by the infrared camera.

Items of Understanding

The Lynnwood Recreation Center was built in 1976 and underwent a remodel in the spring of 2010. The remodel included the addition of a leisure pool with slide and spray features, a Lazy River, a wellness pool and enclosed competitive pool. At this time we understand that the existing

low sloped roofing assembly was specified to be replaced with a new vapor barrier, rigid insulation, cover board and single-ply TPO roof membrane, mechanically attached over the existing wood deck and adhered over the existing concrete on steel deck. New low sloped wood roof structures were constructed and specified to receive a similar roofing assembly. New steep sloped roof structures were constructed with SIPs panels, roof underlayment and standing seam metal roof panels.

The architect on record for the 2010 remodel is NAC Architecture. The roofing contractor was SQI Inc. Roofing. Mortenson was the general contractor.

The Recreation Center is currently undergoing upgrades to the natatorium air handling system which include removal and replacement of HVAC units over the concrete on steel deck roof areas. Existing roofing was removed and scheduled to be replaced in the general area of the HVAC work and where a new chiller room is to be constructed.

The architect for the current natatorium HVAC replacement scope is ORB Architects and Queen City Roofing is performing the roofing work. Holmberg is the general contractor.

During initial removal of the existing roofing to accommodate the HVAC work, we understand that moisture was discovered in the gypsum coverboard by the roofing contractor.

Observations

During our initial walk-through of the roof on September 4, 2013, conditions were observed that appeared to be susceptible to water intrusion. The following items were observed:

- Galvanizing holes atop the sight screen posts along the west and south perimeter of the northwest roof area were open to water entry. These skyward facing openings allow a point of water entry into the hollow tube steel, possibly migrating out at the base into the roofing assembly. This item was pointed out to Holmberg and Mr. Skore as requiring attention.



Context view of sight screen



Top of sight screen showing open galvanizing holes

- Horizontal tube steel, of the sight screen bracing, penetrates the roofing near the bottom of the translucent panel skylight system over the south natatorium. These penetrations are installed with un-terminated membrane flashings. Typically, a band clamp with sealant is used to seal the open ends of the flashing. Because band clamps are missing, there is a potential for water to migrate laterally along the tube steel and enter the roofing system at these locations.



Context view of horizontal tube steel penetrations Close up showing lack of termination

- Termination bar is left exposed where attached to the glulam beam near the north end of the west elevation above the staircase roof. This detail, while possibly warrantable by the manufacturer, requires routine maintenance to the sealant, which in most cases, is excluded in the warranty. Adjacent metal cladding system should have been extended to counterflash this termination point.



Context view of west elevation over staircase roof Exposed termination bar with sealant

- At the access door on the south elevation of the storage room out onto the roof where new HVAC work is being performed, the termination bar for the flashing membrane is exposed at the sill. At the jambs, where the flashing membrane returns back towards the wall, the exposed top edge of the membrane is dependent on sealant which has adhesively failed.



Context view of access door sill



Wall flashing return showing exposed edge of membrane

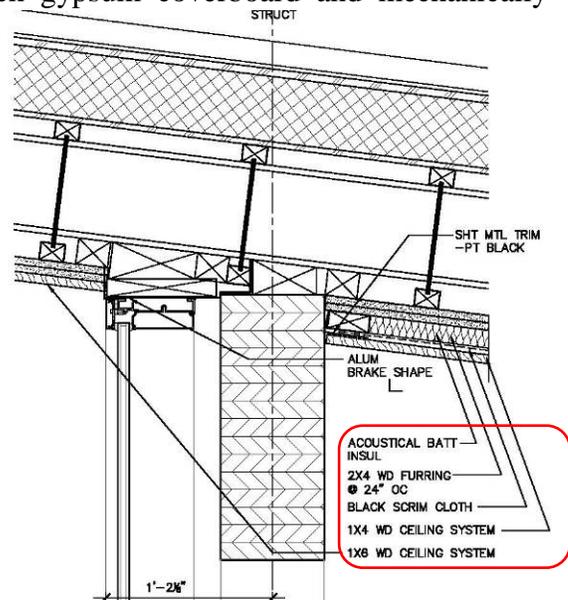
Wetherholt and Associates was retained by the City of Lynnwood to perform part-time roofing application inspections during the current natatorium HVAC replacement scope. During demolition of the existing roofing, it was observed that no vapor barrier was installed over the concrete roof decks. Per plans provided to us by Mr. Skore, a vapor barrier is called out. Thermoplastic membrane roofing specification section, also provided to us by Mr. Skore for review, specifies a two ply Type IV vapor barrier adhered in hot asphalt.

As noted in Field Report #9 from on-site inspection observations, a test cut was performed on the wood roof deck area (not in inspection contract) to the south of the current natatorium HVAC upgrade work. The test cut showed the assembly as being comprised of a polyethylene vapor barrier, multiple layers of polyiso insulation, ¼ inch gypsum coverboard and mechanically fastened TPO.

An IR moisture survey was performed using a Fluke® TiR32 thermal imager. Digital images were captured during the survey to help illustrate conditions observed.

In conjunction with the infrared camera, a Tramex RWS Roof and Wall Scanner was utilized to survey for moisture on the low slope roof where anomalies in the infrared image were observed. The following anomalies were noted:

- At the steep slope metal roof over the natatorium, a higher heat signature was observed in lines running perpendicular



Detail 22/A5.4 from NAC architecture plans dated 12/11/2009 listing ceiling assembly under SIPs

to the roof slope about 4 feet apart. It appears that this correlates with the edges of the SIPs panels which may indicate thermal bridging through the joints. Typically, SIPs connections are assembled with block or I-joist splines which are to be applied with continuous panel sealant on each side of the spline. In most cases, 6 inch SIP tape is specified on the (winter) warm side of the panel to prevent air and moisture infiltration into the assembly.

- 2) South of the clerestory wall of the Lobby roof, a higher heat signature was observed where bridging or unevenness of the coverboard appears to occur. No elevated moisture was detected with the Tramex RWS scanner.
- 3) West of the northwest corner of the Lobby clerestory, a higher heat signature was observed where the single ply membrane has stretched and is bridging over a change in the plane of the roof assembly. No elevated moisture was detected with the Tramex RWS scanner.
- 4) Near the southeast corner of the main low slope roof area, what appears to be bridging or unevenness in the coverboard at perimeter edges resulted in a higher heat signature. No elevated moisture was detected with the Tramex RWS scanner.
- 5) Adjacent to the west elevation of the Lobby clerestory, a higher heat signature was observed with the IR camera. Tramex RWS detected elevated moisture at this location. It appears that moisture intrusion may be present within this area. Destructive testing to confirm is recommended.

Please note that the moisture scan could not be performed where standing water was present. Also, areas of the roof which are shadowed during the day by adjacent tress, roof structures, sight screens or mechanical units were spot checked with the Tramex RWS scanner, where surface conditions allowed.

A roof plan denoting the approximate locations of the anomalies listed above is attached at the end of this report.

Discussion

Based on the IR survey and spot checks with the Tramex RWS scanner, it appears that anomaly location 5 listed above may be the result of moisture infiltration. Test cut(s) by a manufacturers approved installer should be performed to confirm the presence of moisture in the roofing assembly and further investigate potential leak sources if confirmed.

In regards to anomaly location 1, further intrusive investigation is required to determine how the SIPs connections were installed and confirm if a vapor barrier exists under the SIPs. Per Detail 22/A5.4 shown on Page 4, a 'black scrim cloth' is called out which would not provide a vapor barrier. There is a potential for condensation to occur at the Carlisle WIPHT self adhering underlayment due to warm and humid interior air migrating through the SIPs joints.

Considering the pool environment below, a continuous vapor barrier under the SIPs panels must be in place or moisture diffusion through the panels may result in condensation at the impervious roof underlayment over the panels, trapping moisture in the assembly.

Enclosed is a marked-up roof plan and digital photos taken at the time of our site visit for your review with this report. These photographs and notes provide additional information to that discussed above, and should be considered part of this report.

We trust the above discussion has been of assistance. If you have any questions, or if we may be of further service, please do not hesitate to call.

Respectfully,



Jose Laurean, RRO
Field Engineer

Reviewed by,

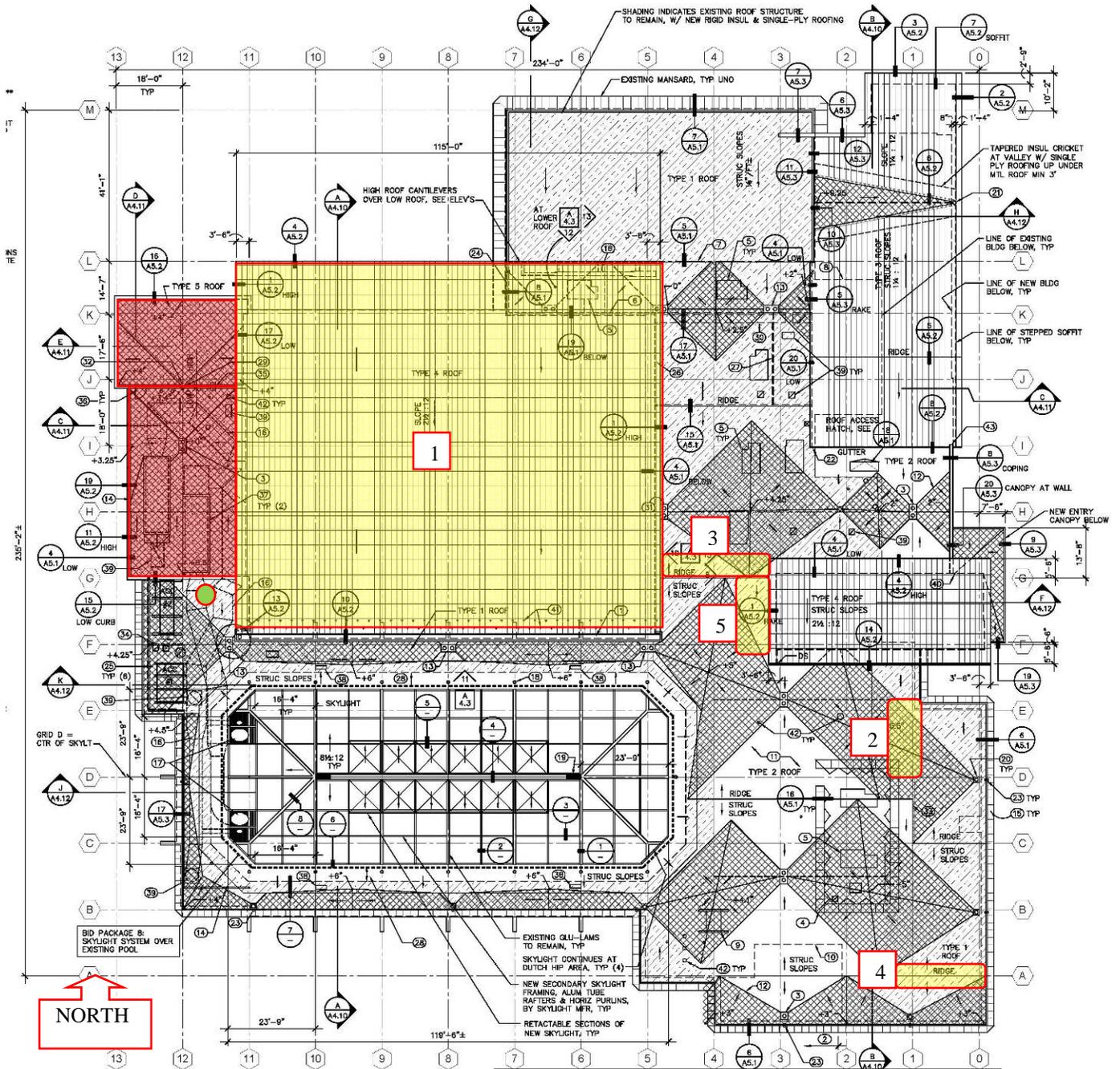


Mike Caniglia, RRC, RWC, REWC, RBEC
Senior Field Engineer

Please note that this survey is provided at the request of Lynn Sordel, whom we understand represents the City of Lynnwood. No liability, warranty of merchantability, or guarantee of building service life is accepted or implied. Wetherholt and Associates, Inc. is a neutral building envelope consulting firm specializing in resolving building and roof related problems.

Moisture Survey Roof Plan

**Please note that areas and locations denoted are approximate.*



Legend

- Area of current natatorium HVAC upgrade work
- Anomaly detected with IR camera
- Test cut made over wood roof deck

Photographs



Photograph #1
Panoramic overview of main low sloped roof area as seen from the southeast.



Photograph #2
Panoramic overview of west lower elevation roof where majority of current HVAC replacement work is scheduled, as seen from higher elevation roof to the north.



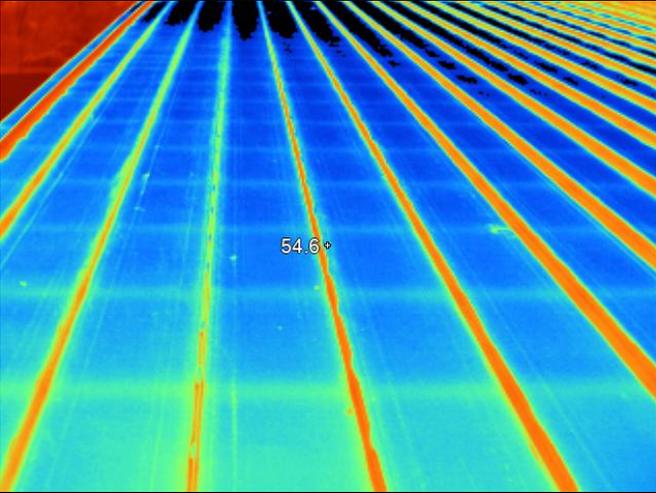
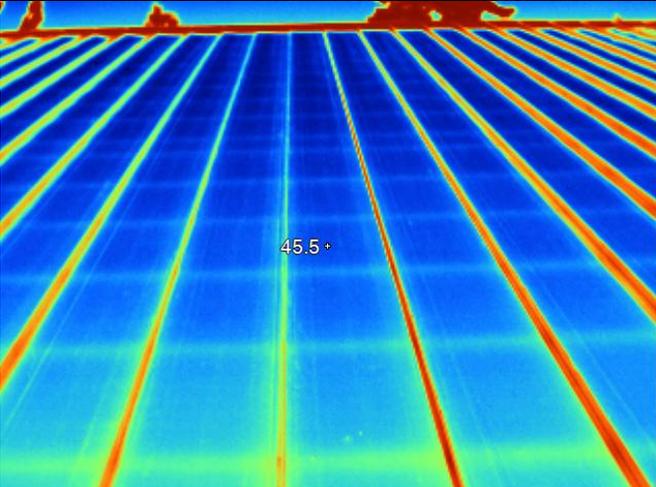
Photograph #3

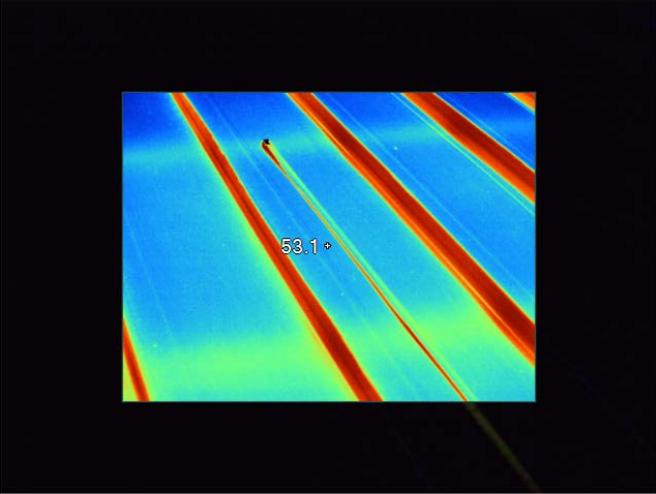
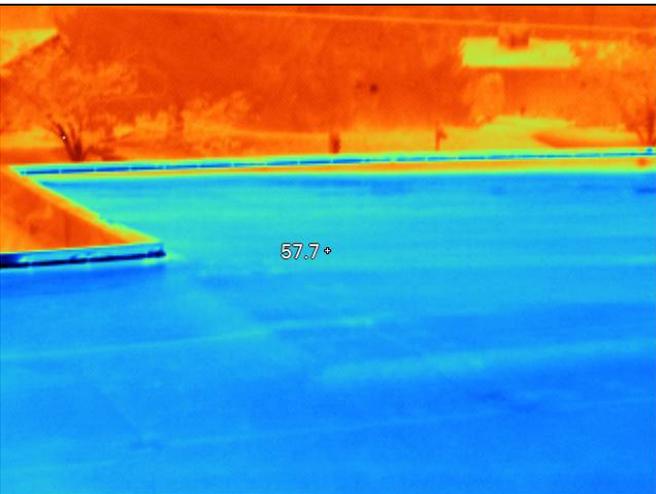
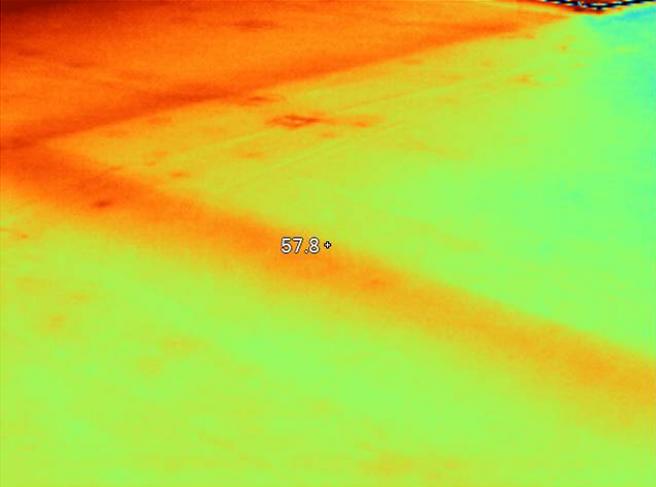
Near northwest corner of roof referenced on previous photo where initial roof demo occurred and halted due to discovering moisture in cover board.

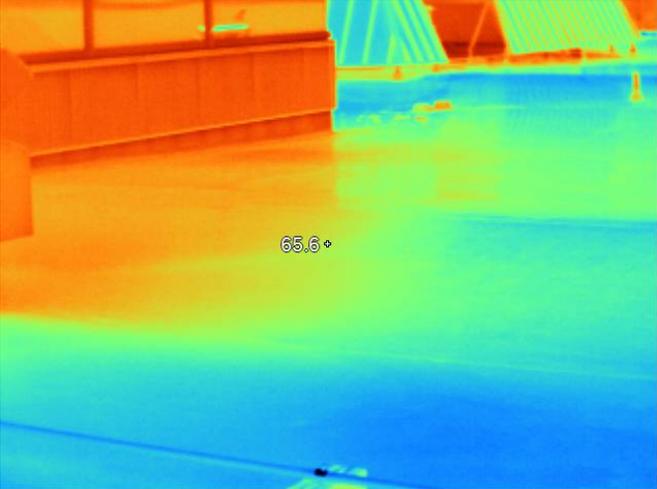
	<p>Photograph #4</p> <p>Penetration pockets for ladder onto higher elevation northwest area roof. Note that this detail typically requires routine maintenance due to the exposed filler material.</p>
	<p>Photograph #5</p> <p>View of sight screen post at base along west perimeter of roof area referenced on photo #2. Metal counterflash with sealant cup appears to be integrated with the coping metal.</p>
	<p>Photograph #6</p> <p>Northeast corner of roof area referenced on photo #2 showing existing duct support curbs to remain from ductwork removal.</p>

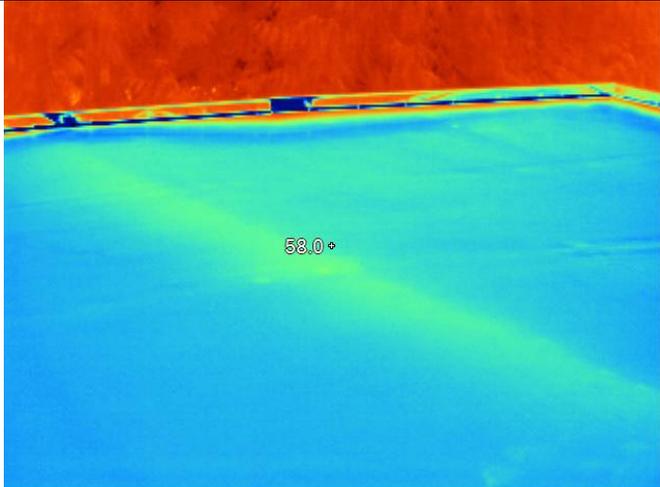
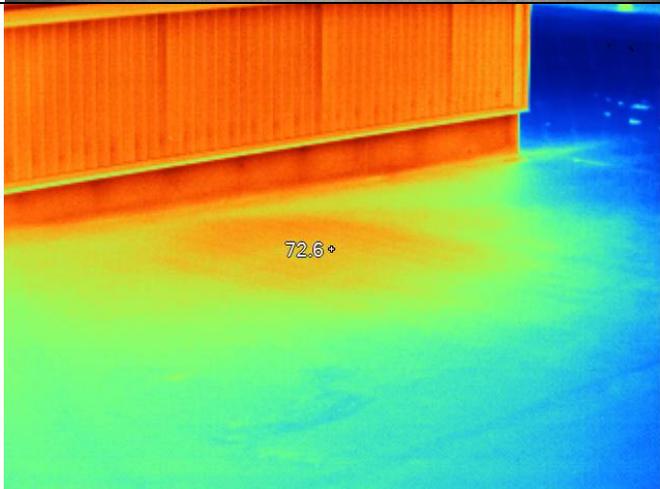
	<p>Photograph #7</p> <p>Close up of remaining duct support curb/sleeper. Plate attached through metal cap on curb appears to have been applied with sealant around fasteners.</p>
	<p>Photograph #8</p> <p>Drain and overflow in typical sump.</p>
	<p>Photograph #9</p> <p>View of curb that divides north roof area (concrete over steel deck) and south roof area (wood deck).</p> <p>Arrow points to self adhered membrane patch.</p>

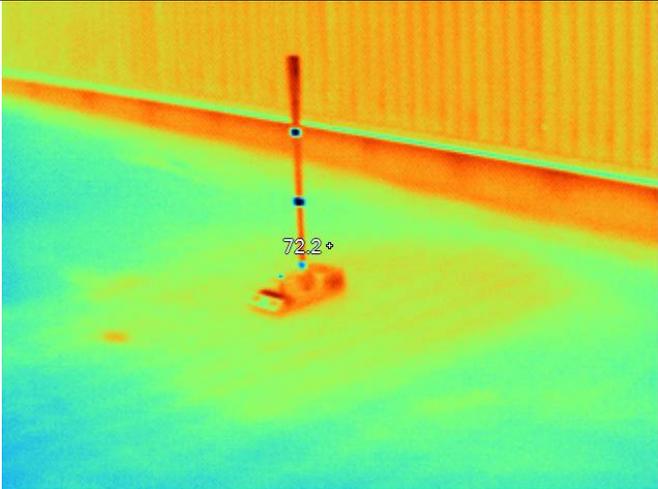
 A close-up photograph of a roof surface showing a dark, rectangular self-adhered membrane patch. The patch is surrounded by a white, fibrous material, likely insulation or a substrate. A date stamp '09/04/2013' is visible in the bottom right corner of the image.	<p>Photograph #10</p> <p>Close-up of previous self adhered membrane patch, appears to be Grace product, installed over TPO membrane. Patch should be replaced with a hot air welded TPO membrane patch.</p>
 A close-up photograph of two HVAC penetrations on a roof. The penetrations are white pipes with black caps. A red arrow points to the left penetration. A date stamp '09/04/2013' is visible in the bottom right corner of the image.	<p>Photograph #11</p> <p>Penetrations adjacent to Carrier HVAC unit near the northeast corner of roof area referenced on photo #2. Caps over membrane flashing wraps appear to be dependent on tape or sealant to keep watertight. Note two penetrations through same pipe on left.</p>
 A photograph showing two sight screen posts on a roof. The posts are grey metal and are surrounded by a white sealant. The roof surface is white and shows some green algae or mold. A date stamp '09/04/2013' is visible in the bottom right corner of the image.	<p>Photograph #12</p> <p>Sight screen post penetrations at the southwest corner of roof adjacent to skylight over natatorium.</p> <p>Sealant in the penetrations should be considered maintenance items.</p>

 A photograph showing a wide view of a large, steeply sloped metal roof structure. The roof is grey and appears to be made of metal panels. In the foreground, there is a concrete surface with a white cylindrical object and a date stamp '09/04/2013'. The background shows some trees and a cloudy sky.	<p>Photograph #13</p> <p>Overview of steep sloped metal roof over north natatorium.</p>
 An infrared thermal image of a standing seam metal roof. The image shows a series of parallel lines representing the roof's structure. The color scale ranges from blue (cooler) to red (warmer). A temperature reading of '54.6°' is visible in the center of the image.	<p>Photograph #14</p> <p>Anomaly 1 - Infrared image of standing seam metal roof over natatorium, west rake area.</p> <p>Note higher heat signature in lines perpendicular to roof slope.</p>
 An infrared thermal image of a standing seam metal roof, similar to the previous one but showing a different area. It features the same parallel line pattern and color scale. A temperature reading of '45.5°' is visible in the center of the image.	<p>Photograph #15</p> <p>Anomaly 1 - Infrared image of standing seam metal roof over natatorium, field of roof.</p> <p>Note higher heat signature in lines perpendicular to roof slope.</p>

	<p>Photograph #16</p> <p>Anomaly 1 - Picture-in picture infrared image of standing seam metal roof over natatorium, field of roof.</p> <p>Note higher heat signature in lines perpendicular to roof slope.</p> <p>Tape measure showed approximate 4-foot on center spacing.</p>
	<p>Photograph #17</p> <p>Anomaly 2 - Infrared image of change in plane in low slope roof, south of Lobby clerestory.</p> <p>Note higher heat signature at edge of what appears to be bridging coverboard.</p>
	<p>Photograph #18</p> <p>Anomaly 2 - Infrared image of change in plane in low slope roof, south of Lobby clerestory.</p> <p>Note higher heat signature at edge of what appears to be bridging coverboard.</p>

	<p>Photograph #19</p> <p>Anomaly 2 – Digital photo of previous digital image, Photo #18.</p>
	<p>Photograph #20</p> <p>Anomaly 3 - Infrared image of change in plane in low slope roof where single ply membrane is stretched, west of northwest corner of Lobby clerestory.</p>
	<p>Photograph #21</p> <p>Anomaly 3 – Digital photo of previous digital image, Photo #20.</p>

		<p>Photograph #22</p> <p>Anomaly 4 - Infrared image of change in plane in low slope roof, southeast corner.</p> <p>Note higher heat signature at edge of what appears to be bridging coverboard.</p>
		<p>Photograph #23</p> <p>Anomaly 4 – Digital photo of previous digital image, Photo #22.</p>
		<p>Photograph #24</p> <p>Anomaly 5 - Infrared image west of Lobby clerestory.</p> <p>Note higher heat signature which may be an indication of moisture entrapment.</p>

	<p>Photograph #25</p> <p>Anomaly 5 - Infrared image west of Lobby clerestory, looking in a northeast direction.</p> <p>Tramex RWS scanner placed over area where anomaly was detected with IR camera.</p>
	<p>Photograph #26</p> <p>Anomaly 5 – Digital photo of previous infrared image looking in a southeast direction.</p> <p>Tramex RWS scanner placed over area where anomaly was detected with IR camera.</p>
	<p>Photograph #27</p> <p>Anomaly 5 – View of Tramex RWS analog display indicating high moisture content.</p> <p>Test cut should be performed and repaired by manufacturer’s approved installer to confirm readings.</p>