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 .

Port of Tacoma – Straddle Carrier Shop
Roof Evaluation
SITE VISIT – March 24, and April 7, 2016

for

Helix Design Group, Inc.
6021 12th Street East, Suite 201
Tacoma, WA 98424

Attn: Lowell Cate

April 26, 2016

Job Number Pending

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April 26, 2016
Job Number Pending

Helix Design Group, Inc.
6021 12th Street Eat, Suite 201 Phone #: 253 922-9037
Tacoma, WA 98424

Attn: Lowell Cate Sent via email: Lowellc@HelixDesignGroup.net

Cc: Jeff Blachowski Sent via email: Jeffb@HelixDesignGroup.net

Ref: Pierce County Terminal (Evergreen)
Maintenance Facility Straddle Carrier Bays
Port of Tacoma Road
Tacoma, WA

Greetings,

At the request of Lowell Cate, this writer met with Mr. Cate, along with Jeff Blachowski, Helix Design Group; Dave Myers, Port of Tacoma; and Jon Havelock, Med-Tox Northwest, on March 24, 2016 to review the roof currently in place at the Port of Tacoma, Straddle Carrier Maintenance Shop. This writer and Ray Wetherholt returned to the site on April 7, 2016 to meet with Mr. Blachowski, and Mike Kisak, Port of Tacoma to perform an infrared scan of the insulation within the Straddle Carrier Maintenance Shop.

The primary focus of the evaluation was the maintenance shop portion of the structure. The roofing on the lower roof to the south of the maintenance bays, and the break room were also reviewed.

Observations

The Port of Tacoma, Straddle Carrier Maintenance Shop Building was reportedly constructed in 2004. The structure is steel framed with steel roof deck over which is installed trapezoidal standing seam sheet metal roofing. The vertical exterior walls of the building are clad with box rib sheet metal. An air space and fiberglass batt insulation with PSK faced vapor barrier are positioned under the metal roof deck. Access at the east elevation of the shop space is provided via four 60-foot tall garage doors. The garage doors are reportedly left open for the majority of the day during all weather types.

The standing seam roof panels slope to the east at approximately a 1:12 slope, and the runoff water is collected by an external hung gutter which is drained via downspouts. There are 14 fall protection anchors and one pipe penetration placed through the sheet metal roof. The penetrations are flashed with Dek-tite style penetration flashings. The flashings are secured to the metal roof panels with gasketed fasteners. Sealant is applied at the top of the flashings, hose clamps were not observed placed to seal the tops of the flashings.

Water entry to the interior of the building has been reported, which had been identified by shop personnel from below. Portions of the batt insulation have become displaced and fallen to the floor below exposing the metal roof deck. The vapor retarder has openings that expose the batt insulation the breaches in the vapor barrier may allow warm moisture laden air to contact the cold roof deck and form water droplets as the moisture reaches dew point.

The sheet metal roof system is breached by fall protection anchors. The leak locations identified roughly align with these fall protection anchors. The fall protection anchors have galvanizing relief holes near the top of the anchors with hard plastic plugs placed within the holes. At some of the anchors the plugs have been displaced. Remedial repairs have been attempted at some of the anchors. In some locations what appears to be clear silicone sealant has been applied at the penetration flashing to metal panel junctures, possibly in an attempt to prevent water entry beyond the roofing.

An infrared survey was performed from the interior between approximately 6:30 and 7:30 am. Anomalous readings which indicate a temperature differential were minimal. The insulation was access via an 80-foot boom lift to verify readings taken with the infrared camera. Readings were taken with a Delmhorst BD-2100 Moisture Meter to confirm findings. Additionally the insulation was felt by hand. Readings with the Delmhorst BD-2100 Moisture Meter and physical inspection indicated the insulation did not contain elevated levels of moisture.

Aluminum framed storefront window at the break room located at the south side of the building shows signs of water entry at the head of the window and damage to the drywall at the window sill. The damaged dry wall is likely due to water collecting from above. Infrared images show an area of differential in temperature above the window emanating from below a louver. It appears the louver, or sealant joint at the perimeter of the louver is allowing water to penetrate into the wall assembly.

Signs of water entry were also observed at the south elevation in the interstitial/storage space below the control tower. Water was observed below the round windows, and louvers within the stud track. Infrared images did not indicate any anomalies.

Discussion and Recommendations

The roof panels appear to be in fair to good condition and should function as intended for 4-5 years with proper repairs and minimal tenant improvements. At which point the roofing should be reevaluated for options for repair.

Water penetration through the roof panels appears to be entering at the through roof penetrations, specifically through the fall protection anchors. The galvanizing relief holes appear to be allowing water into the building. The plastic plugs where in place do not offer adequate protection from water entry. Additionally the through roof penetration flashing are likely compromised which provides another pathway for water entry into the building.

The water entry through the roof may be remediated by replacing the through roof flashing with new flashings, secured to the metal panels set over butyl tape/sealant. The top of the flashings should have sealant and stainless steel band clamps installed. The galvanizing relief holes should have sealant applied over the holes to prevent water entry. Fill the fall protection anchors with spray foam insulation to minimize condensation.

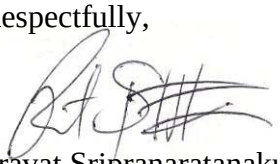
At the south elevation, the louvers should be removed, soldered stainless steel sill pans installed, the louvers reinstalled and new properly configured sealant joints installed around the louvers leaving weeps at the sill. If moisture entry continuous after proper installation of sill pans, the sheet metal cladding assembly should be removed to allow the weather barrier to be reviewed and repaired where necessary to provide a weather tight installation. Remove the sealant joints around the windows and replace with new properly configured sealant joints.

The batt insulation below the roof deck is displaced or missing in several areas and the vapor barrier is discontinuous. The batt insulation should be reworked to provide a full coverage, and the vapor barrier made continuous at all locations. This work may help prevent water accumulation as a result of condensation.

Enclosed are photographs and notes taken during our site visit for your review. These photographs and notes may provide additional information to that discussed above, and should be considered as 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,



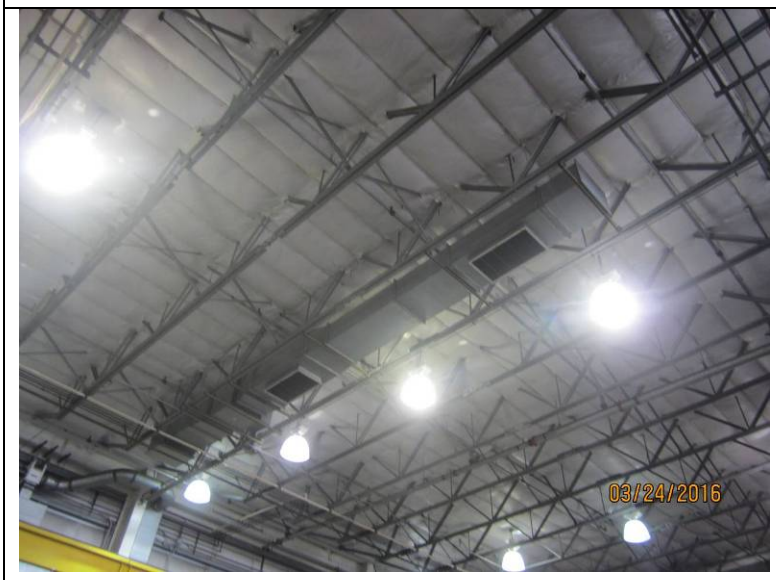
Pravat Sripranaratanakul, RRO, RRC
Field Engineer
Wetherholt and Associates, Inc.

Reviewed by,

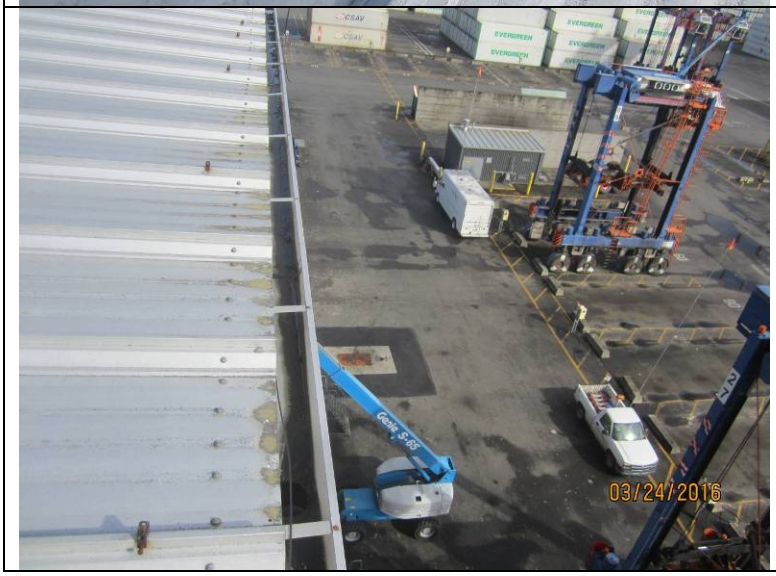
Jeorge Hopkins, RRO, RRC
Senior Field Engineer
Wetherholt and Associates

Enclosures: photographs

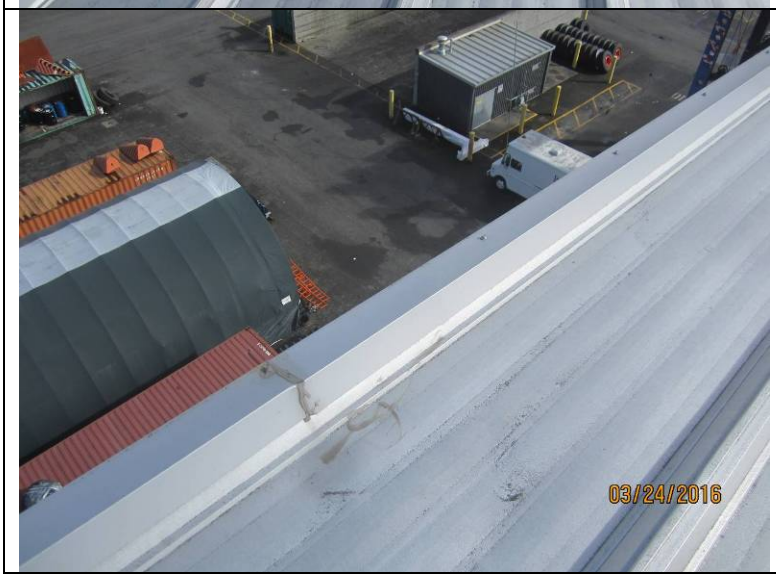
Please note that this evaluation is provided at the request of Lowell Cate. No liability, warranty of merchantability, or guarantee of roof service life is accepted or implied. Wetherholt and Associates, Inc., is a neutral roofing consulting firm specializing in resolving building and roof related issues.

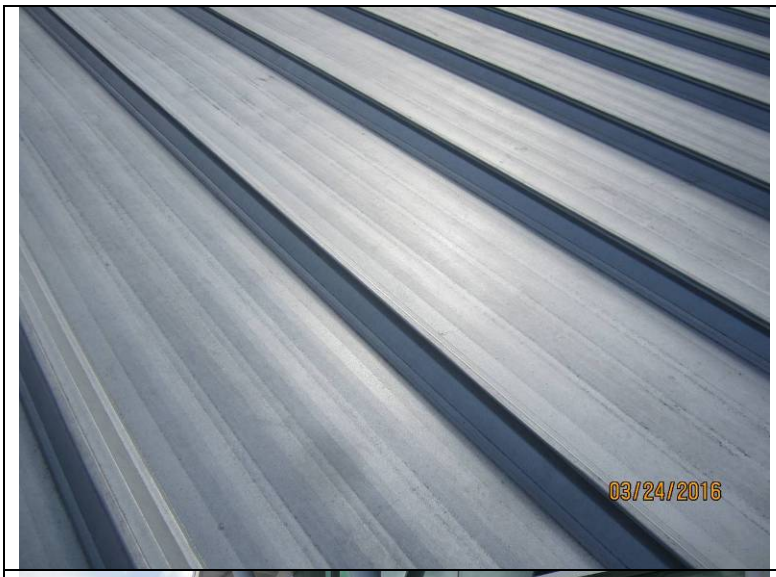
	Photograph 1: Overview of the Straddle Carrier Shop.
	Photograph 2: Looking up at the underside of the roof deck with PSK vapor barrier.
	Photograph 3: A location of missing insulation exposing the underside of the metal roof deck.

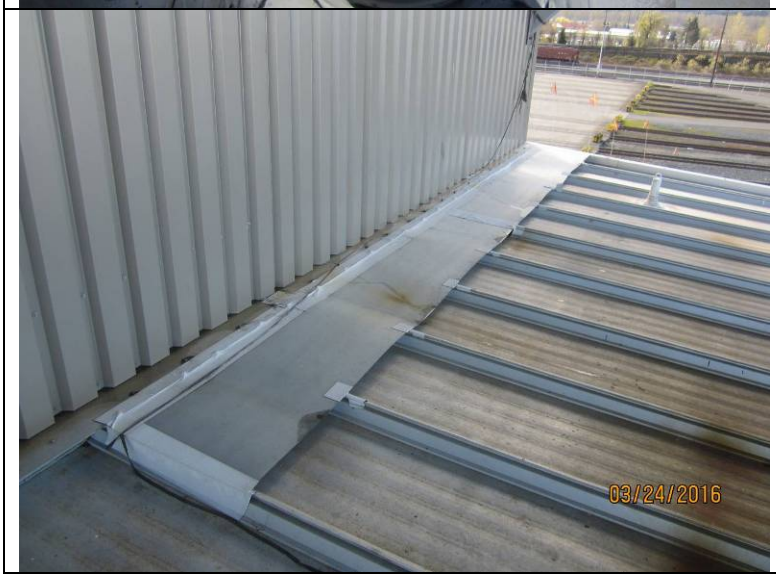
	Photograph 4: Displaced insulation and discontinuous vapor barrier. The voids in the insulation show up as dark spots in the infrared photographs.
	Photograph 5: Looking south along the upslope edge of the Maintenance Roof. Edge metal is in place hooked into a cleat at the exterior and secured to z-closures at the interior of the roof.
	Photograph 6: Looking upslope at the upslope edge flashing and z-closure.

	Photograph 7: Looking north along the draining edge of the Maintenance Roof.
	Photograph 8: View of the draining edge of the Maintenance Roof.
	Photograph 9: Overview of the external hung gutter at the east side of the Maintenance Roof.

	Photograph 10: Typical pipe penetration flashed with a Dek-tite style flashing.
	Photograph 11: Typical fall protection anchor flashed with a Dek-tite style flashing.
	Photograph 12: Plastic plug placed within the galvanizing relief hole.

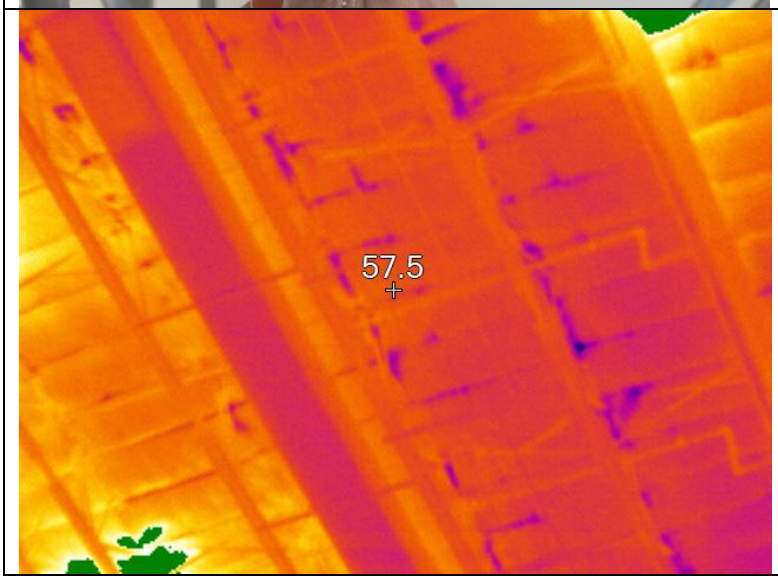
	Photograph 13: Sealant applied at the transition between the through roof penetration flashing and the metal roof panel.
	Photograph 14: Overview of the North rake edge at the Maintenance Roof.
	Photograph 15: Closer view of the sheet metal cap at the rake edge, the cap is top fastened with gasketed fasteners and is configured with simple laps.

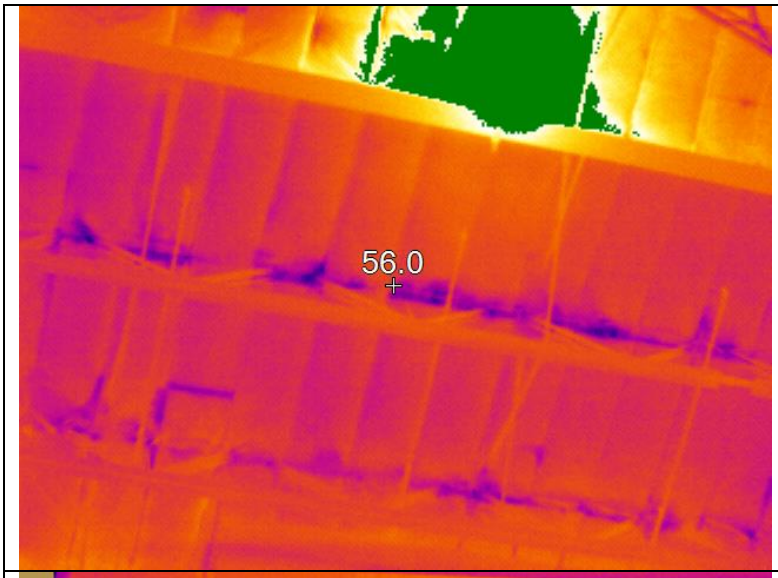
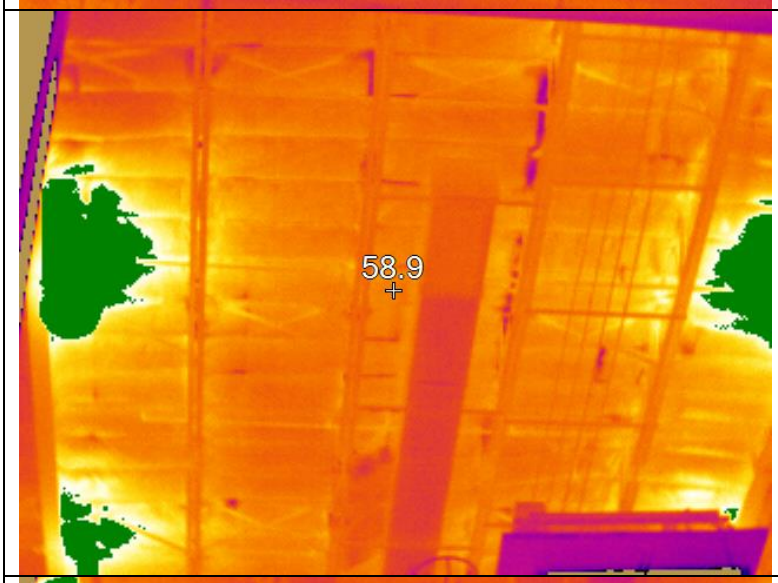
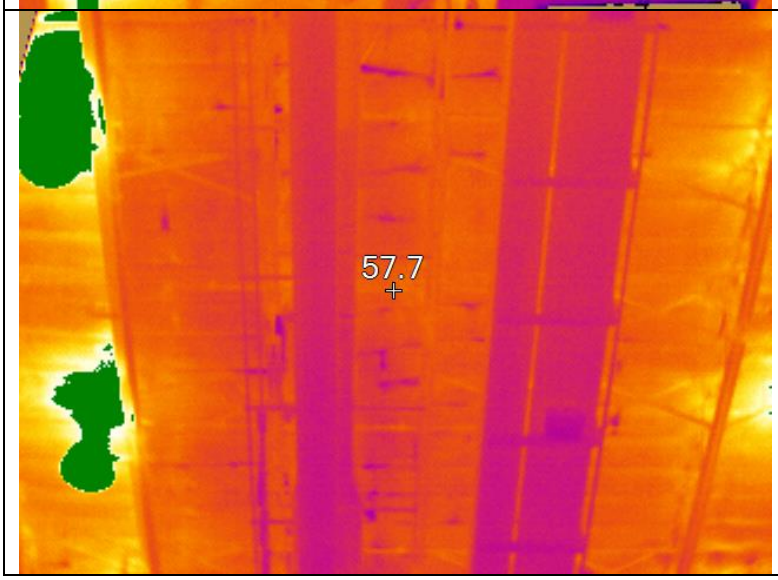
	Photograph 16: Trapezoidal seams of the sheet metal roofing.
	Photograph 17: Transition to the rising building wall at the south side of the roof.
	Photograph 18: Fall protection anchor with sealant applied over the base of the through roof penetration flashing.

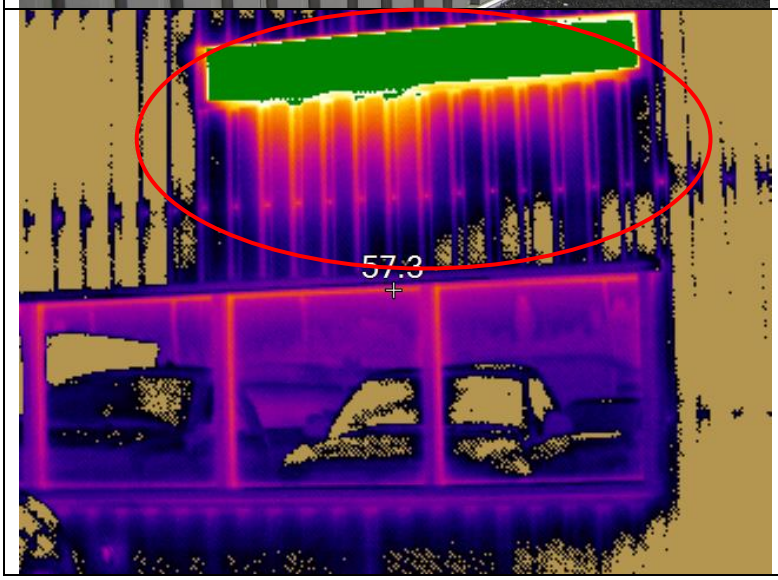
	Photograph 19: Through roof penetration flashing fastener that has backed out. This may be a source of water entry.
	Photograph 20: Sealant applied over the galvanizing relief hole at the lower roof area.
	Photograph 21: Extended base of wall flashing at the lower roof to rising wall transition. Reportedly the flashing was extended to stop previous water entry.

	Photograph 22: EternaBond tape applied at the added flashing laps and transition to the existing flashing.
	Photograph 23: Looking up at the underside of the insulation and vapor barrier form within the Maintenance Shop.
	Photograph 24: Fiberglass batt insulation exposed. The insulation shows signs of dirt accumulation.

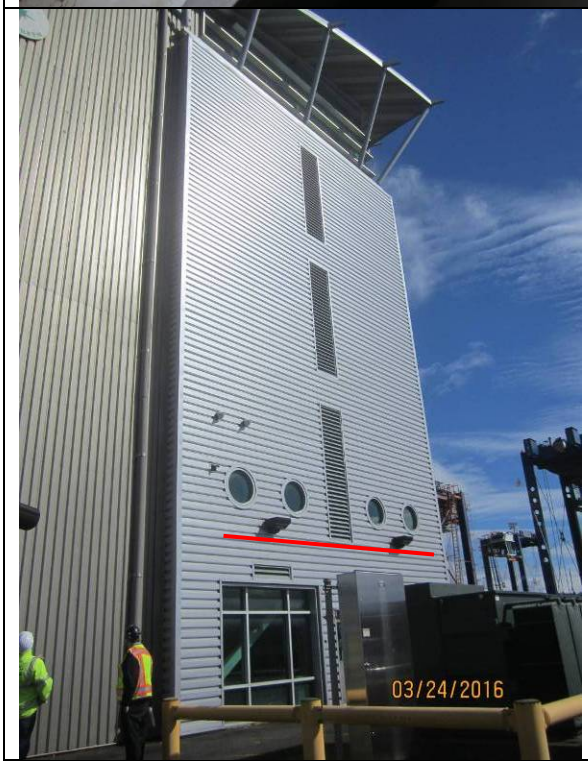
	Photograph 25: Additional location of exposed fiberglass insulation with signs of dirt accumulation. Dirt may be an indication of air movement over the insulation.
	Photograph 26: Closer view of the exposed insulation.
	Photograph 27: Delmhorst reading indicating low moisture.

	Photograph 28: Additional location of a Delmhorst reading indicating low moisture.
	Photograph 29: Additional location of a Delmhorst reading indicating low moisture.
	Photograph 30: Infrared image of the insulation. The darker areas indicate colder areas. Further investigation of the colder areas found the areas are voids in the insulation.

	Photograph 31: Infrared image of the insulation. The darker areas indicate colder areas. Further investigation of the colder areas found the areas are voids in the insulation.
	Photograph 32: Infrared image of the insulation. The darker areas indicate colder areas. Further investigation of the colder areas found the areas are voids in the insulation.
	Photograph 33: Infrared image of the insulation. The darker areas indicate colder areas. Further investigation of the colder areas found the areas are voids in the insulation.

	Photograph 34: Overview of the south elevation of the break room. The arrow indicates the window where signs of water entry were observed in the interior.
	Photograph 35: Closer view of the window shown in Photograph 34.
	Photograph 36: Infrared view of the window shown in Photograph 34. Note the temperate differential below the louver and above the window head. This type of temperature differential may indicate components have been wetted thereby reducing the components thermal resistance.

	Photograph 37: Looking across the head flashing at the window shown in Photograph 34.
	Photograph 38: Interior view of head of the window shown in Photograph 34. The drywall and paint show signs of water damage.
	Photograph 39: Interior view of sill of the window shown in Photograph 34. Note the drywall and paint show signs of water damage.

	Photograph 40: Closer view of the area shown in Photograph 39.
	Photograph 41: Overview of the south elevation below the control tower. The line shows the approximate location of the sill track with water observed.

	Photograph 42: Closer view of the area shown in Photograph 41. The line shows the approximate location of the sill track with water observed.
	Photograph 43: Interior view of the area below the control tower. The arrow indicates the sill track where water was observed.
	Photograph 44: Closer view of the area shown in Photograph 43.

	Photograph 45: Area below the sill track shown in Photograph 43 showing signs of water entry.