



ROOF INSPECTION REPORT
&
CONDITION ASSESSMENT & RECOMMENDATIONS

**COHASSET PUBLIC SCHOOLS
COHASSET SENIOR HIGH SCHOOL & MIDDLE SCHOOL
143 POND STREET
COHASSET, MASSACHUSETTS**

TREMCO INSPECTION NO. 11-CHSMS-011.03



DECEMBER 2011





GENERAL INFORMATION: ROOF INSPECTION/SURVEY

In October/November 2011, a comprehensive inspection was completed on the roofing systems covering the Cohasset High School/Middle School complex located at 143 Pond Street in Cohasset, Massachusetts. Although we were not provided this information, we believe the original portions of this facility were constructed prior-to 1950. In 2001/2002, a large-scale renovation and addition was constructed, which substantially-increased the footprint of this building. Based on conversations with inhouse staff, and a cursory review of available drawings, we believe the roofing systems at this site all date from the renovation completed in 2001/2002.

Survey access was provided to all roof levels through the course of the inspection, either via interior hatch/access-doors, or from ground-based extension ladders. Aside from the primary inspection completed in late-October, several additional visual inspections were completed in November/December to help field-verify various conditions.

The general scope of our inspection and condition assessment involved the following items:

- Careful, visual examination of all accessible exterior roof surfaces and flashing systems.
- Cursory, visual examination of existing brick/masonry walls rising above various roof levels (where visually accessible).
- Thermographic, infrared testing of all accessible roof areas across the complex.
- Photographical documentations of various key conditions and overview photos of various roof areas.
- Field-measurements of all existing roof sections.
- Development of a scaled AutoCAD roof plan drawing showing different roof elevations/sections.
- Isolated core-sample extractions to help understand existing roof construction and obtain specific information about internal conditions.

The roofing survey at this site was performed for two (2) primary reasons. Facilities personnel have expressed an interest in developing an on-going inspection/maintenance program for the sizable roofing inventory at this site. A variety of isolated leakage issues, coupled with the increasing age ($10 \pm$ years) of the roofing system have prompted a concentrated focus on making-sure the roofing systems are properly-maintained. An updated condition survey was considered a good first-step in identifying various source(s) of leakage, as well as helping to determine the presence of any sub-surface, latent issues in the roofing systems.





Of equal importance, and running in a parallel path, the Town has expressed interest in the installation of solar power-generating equipment on large-portions of the roof surface. Assessing the condition of the roofing assembly was considered an essential part of the overall evaluation process. Given a relatively long cost-recovery period, in certain instances, solar vendors may be unable to justify the installation of solar equipment on roofing assemblies that do not have 15-20 years of

guaranteed/warranted additional service-life. Power Purchasing Agreements (PPAs) can be relatively complicated arrangements that eliminate the upfront costs associated with the purchase and installation of solar arrays. For roof-mounted solar installations, these PPA vendors typically want to be sure that the roofing assembly will perform at least as-long as the term of their agreement (typically 15-20 years).

Data contained on the following pages provides information on existing conditions encountered during the survey-process, as well as recommendations for a host of routine repairs/maintenance and isolated, sectional roof replacement.





SURVEY PROCEDURE & MOISTURE-DETECTION RESULTS:

As mentioned on the preceding pages, a significant portion of the roof inspection process involved a non-destructive/non-invasive inspection of the roofing assembly with infrared-imaging equipment. Highly-sensitive to variations in temperature, infrared imaging provides accurate information on the location(s) of sub-surface moisture which may have accumulated within various types of roofing assemblies. Essentially, this equipment is detecting the differences/variations in insulating-qualities between wet and dry roof insulation materials. Wet/damp thermal insulation within a roof system generates reduced insulating properties that are detectable with this type of sensitive equipment.

Given the size and complexity of the roofing inventory at this site, we are extremely-pleased with the extremely-minor amounts of wet/damp roof insulation identified during this survey. Across thirty-five (35) roof levels and almost one-hundred-thirty-thousand (130,000) square feet of roof area, only two (2) small areas of wet-insulation (totaling less than three-hundred (300) square feet) were identified.

In one instance, over the Middle School portion of the building, the source of the wet-insulation was traced to a small (1/2" dia.) puncture in the EPDM roofing membrane. Another lower-level roof section along the front portion of the building tested positive for moisture. We believe the problems with this lower-level roof section stem from very poor drainage and a variety of marginally-executed flashing details at perimeters.

In several isolated areas, where standing-water was present on the roof surface, sub-surface moisture-detection was impossible. These isolated areas represent a miniscule portion of the overall roof area at this site and do not play a substantial, meaningful role in the overall assessment of the roof's condition.

A variety of small holes/punctures were identified during our visual inspection process. These small holes, likely associated with routine rooftop traffic and/or bird-damage, have not (in all cases) produced measureable quantities of wet-insulation. While reviewing these areas with inhouse facilities staff, several of these holes/punctures are thought to be the source of minor, isolated leakage issues.

Additional, descriptive data on the infrared-imaging inspection process is provided on the following pages.



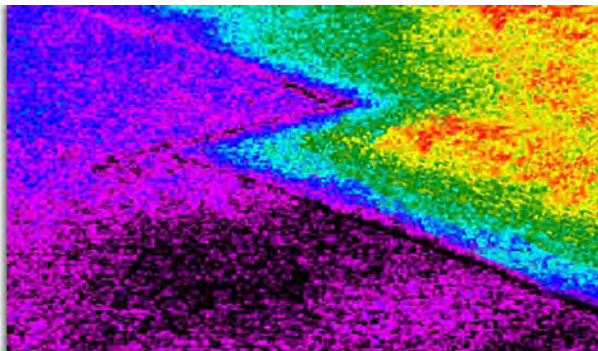
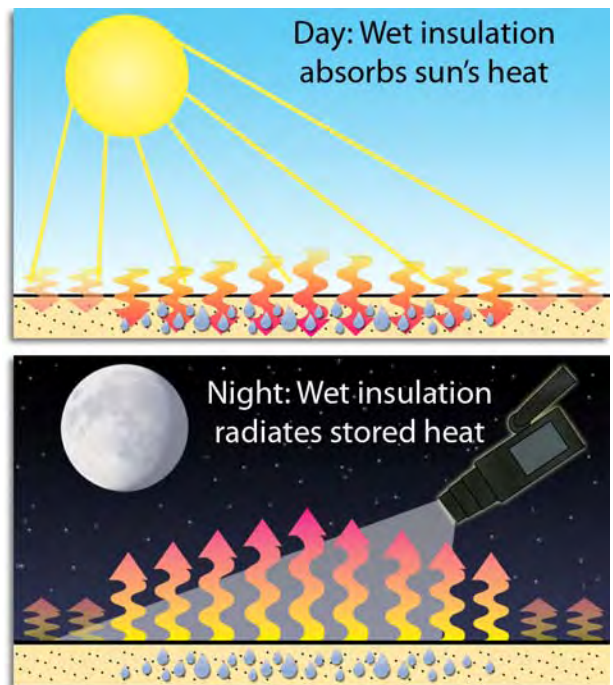
INFRARED THERMOGRAPHY

All objects emit heat (i.e. infrared radiation). This radiation is constantly being absorbed and re-emitted by ourselves and everything around us. “Infrared scanning” and “thermography” are the terms used to describe the process of making this thermal radiation visible and capable of interpretation.

Infrared imaging technology is a highly-accurate tool in helping to locate sub-surface areas of wet insulation within a roofing assembly. These areas of wet insulation can be pinpointed with the infrared scanner because wet and dry insulations have different abilities to conduct, absorb and retain heat. The thermal differences between wet and dry insulation are especially evident under two sets of circumstances.

First, wet roof insulation absorbs much more heat than dry insulation. Moisture-damaged insulation also stores more heat over a longer period of time than intact, dry materials. During the day, the sun’s heat steadily raises the temperature of wet insulation in the roofing system. As the roof cools off at night, the areas of wet insulation will stay warm longer than the dry areas. During the evening, this stored “solar gain” is released as radiant heat that is detectable with the infrared camera. As the evening progresses, areas of wet insulation will appear warmer to the infrared sensing equipment than adjacent dry roofing.

Second, when there is a significant difference in ambient temperature between the interior and exterior of the building, heat losses from inside the building will be greater through the wet areas due to the reduced R-value of the wet insulation. This is especially true during the heating season. In both instances, when viewed from the roof side, wet insulation will show up as warmer in the infrared image. Often these two phenomena work together, creating strong, long-lasting thermal images that clearly illustrate the differences between wet and dry insulation.



Thermographic image from infrared camera



Control image, wet sections marked for removal

MOISTURE-SENSING EQUIPMENT

We use top-quality instruments when performing infrared imaging surveys. The portable, high-resolution ThermoCAM Pm390 (FLIR Systems Inc.) is one of the most-sensitive and sophisticated scanners available. It is capable of resolving temperature differences as small as 0.1 degree Centigrade. The system consists of an infrared camera unit, a color viewfinder, photo recording attachments and battery packs.



The camera unit receives infrared radiation from the object being surveyed and converts it to an electrical signal that is instantaneously displayed on the color viewfinder. This high-resolution thermal image is then interpreted by Certified Thermographers.

Each accessible EPDM roof system was inspected with a ThermoCAM Pm390 Short Wave System. We use scanners that operate in both Short Wave (3-5.6 microns) and Long Wave (8-12 microns) segments of the infrared spectrum. Due to the reflectivity of the EPDM membrane on your roofs, a Short Wave Scanner was used in order to provide high-quality, accurate readings. While other consultants may use Long Wave imaging systems on these types of roofs, in our experience the highest quality information can only be provided by using a Short Wave Scanner.

SURVEY PROCEDURES

Our Certified Thermographers followed defined survey procedures when inspecting the roofing assemblies at the Cohasset HS/MS complex.

Every square foot of (accessible) roofing at the site was scanned a minimum of two (2) times. All wet/damp areas were marked directly on the roof with long-lasting paint. The locations of all physical testing (probes, core-samples, etc.), as may have been necessary, were also marked on the surface.

Every effort is made to have the lines painted on the roof indicate (with accuracy) the boundaries of the wet insulation below. However, communication between the thermographer and the helper painting the lines can sometimes result in small inaccuracies. Therefore, the thermographer will generally mark outside the wet area by about 6" to 12" to provide for a reasonable margin of error. In all instances, it is advisable to calculate a slightly larger area of insulation than what is actually outlined/painted on the roof surface. Additionally, water tends to migrate through insulation materials in a somewhat random, non-homogenous way, and it may happen that there are a few square feet of dry insulation within the boundaries of the larger wet area. As a practical matter, these small dry spots are not significant, and the thermographer will just define the overall boundaries of the wet area.

After all the scanning and verification were completed, the roofs were mapped. A draft copy of your drawing was made at the site, documenting all the information generated during the inspection. A final copy of the map was plotted in our offices using a CAD/drafting system.

VISUAL INSPECTION & GENERAL COMMENTS:

Our field-inspection revealed that all of the roofing assemblies at this site consist-of lightweight EPDM (ethylene propylene diene monomer) membrane roofing systems, in fully-adhered configurations. As mentioned earlier, we believe all of these roofs date from 2001/2002, making all roof areas approximately eleven (11) years old. During the review of available drawings, we believe the underlying, structural roof decks consist-of steel (new construction, circa 2001/2002), concrete, gypsum and wood plank. We have not confirmed these roof deck constructions, however.

Across all roof levels (upper and lower sections of the facility), we identified a fairly-substantial quantity of previously-repaired holes/punctures in the roof membrane and flashings. Most of these repairs appear to be related to (unintended) physical damage from the routine service of rooftop HVAC equipment or (possibly) bird/seagull related damage. It should be noted that minor puncture repairs on this type of lightweight membrane roofing assembly are fairly-routine and none of the past-repairs appeared to be excessive or particularly unusual.

Portions of the roofing inventory are cluttered with fairly-concentrated quantities of roof-mounted HVAC equipment. The largest, curb-mounted units consist-of heating/cooling units, as well as exhaust fans and sanitary vents. We were surprised to see that none of the HVAC units contained any type of roof-mounted, protective service-pads. Minor damage to the roofing membrane is possible in these areas, when these rooftop units are serviced/maintained.

Access between the various roof levels is accomplished through fixed steel ladders. There are several roof access hatches, as well as a roof-access-door that provides primary access to the roof surfaces from the interior. Unfortunately, there are several areas where roof access ladders are either missing, never-installed, improperly-attached, or require various improvements to meet current OSHA fall-protection mandates. We have targeted these improvements as priorities in the recommendation-section of this report (see photo log).

With a few notable exceptions, the drainage on these roofing systems is acceptable. A number of small roof areas (see provided drawing), as well as a number of isolated areas across the larger roof sections collect standing-water. Based on our survey, we are recommending the immediate replacement of one particular roof section over/near the entrance to the Administration Office. Several other lower-level roof areas, primarily along the front portion of the building are also targeted for replacement due to poor drainage and wet-insulation.

While inspecting the Middle School classroom wing, we identified two (2) previous roof drain locations that were either covered-over, or eliminated for some reason. Regardless of reason, these two (2) former drain locations hold a substantial quantity (3-5") of water and should be considered a priority for investigation and repair (see photo log).

Roof drains at this site consist-of both conventional cast-iron assemblies, as well as a number of retrofit/sleeved roof drain inserts. We are wary of sleeved/insert feeds, which are often responsible for roof damage during very heavy rain-events (particularly when drainage-feeds are unable to handle rain volume). Fortunately, we did not detect any evidence of wet/damp insulation around roof drains, so this concern is a relatively minor one. We did notice that all of the protective strainers on these



roof drains (aside from the insert systems) are fabricated from PVC plastic. Over time, these strainers become brittle and deteriorate. One of our recommendations involves the replacement of these strainers with properly-sized/fitted cast-iron components. We do not consider this an urgent priority, but one that should be planned across the coming years.

As a frequent contributor to leakage problems, we have performed a very cursory inspection of the masonry components that rise above various roof levels. In coastal areas, wind-driven rain is often able to migrate into/through sidewall locations, resulting in leakage issues or roof system damage. We identified several locations where we'd recommend remedial repairs to rising brick/masonry walls surfaces directly above the roofing systems. In several locations, we have also identified areas where the embedded, through-wall copper flashing components are either missing, or appear to be in poor condition. We have not performed any type of detailed inspection (opening brick walls, etc.) at these locations, but believe at least one current area of leakage may be attributable to openings/voids at embedded copper masonry flashings. We assisted in resolving a similar type of leakage problem through the rising wall above the library several years ago. We have provided some approximate budget-estimates for this work, but additional field-investigations and detailing would be required prior-to actually proceeding with any of these recommended repairs.

OSHA regulations require building-owners to provide fall-protection in areas which pose a hazard to workers/personnel. With roofing installations, HVAC equipment that requires service and is located within ten (10) feet of an unprotected perimeter requires some form of fall-protection. Across the HS/MS complex there are several areas where units/equipment bring service/maintenance personnel to within ten (10) feet of roof perimeters. We are suggesting that these areas be fitted with roof-mounted safety-rails, which can be purchased/installed by inhouse staff, or outside contractors.

ROOF-MOUNTED SOLAR POWER-GENERATING EQUIPMENT:

In regards to the overall condition of the roofing assembly and the ability of the existing membrane assembly to accommodate new solar equipment, we have a number of comments:

- Structural Assessment: While most solar assemblies represent a fairly-modest overall additional load, it will be important to have the structural components of the roofing system evaluated by a licensed, structural engineer. Wood, gypsum and steel roof decks are more-susceptible to being negatively-impacted by the additional weight/load of solar equipment. Prior to moving to any next-step, we would suggest that these structural components be investigated for their ability to accommodate additional dead-load.
- Wind-Loads: Solar equipment placed on an elevated surface, in a coastal-zone will require various provisions to prevent exposure to wind-damage. Depending-on the particular solar-equipment, this could involve the use of additional ballast and/or mechanical-anchorage into/through the roofing assembly. We would advise that these variables be reviewed by a licensed, structural engineer to understand what specific attachment/securement regimen would be required in this particular location.





ROOF-MOUNTED SOLAR POWER-GENERATING EQUIPMENT:

(Continued..)

- Future Roof System Service-Life: EPDM roofing assemblies, when properly-installed, properly-maintained and protected are capable of providing a service-life that typically-approaches twenty (20) years. In the present case, these roofing assemblies are approximately half-way through their expected/typical lifespan. To perform through the term of a PPA (*Power Purchase Agreement*) which is usually 15-20 years in-length, the roofing assemblies at this site should be targeted to receive a host of life-extending improvements/treatments. Typically, this process involves various membrane repairs; lap/seam reinforcements and the application of additional weatherproofing materials/coatings to extend the service-life past the term of the PPA program. An added benefit, aside from extending the lifespan of the roofing system, is that these treatments/improvements can reduce cooling-loads by greatly-reducing roof surface temperatures in the summer months. Photos from a typical type of project are provided on the following page, as a reference. Approximate construction cost-estimates for this type of restoration process is also included in this report.

As a reference, we have included a conceptual layout, as prepared by Alteris Renewables Inc., for a roof-mounted solar-array at this site. This draft drawing provides an approximate footprint of available, non-shaded roof areas that are likely to represent an acceptable footprint for new solar equipment. Combined, this concept drawing provides a solar footprint that approaches thirty-seven-thousand (37,000) square-feet in total size. *To be clear, we are providing this solar-layout as a concept/guide, ONLY. We would not recommend that this be used as a basis for any type of planning/design, etc.*





EPDM Roof Restoration/Treatment/Coating Process: Typical Installation Photos



Workers in the photos above are shown cleaning, priming and coating a black EPDM roofing membrane with a restorative coating. Finish-surfacing is a bright-white, *Energy-Star®* rated system capable of providing a greatly-extended service-life.



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ROOF # DESIGNATION	SQUARE FOOTAGE
ROOF # 1	17,762
ROOF # 2	1,394
ROOF # 3	26,773
ROOF # 4	8,768
ROOF # 5	6,197
ROOF # 6	2,962
ROOF # 7	1,429
ROOF # 8	2,788
ROOF # 9	3,916
ROOF # 10	5,859
ROOF # 11	907
ROOF # 12	189
ROOF # 13	144
ROOF # 14	88
ROOF # 15	576
ROOF # 16	144
ROOF # 17	144
ROOF # 18	1,092
ROOF # 19	12,014
ROOF # 20	320
ROOF # 21	144
ROOF # 22	1,000
ROOF # 23	130
ROOF # 24	94
ROOF # 25	471
ROOF # 26	130
ROOF # 27	4,025
ROOF # 28	1,380
ROOF # 29	3,945
ROOF # 30	5,244
ROOF # 31	1,560
ROOF # 32	1,463
ROOF # 33	562
ROOF # 34	15,400
TOTAL:	132,489

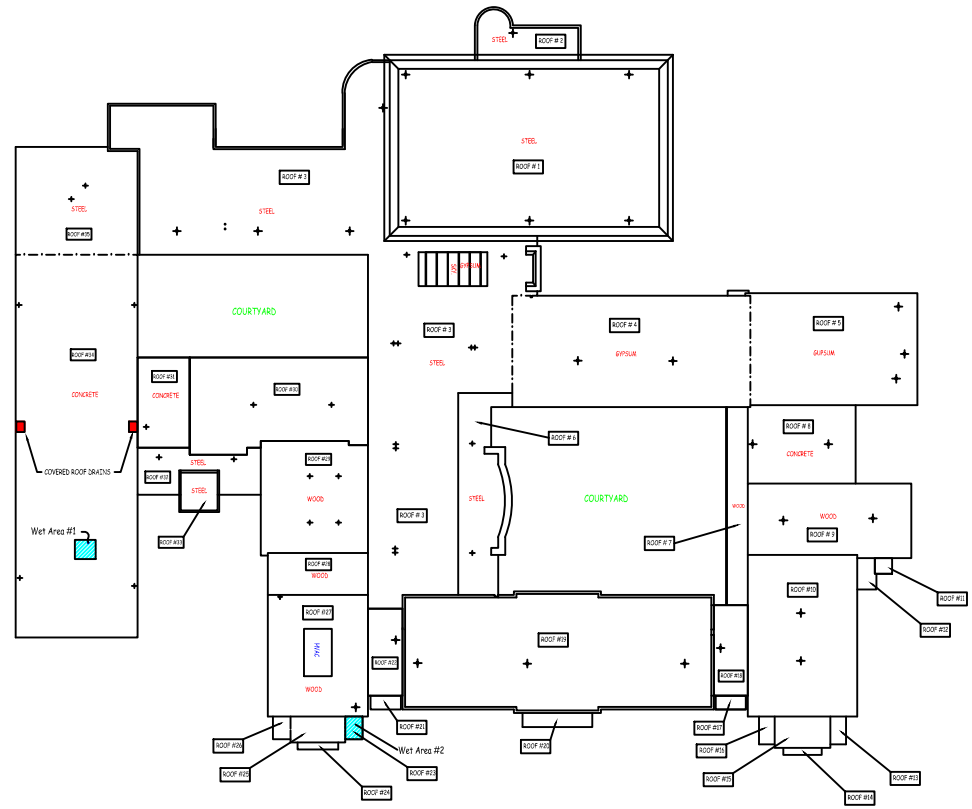
- Legend**
- + DRAIN
 - WET INSULATION
 - - - EXPANSION JOINT

Areas Surveyed: (in approximate square feet)

Square Footage of Roof Inspected: 128,298

Square Footage of Wet Area: 262

Percentage of Wet Area: <1%



EXISTING ROOF DECK CONSTRUCTION NOTES:

CONCRETE, WOOD, STEEL, ASPHALT ROOF DECKS - INFORMATION OBTAINED SOLELY FROM RENOVATION PLAN SHWS (CSCA 1-03-2000). INFORMATION HAS NOT BEEN FIELD-VERIFIED AND CANNOT BE CONSIDERED BENEATH AGGREGATE. ADDITIONAL INSPECTIONS REQUIRED TO DETERMINE THE PHYSICAL/STRUCTURAL CONSTRUCTION OF ANY ALL ROOF DECK SUBSTRATES.



INFRA-RED ROOF MOISTURE ANALYSIS

TREMCO

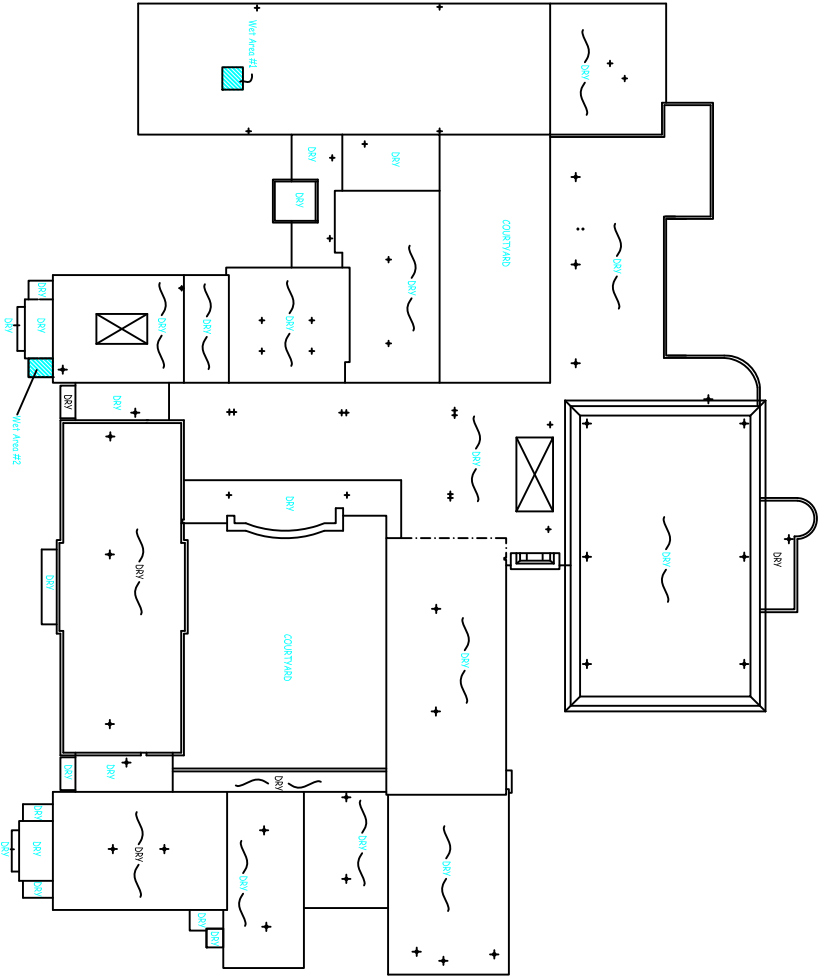
COHASSET HIGH/MIDDLE SCHOOL
COHASSET, MA

SCALE: 1/32"=1'-0"

DATE: 10-27-11

PAGE: 1 OF 1

DRAWN BY: G. DAVIS
JOB#: 11589COH



Legend

+

DRAIN

WET INSULATION

- - -

EXPANSION JOINT

Areas	
(In approximate square feet)	
Square Footage of Roof Inspected	128,298
Square Footage of Wet Areas	262
Percentage of Wet Areas	<1%

INFRA-RED ROOF MOISTURE ANALYSIS

COHASSET HIGH/MIDDLE SCHOOL
COHASSET, MA

SCALE: 1/32"=1'-0"

DATE: 10-27-11

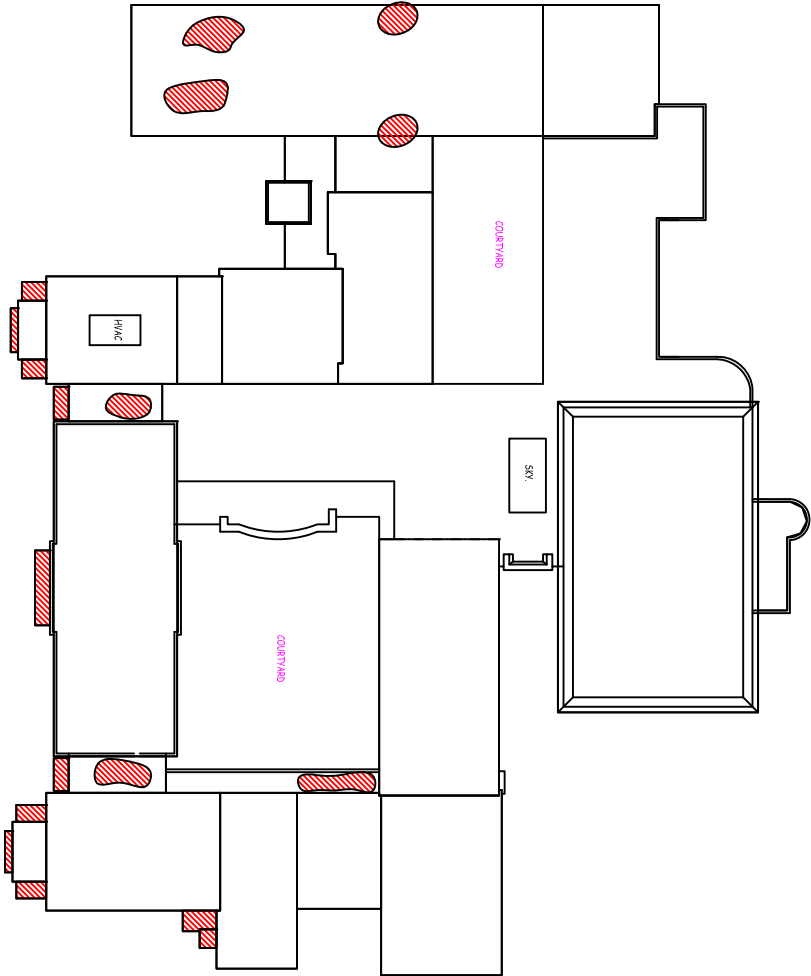
PAGE: 1 OF 1

DRAWN BY: DMR

JOB#: 11583COH



Areas:
(If appropriate, name, sqft)
Square Footage of Roof Inspected: 128,298
Square Footage of Wet Area: 262
Percentage of Wet Area: <1%



APPROXIMATE LOCATIONS - PONDING WATER
APPROXIMATE ROUGH LOCATION OF AREAS IDENTIFIED AS
CONTAINING MINOR/POOR ROOF DRAINAGE. LOCATIONS
& BOUNDARIES ARE APPROXIMATE

ROOF DRAINAGE - STANDING-WATER



COHASSET HIGH/MIDDLE SCHOOL
COHASSET, MA

SCALE: 1/32"=1'-0"
DATE: 10-27-11
PAGE: 1 OF 1
DRAWN BY: DMR
JOB#: 11589COH

Areas:	(in approximate square feet)
Square Footage of Roof Inspected:	128,298
Square Footage of Wet Area:	262
Percentage of Wet Area:	<1%



CONCEPTUAL SOLAR EQUIPMENT LAYOUT/ARRAY:
(PREPARED BY: ALTERIS RENEWABLES, INC.)

POTENTIAL LAYOUT - SOLAR EQUIPMENT
(NET SQUARE FOOTAGE: 37,000-)

ROOFTOP SHADING ASSESSMENT



TREMCO

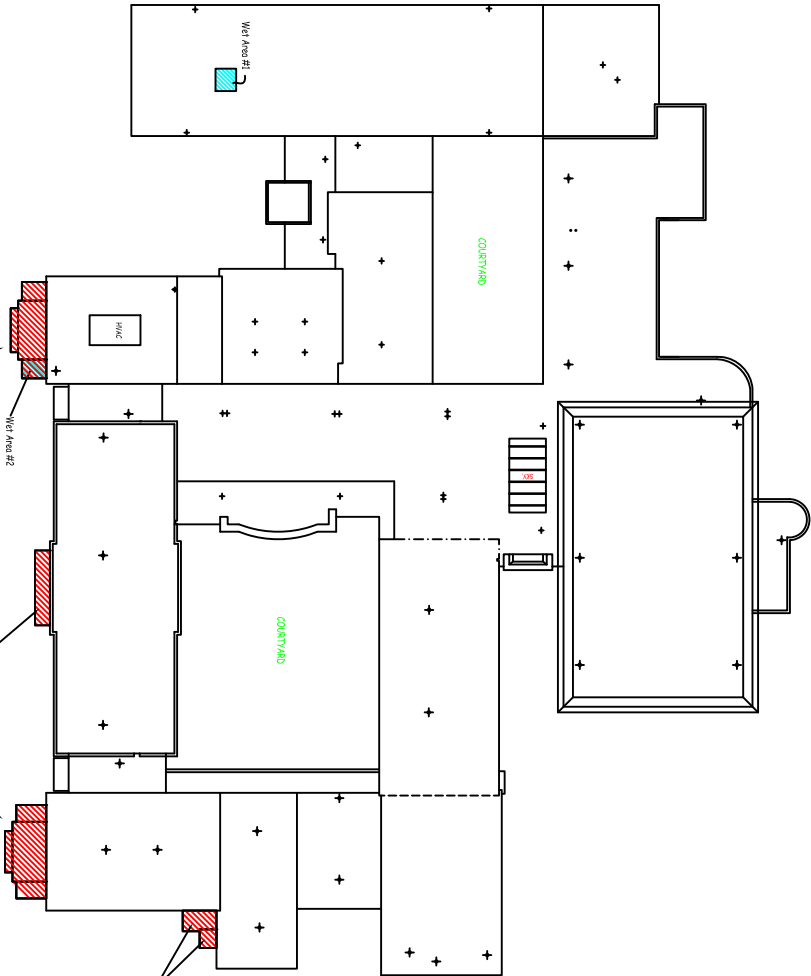
CONCEPTUAL SOLAR EQUIPMENT LAYOUT/ARRAY
ALTERIS RENEWABLES, INC.

COHASSET HIGH/MIDDLE SCHOOL
COHASSET, MA

SCALE: NTS
DATE: 10-27-11
PAGE: 1 OF 1
DRAWN BY: DMR
JOB#: 11589COH

Areas	
In appropriate square feet	
Square Footage of Roof Inspected:	128,298
Square Footage of Wet Areas:	262
Percentage of Wet Areas:	<1%

- Legend**
- + DRAIN
 - WET INSULATION
 - EXPANSION JOINT



PRIORITY #2 (2012)
WET INSULATION DETECTED DURING MOISTURE SCAN/
VERY POOR ROOF SURFACE DRAINAGE

PRIORITY #3 (2013-2014)
VERY POOR SURFACE DRAINAGE
CANDIDATE FOR REPLACEMENT

PRIORITY #1 (2012)
ACTIVE LEAKAGE & EXTENSIVE INTERIOR DAMAGE VISIBLE.
ROOF DOES NOT DRAIN PROPERLY & DOES NOT HAVE PROPER
FLASHING/INSULATION AND MISSING SECTIONS.

EXTREMELY POOR ROOF TOP DRAINAGE

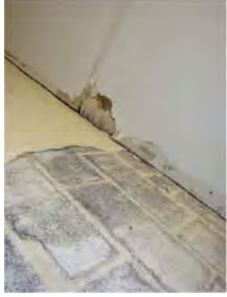
ACTIVE LEAKAGE & INTERIOR CEILING DAMAGE



LOWER FRONT ROOFS - VERY POOR DRAINAGE



LOWER FRONT ROOFS - WET INSULATION



TARGET ROOF REPLACEMENT PRIORITIES:
ROOFING SECTIONS WITH WET/DAMP INSULATION AND/OR
VERY POOR DRAINAGE, CONSIDER AS PRIORITIES FOR
REMOVAL AND REPLACEMENT.

ROOF REPLACEMENT PRIORITIES (2012 - 2014)

TREMCO		COHASSET HIGH/MIDDLE SCHOOL COHASSET, MA	
SCALE:	1/32"=1'-0"	DRAWN BY:	DMR
DATE:	10-27-11	JOB#:	11589COH
PAGE:	1 OF 1		





The remainder of this report provides insight into specific conditions, recommendations and construction cost-estimates for the various items identified through the course of our survey.

EPDM MEMBRANE ROOF COMPOSITION/CONSTRUCTION:

As described previously, the current roofing systems consist-of lightweight EPDM (ethylene propylene diene monomer) membrane roofing systems fully-adhered configurations.

In a fully-adhered configuration, wide rolls (10' +/-) of roofing membrane are adhered over fastened/adhered roof insulation materials, with approximately 3-5" laps/seams. Fully-adhered assemblies include mechanically-fastened (or adhered) insulation components, with the EPDM membrane 'glued' to the insulation with a solvent-based, contact adhesive.

Typically, the service-life of these types of membrane (EPDM) roofing systems, is somewhere close to twenty (20) years. The primary factors that combine to determine the service-life for these types of roofing systems, include but are not-limited-to:

- Initial Contractor workmanship during roof installation.
- Design-parameters at flashing conditions (perimeters, roof penetrations, etc.).
- Inspection and preventive-maintenance programs (or lack-thereof).
- Damage and/or abuse caused by foot-traffic, service-personnel, vandalism, etc.
- Extended exposure to harsh-weather (wind, snow/ice, etc.) and/or U.V. conditions.
- Positive slope-to-drain (or lack-thereof).

Across the various roof levels, there are many areas where previously-completed repairs are visible. As mentioned, most of these repairs appear to be related-to holes/punctures and/or seams/laps in the EPDM roofing membrane.





ROOFTOP DRAINAGE:

A portion of our survey included a cursory-inspection of existing rooftop drainage. The focus was to understand, in general-terms, how the roof systems drain and to help identify any potential corrections which may help the roof system's performance. We have identified a problem with covered roof drains located over the classroom wing on the Middle School portion of the building.

Generally, the majority of the buildings appear to have a reasonably-positive slope-to-drain provided through the building frame or through the use of tapered roof insulation. As mentioned earlier in this report, a number of drainage problems exist on smaller, lower-level roof areas across the building. We have attempted to show these locations on the drawing located on the following page.

Standing-water, on any roofing system, is, by industry-standards, considered a defect. Positive drainage is vital to the longterm success of any roofing system. Without taking steps to correct drainage on roof areas that currently contain standing-water, the lifespan of any new roofing assembly will be substantially-reduced.





SUMMARY DATA:

RECOMMENDATIONS/SUGGESTIONS

Information provided in the Table on the following page is meant to provide an approximate guide to various repair, maintenance and roof restoration cost-items identified/discussed through the course of the roof inspection. Actual construction/repair/maintenance costs are impacted by a large-array of variables, including prevailing-wages, general economic conditions, time-of-year, inflationary pressures and a host of other difficult-to-predict items.

Supplied estimates are, in some cases, provided as allowances – pending additional investigation and scope-determinations. As an example, addressing the covered-over roof drains identified on the classroom wing of the Middle School will require some investigation to understand why these drain sites were never re-established. Another example involves the detailing and work-scope involved with the removal and replacement of damaged thru-wall flashing conditions in several rising masonry sidewalls.

Certain identified work-scopes will involve the assistance of a licensed, structural engineer to prepare drawings/specifications. Exterior fixed roof ladders to access the upper gymnasium roof and lower, interior courtyard roof (above the library) are examples of scenarios where this type of professional assistance is recommended. Supplied estimates attempt to provide allowances for these types of professional engineering services.

Please consider these cost-estimates as an approximate guide. Refined construction estimates and engineering fees can be assembled, as projects and priorities are established.





CONSOLIDATED PRIORITIES (2012 – 2013)
(Cohasset Senior High School & Middle School, Cohasset, Massachusetts)

	<i>Repair/Maintenance/Replacement Scope-of-Work</i>	<i>Qty.</i>	<i>Cost Estimate</i>	<i>Maint./ Repair/ Replacement</i>	<i>Priorit y (Year)</i>
1	<i>Remove & replace leaking roof area above stairwell and entrance canopy near Admin. Offices. Repair interior ceilings.</i>	290 sq. ft.	\$ 11,200	<i>Replacement</i>	2012 !
2	<i>Remove & replace small area of wet-insulation identified on classroom wing of Middle School.</i>	140 sq/ft.	\$ 2,910	<i>Repair</i>	2012 !
3	<i>Investigate & correct closed-off roof drain assemblies on classroom wing of Middle School.</i>	2 drains	\$ 10,000 *	<i>Repair</i>	2012 !
4	<i>Properly-secure small, <u>existing</u> loose ladders between roof levels.</i>	3 ladders	\$ 3,500 *	<i>Repair</i>	2012 !
5	<i>Fabricate and install new OSHA-compliant access ladders to provide access to lower roof adjacent to courtyard and to upper gymnasium.</i>	3 ladders - 15' ladder - 20' ladder - 4' ladder	\$ 15,200 *	<i>Repair</i>	2012 !
6	<i>Purchase and install OSHA-compliant fall-protection rails for HVAC equipment located w/in 10' of unprotected roof perimeters.</i>	6 – 10' rails 12 – 5' rails	\$ 9,200 *	<i>Repair</i>	2012 !
7	<i>Purchase & install protective service-pads at all rooftop air-handlers (HVAC) units.</i>	76 pads	\$ 7,488	<i>Repair</i>	2012
8	<i>Purchase & install missing roof drain strainers w/new cast-iron strainers.</i>	15 ± each	\$ 1,800	<i>Repair</i>	2012
9	<i>Remove and replace damaged and/or missing masonry thru-wall flashings in rising sidewalls.</i>	140 lin. ft. - 3 areas	\$ 21,063	<i>Repair</i>	2013
10	<i>Remove & replace poorly-sloped and leaking lower-level roofs along the front of the building (3 separate areas).</i>	1,974 sq. ft.	\$ 71,456	<i>Replacement</i>	2013
	<i>Cut and re-point failing mortar joints and clean/prepare and waterproof masonry sidewalls - Roofs #7, #31 & #32.</i>	510 sq. ft.	\$ 7,380	<i>Repair</i>	2013
	<i>Institute a yearly-program of professional roof inspections, preventive-maintenance & condition reporting across all roof sections.</i>	128,298 sq. ft.	\$ 8,610 (per year)	<i>Maintenance</i>	2013
	<i>Perform warranted (15-20 yrs) restoration & repairs to <u>all</u> existing roof areas targeted to receive new solar arrays. (Roof areas are mapped against conceptual layout provided by Alteris Renewables Inc.)</i>	109,433 sq. ft.	\$1,006,000	<i>Repair/ Maintenance</i>	2012 / 2013
* Allowances - ONLY.					





Pic #1: Roof #12: Overview photo showing standing-water on the roof area above the stairwell near the Administration Offices. Inadequate drainage and interior leakage qualify this roof as a top-priority for replacement (2012).



Pic #2: Roof #12: Interior photo of leakage/damage inside the stairwell roof area near the Administration Offices. Damage in this area has progressed to the point where interior ceilings and wall-finishes require significant repairs.



Pic #3: Roof #11: Photo looking-down on the small canopy area above the Administration Offices. Similar to conditions on Roof #12, this roof area should be targeted for replacement, with drainage-improvements.



Pic #4: Roof #12: Leakage from/behind/under Roof #12, near the Administration Offices, is damaging/staining the brick sidewall and leaching into the interior stairwell. These roofs are the top-priority for replacement.



Pic #5: Roof #34: Overview photo of the main classroom wing on the Middle School portion of the building. Several covered-over roof drains were located on this portion of the roof. The reasons why, remain a mystery.



Pic #6: Roof #34: A close-up photo showing, what is believed to be, a covered-over roof drain. Water in this location is approximately 3-5" deep. Investigating and resolving these issues should be a top-priority (2012).



Pic #7: Roof #34: This photo shows an area of wet-insulation (± 150 sq/ft) identified over the main classroom wing on the Middle School portion of the complex. A hole/puncture in the membrane is the source of the damage.



Pic #8: Roof #34: Photo showing a close-up of the small hole responsible for the wet-insulation in Pic #7 (above). Lightweight membrane roof systems are easily-damaged and must be regularly-inspected to identify holes/punctures.



Pic #9: Roof #7: Photo showing spalled cementitious parge-coat materials on the exterior face of the rising wall between Roof #7 and Roof #'s 8/9. Remedial repairs are needed to prevent damage and leakage problems.



Pic #10: Roof #7: Overview photo showing the rising masonry wall between Roof #7 and Roofs #8/9. Minor masonry repairs are required to keep this area in a protected, watertight condition.



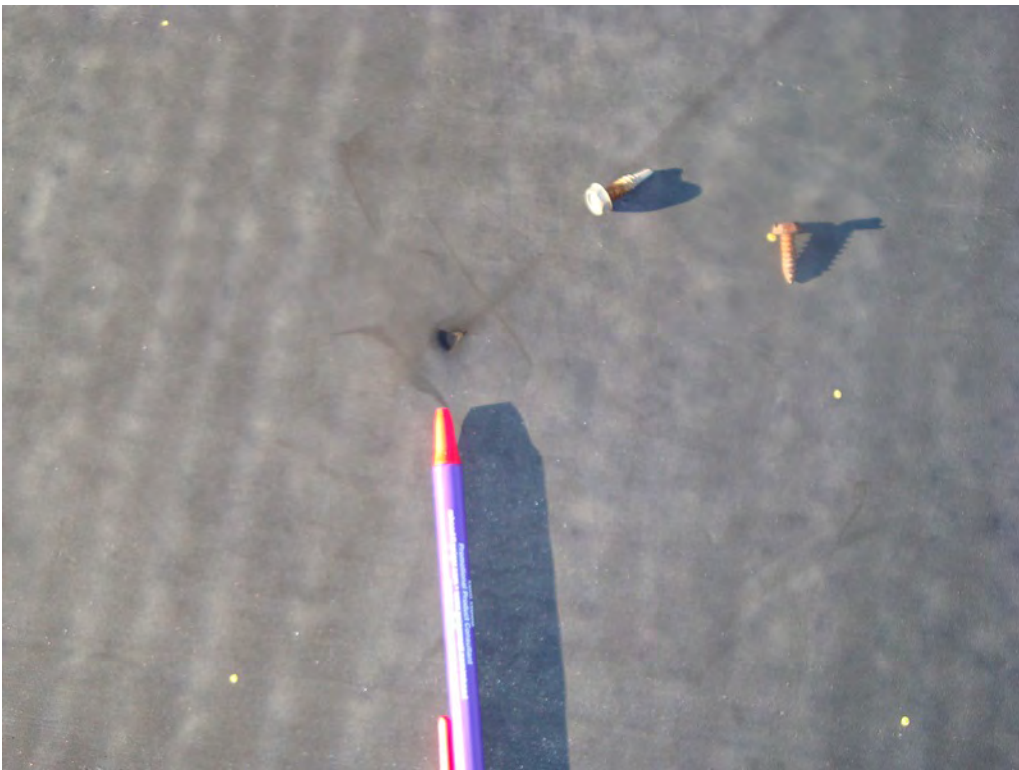
Pic #11: Roof #7: Photo showing clogged-gutters and standing water on Roof #7. A professional inspection, maintenance and reporting program is recommended on all roof areas to help prevent premature problems.



Pic #12: Roof #7: Photo showing organic-debris clogged-gutters and standing water on Roof #7. A professional inspection, maintenance and reporting program is recommended on all roof areas to help prevent premature problems.



Pic #13: (Typical): Photo showing one (of many..) missing roof drain strainers. To help prevent clogged drainage-lines and standing-water on roof surfaces, we'd suggest that new cast-iron strainers be installed, where missing.



Pic #14: Roof #3: Photo showing a (typical) small puncture in the membrane roof system. A professional inspection, maintenance and reporting program is recommended to catch/find/fix these types of minor issues.



Pic #15: [Roof #1](#): Photo showing one of the starter-course of shingles (gym roof mansard) that has slipped and is now a potential source of leakage. Yearly-inspections and maintenance is recommended to catch/fix these issues.



Pic #16: [Roof #34](#): Photo showing a poorly-installed flashing-boot detail at an electrical feed through the roof. Identifying and correcting these types of issues will help prevent leakage and improve roof service-life.



Pic #17: Roof #31: Overview photo showing the short, rising wall between Roof #31 and Roof #34. Various masonry repairs are required to help keep water from migrating into the building along this area.



Pic #18: Roof #31: Close-up photo showing missing/deteriorated mortar joints in the short, rising wall between Roof #31 and Roof #34. Various repairs are required to keep water from migrating into the building along this area.



Pic #19: **Roof #29**: Overview photos showing an area of damaged and/or missing flashing (rising wall between Roof #29 and Roof #28) which should be considered a priority for repair.



Pic #20: **Roof #29**: Close-up photo showing missing/deteriorated copper flashing at the rising wall between Roof #29 and Roof #28. Repairs are suggested in this area to prevent the potential for leakage problems.



Pic #21: Roof #9: Close-up photo showing deteriorated copper flashing at the rising wall between Roof #9 and Roof #10. Leakage problems in this area are believed to be (partially) attributable to failures in this copper flashing detail.



Pic #22: Roof #12: Another photo showing an area where failed copper flashings in the rising masonry walls are believed to be contributing to leakage problems inside the building.



Pic #23: Roof #18: Photo showing one of several loose and/or disconnected ladders between roof levels. Properly-designed ladders/stairs should be installed and secured to help prevent the potential for an accidental fall.



Pic #24: Roof #1: At present, there is no OSHA-compliant means-of-access to service rooftop equipment on the upper roof over the gymnasium. Proper, exterior access should be a priority to avoid the possibility of safety-issues.



Pic #25: Roof #23: Lower-level roofs along the front of the building exhibit very-poor slope-to-drain, and Roof #23 was found to be entirely-saturated. These lower-level roof areas are targeted as replacement candidates in 2013.



Pic #26: Roof #13: Another example of drainage/slope problems on the lower-level roof areas along the front portion of the building. These lower-level roof areas are targeted as replacement candidates in 2013.



Pic #27 Roof #3: OSHA regulations require fall-protection provisions in situations where workers/service-staff are exposed to unprotected perimeters (w/in 10'). Roof-mounted safety-rails are recommended in all such areas.



Pic #28 Roof #3: Another example of rooftop ventilation equipment located in close-proximity to an unprotected roof perimeter. OSHA regulations require fall-protection provisions in these types of situations.



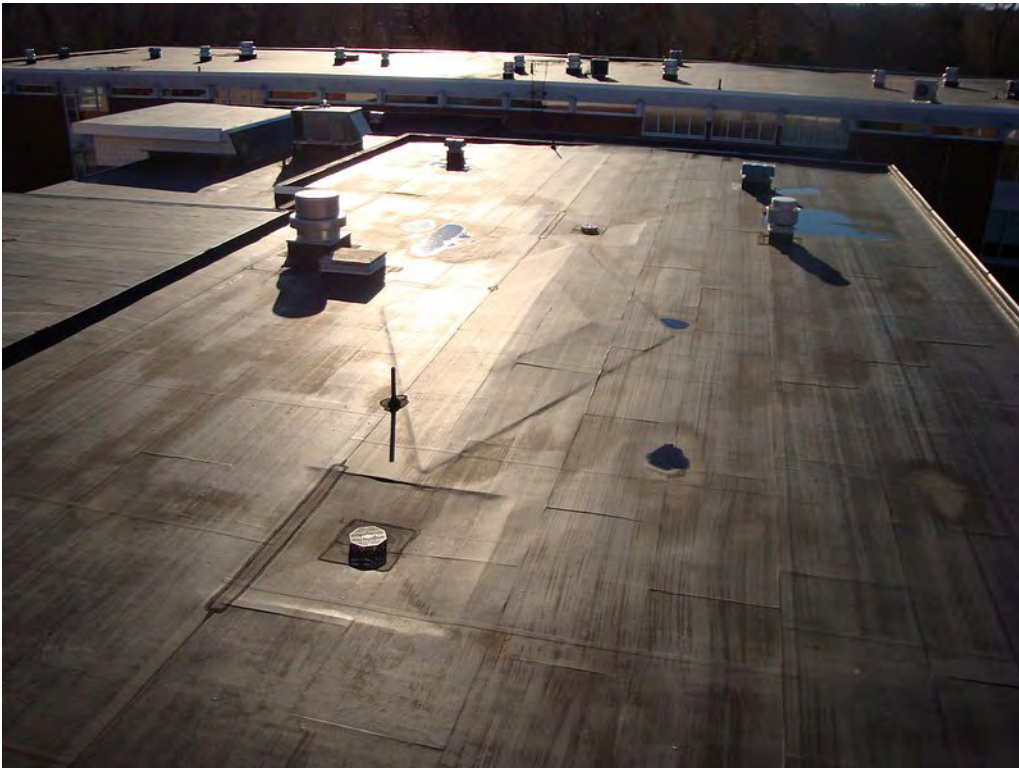
Pic #29 Roof #3: Large roof-mounted air-handlers require periodic service (filters, belts, etc.). Protective service-pads are recommended on the roof surface surrounding each of these units to help prevent roof damage.



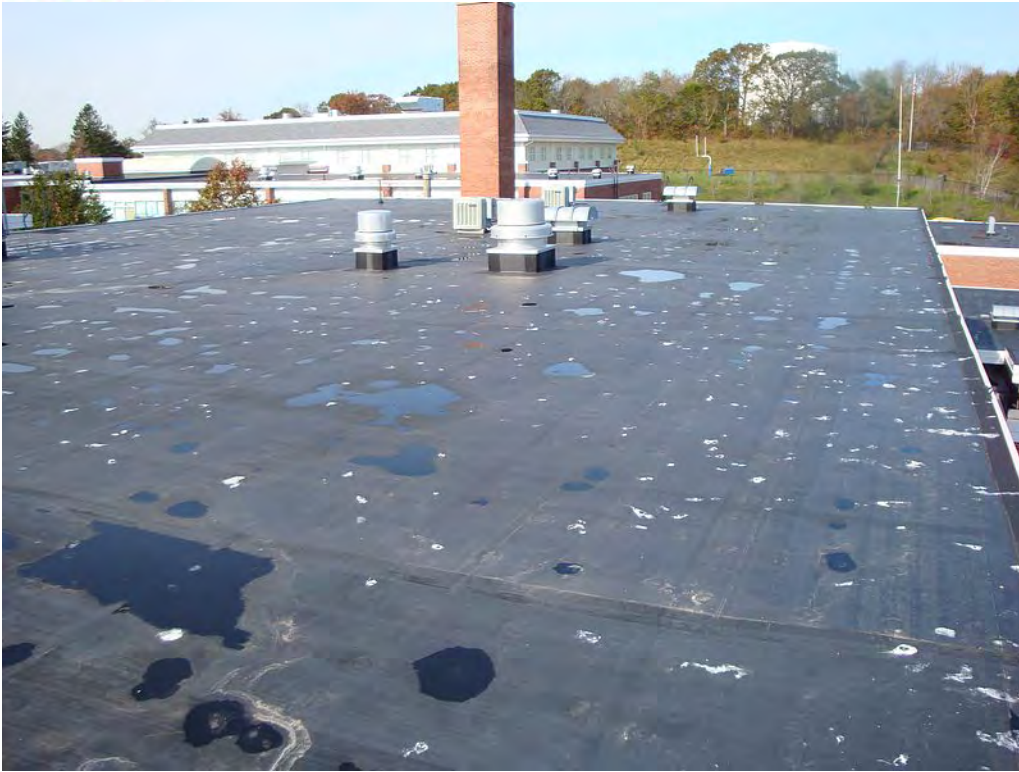
Pic #30 Roof #3: Large roof-mounted air-handlers require periodic service (filters, belts, etc.). Protective service-pads are recommended on the roof surface surrounding each of these units to help prevent roof damage.



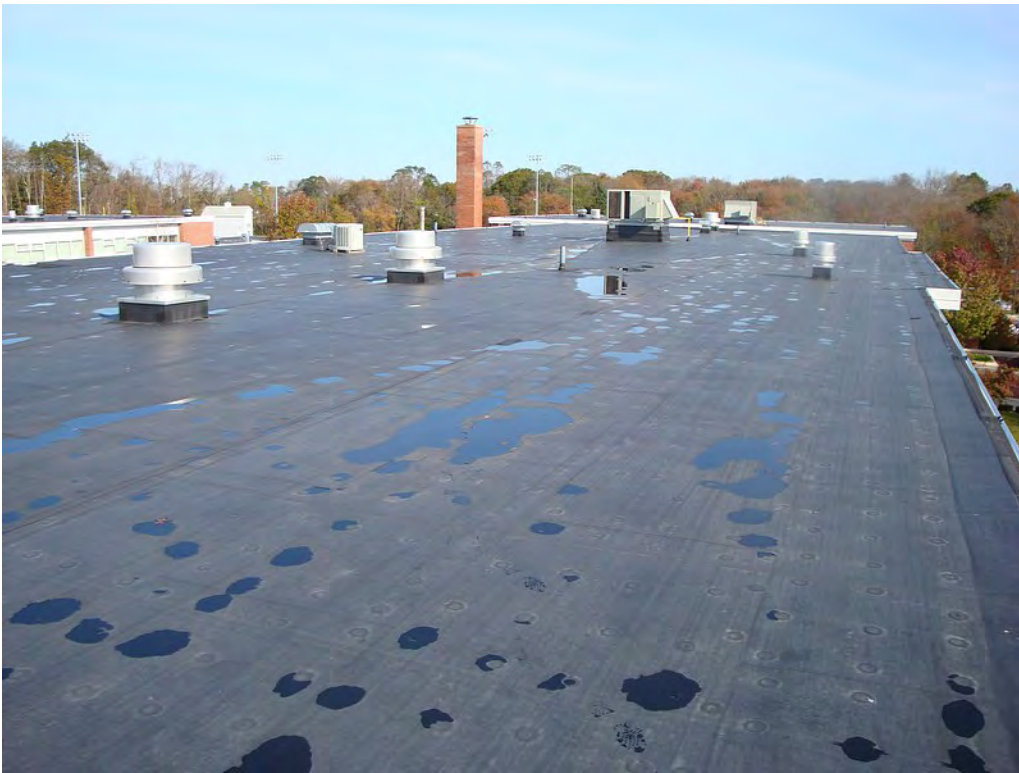
Pic #31 Roof #34: Overview photo of Roof #34, which covers a classroom wing on the Middle School.



Pic #32: Roof #30: Overview photo of Roof #30 – looking west.



Pic #33: Roof #10: Overview photo of Roof #10 – looking north.



Pic #32: Roof #19: Overview photo of Roof #19 – looking east.

END OF PHOTOGRAPHICAL NARRATIVES