LEADERSHIP IN FISCAL RESPONSIBILITY: APPROACHING FACILITY ASSET MANAGEMENT FOR ROI

TRM 034

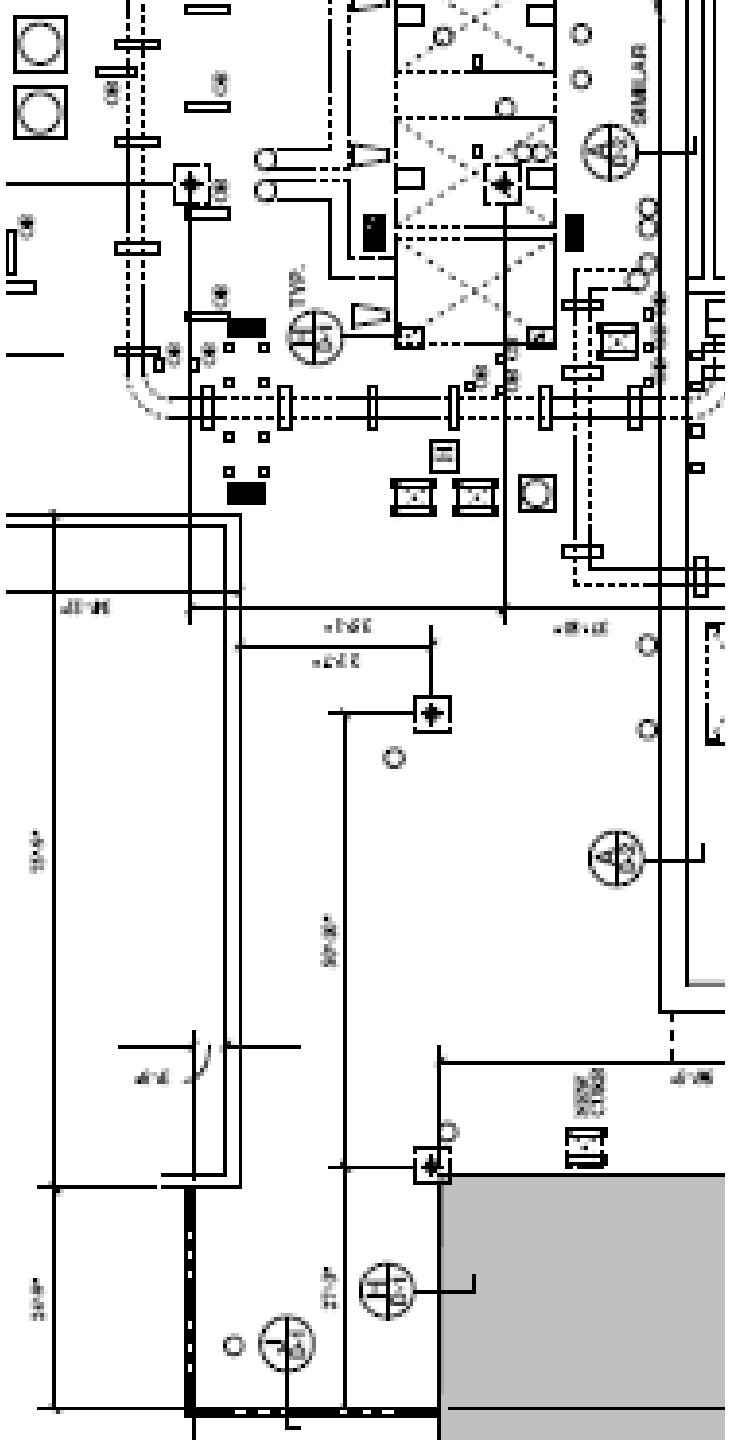
Tremco Roofing and Building Maintenance

J157

Kristophor C. Linster, P.E., LEED AP, CDT, RRO

January 30, 2020

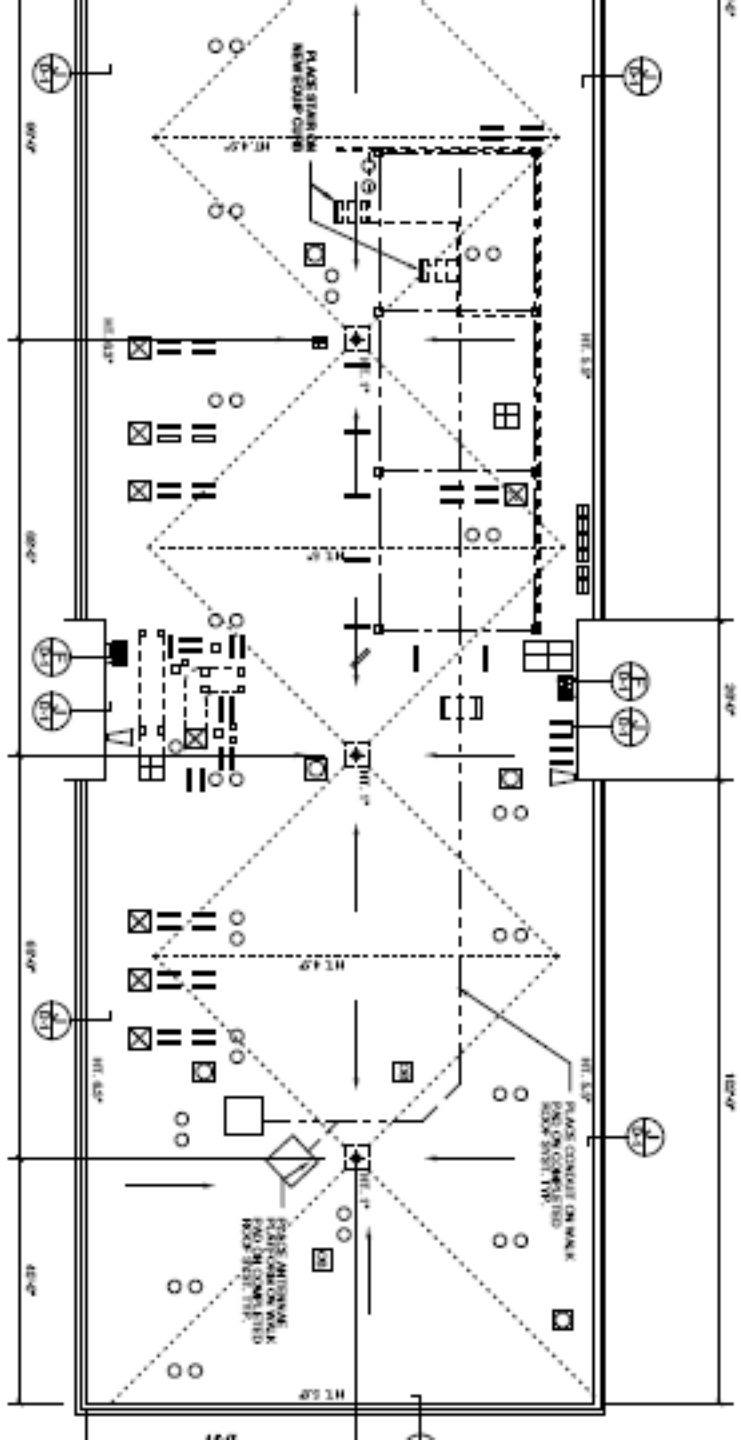
CONTINUING EDUCATION AIA



Assessing and Maintaining Roofing and Building Envelope Integrity

Commercial roofing systems and roofing details can be very complex and difficult to properly maintain. Regular inspections and preventative maintenance can make all the difference in keeping these expensive assets performing well, even beyond their warranty. We will review possible water infiltration points in the building envelope and provide a basic review of often overlooked areas including coping joints, porous/deteriorated masonry walls, flashings, counterflashings, window and door openings, and HVAC penetrations. Attendees will learn how to perform basic roof inspections and understand the different types of diagnostic tools used to discern roof problems.

CONTINUING EDUCATION AIA



Analyzing and Maintaining Roofing and Building Envelope Integrity

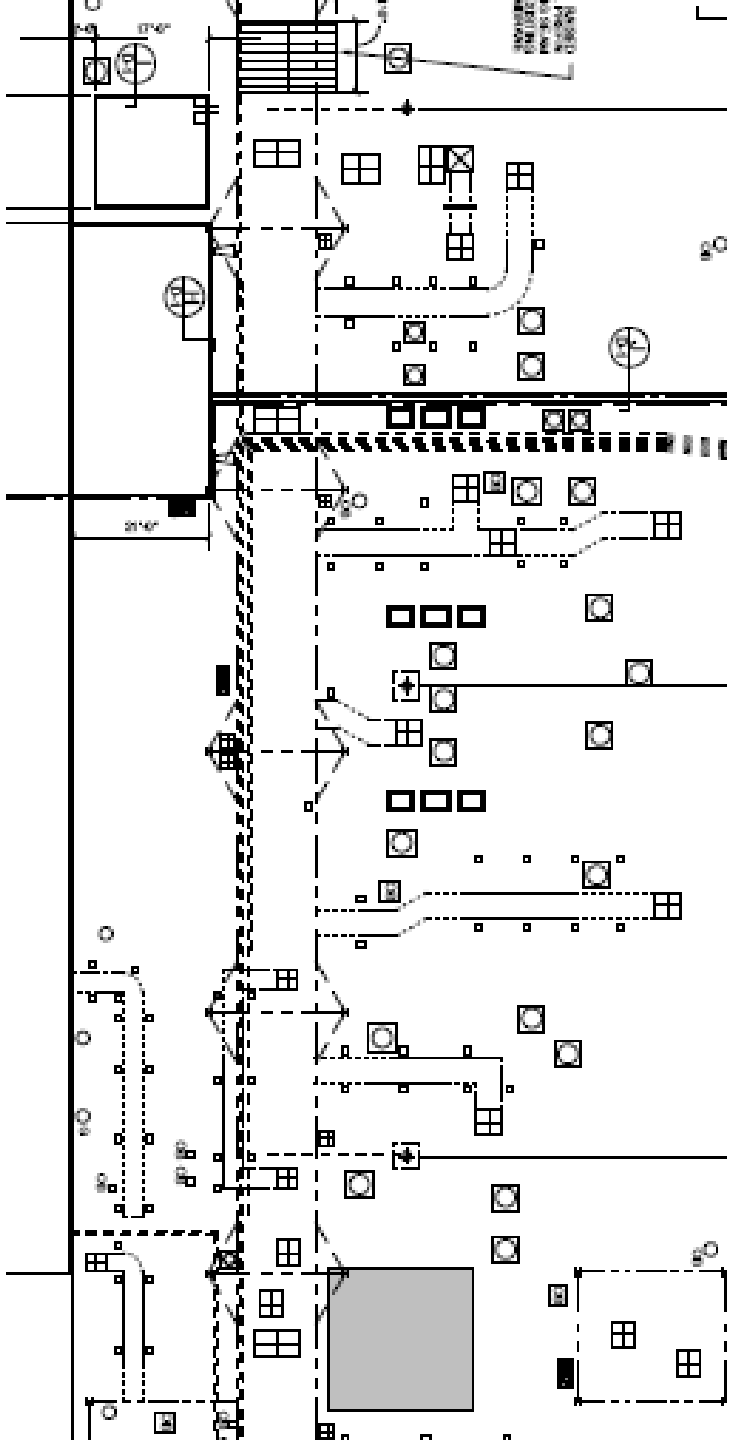
Credit(s) earned on completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

This course is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

Tremco Incorporated is a Registered Provider with The American Institute of Architects Continuing Education Systems.

Copyright Materials. This presentation is protected by US and International Copyright laws. Reproduction, distribution, display and use of the presentation without written permission of the speaker is prohibited.

© Tremco Roofing and Building Maintenance 2014



LEARNING OBJECTIVES

At the end of the this course, participants will be able to:

- Discern a roof leak, from a leak attributable to another building element.
- Understand how to identify water leak sources at masonry walls and counterflashings.
- Identify the different types of diagnostic tools used for evaluating roof systems.
- List and understand all the requirements that should be part of a comprehensive building envelope evaluation.

WHERE IS THE WATER COMING FROM?

Experience has *repeatedly shown* that there are more potential water entry areas than just through the roof:

- Coping
- Masonry walls
- Flashings
- Counterflashings
- Windows, louvers, and doors
- HVAC and duct work
- Plumbing and drainage
- Snow
- Sealant joints

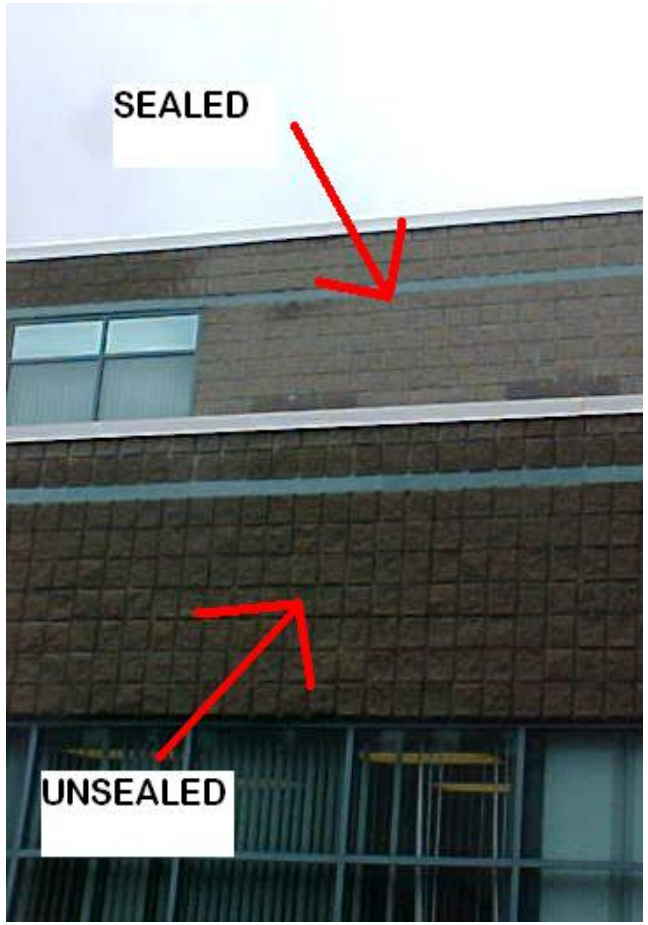
Copings

COPINGS

COPINGS

MASONRY WALLS

MASONRY WALLS



EFFLORESCENCE

CRACKED AND SPALLED MASONRY

DETAILS

COUNTER FLASHING

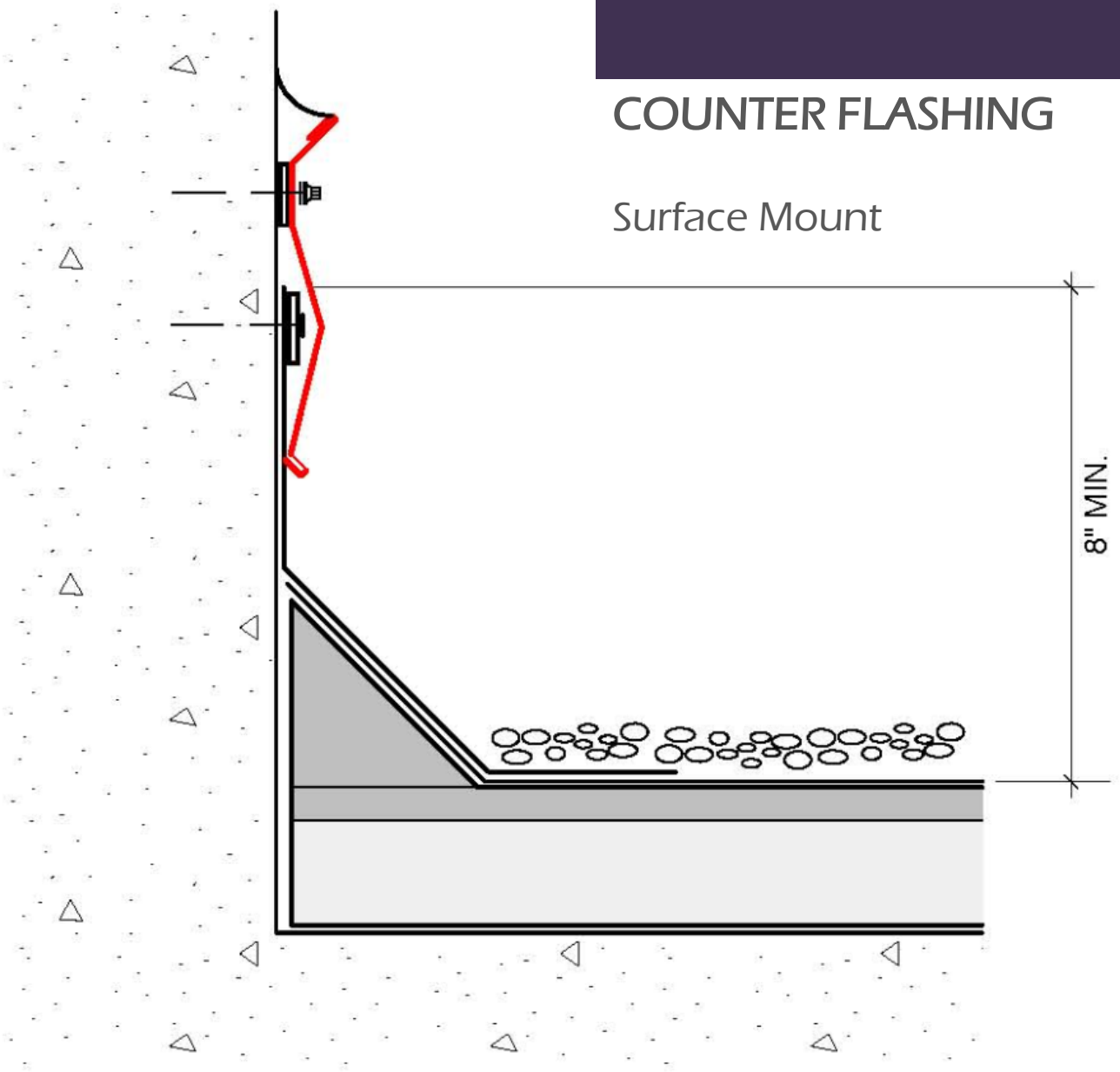
"Formed metal or elastomeric sheeting secured on or into a wall, curb, pipe, rooftop unit or other surface, to cover and protect the upper edge of a base flashing and its associated fasteners."

Source: The NRCA Roofing Manual Current Edition

DETAILS

COUNTER FLASHING

Surface Mount



DETAILS

COUNTER FLASHING

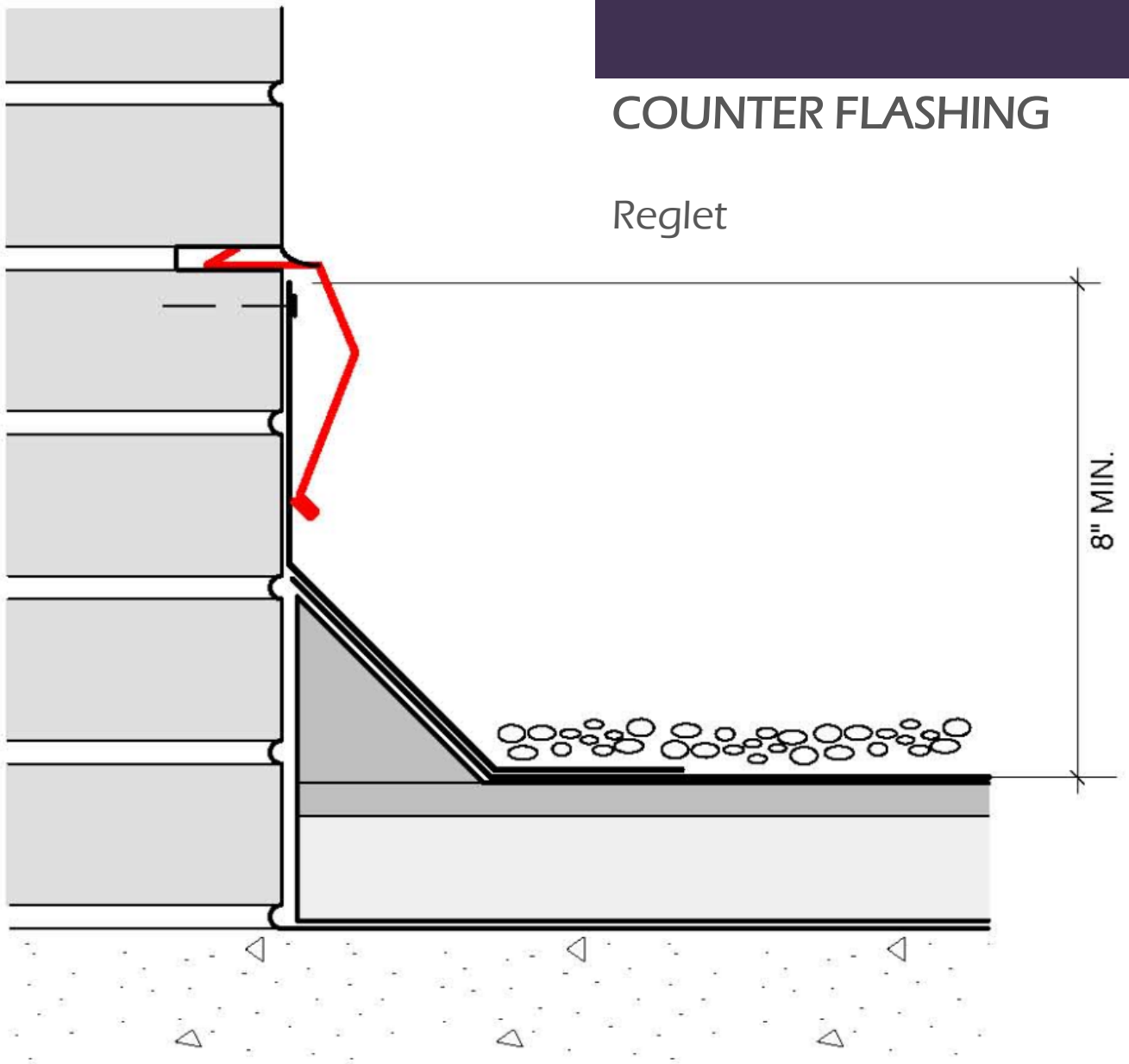
Surface Mount

GOOD

DETAILS

COUNTER FLASHING

Reglet



DETAILS

COUNTER FLASHING

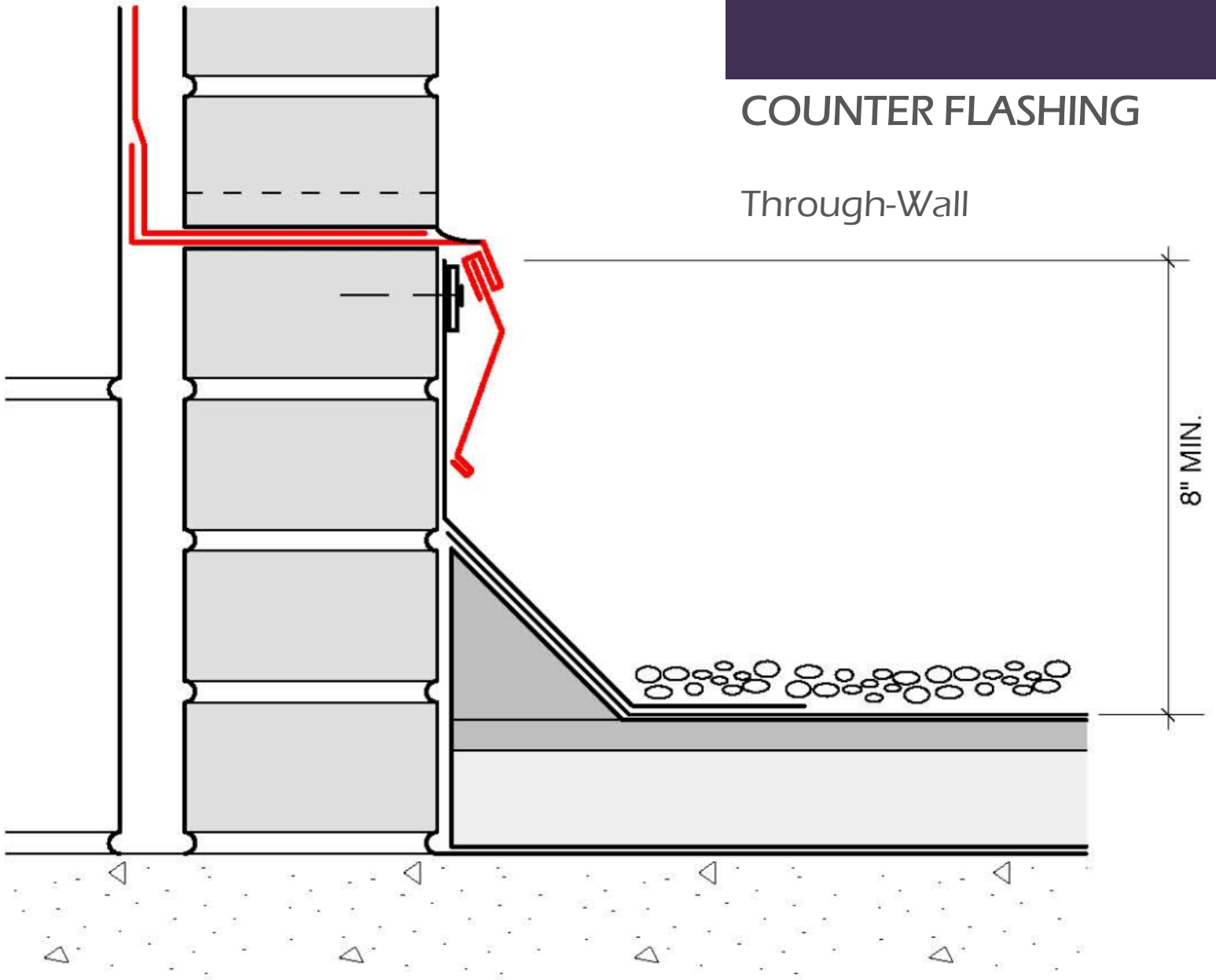
Reglet

BETTER

DETAILS

COUNTER FLASHING

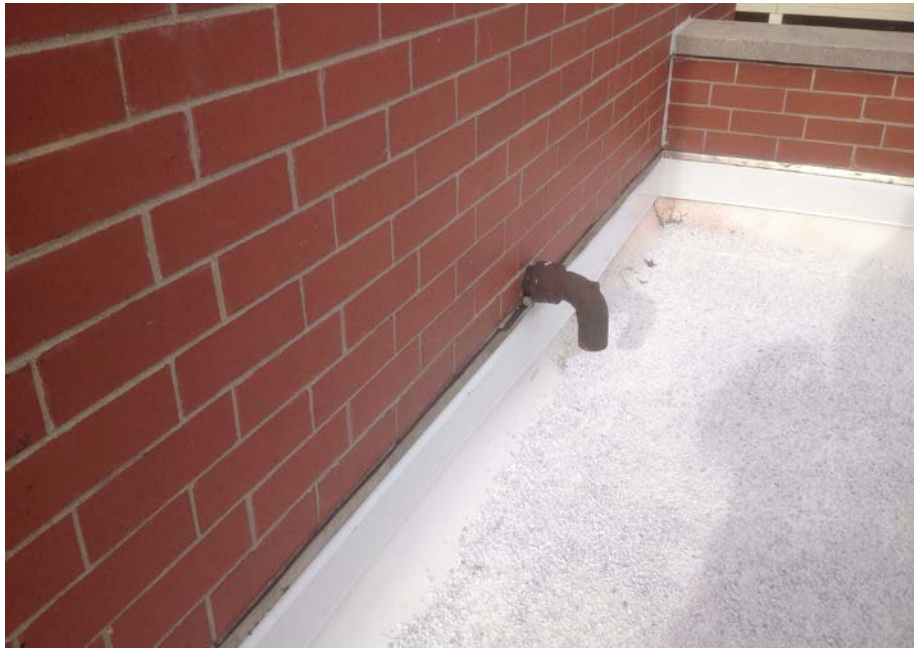
Through-Wall



DETAILS

COUNTER FLASHING

Through-Wall



BEST

MASONRY FLASHINGS

MASONRY WEEP HOLES

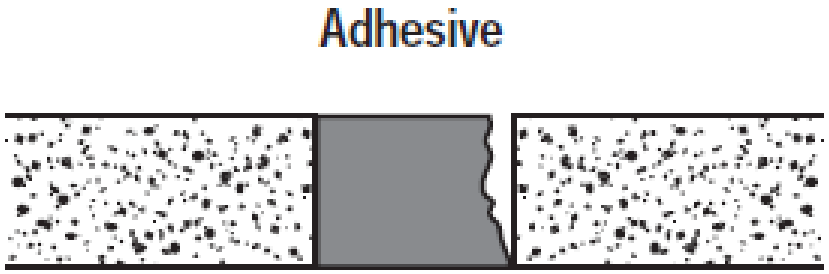
WINDOWS, LOUVERS, DOORS

HVAC

DUCT WORK

PLUMBING AND DRAINAGE

SEALANT FAILURES



"Loss of Adhesion" is failure of the sealant to adhere along the bond line of the surface to which it is attached, causing it to break away. Possible causes are joint movement exceeding the sealant capability, improper surface preparation, or improper bead configuration.

SEALANT FAILURES

Cohesive

"Cohesive Failure" occurs when the sealant fails to hold together . Cohesive failure can take the form of splits and tears in both transverse and longitudinal directions. Usual causes include improper sealant selection, poor mixing of multi-component sealants, possible air entrapment in the sealant from mixing, or improper bead configuration.

YOUR ROOF SYSTEM IS AN ASSET

CONTINUING EDUCATION AIA

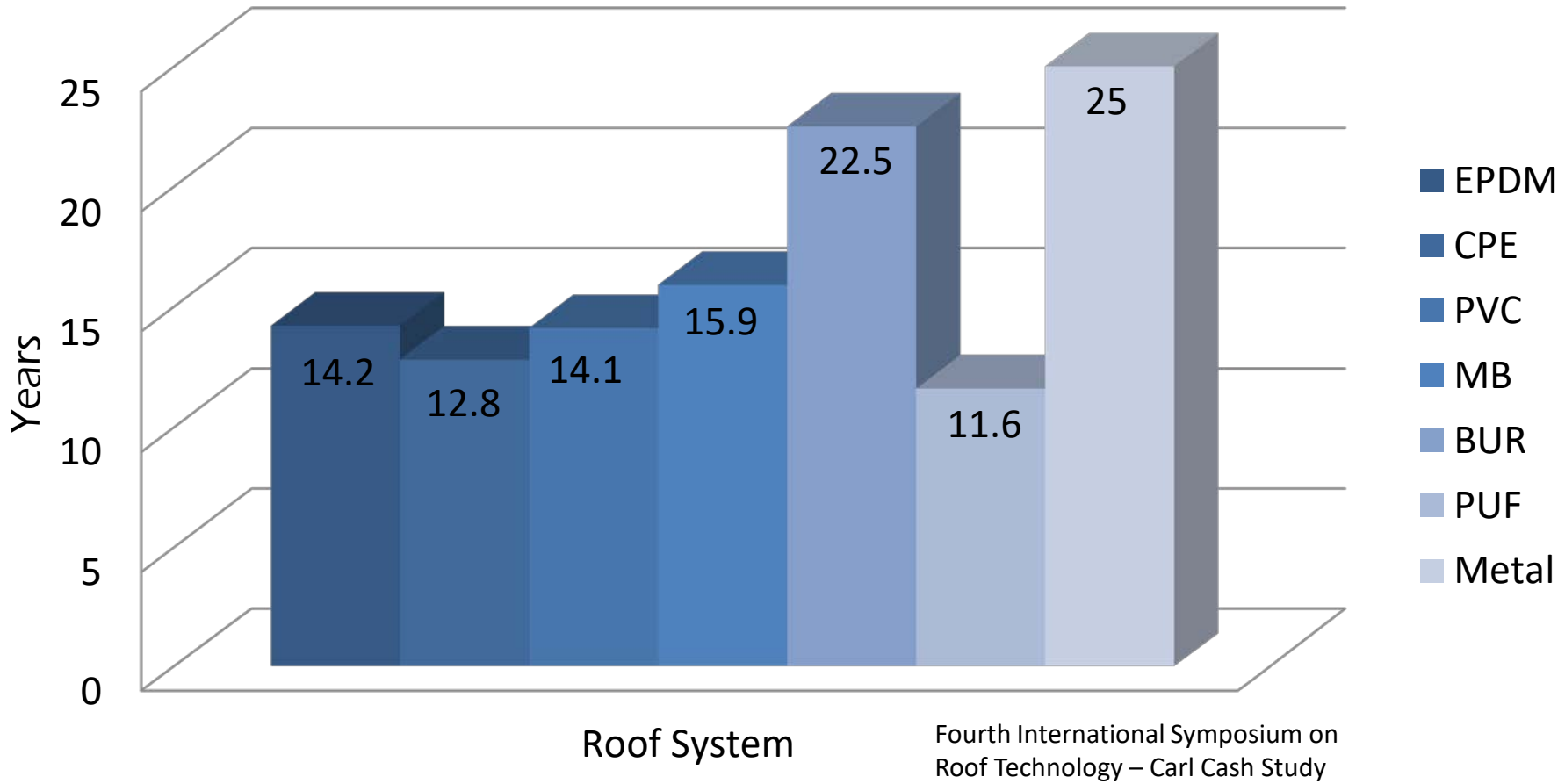
YOUR ROOF SYSTEM IS AN ASSET

Many facilities and buildings have roofing assets in the MILLIONS OF DOLLARS.

Depending on the type of Roof System / Insulation Type(s) & Thickness / Roof Access, Safety, etc., your asset will likely be worth between $8.00 to $15.00 sq. ft., though it could be worth much more!

CONTINUING EDUCATION AIA

LIFE EXPECTANCY



Fourth International Symposium on Roof Technology – Carl Cash Study

LIFE EXPECTANCY

It is important to EXTEND the life expectancy of your roofing assets.

First Cost

The less costly option is not always the right solution for long term roof performance.

Too often, the roof system is "OUT OF SIGHT AND OUT OF MIND" and nothing is done until there is a problem, ie, there is a ROOF LEAK.

Minor problems will eventually turn into major problems. A $100 problem can turn into a $1000 (if not $100,000) problem if left undetected.

CONTINUING EDUCATION AIA

Cost of Neglect Case Study – Year 3

1,155 sf wet

$10.00 / sf

$11,550 cost

Cost of Neglect Case Study– Year 6

6,160 sf wet

$10.00 / sf

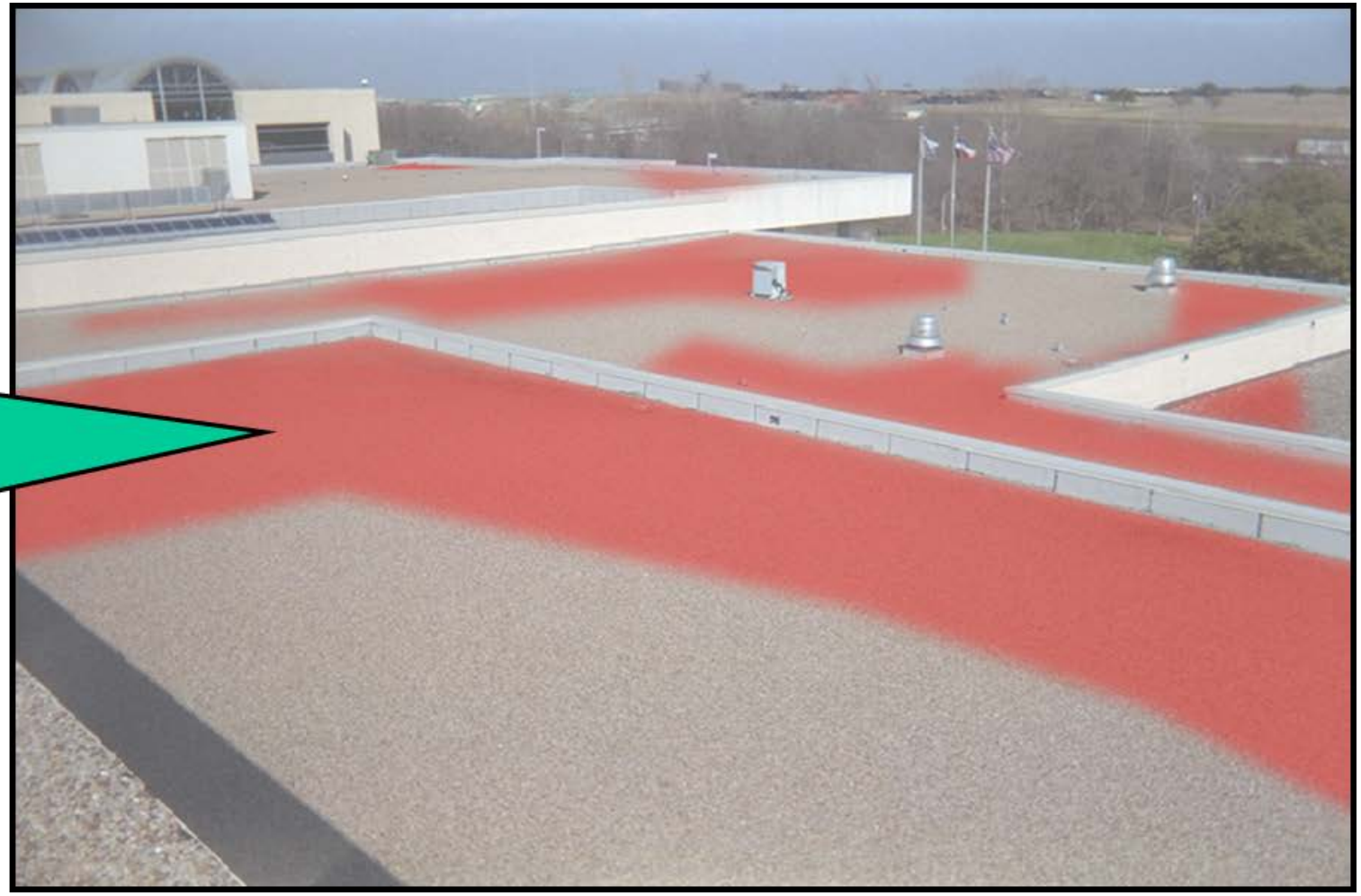
$61,600 cost

Cost of Neglect Case Study– Year 8

27,201 sf wet

$10.00 / sf

$272,000 cost

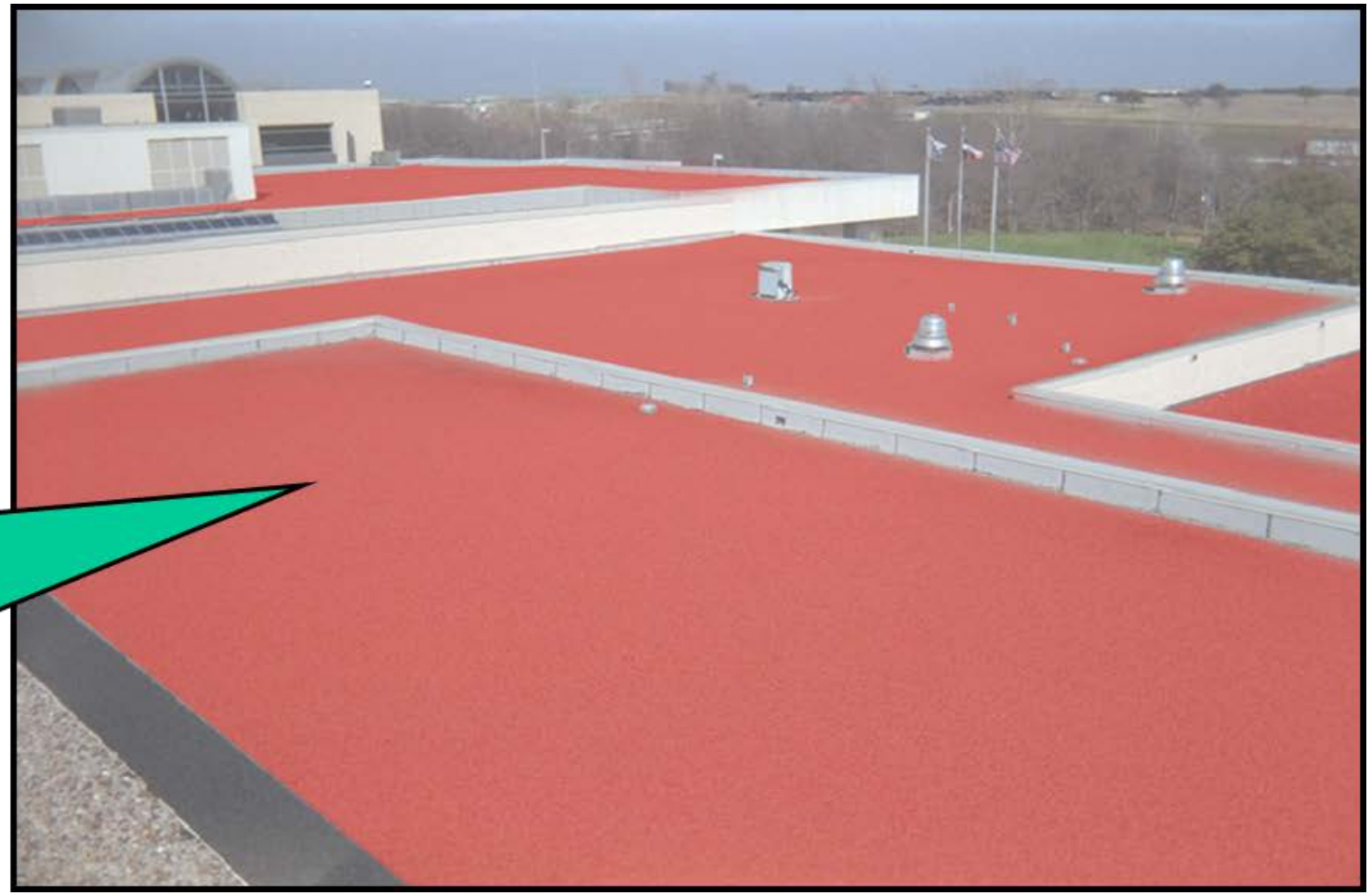


Cost of Neglect Case Study– Year 14

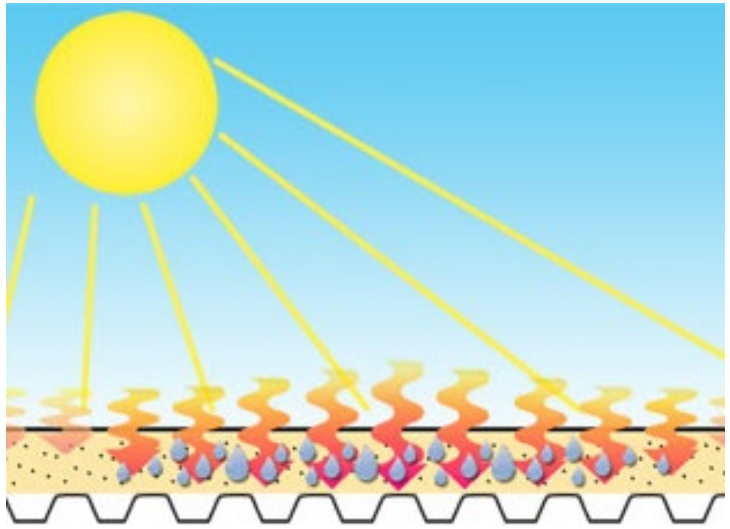
65,000 sf wet

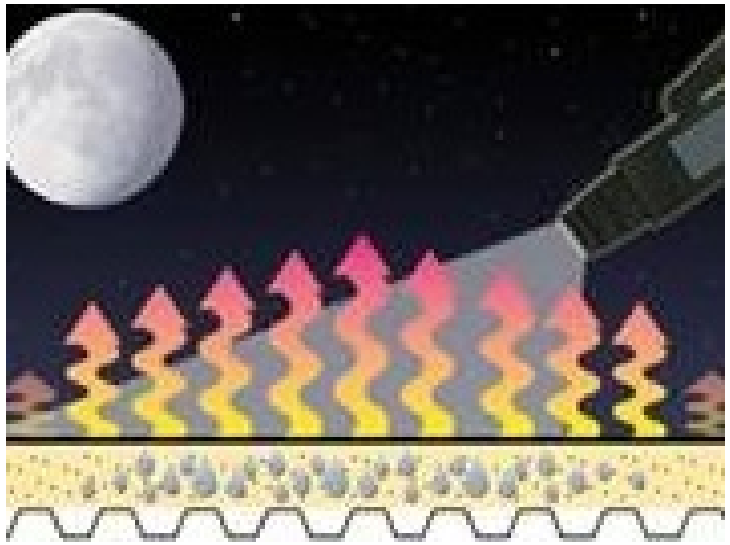
$10.00 / sf

$650,000 cost



DIAGNOSTIC TOOLS





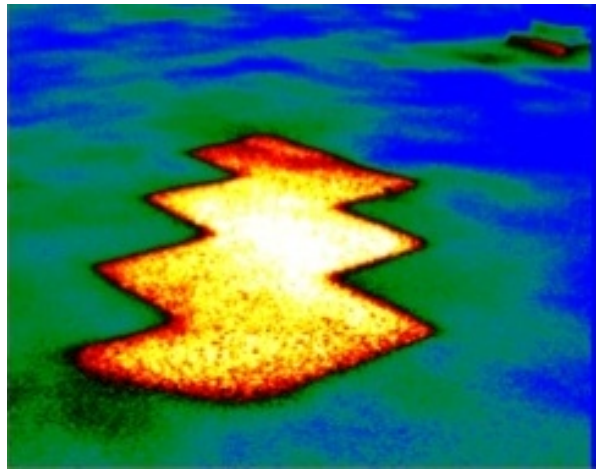
INFRARED
ROOF MOISTURE SURVEYS

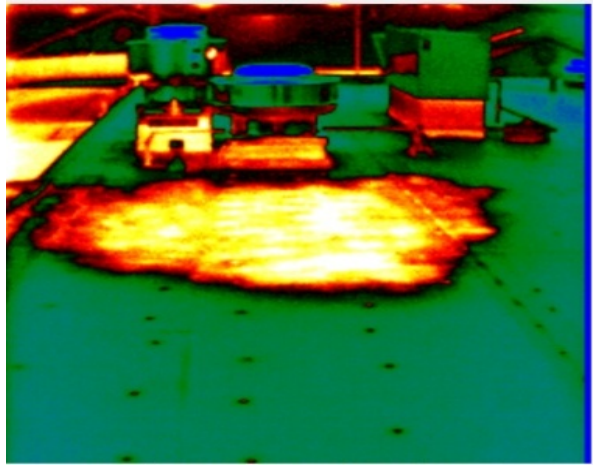
HOW IT WORKS

During the daytime, wet roof insulation will absorb more solar energy from the sun than dry roof insulation. During the night, after the roof surface cools, the wet roof insulation will retain more solar energy than dry insulation. It is these temperature differentials that are detected by the infrared camera.

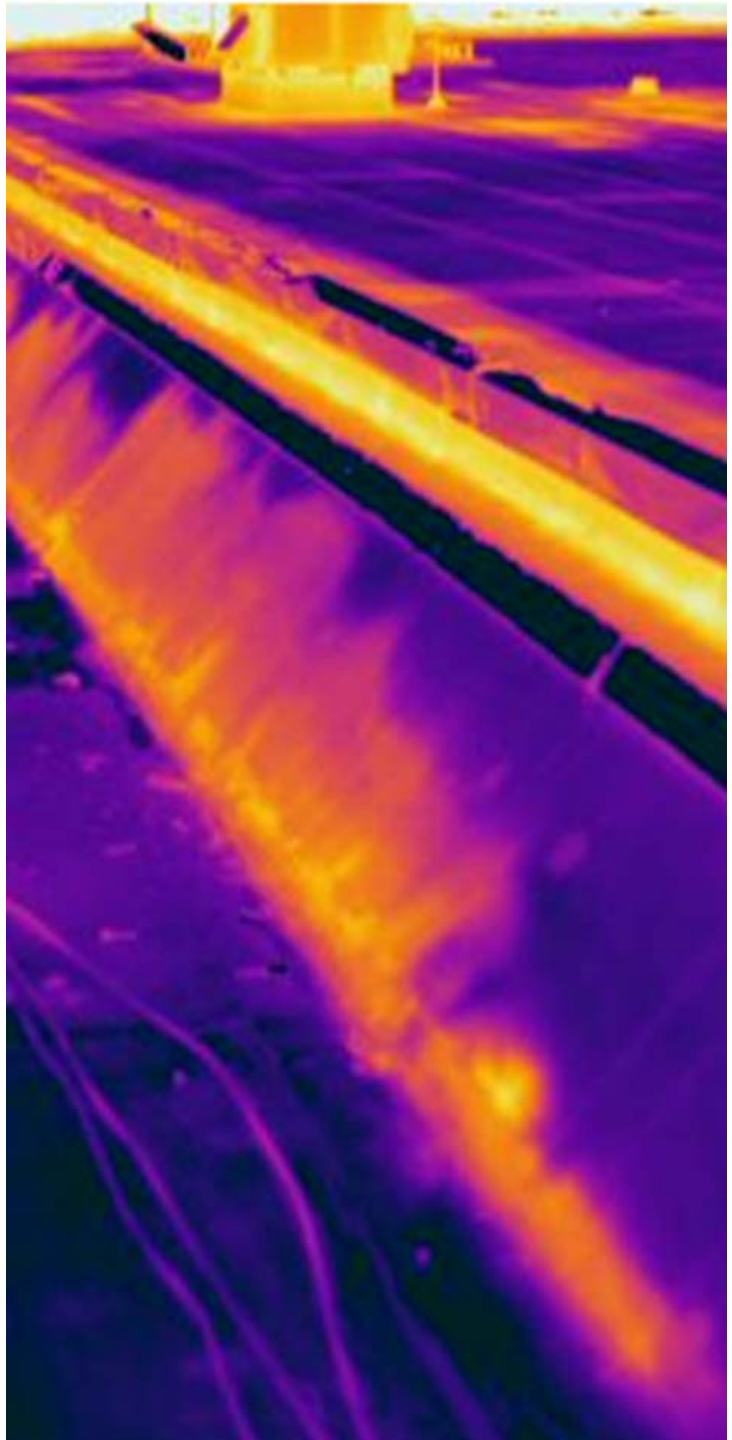
CONTINUING EDUCATION AIA

INFRARED
ROOF MOISTURE SURVEYS





CONTINUING EDUCATION AIA



INFRARED ROOF MOISTURE SURVEYS

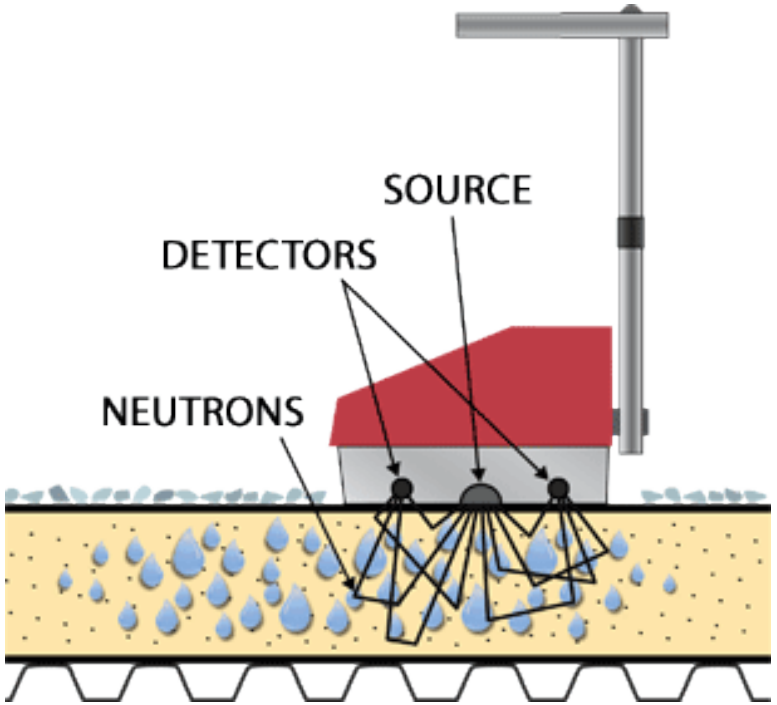
All Infrared Roof Moisture Surveys are NOT Created Equal

CONTINUING EDUCATION AIA

NUCLEAR
ROOF MOISTURE SURVEYS

CONTINUING EDUCATION
AIA

NUCLEAR
ROOF MOISTURE SURVEYS



HOW IT WORKS

During the daytime, a grid pattern (5'x5' or 10'x10') is marked on the roof surface. Readings are taken and recorded at each grid intersection.

Fast neutrons are emitted from a radioactive source in the Nuclear Gauge into the roof system. The presence of hydrogen in the roof system slows the neutrons. These slowed neutrons, as well as the fast neutrons, are detected by the Nuclear Gauge detectors. A reading is displayed in the digital readout and recorded.

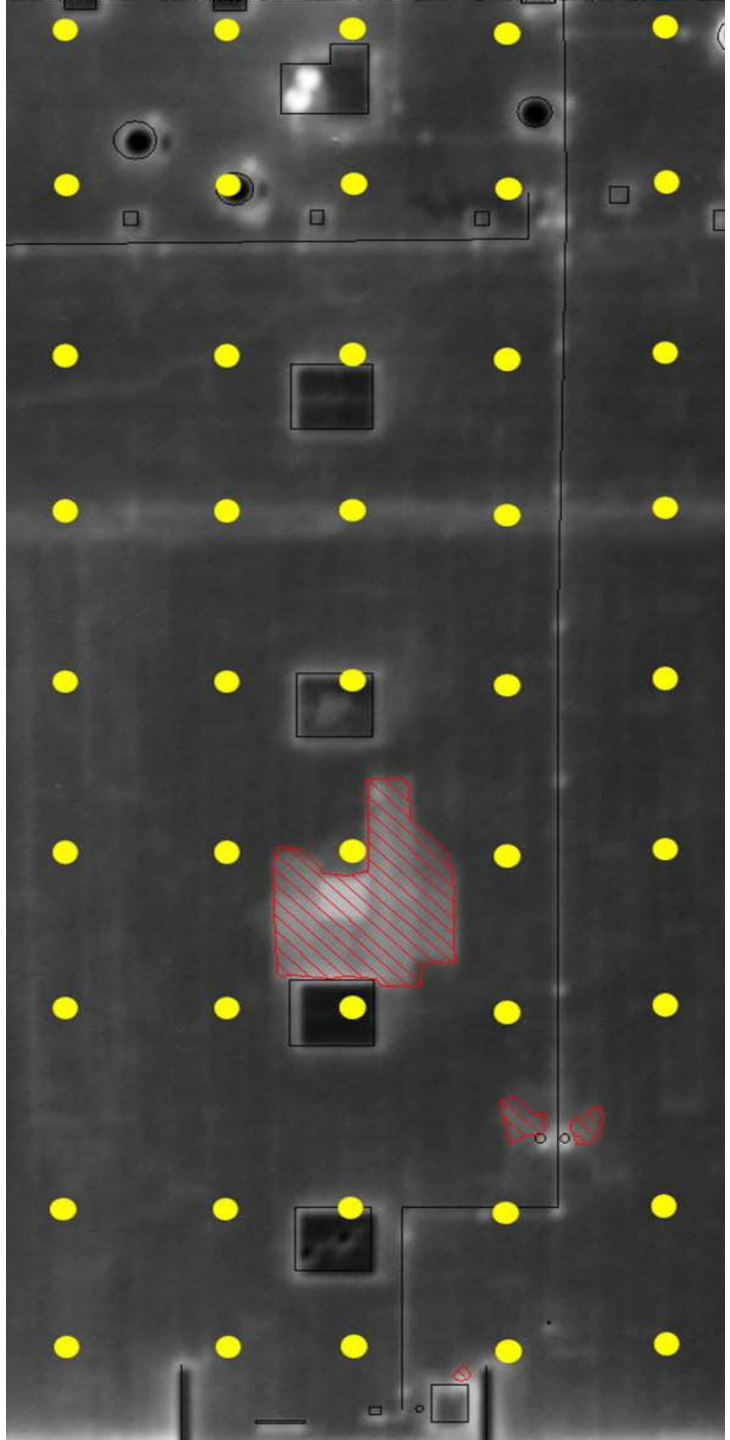
CONTINUING EDUCATION AIA

NUCLEAR
ROOF MOISTURE SURVEYS

REGULATIONS

- Highly Regulated
- Yearly License Fee
- Must be approved in each individual State and/or by the US NRC (15 states)
- Strict Storage & Transportation Rules
- Employee Nuclear Gauge/HAZMAT Training
- Employee Radiation Monitoring
- Yearly Equipment Testing

CONTINUING EDUCATION AIA



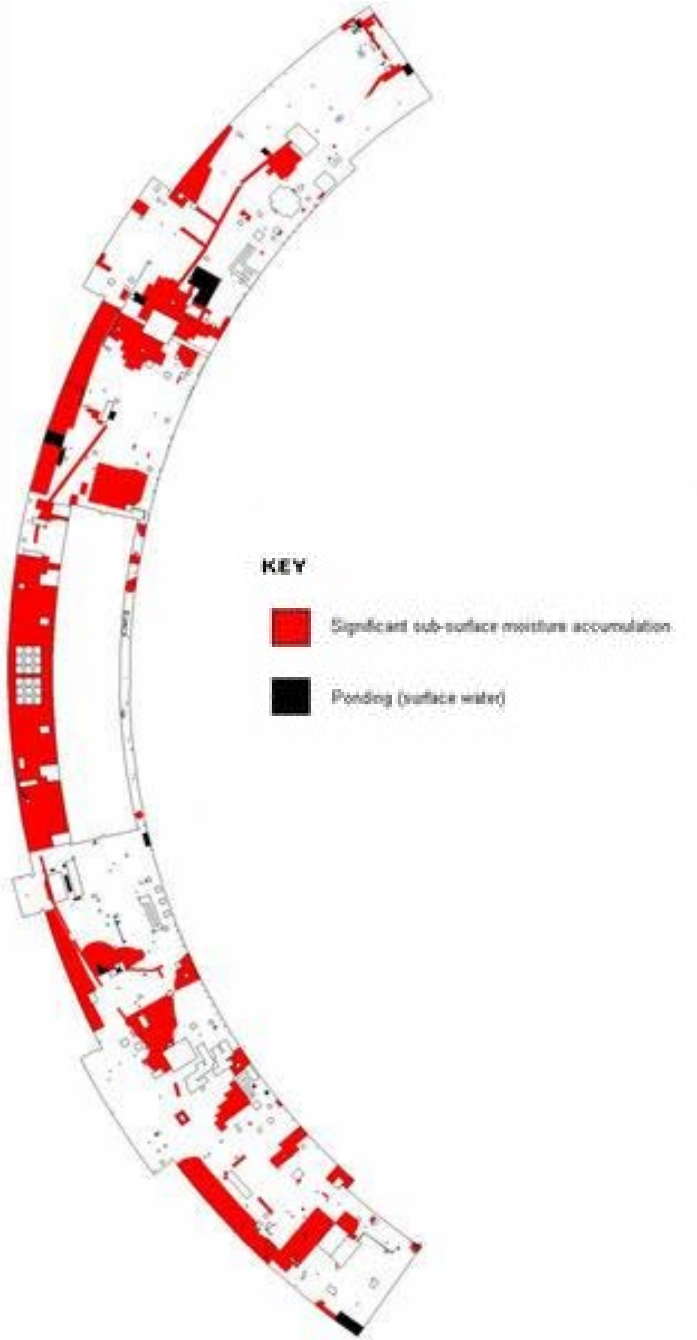
COMBINATION ROOF MOISTURE SURVEYS

INFARED/NUCLEAR

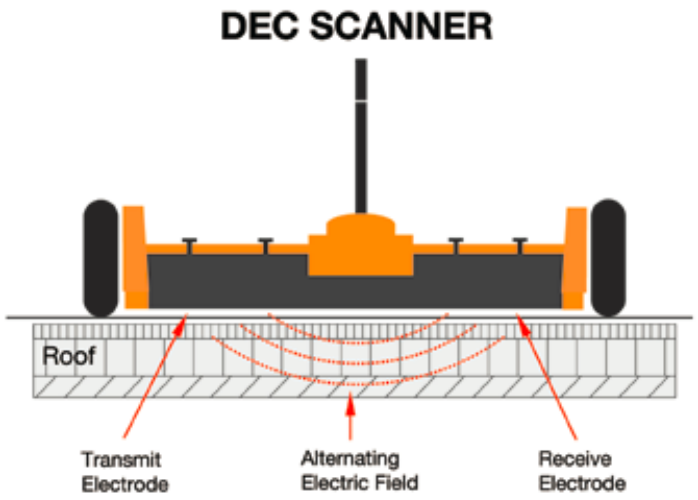
HOW IT WORKS

Combining both infrared and nuclear surveys to detect moisture within roofing systems provides the benefits of both systems while virtually eliminating the disadvantages of either.

CAPACITANCE
ROOF MOISTURE SURVEYS



CAPACITANCE
ROOF MOISTURE SURVEYS



HOW IT WORKS

A low frequency electronic signal is transmitted into the material via one of the two electrodes and received by the second electrode. The strength of this signal varies in proportion to the amount of moisture in the material. The strength of the current is converted to a comparative moisture content value.

CONTINUING EDUCATION AIA

ROOF CORE SAMPLES AND TESTING

Roof core sampling, cut tests & analysis

ROOF CORE SAMPLES AND TESTING

DIAGNOSTIC TOOLS

INFRARED

- Detects heat patterns / anomalies

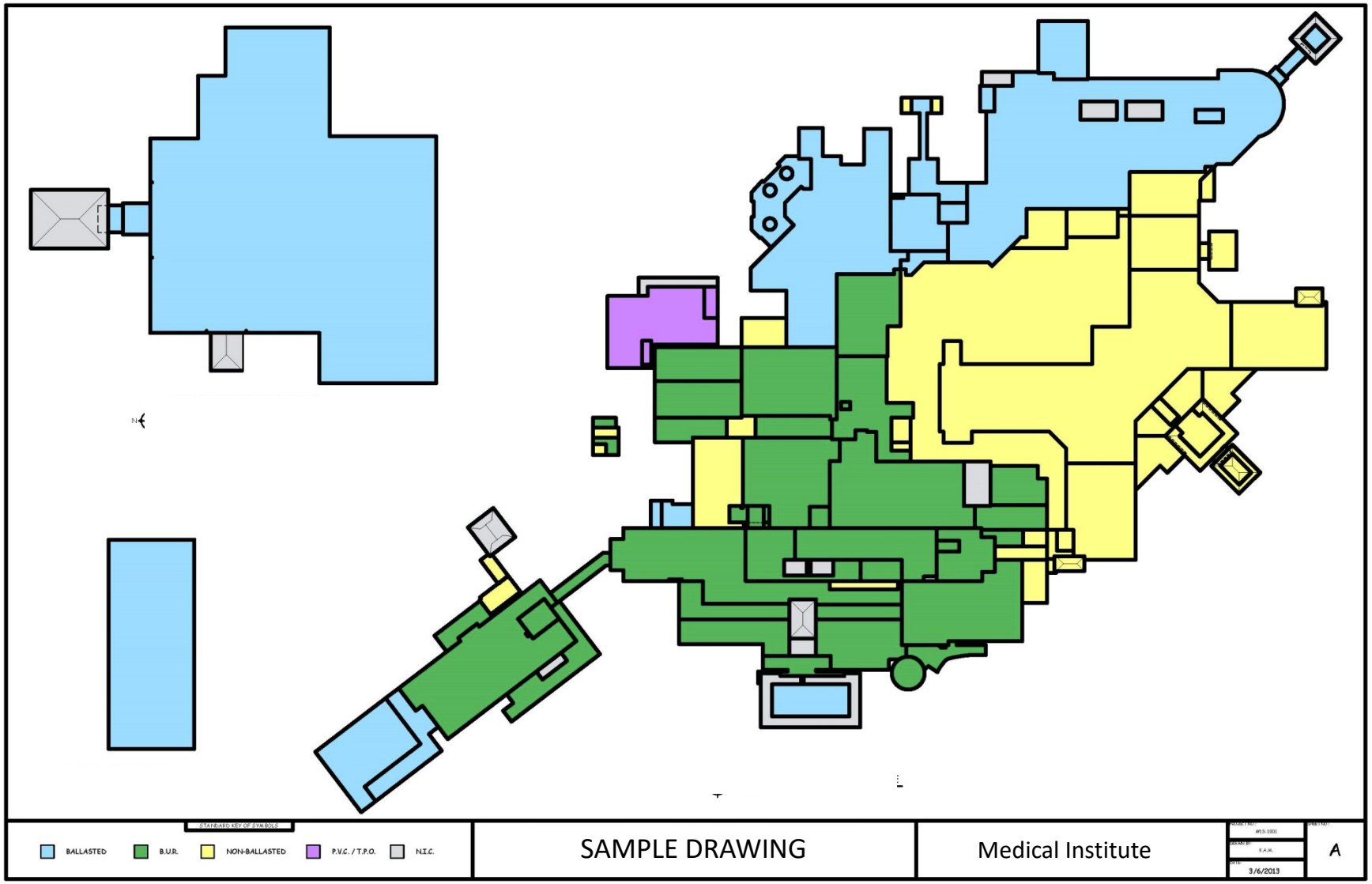
NUCLEAR

- Measures hydrogen content

CAPACITANCE / IMPEDANCE

- Measures Electrical resistance between electrodes

SAMPLE REPORTS


STANDARD KEY OF SYMBOLS
BALLASTED
B.U.R.
NON-BALLASTED
P.V.C. / T.P.O.
N.I.C.
SAMPLE DRAWING
Medical Institute
3/6/2013
A

How A Moisture Density Survey Works:

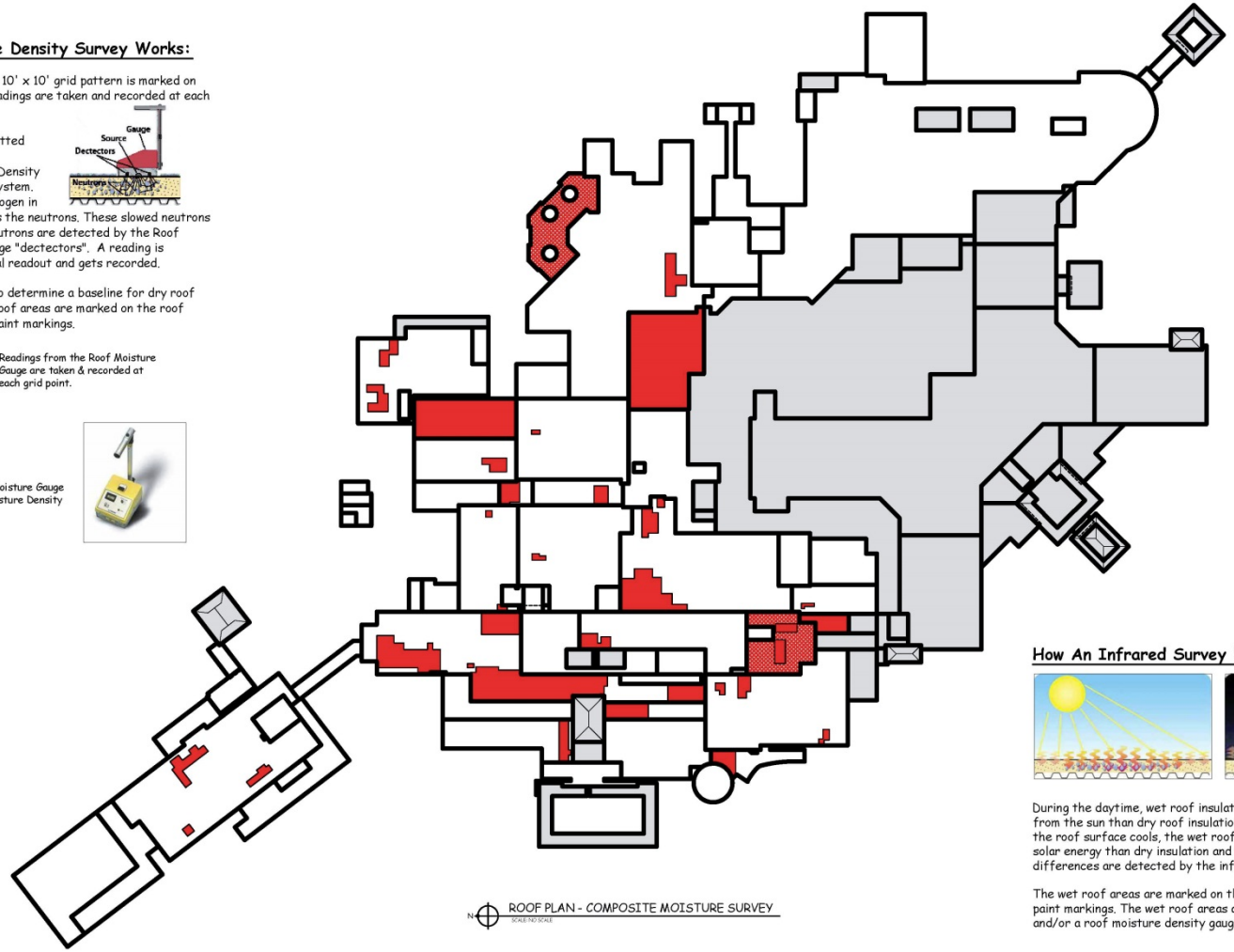
During the daytime, a 10' x 10' grid pattern is marked on the roof surface. Readings are taken and recorded at each grid intersection.

Fast neutrons are emitted from the source in the Roof Moisture Density Gauge into the roof system. The presence of hydrogen in the roof system slows the neutrons. These slowed neutrons as well as the fast neutrons are detected by the Roof Moisture Density Gauge "dectectors". A reading is displayed in the digital readout and gets recorded.

Core cuts are taken to determine a baseline for dry roof materials. Then wet roof areas are marked on the roof surface with visible paint markings.

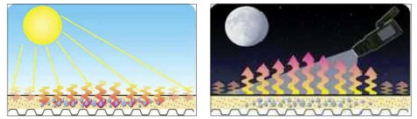
Readings from the Roof Moisture Gauge are taken & recorded at each grid point.

A typical Roof Moisture Gauge used in Roof Moisture Density Surveys.



ROOF PLAN - COMPOSITE MOISTURE SURVEY

How An Infrared Survey Works:



During the daytime, wet roof insulation absorbs more solar energy from the sun than dry roof insulation. During the nighttime, after the roof surface cools, the wet roof insulation will retain more solar energy than dry insulation and these temperature differences are detected by the infrared camera.

The wet roof areas are marked on the roof surface with visible paint markings. The wet roof areas are verified through core cuts and/or a roof moisture density gauge.

STANDARD KEY OF SYMBOLS

A Area Designation | R.I.M. (Random Intermittant Moisture) | N.I.C. | Thermogram

Dry Probe | Wet Probe | Wet Insulation | 56 Moisture Density Reading | Moisture Density Grid | Photograph

SAMPLE DRAWING

Medical Institute

#13-3001

K.A.M.

3/6/2013

C

ROOF AREA DATA			
ROOF AREA	SIZE (S.F.)	WET (S.F.)	% WET
1	6,511	0	0.00%
2	3,203	0	0.00%
3	13,307	724	5.44%
4	0	0	0.00%
5	972	0	0.00%
6	3,304	0	0.00%
7	1,282	0	0.00%
8	898	0	0.00%
9	467	0	0.00%
10	1,002	0	0.00%
11	13,979	6,028	43.12%
12	360	0	0.00%
13	932	0	0.00%
14	3,644	370	10.15%
15	2,707	0	0.00%
16	5,185	94	1.81%
17	707	389	55.02%
18	1,939	0	0.00%
19	168	0	0.00%
20	364	0	0.00%
21	308	0	0.00%
22	275	0	0.00%
23	3,800	610	16.05%
24	3,515	3,515	100.00%
25	36	0	0.00%
26	171	0	0.00%
27	260	0	0.00%
28	7,765	255	3.28%
29	510	0	0.00%
30	3,002	0	0.00%
31	1,018	0	0.00%
32	3,870	0	0.00%
33	168	0	0.00%
34	356	0	0.00%
35	432	0	0.00%
36	102	0	0.00%
37	506	0	0.00%
38	8,472	66	0.78%
39	1,994	234	11.74%
40	7,828	32	0.41%
41	1,568	0	0.00%
42	21,536	500	2.32%
43	3,292	2,800	85.05%
44	133	0	0.00%
45	133	0	0.00%
46	133	0	0.00%
47	4,841	0	0.00%
48	1,504	656	43.62%
49	675	0	0.00%
50	68	0	0.00%
51	6,229	381	6.12%
52	12,173	2,036	16.73%
53	0	0	0.00%
54	6,050	0	0.00%
55	80	0	0.00%
56	5,873	5,873	100.00%
57	1,018	0	0.00%
58	1,448	402	27.76%
59	9,746	412	4.23%
60	3,122	2,655	85.04%
61	300	0	0.00%
62	678	678	100.00%
63	0	0	0.00%
64	2,102	42	2.00%
65	2,517	0	0.00%
66	774	0	0.00%
67	3,540	0	0.00%
68	682	0	0.00%
69	2,717	0	0.00%
70	187	0	0.00%
71	187	0	0.00%
72	40,322	0	0.00%
73	448	0	0.00%
74	3,337	0	0.00%
75	420	0	0.00%
76	220	0	0.00%
77	462	0	0.00%
78	441	0	0.00%
79	0	0	0.00%
80	0	0	0.00%
81	0	0	0.00%
82	0	0	0.00%
83	0	0	0.00%
84	0	0	0.00%
85	0	0	0.00%
86	0	0	0.00%
87	0	0	0.00%
88	0	0	0.00%
89	0	0	0.00%
90	0	0	0.00%
91	0	0	0.00%
92	0	0	0.00%
93	0	0	0.00%
94	0	0	0.00%
95	0	0	0.00%
96	0	0	0.00%
97	0	0	0.00%
98	0	0	0.00%
99	0	0	0.00%
100	0	0	0.00%
101	0	0	0.00%
TOTALS	244,275	28,752	11.77%

STANDARD KEY OF SYMBOLS

N.I.C.

SAMPLE DRAWING

Medical Institute

PROJECT NO. #13-1001

DRAWN BY K.A.B.

DATE 3/6/2013

SHEET NO. J

CONTINUING EDUCATION AIA

PRESERVE OR REPLACE

TO PRESERVE OR TO REPLACE?

Instead of **preserving** their roofs, why do people **replace** their roofs?

- The roof leaks
- The roof is old
- Contractors and design professionals say they need to be replaced
- Roof insulation is substandard
- Standard policy at a specific age
- Funding is available

MOST ARE **NOT** AWARE OF THEIR OPTIONS!!

TO PRESERVE OR TO REPLACE?

CONSTRUCTION WASTE

Millions of square feet of dry, sound, and serviceable, commercial/industrial/educational/health care roofing is torn off.

This debris dumped into landfills every year **DOES NOT NEED TO BE REPLACED!**

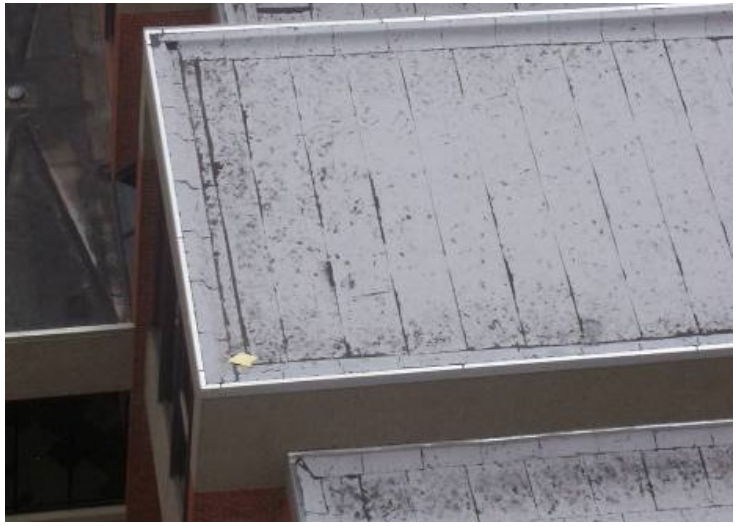
PRESERVATION CANDIDATES

BUR

Hot & Cold applied built-up roofing?

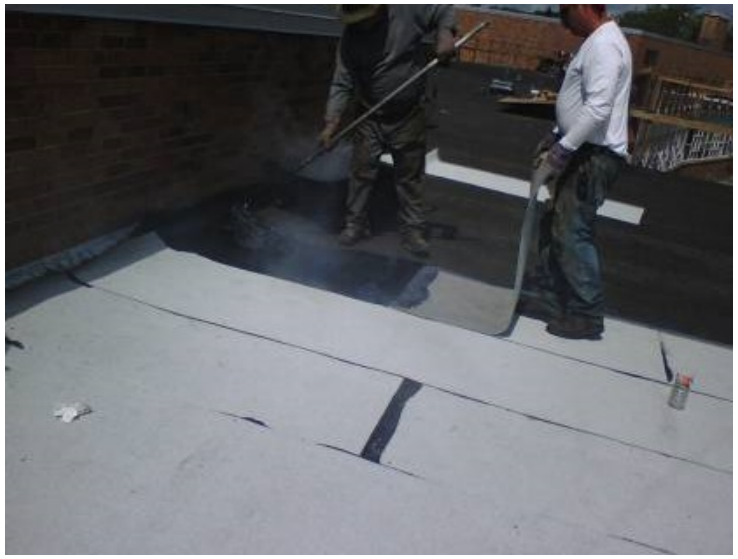
yes

PRESERVATION CANDIDATES



MOD BITS

SBS or APP Cold Adhesive, Hot or Torch Applied Modified Bitumen Systems?



yes

PRESERVATION CANDIDATES

SINGLE PLY

EPDM, PVC, TPO, Hypalon, etc. single ply Systems?

yes

PRESERVATION CANDIDATES

Metal roofing systems

Any?

yes

PRESERVATION PROCESS

REPAIRING & PREPARING ROOF SURFACE FOR PRESERVATION

- Replace or restore flashings
- Reinforce seams
- Reinforce identified defects
- Prime surfaces as required

PRESERVATION PROCESS

INSTALLATION OF A NEW WEATHERING SURFACE

Gravel surfaced BUR

- New adhesive flood coat & embedded aggregate

PRESERVATION PROCESS

INSTALLATION OF A NEW WEATHERING SURFACE

GRANULE-SURFACED MOD-BIT

- Multiple design options

PRESERVATION PROCESS

INSTALLATION OF A NEW WEATHERING SURFACE

Metal roofing systems

SUMMARY

- Water infiltration can be very difficult to trace; in many instances the leak is not attributable to the roof.
- Every roof asset management program (roof maintenance/preventive maintenance program) should include periodic comprehensive diagnostic evaluations:
  - Yearly
  - Every 2, 3, 4, or 5 years, etc..
- The cost of neglect includes everything from minor roof leaks to complete roofing system failure.

CONTINUING EDUCATION AIA

SUMMARY

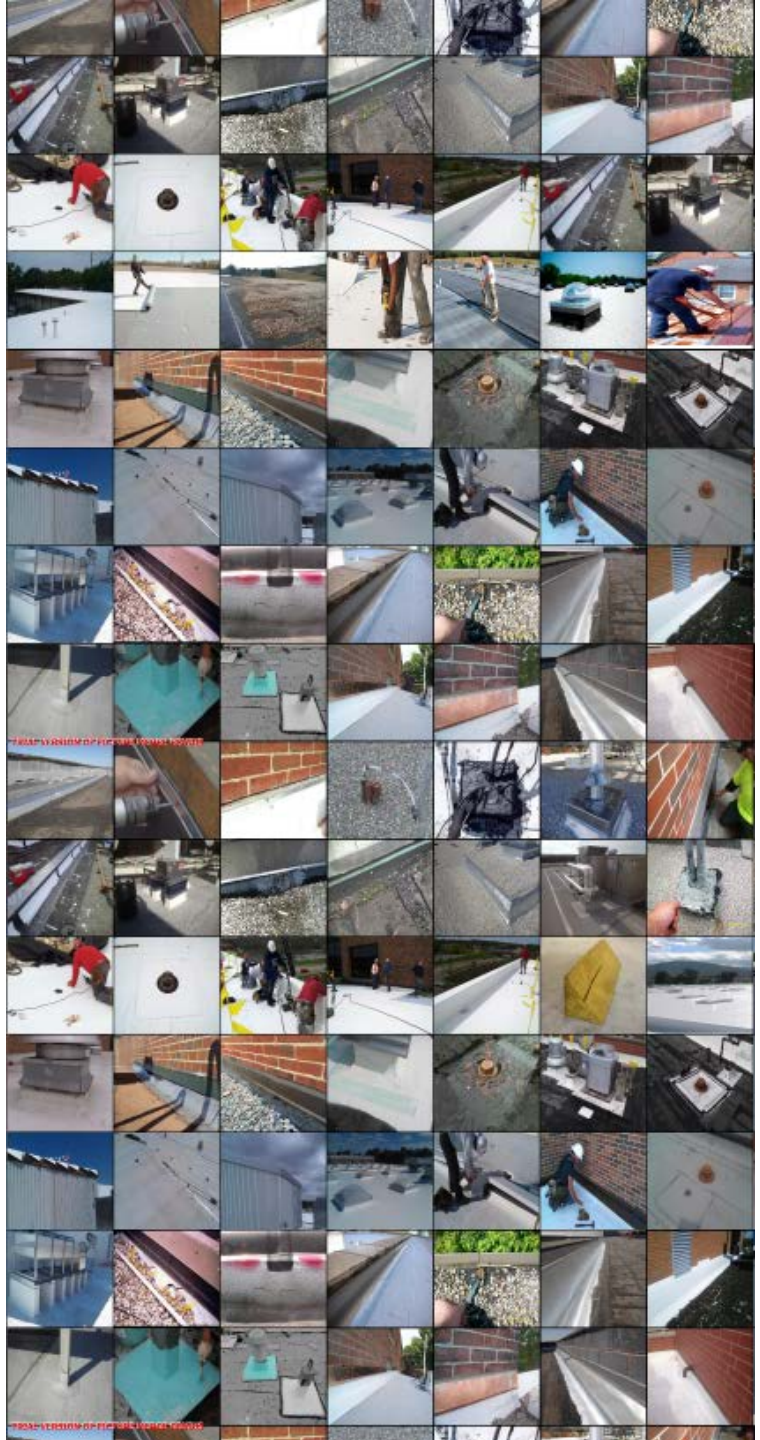
- *Performing a comprehensive diagnostic evaluation will:*
  - Determine the condition of existing roof systems and the extent of any moisture trapped within those systems
  - Enable one to effectively manage an entire roof portfolio in terms of setting priorities, and determining budgets.
- *Financial roofing decisions should NOT be made until a comprehensive diagnostic evaluation is performed.*
- *Roof restoration can cost 25-50% less than roof replacement.*

CONTINUING EDUCATION AIA

SUMMARY

ROOF FINANCIAL ANALYSIS - EXECUTIVE SUMMARY		
[redacted]	[redacted] Roof Restoration	[redacted] Roof Retrofit
TOTAL EST. ANNUAL (ROOF) ENERGY SAVINGS - (CONDUCTION & SOLAR)		
Estimated Annual (Conduction) Energy Cost Savings	$0	$697
Estimated Annual (Solar Insolation) Energy Cost Savings	$2,836	$2,856
Total Estimted Annual Energy Cost Savings	**$2,836**	**$3,553**
PROPOSED - COMBINED PROJECT FINANCIALS		
Initial Project Value (Year 0)	-$860,000	-$905,000
Total Project Value (20-Year)	-$860,000	-$905,000
Total Project Value (40-Year)	**-$1,526,994**	**-$5,664,389**
Annual (Canam) Energy Savings *(Building Weatherization)*	$0	$0
Annual (1st Restoration) Cost Avoidance Savings	$0	$0
Estimated Annual Maintenance Savings	$0	$0
Total Est. (Combined) Annual Savings *(Including Roof Analysis)*	$2,836	$3,553
TOTAL PROJECT SAVINGS (Over 40-Years)	**$4,205,849**	**$126,197**
TOTAL PROJECT PAYMENTS (Over 40-Years)	**-$1,526,994**	**-$5,664,389**
Net Present Value (at Year 20)	-$824,653	-$860,718
Net Present Value (at Year 40)	$140,242	-$2,556,117

CONTINUING EDUCATION AIA



RESOURCES

National Roofing Contractors Association
www.nrca.net

Infraspection Institute
www.infraspection.com

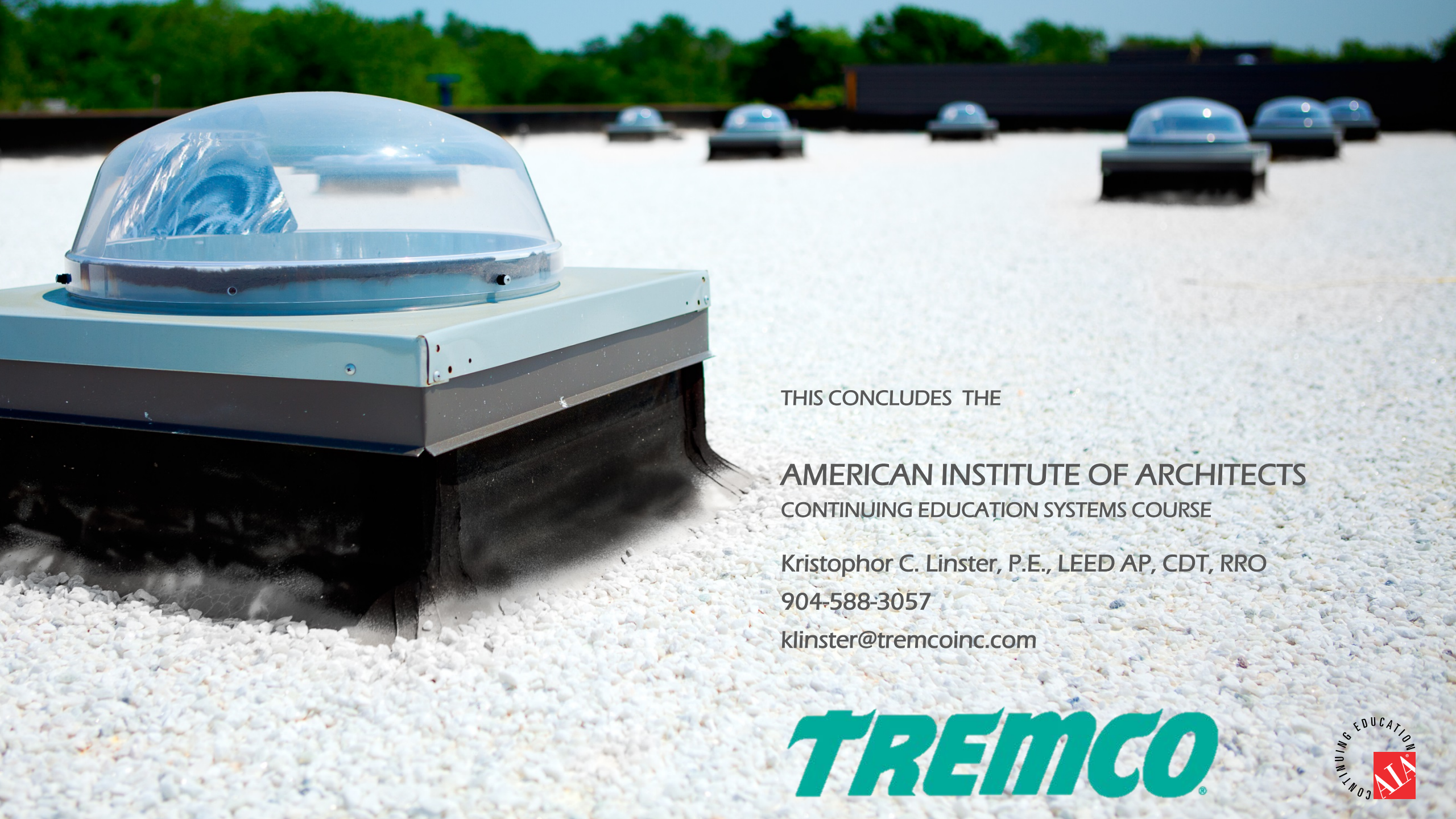
Sheet Metal and Air Conditioning Contractors National Association
www.smacna.org

Single Ply Roofing Industry
www.spri.org

International Code Council
www.iccsafe.org

FM Global
www.fmglobal.com

CONTINUING EDUCATION AIA



THIS CONCLUDES THE

AMERICAN INSTITUTE OF ARCHITECTS

CONTINUING EDUCATION SYSTEMS COURSE

Kristophor C. Linster, P.E., LEED AP, CDT, RRO

904-588-3057

klinster@tremcoinc.com

TREMCO®

CONTINUING EDUCATION AIA