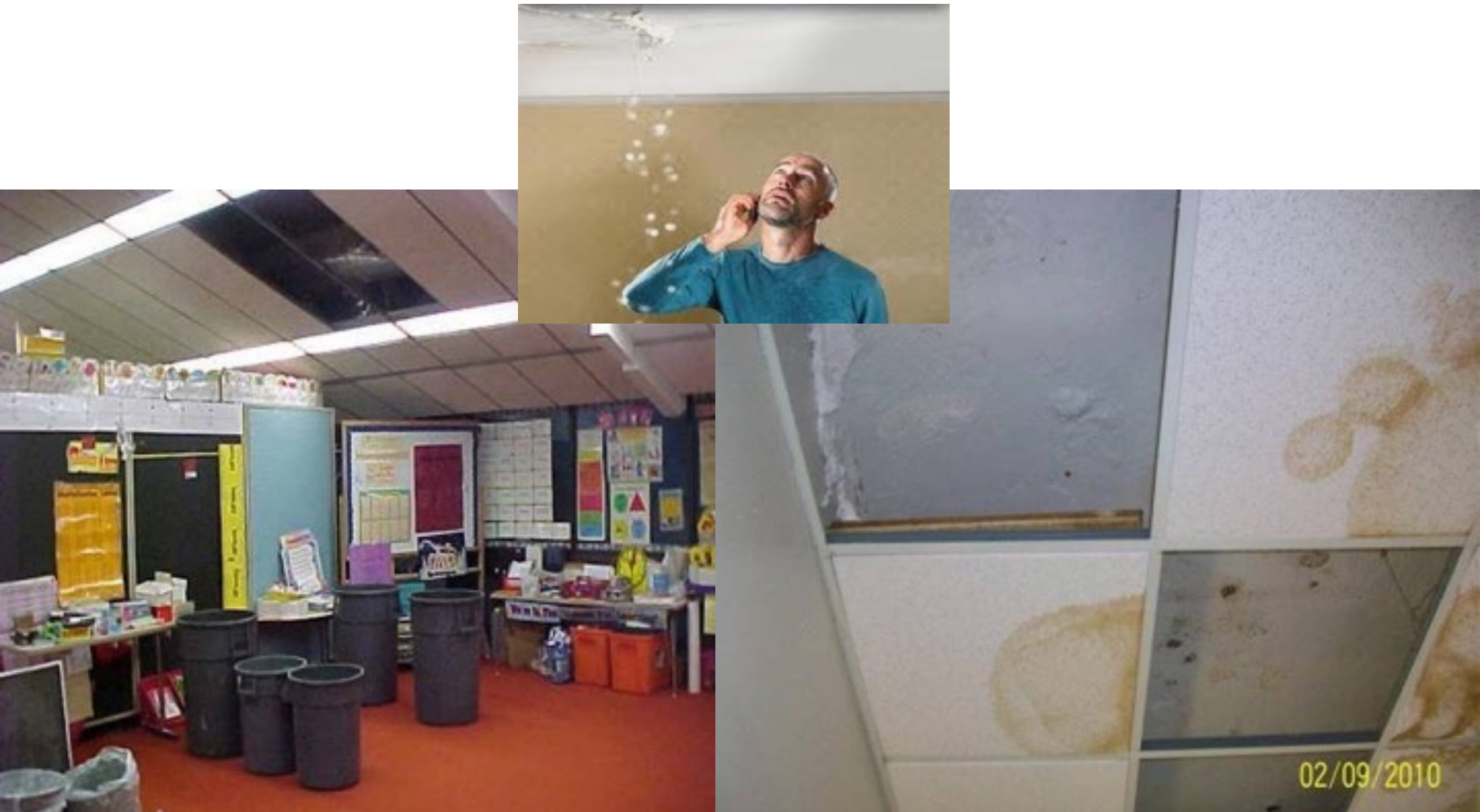


# Maintaining Building Envelope Integrity

Is Your Leak *REALLY* a Roof Leak?



# Learning Objectives:



- Recognize what is, and what is not, a roof leak.
- Identify water leak sources at masonry walls and counterflashings.
- Identify water leak sources at HVAC and ducting.
- Identify the two main types of failures on exterior sealant joints.





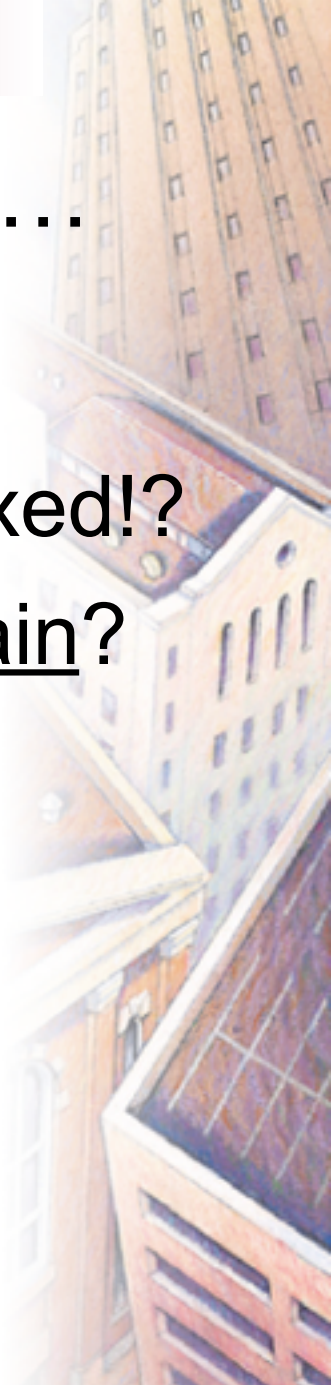
# What would be your next step?

- Call building engineer/maintenance?
- Call a roofing contractor for repair?
- Live with it (more buckets)?
- Try and find your warranty?



You took one or more of those steps...  
what if the leak was not fixed?

- You paid for something that was not fixed!?
- Call a roofing contractor for repair, again?
- Damaged internal finishes?
- Damaged equipment?
- Complaining employees?
- *Safety?*
- *Maybe mold?*



- Call contractor again
- Review warranty again
- Contact manufacturer again
- Contact attorney or legal dept?

*Definition of Insanity:*

Doing the same thing over and over again  
and expecting different results

Albert Einstein



*Where* could the leak  
be coming from?



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





# Where do you start to look?

It will not always be this obvious...



# ***Coping***





***New roof is not leaking....but...coping is leaking***



# Porous Masonry



**Split-faced block is *particularly* sensitive**



SEALED



UNSEALED





**What causes efflorescence?**

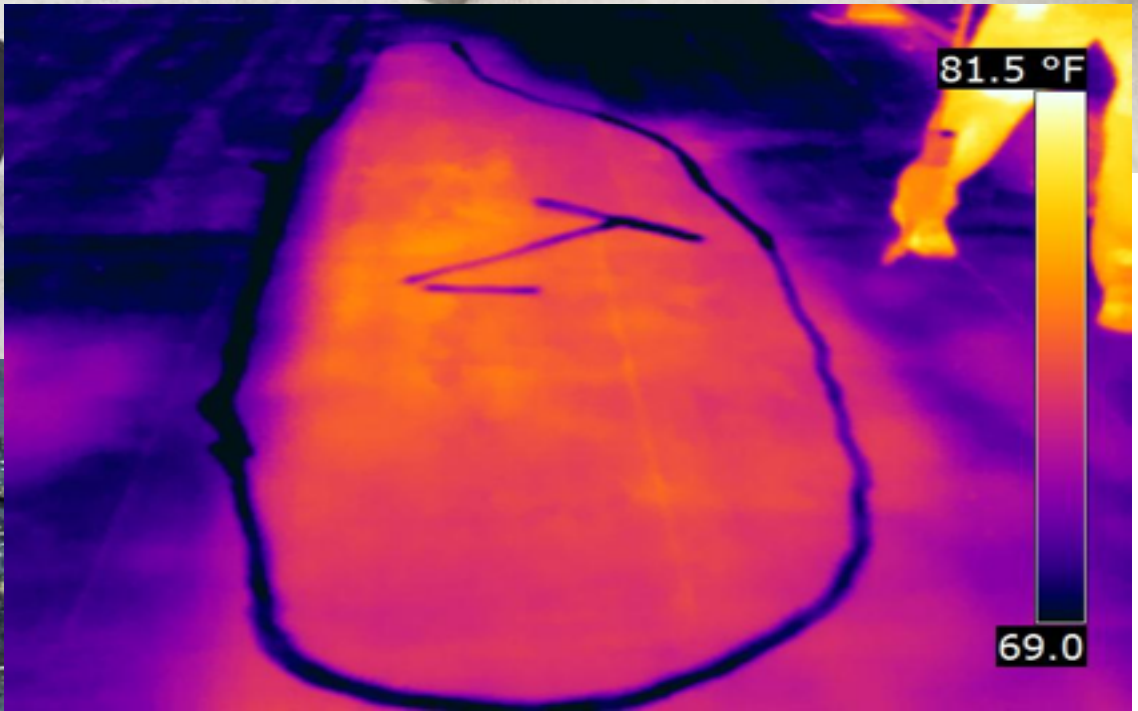


# Cracked & Spalling Masonry













# Counterflashing & Thru-wall

Problems are NOT always immediately identifiable









# 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.”

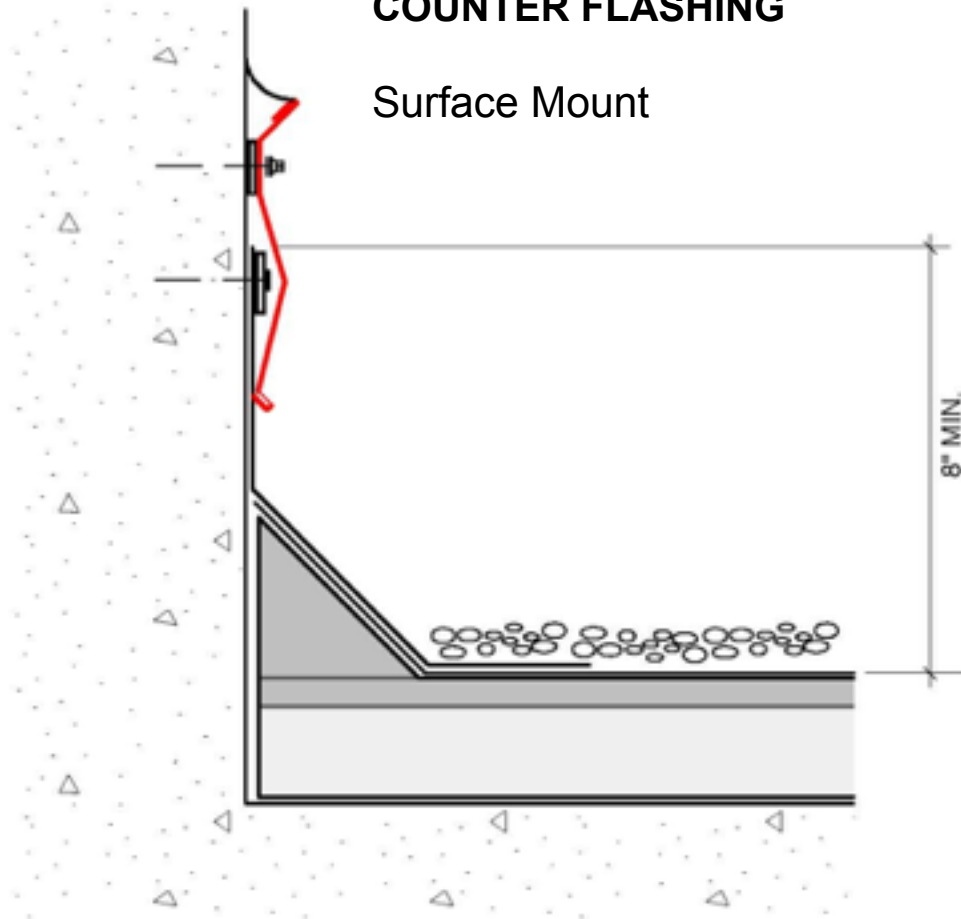
Source: The NRCA Roofing Manual Current Edition



# DETAILS

## COUNTER FLASHING

Surface Mount



# DETAILS

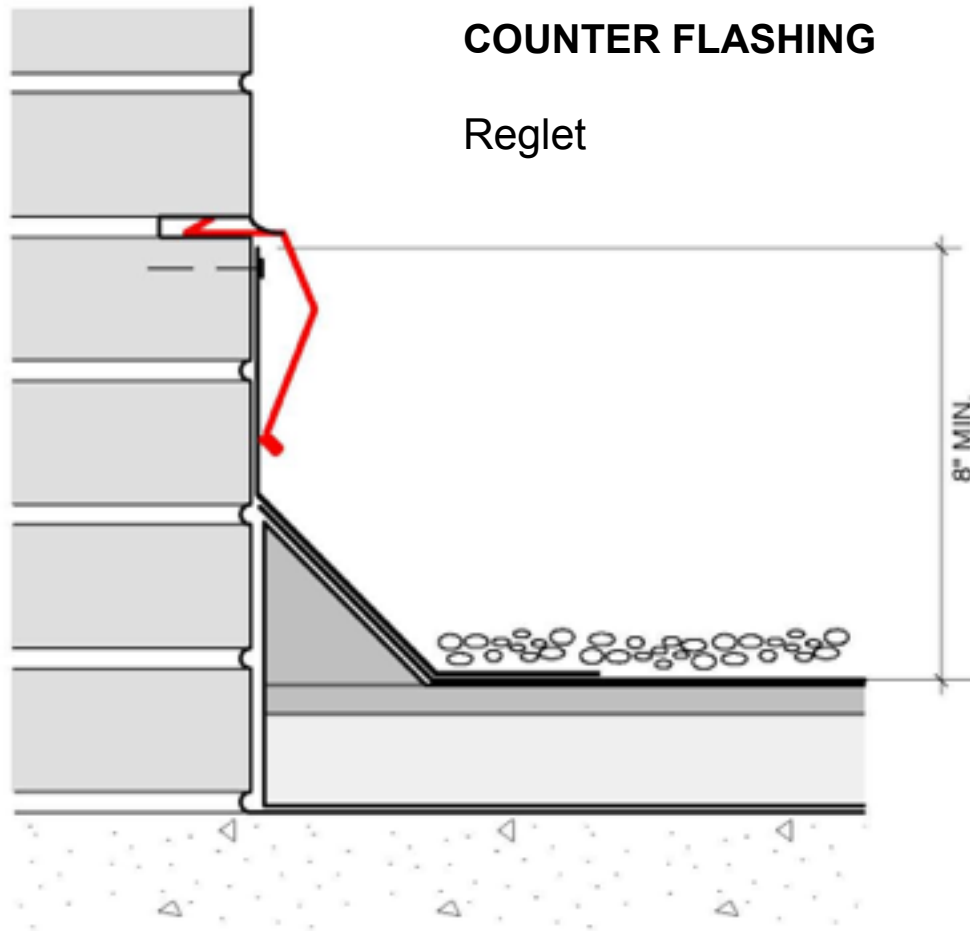
## COUNTER FLASHING

Surface Mount



GOOD

# DETAILS



# DETAILS

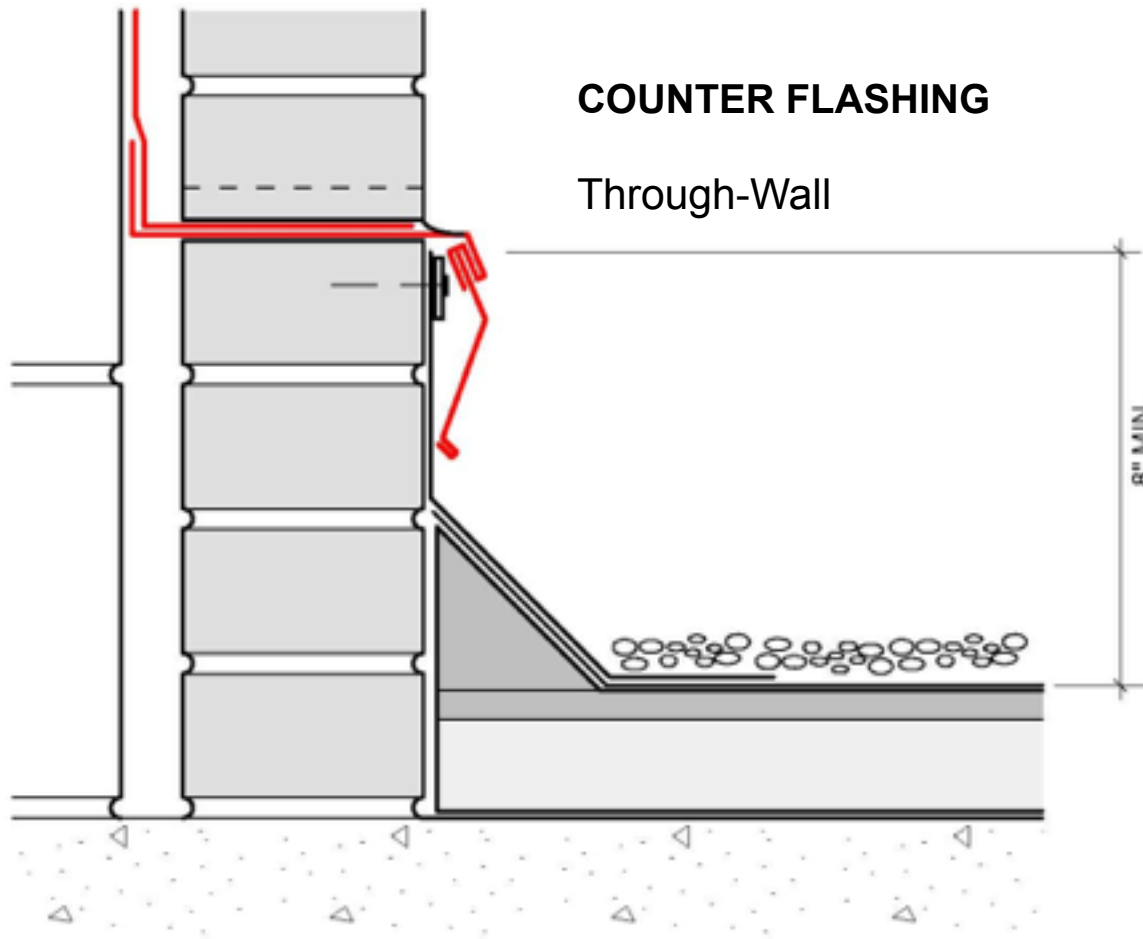
## COUNTER FLASHING

Reglet



**BETTER**

# DETAILS



# DETAILS

## COUNTER FLASHING

Through-Wall



**BEST**



# Louvers, Windows & Doors





# HVAC Issues



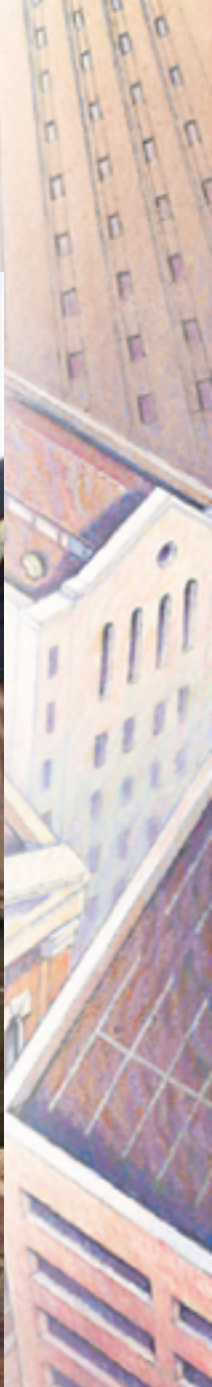


SPF contractor's idea of how to handle a nuisance roof leak...



“mummification”

# Duct work









# Plumbing & Drainage





30 SECONDS OF WORK TO CLEAR DRAIN & REMOVE 18,000 LBS OF WATER









**Old cast iron pipe is  
prone to splitting**



# Drifted & Blowing Snow



# Sealant Failures



Adhesive



“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

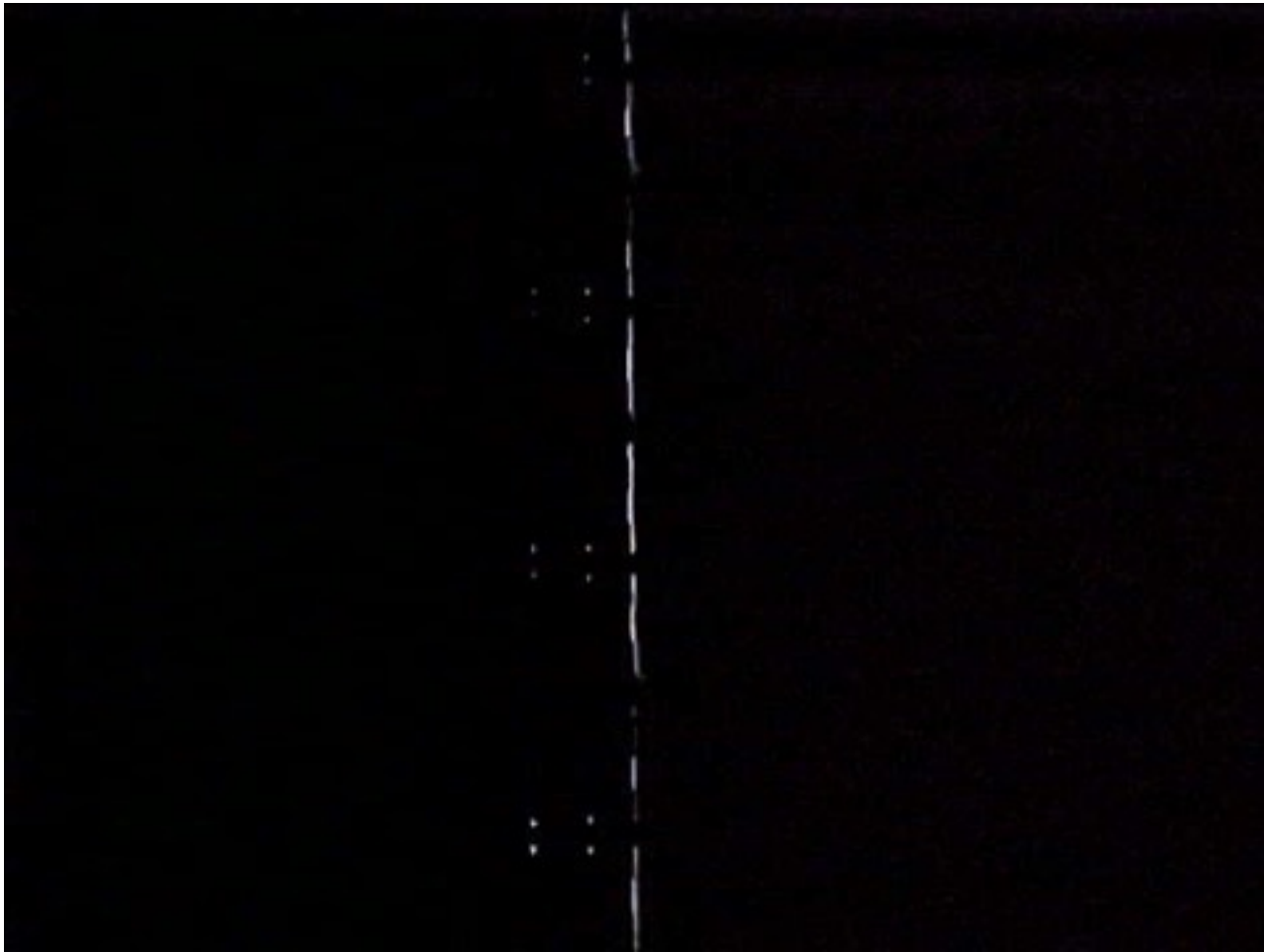


“Cohesive Failure” occurs when the sealant fails to hold together. Cohesive failure can take the form of splits and tears in both transverse and longitudinal directions. Usual causes include improper sealant selection, poor mixing of multi-component sealants, possible air entrapment in the sealant from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



**Looks minor from the outside...**



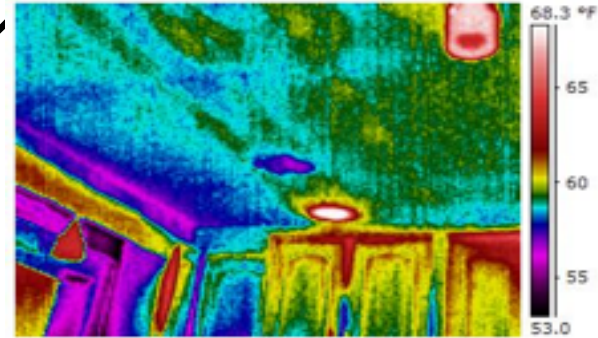


**Daylight visible from the inside = water & air leakage**

# How Can You Determine the Impact of a

Leak

- Thermal Comfort
- Air Quality (egress and ingress of contaminants)

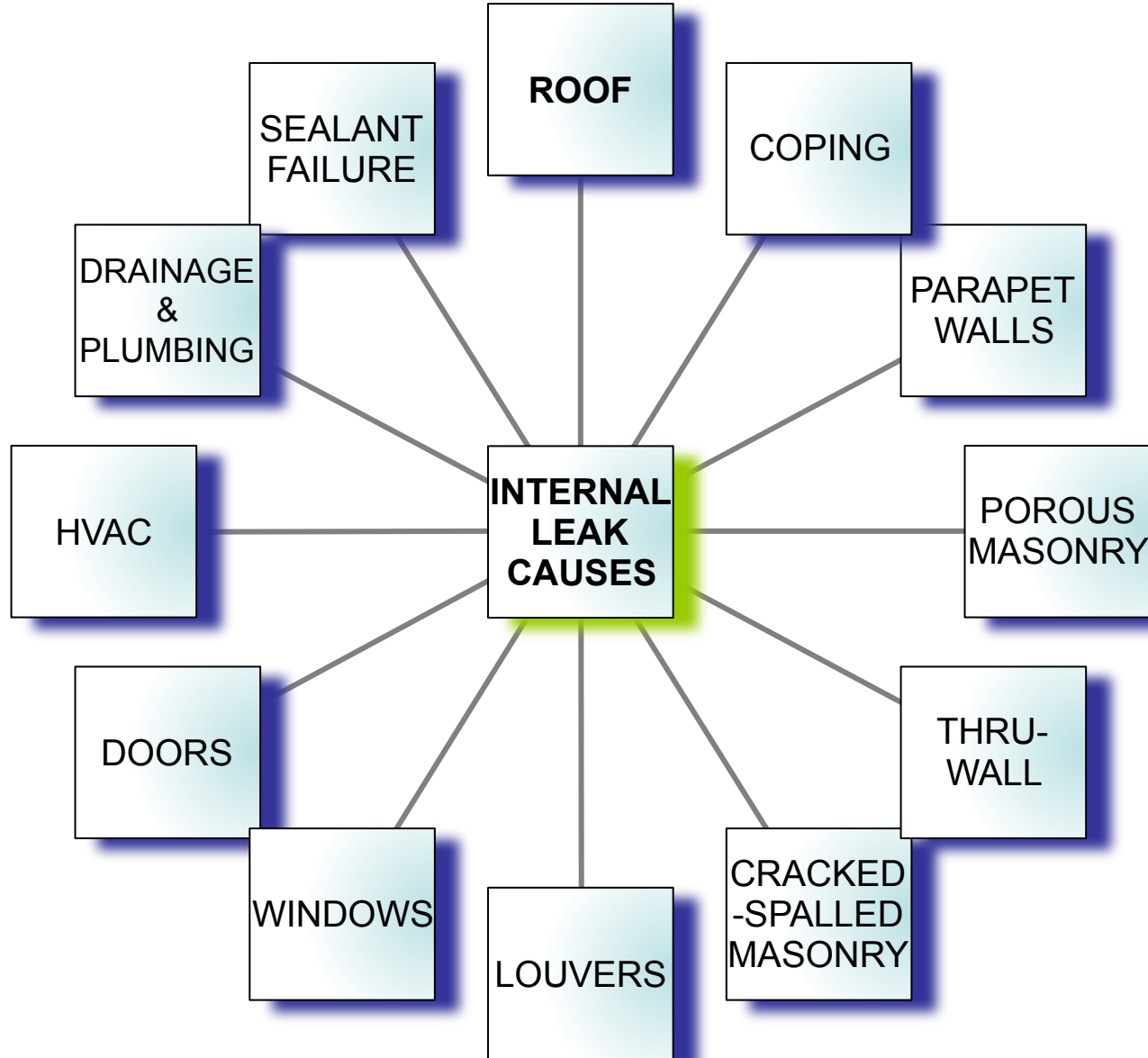


## HOLE AREA “A” BASED UPON:

35 doors x 20 ft. perimeter x 1/16” crack	=	3.65 FT.	2
24’ overhead door w/s x 1/8” crack	=	0.25 FT.	2
16,204 ft. of window sealing x 1/64” crack	=	21.09 FT.	2
12,317 ft. window perimeter sealing x 1/128” crack	=	8.02 FT.	2
264’ skylight sealing x 1/16” crack	=	1.38 FT.	2
Mechanical penthouse	=	0.40 FT.	2
TOTAL:	=	34.785 FT.	2

## REVIEW:

Roofing, albeit a major concern, is only one piece of a building's waterproofing protection:





**CANDIDATES**



# PRESERVATION CANDIDATES

## BUR

Hot & Cold applied built-up  
roofing?

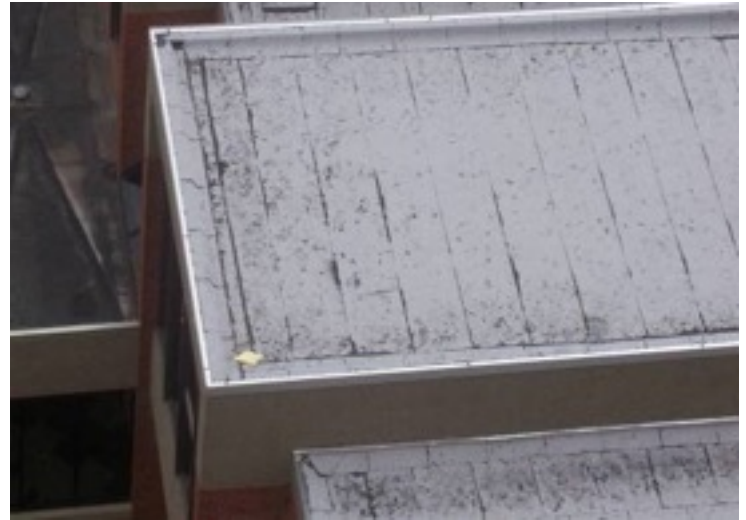


yes

# 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?



no

# PRESERVATION CANDIDATES

## **SINGLE PLY**

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



**yes**

# PRESERVATION CANDIDATES

## **Metal roofing systems**

Any?



yes

- **No Cover Board**
- **No Restoration**

# PRESERVATION CANDIDATES



# WHAT IS FLUID APPLIED ROOFING?

Fluid applied roofing is:

- A monolithic and fully bonded roof coating
- Liquid based
- Cures to form a waterproof membrane.
- Capable of stretching and returning to its original shape without damage



# WHAT IS FLUID APPLIED ROOFING?

Fluid applied roofing is almost always a combination of:

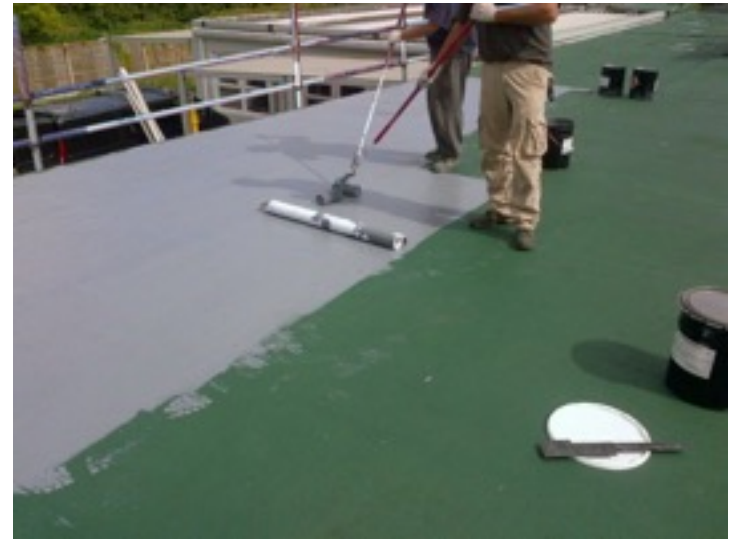
- Primer (primer type depends on substrate)
- Base coat
- Reinforcing Membrane: fiberglass or polyester
- Top Coat



# WHAT IS FLUID APPLIED ROOFING?

Material is applied by:

- Trowel
- Squeegee
- Roller
- Brush
- Spray apparatus
- Or other method recommended by membrane manufacturer.



## REPAIR (on most roof types)

# APPLICATIONS



## RESTORATION

For existing roofing systems:

- Mod Bit
- Single ply
- Smooth BUR
- Metal
- Sprayed Polyurethane
- Previously coated surfaces

## APPLICATIONS





## OTHER COURSES IN THE SERIES

TR1	Roofing Options: Alternative Roofing Systems
TR2	Cold Process Roofing
TR3	Modified Bitumen Roofing
TR4	Single Ply Roofing
TR7	Metal Roofing Systems
TRM003	Codes and Approvals
TRM011	Roof Warranties
TRM031	Safe Solutions

**TREMCO**





MERIDIAN PARK  
MEDICAL CENTER

# TREMCO®



# LAIKA

## ROOFING & BUILDING MAINTENANCE



KADLEC



**WinCo  
FOODS**



GOOD SAMARITAN  
MEDICAL CENTER



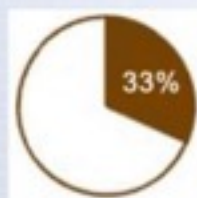
EMANUEL  
MEDICAL CENTER



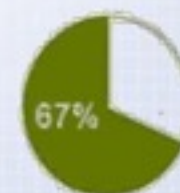
A World Leader in Specialty Coatings and Sealants  
**RPM International Inc.**



## Consumer Companies



## Industrial Companies

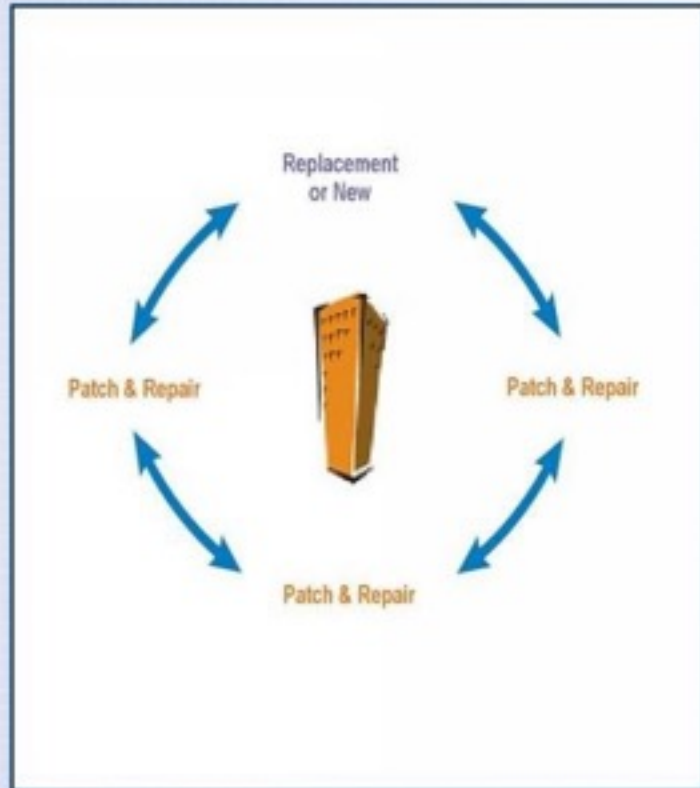


Building Life. Managed.

**TREMCO**  
EDUCATION SOLUTIONS

# Traditional Approach

## Guarantees Premature Failure



- Replace
- Repair
- Repeat
- “20-Year” designs fail in 10 - 12 years.

# Managing the Building Envelope

## Financial Assets for Return on Investment

- Manufacturing facilities are composed of long term institutional buildings that represent significant asset value.
- Facilities represent 25-40% of corporate wealth. \*
- Less than 10% are managed as financial assets for a return on investment.

\*Harvard Study

# Managing the Building Envelope

## Financial Assets for Return on Investment

### Life Expectancy with Maintenance and Restoration

- Through preventive maintenance the service life of a roof is increased anywhere from 30% to 100% according to NRCA\* and AIPE\*\*
- With restoration, roof life can be extended even further. We have local building owners with roofs that have lasted well over 50 years with preventive maintenance and restoration

\*NRCA – National Roofing Contractors Association

\*\*AIPE – American Institute of Plant Engineers (Now AFE)

# Cost of Neglect

## Case Study - 1996 Infrared Results

1,155 sf wet  
\$15.00 / sf  
\$17,000 cost



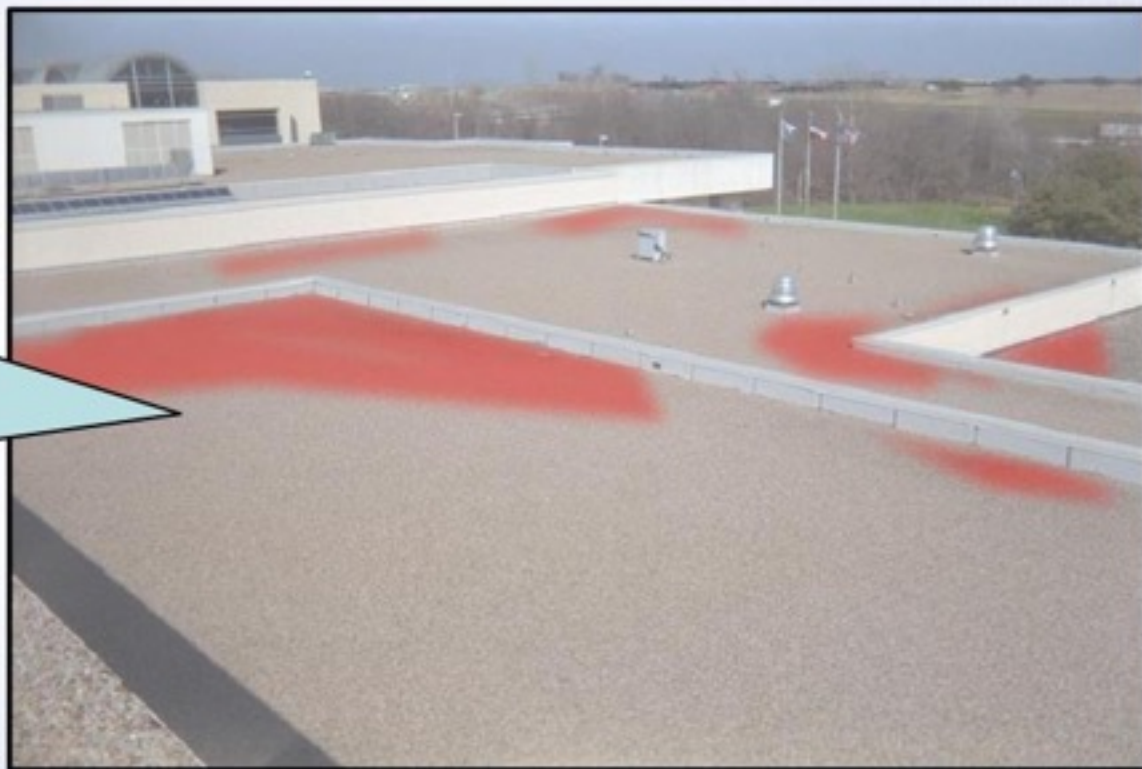
# Cost of Neglect

## Case Study - 1999 Infrared Results

6,160 sf wet

\$15.00 / sf

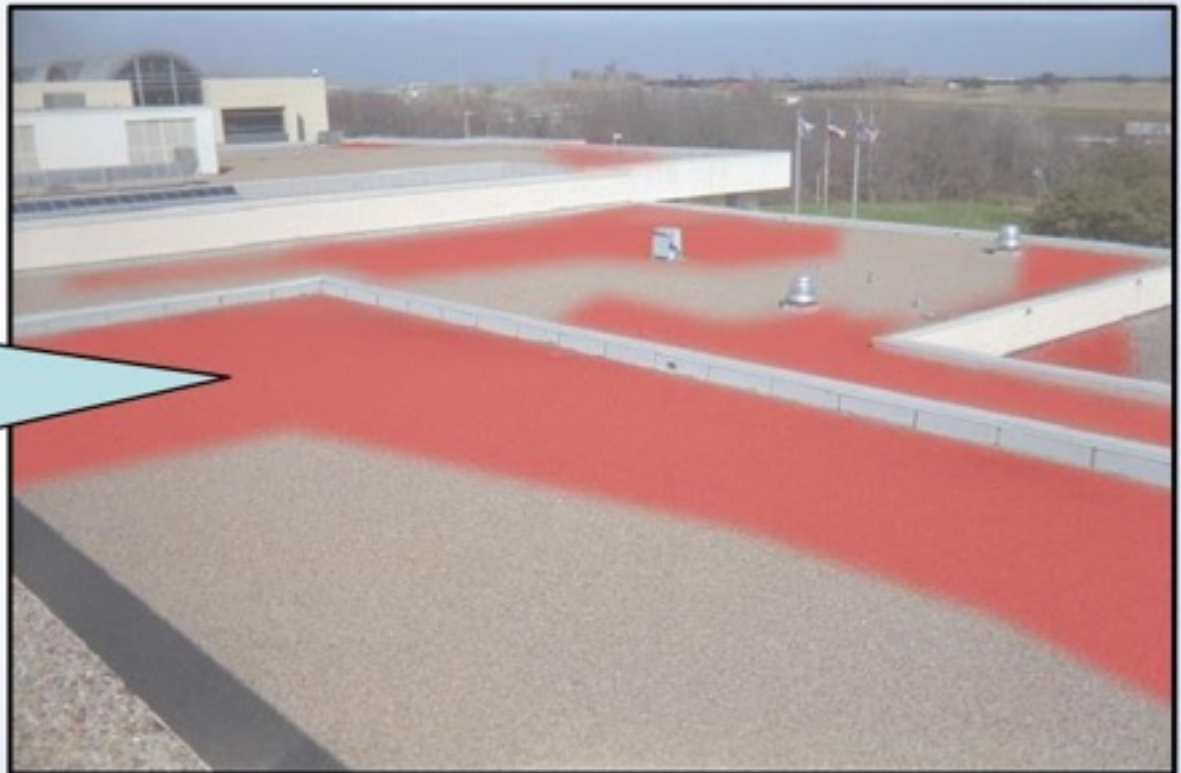
\$92,000 cost



# Cost of Neglect

## Case Study - 2001 Infrared Results

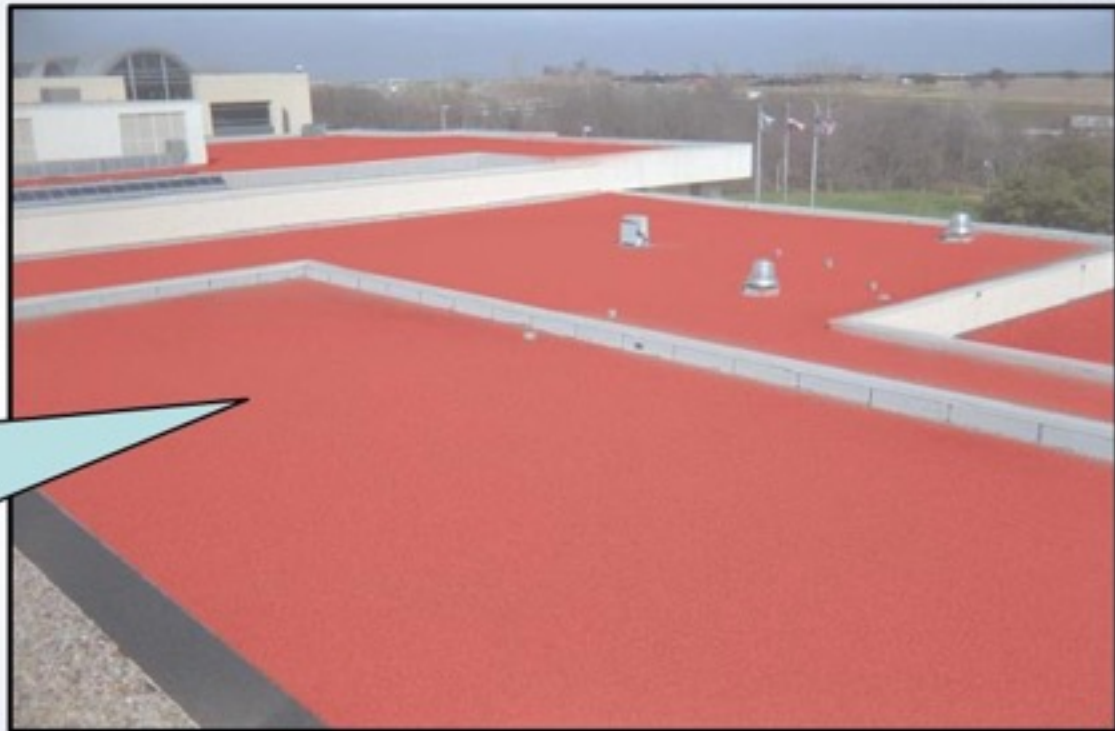
27,201 sf wet  
\$15.00 / sf  
\$408,000 cost



# Cost of Neglect

## Roof Replacement 2005

65,000 sf wet  
\$15.00 / sf  
\$975,000 cost



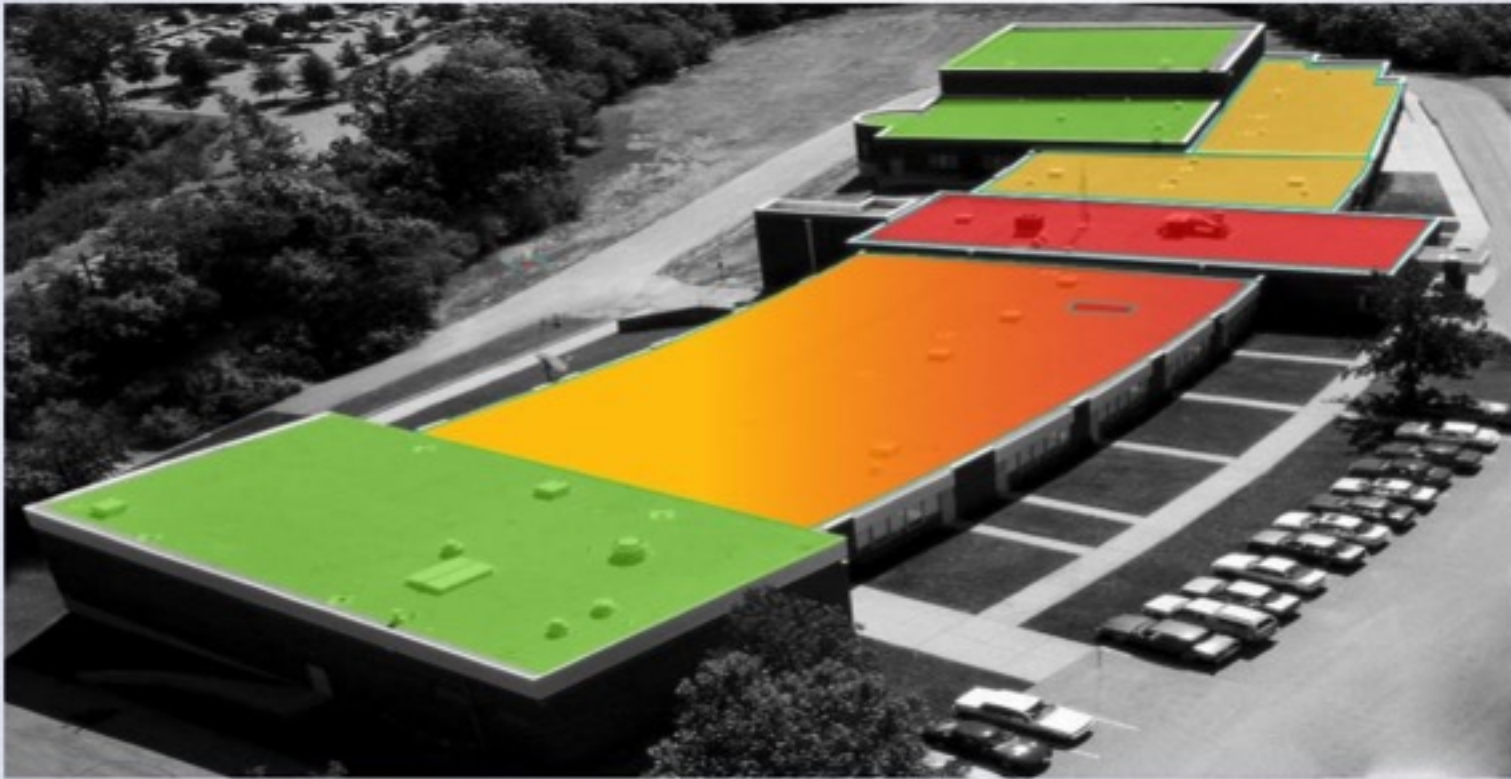
# Cost of Neglect

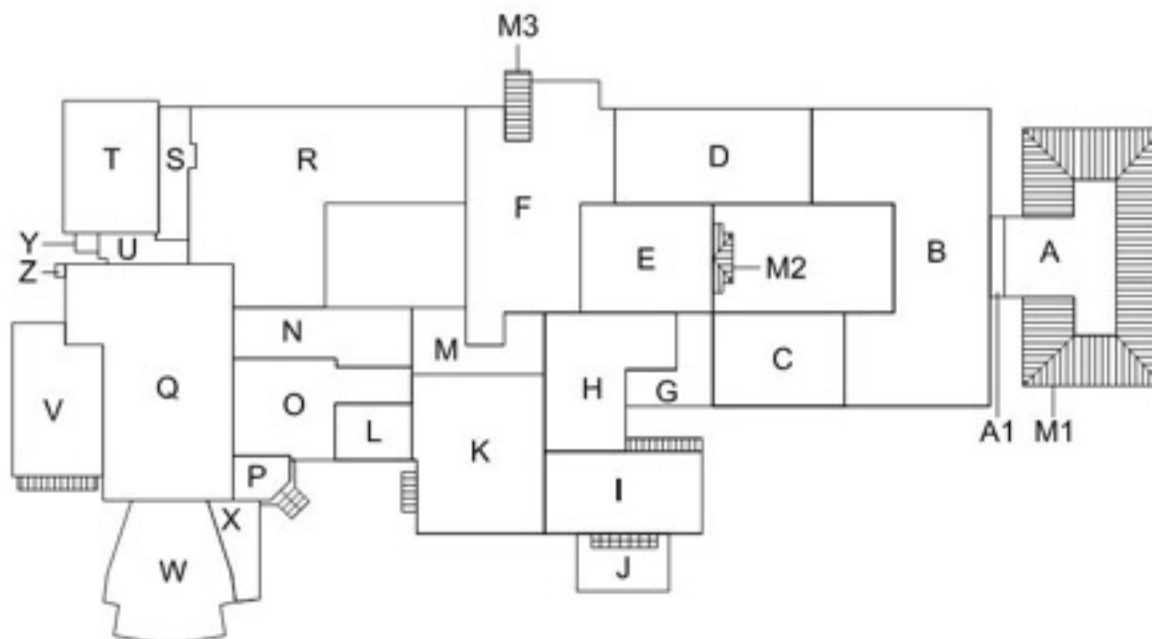
- Phase 1 Failure \$17,000
- Phase 2 Failure \$92,000
- Phase 3 Failure \$408,000
- Phase 4 Failure \$975,000
  
- Asset Management Program  
Priceless

# The Asset Management Solution

## Methodology to Extend Asset Life

- Know what you have





# TREMCO

ROOFING & BUILDING MAINTENANCE

9013 NE Hwy. 99 Ste 8,  
Vancouver, WA 98665  
Tel: (253)355-4000

Client:

**Centennial High School**

Address:

**3505 SE 182nd Ave  
Gresham, OR 97030**

Drawn By:

**KS**

Date:

**3-15-18**

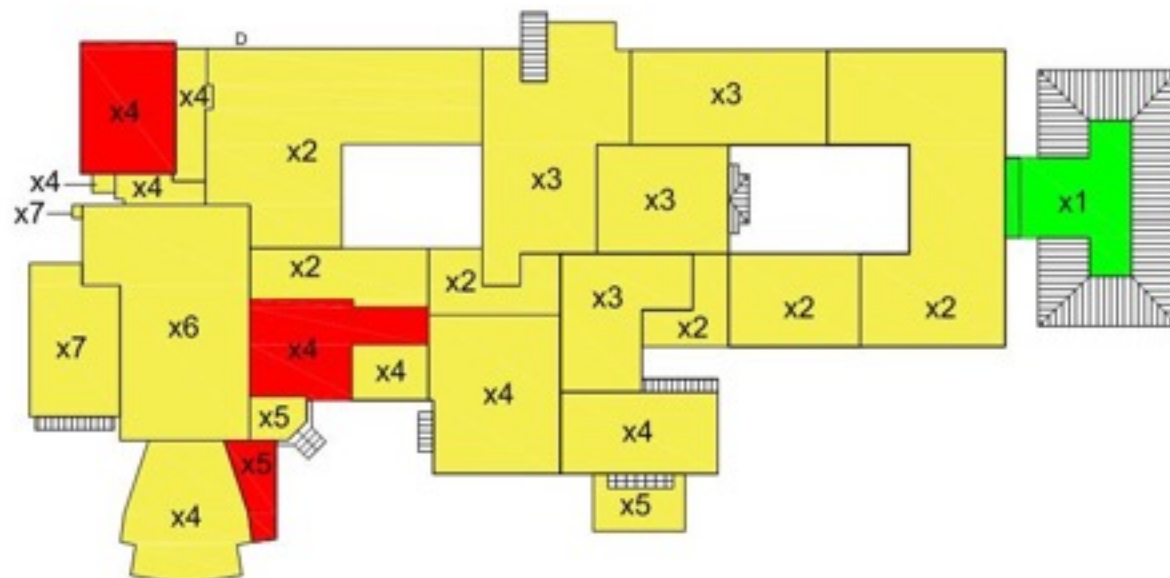
Roof A: 4,513 sq.ft.	Roof T: 4,662 sq.ft.
Roof A1: 440 sq.ft.	Roof U: 933 sq.ft.
Roof B: 15,165 sq.ft.	Roof V: 4,844 sq.ft.
Roof C: 4,560 sq.ft.	Roof W: 5,583 sq.ft.
Roof D: 6,931 sq.ft.	Roof X: 1,357 sq.ft.
Roof E: 5,345 sq.ft.	Roof Y: 165 sq.ft.
Roof F: 10,748 sq.ft.	Roof Z: 48 sq.ft.
Roof G: 1,950 sq.ft.	
Roof H: 5,261 sq.ft.	
Roof I: 4,789 sq.ft.	
Roof J: 1,960 sq.ft.	
Roof K: 7,685 sq.ft.	
Roof L: 1,604 sq.ft.	
Roof M: 2,663 sq.ft.	
Roof N: 3,619 sq.ft.	
Roof O: 4,787 sq.ft.	
Roof P: 873 sq.ft.	
Roof Q: 12,496 sq.ft.	
Roof R: 14,374 sq.ft.	
Roof S: 1,568 sq.ft.	

Total Low Slope: 129,922 sq.ft.





- Maintain/Restore Delay 7-10
- Restore 2-3
- Replace 1-2



#### Core Information:

- |   |  |   |   |
|---|--|---|---|
| <p>x1: Wood Deck<br/>2 Layers 2" ISO<br/>1/2" Gypsum<br/>Multi Ply + Cap</p>          | <p>x2: Wood Deck<br/>Rosin Paper<br/>1/2" Wood Fiber<br/>Multi Ply + Cap</p> | <p>x3: Wood Deck<br/>2 layers Tapered ISO<br/>Multi Ply + Cap</p> | <p>x4: Wood Deck<br/>1" Yellow Fiberglass<br/>Multi Ply + Cap</p> |
| <p>x5: Wood Deck<br/>2 Layers 2" ISO<br/>2 Layers 1/4" Gypsum<br/>Multi Ply + Cap</p> | <p>x6: Tectum Deck<br/>1" Yellow Fiberglass<br/>Multi Ply + Cap</p>          | <p>x7: Wood Deck<br/>Multi Ply + Cap</p>                          |   |

**TREMCO**  
ROOFING & BUILDING MAINTENANCE

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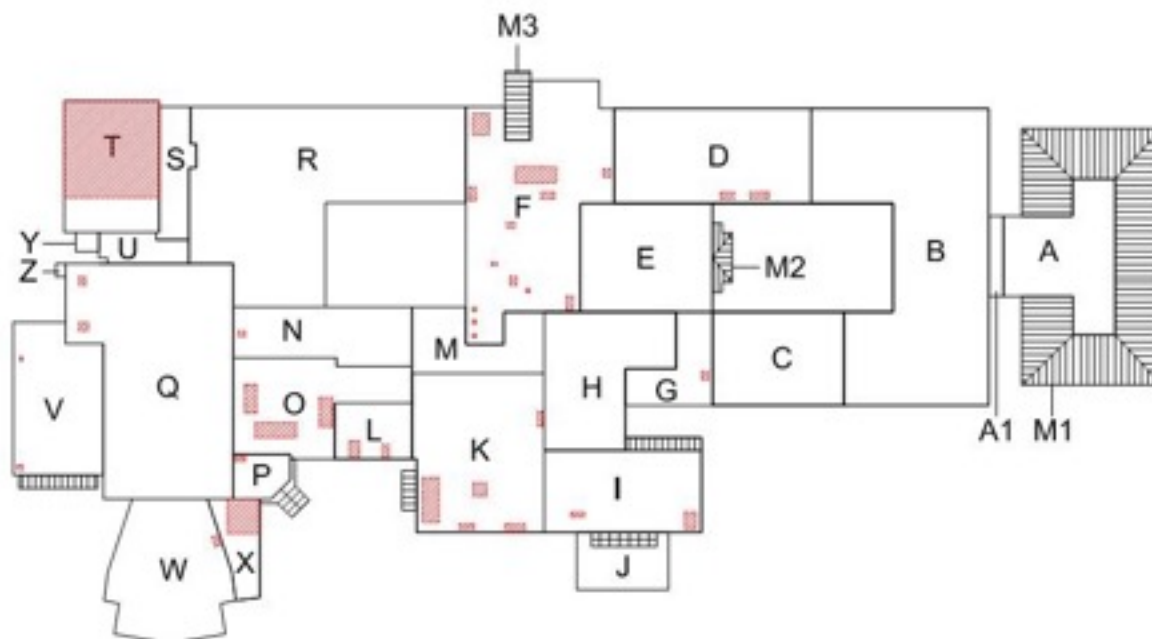
Date:

**3-15-18**

#### Category Drawing

Maintain: 6,743 sq.ft. (6%)  
Restore: 111,374 sq.ft (86%)  
Replace: 10,806 sq.ft. (8%)





**TREMCO**

ROOFING & BUILDING MAINTENANCE

9013 NE Hwy. 99 Ste 8,  
Vancouver, WA 98665  
Tel: (253)355-4000

Client:

**Centennial High School**

Address:

**3505 SE 182nd Ave  
Gresham, OR 97030**

Drawn By:

**KS**

Date:

**3-15-18**

Roof D: 1% Wet  
Roof F: 7% Wet  
Roof G: 1% Wet  
Roof I: 2% Wet  
Roof K: 6% Wet  
Roof L: 6% Wet  
Roof N: 1% Wet  
Roof O: 10% Wet  
Roof P: 2% Wet  
Roof Q: 2% Wet  
Roof T: 80% Wet  
Roof V: 1% Wet  
Roof W: 1% Wet  
Roof X: 30% Wet





**Centennial High School**  
3505 SE 182<sup>nd</sup> Ave  
Gresham, OR 97030



**Centennial High School**  
3505 SE 182<sup>nd</sup> Ave  
Gresham, OR 97030



#### GENERAL INFORMATION:

ROOF AREA: Centennial High School  
SQUARE FOOTAGE: 129,222 sq. ft.  
DATE INSTALLED: Unknown

#### ROOF COMPOSITION:

MAJORITY SURFACING: MB Cap Sheet (sq. ft.)  
  
MEMBRANE: MB Cap Sheet  
INSULATION: Yellow Fiber Glass  
INSULATION: Polyisocyanurate  
COVERBOARD: Perlite  
COVERBOARD: Gypsum  
DECK: Wood

#### DEFICIENCIES NOTED:

- Clean all membrane surfaces of organic build up.
- Foil Flashing face is failing
- Clean drains of all debris and organics.
- Defective Membrane fishmouths
- Clean all gutters free of organic debris.
- Deteriorated rubber expansion joint.
- Replace walkway on stadium
- Poor termination of foil to masonry
- Poorly installed cap repair
- Exposed lead flashings
- Fill all pitch pockets
- Replace missing wall clad metal
- Failing flashing at Scuppers
- Racked membrane by drain

#### INSPECTOR COMMENTS:

Centennial High School MB Cap sheet is in fair condition and should be budgeted for restoration in 3-5 years. Fix all deficiencies and maintain twice a year to extend the life of the system.

Roof A was more recent and should be maintained and budgeted for delayed restoration in 5-7 years. Moderate areas of Granule loss will continue to expand.

#### RECOMMENDATIONS:

##### Good

AlphaGuard NR Clean the existing roof system clean of all dirt and debris. Apply reinforcing at all seams in AlphaGuard Base Coat. AlphaGuard Top Coat. Provide a 12-year Tremco QA Warranty with inspection and maintenance on years 2, 5, 10.

##### Best

AlphaGuard Fully Reinforced System Clean the existing roof system clean of all dirt and debris. Fully reinforce Base Coat and all flashings with Polyester fabric in Base Coat. Install Top Coat at 2 Gallons/sq. Provide a 20-year Tremco QA Warranty with inspection and maintenance on years 2, 5, 10 & 15.

**Note:** At the end of year 20, the system can be cleaned, primed, and 2 gallons per 100 sq. ft. of AlphaGuard Top Coat can be installed to extend the system life cycle by providing an additional 10-year warranty with inspection and maintenance again, on years 2 & 5. The system can be restored indefinitely for the life of the building.

ROOF CATEGORY: **Restore**

RESTORATION BUDGET: Range: \$1,162,998-\$1,421,442

REPLACEMENT BUDGET: \$1,809,108

Building/Condition	Sq.Ft.	2018	2019	2020	2021	2022	2023	2024	2025	2026
RESTORE										
Chiller Building	3,797		\$55,792							
Eastern State Hospital	29,311	\$392,545				\$92,815				
Laundry Facility	37,145		\$310,612	\$189,273						
REPLACE										
Eastern State Hospital	7,551				\$181,675					
Motorpool	5,686				\$127,990					
Warehouse	15,279			\$335,790						
MAINTAIN/RESTORE DELAY										
Activity Therapy	21,141									\$242,792
Chiller Building	3,010									\$36,120
Custodial Services	24,990									
Eastern State Hospital	52,249					\$226,663	\$226,663	\$226,663		
Westlake Campus	77,072						\$282,598	\$282,598	\$282,598	
Square Foot Total -	277,231									
Yearly Capital -		\$392,545	\$366,404	\$525,063	\$309,665	\$319,478	\$509,261	\$509,261	\$282,598	\$278,912
								Total Capital -		\$3,493,187

**Total Asset 6,736,901 Sq. Ft.**  
**Total Asset Value \$202,107,030**

