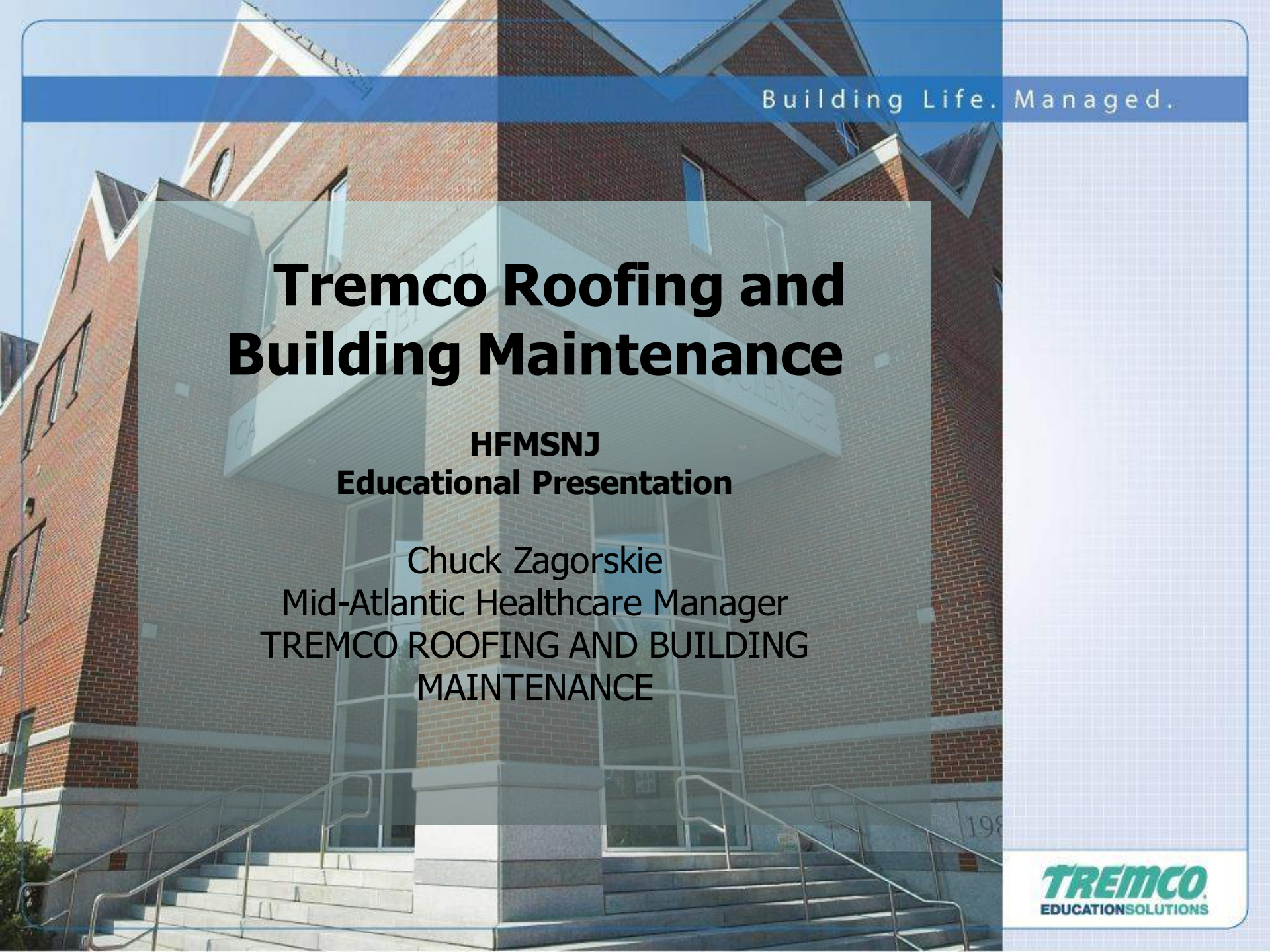


Tremco Roofing and Building Maintenance

HFMSNJ
Educational Presentation

Chuck Zagorskie
Mid-Atlantic Healthcare Manager
TREMCO ROOFING AND BUILDING MAINTENANCE

TREMCO
EDUCATIONSOLUTIONS

Tonight's Program:

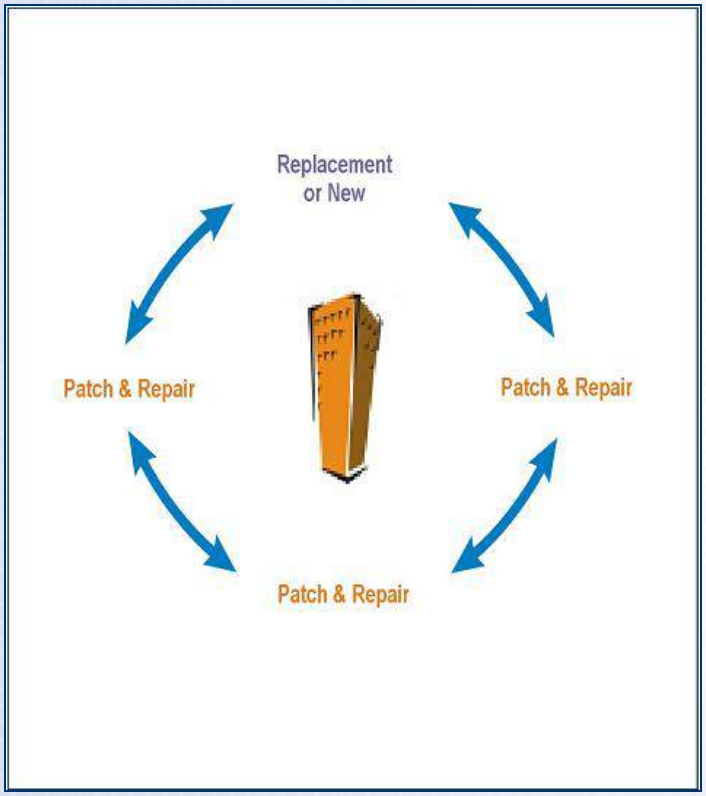
Part 1: **Managed Assets-Knowing what you have** for all parts of the building envelope. (Chuck Zagorskie, Mid-Atlantic Healthcare Manager/Tremco.)

Part 2: **Roofing Systems; Know your options,** no one roof system fits all. (Jeff Dorfler, Tremco Field Advisor, Union, Hudson, Essex Counties)

Part 3: **Roof Preservation/Restoration:** a cost effective replacement alternative. (Ed Broderick, Jr. Tremco Field Advisor, Mercer, Hunterdon, Warren, and Somerset Counties.)

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

- Healthcare Organizations are comprised 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

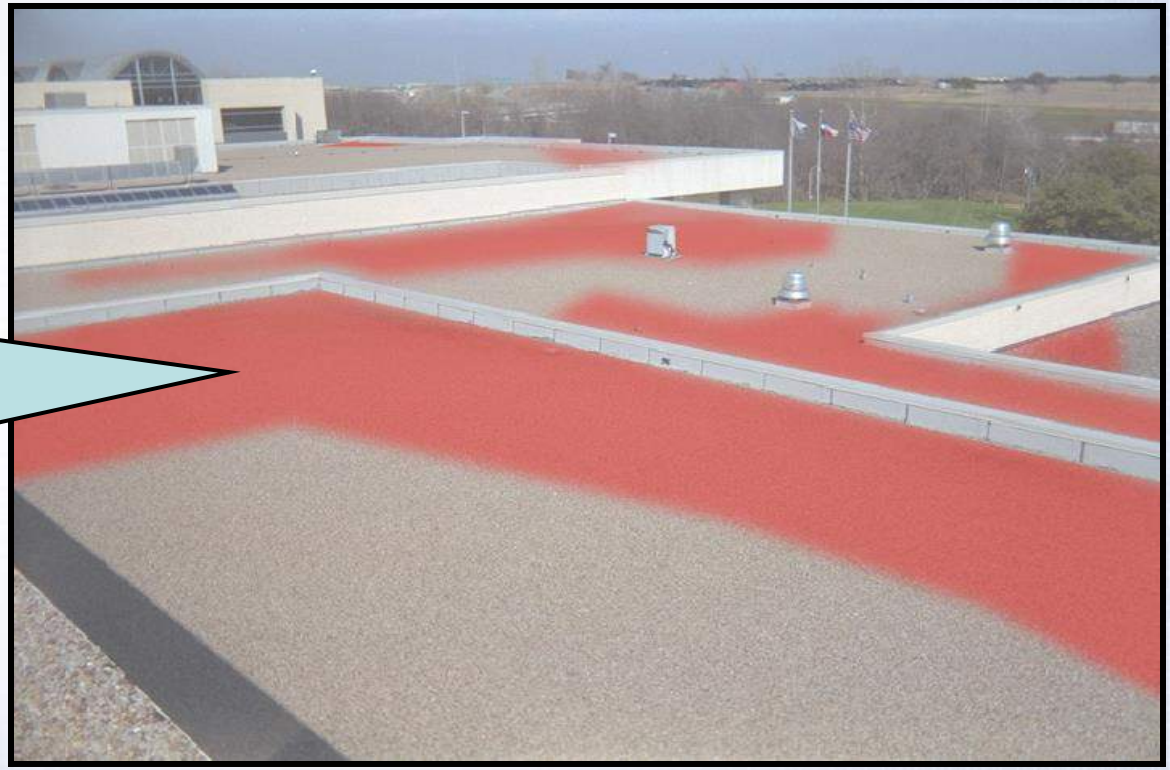
6,160 sf wet

$15.00 / sf

$92,000 cost

Cost of Neglect

Case Study - 2001 Infrared Results



27,201 sf wet

$15.00 / sf

$408,000 cost

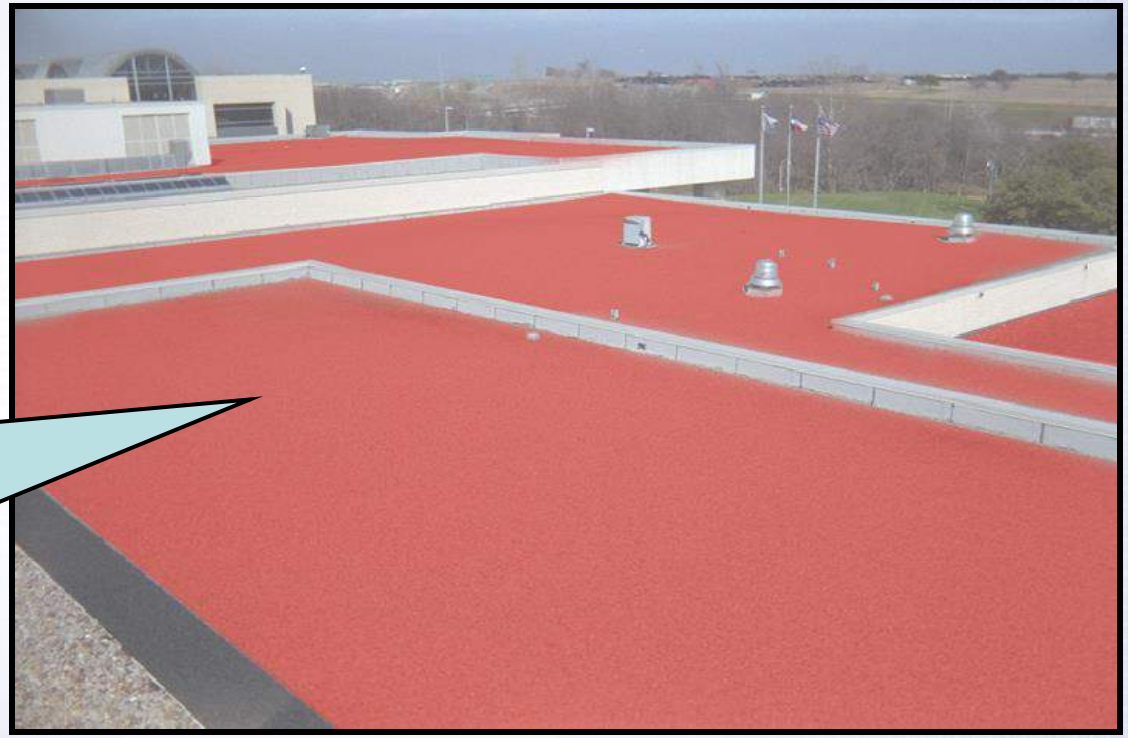
Cost of Neglect

Roof Replacement

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

Asset Management Program

Enhancing Performance

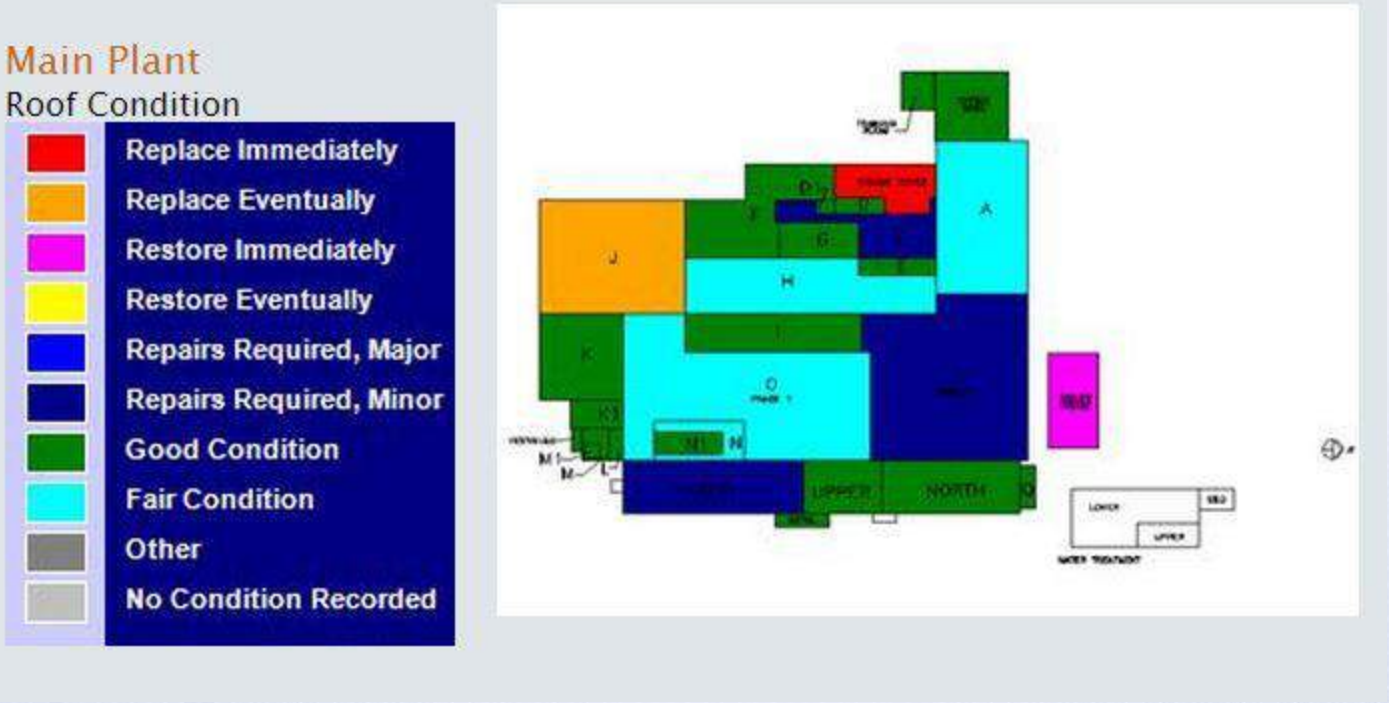
Achieve the result, a dry building and improved performance

- Assets exceed expected service life
- Dry, healthy environments
- Reduced dollars per sq. ft. per year
- Budget predictability
- Higher return on investment
- Save Money

The Asset Management Solution

Methodology to Extend Asset Life

- Know what you have



The Asset Management Solution

Methodology to Extend Asset Life

- Triage what you have
  - Maintain the "good"
  - Restore the "marginal"
  - Replace only the "failed"
- Use this data to protect what you have by planning maintenance, repairs, and/or restoration in time to avoid replacement of roofs that can still be saved

TREMCO
ROOFING & BUILDING MAINTENANCE

Roof Restoration

TREMCO
ROOFING & BUILDING MAINTENANCE

Part 1: Roof Diagnostics

LIFE EXPECTANCY

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

(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.

EFFECTS OF WET INSULATION

ROOF LEAKS lead to wet insulation, which can lead to:

- Energy loss
- Mold
- Structural Damage

ENERGY LOSS

A consequence of wet insulation is loss of thermal insulation value.

- Wet insulation is a conductor of energy rather than a resister
- Wet insulation will result in higher Heating and Cooling bills
- Vapor retarders do not perform properly

MOLD

Wet insulation can promote mold growth

There are 3-primary conditions needed for mold to spread

- Temperature Ranging from 47 – 120 degrees F
- Nutrients (organic matter, providing the food source)
- Moisture / Water

STRUCTURAL DAMAGE

Wet insulation can be a major factor leading to roof deck and wall deterioration

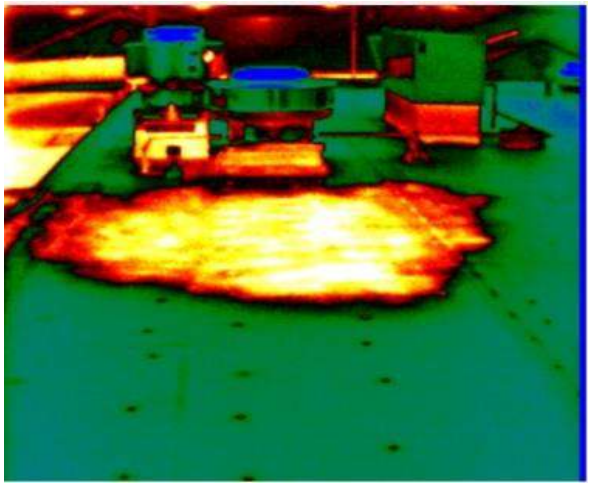
- Damaged/Deteriorated Roof Deck and components can become costly to repair and/or replace
- Steel/Concrete/Wood/Tectum/Gypsum/ Lightweight

THE SOLUTION

To effectively manage your roofing portfolio and extend the service life of your roofing assets, you need to start with a

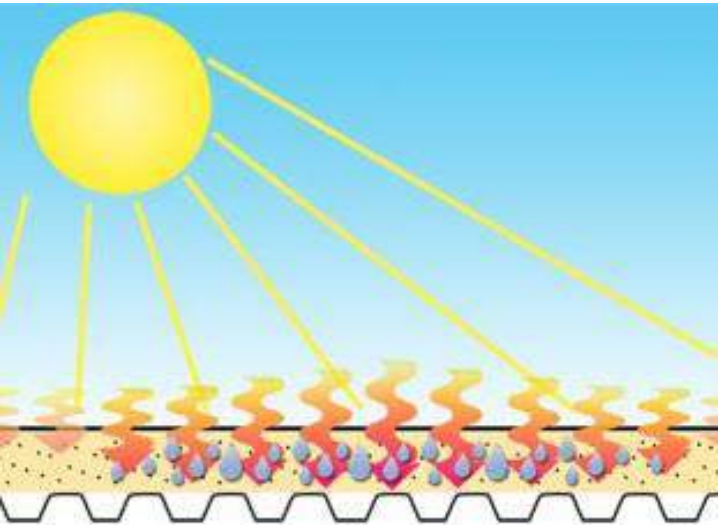
COMPREHENSIVE DIAGNOSTIC ROOF MOISTURE EVALUATION

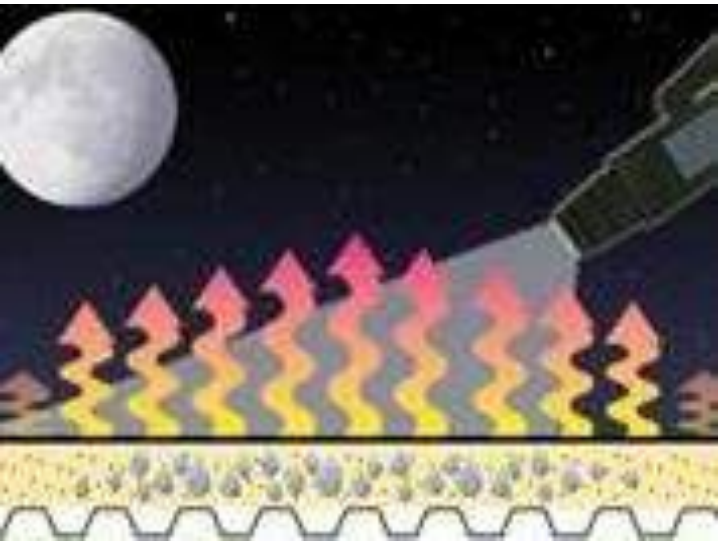
to determine the extent of wet roof insulation.



INFRARED ROOF MOISTURE SURVEYS

- Flat Roof leak detection for buildings
- Identify water damage portions for a roof quickly and accurately
- Eliminate unnecessary replacement of good roofing
- Plan accurate budgets based on facts
- Document problems before the warranty expires.





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.

Infrared Scan Results
West EPDM, Center, East EPDM
7/27/2017

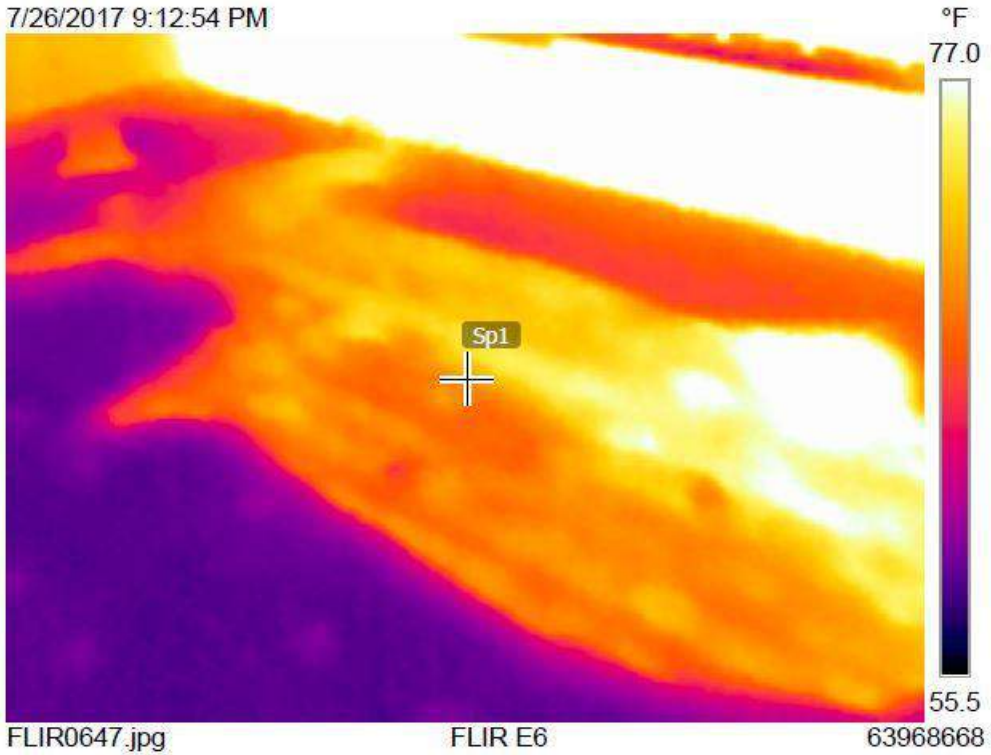
Measurements

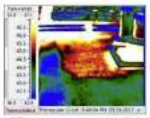
Sp1	70.4 °F

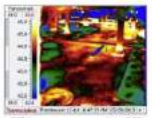
Parameters

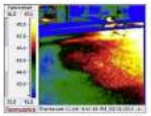
Emissivity	0.95
Refl. temp.	68 °F
Distance	6.6 ft
Atmospheric temp.	68 °F
Ext. optics temp.	68 °F
Ext. optics trans.	1
Relative humidity	77 %

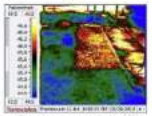
This image depicts wet insulation area 6, which is located near a drain. This area is ~50 sq. ft.

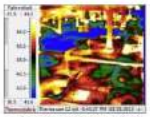


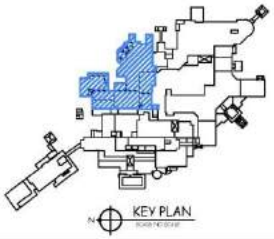

Thermogram A-04


Thermogram A-07


Thermogram A-05


Thermogram A-08


Thermogram A-06



STANDARD KEY OF SYMBOLS

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

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

SAMPLE DRAWING

Medical Institute

4/15/2013

G

NUCLEAR
ROOF MOISTURE SURVEYS

HOW IT WORKS

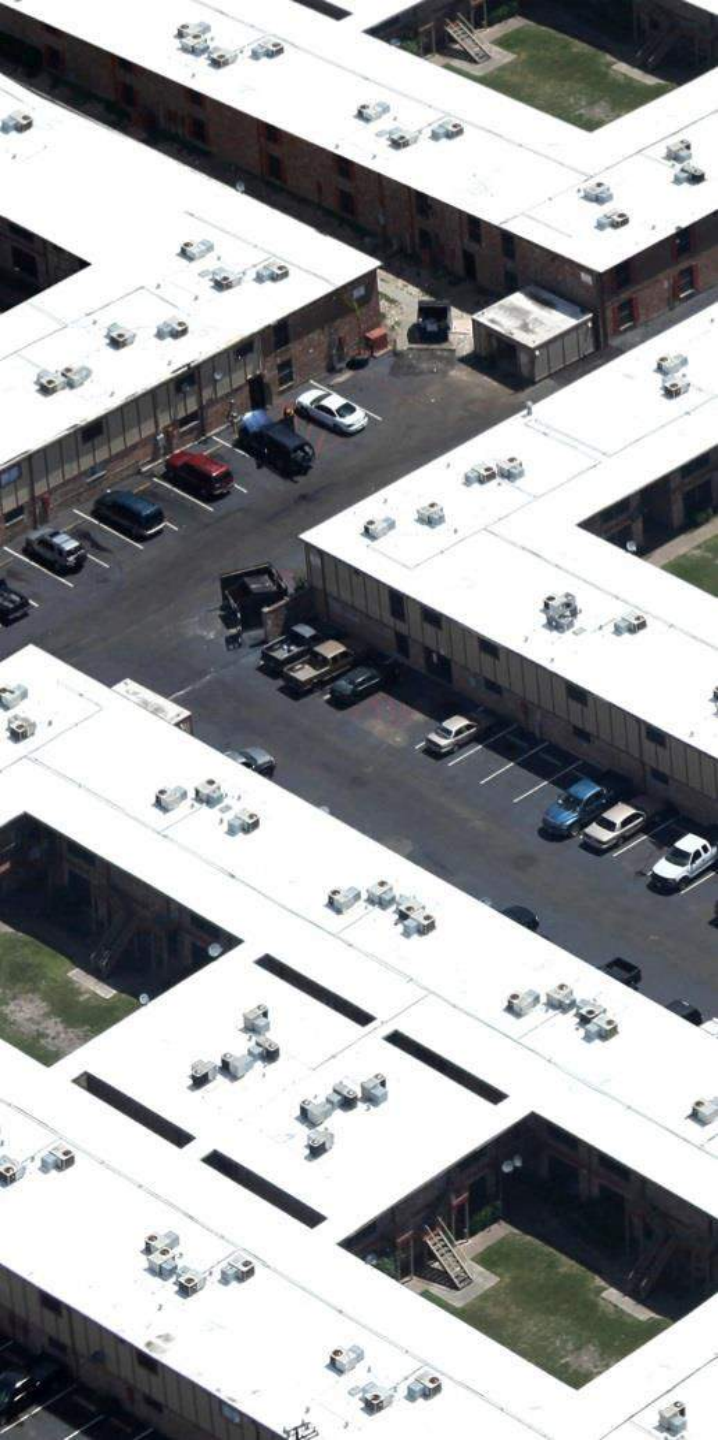
During the daytime, a grid pattern (5'x5' or 10'x10') is marked on the roof surface. Readings are taken and recorded at each grid intersection.

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.

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.



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.

TREMCO
ROOFING & BUILDING MAINTENANCE

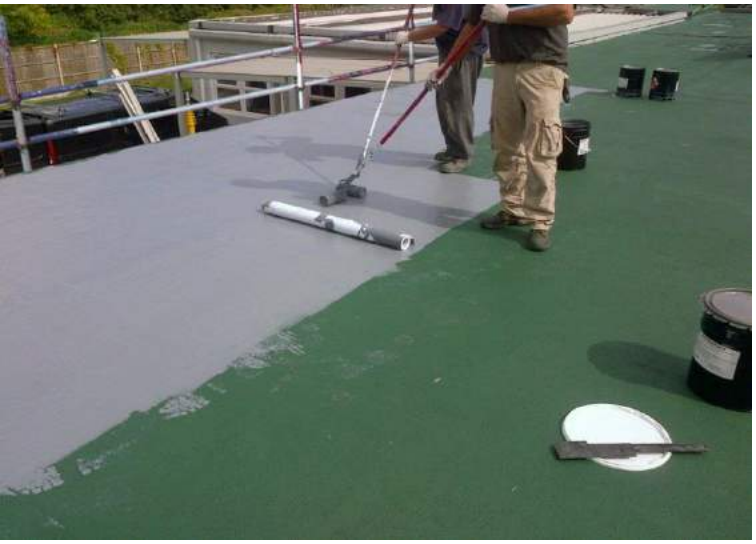
Part 2: Fluid Applied-Roofing Systems

What is Fluid-applied Roofing?

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?

Material is applied by:

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

Why Fluid Applied Roofing?

WHY FLUID APPLIED?

Traditional roofing systems are a combination of both membrane/ply sheets + cold/hot adhesives

In fluid applied roofing, the membrane is the waterproofing

Fluid applied systems derive most of their performance characteristics from the "fluid material" used, ie. acrylic, polyurethane, polymethylmethacrylate, etc.

Single ply, Modified and BUR systems derive their primary performance characteristics from their ply sheets and ply sheet structure.

WHY FLUID APPLIED?

In fluid-applied:

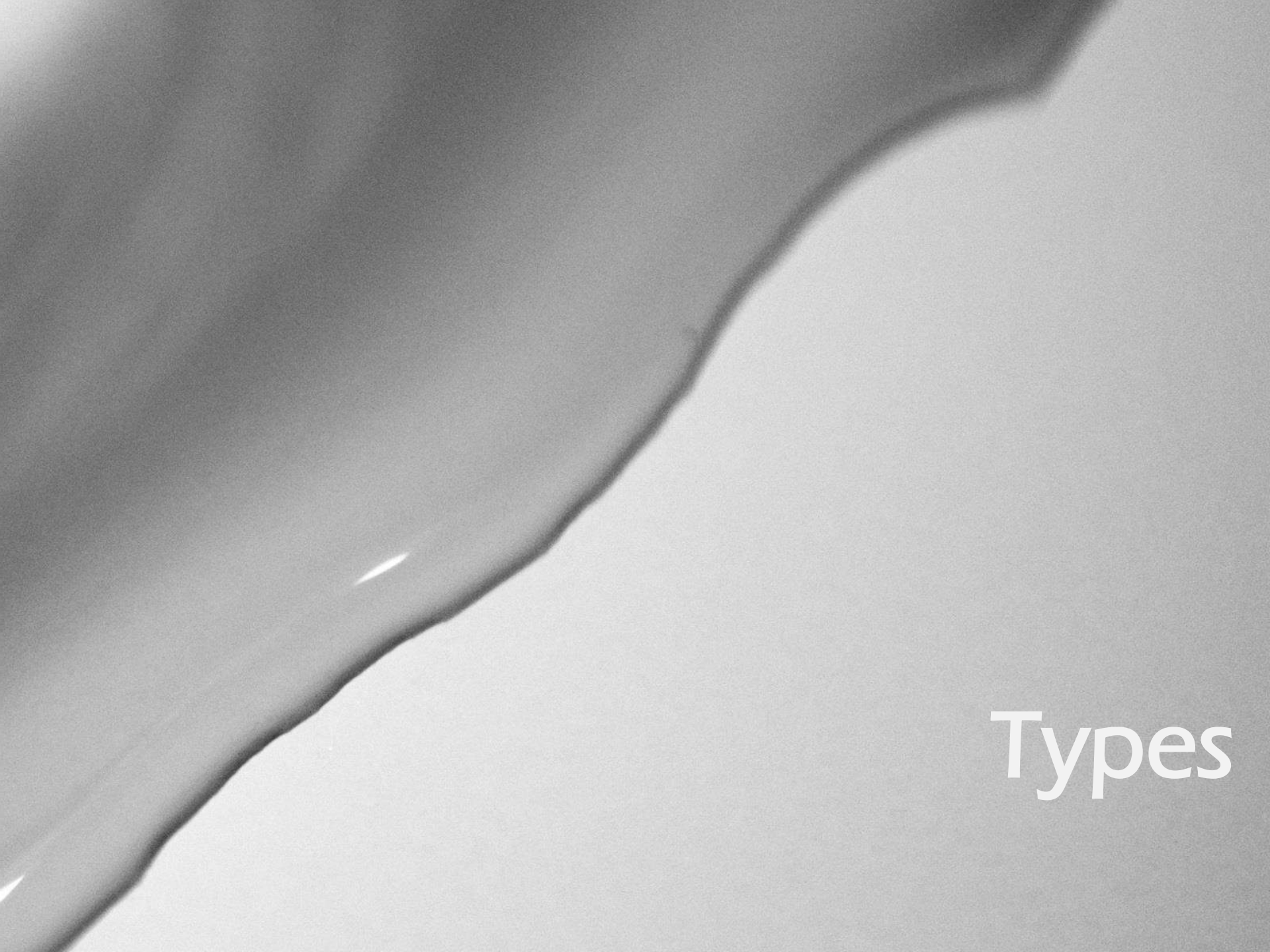
- The liquids are the waterproofing
- Coatings can be applied over most traditional roofing materials, including:

RESTORE

- SPUF
- Single Plies
- Bitumen
- Metal

New System

- Concrete
- Asphalt & Felt


Types

TYPES

Asphalt-based Aluminum

- Solvent and water-based
- Metallic content provides protection for asphaltic binder
- Applied as protective surfacing for new asphalt-based roll roofing or as restoration option on existing roofs.

SRI solution possible.

Asphalt-based Aluminum

Asphalt-based
Aluminum

Asphalt-based
Aluminum

Asphalt-based
Aluminum

TYPES

Silicone

- Solvent-based
- Single-component
- Moisture cured
- Applied to new SPUF roofs or as a restoration option for a variety of roof types
- Not Reinforced
- Exceptional weathering properties

TYPES

Methyl Methacrylate/ Poly Methyl Methacrylate

- Multi-component - Chemical Cure
- Full reinforcement
- Used in restoration and liquid applied flashing applications
- SRI solution possible

TYPES

Polyurethane methyl methacrylates

- Multi-component - Chemical Cure
- Full reinforcement
- Used in restoration and liquid applied flashing applications
- SRI solution possible
- Elongation can be superior in comparison to traditional MMA and PMMA

TYPES

Aromatic polyurethane

- Single component - Moisture Cure
- Multi-component - Chemical Cure
- Reinforcement - Full or partial
- Must be top coated for UV protection

TYPES

Aliphatic polyurethane

- Single component - Moisture Cure or Moisture Triggered Cure
- Multi-component - Chemical Cure
- Full reinforcement when used in waterproofing layer
- No reinforcement in top coat applications
- Excellent weathering performance

Polyurethane Curing Technologies

- Moisture-cured

Heavily influenced by relative humidity

Releases carbon dioxide

Typically applied in multiple thin layers.

Requires moisture for the entire curing process.

One component

- Moisture-triggered

Requires moisture only for the beginning of the curing process.

Uses atmospheric moisture to **trigger** the curing process.

Does not release carbon dioxide.

One component

- Catalyst-triggered

Requires a catalyst (such as a polyol) to initiate the curing process.

Short pot life.

Very low odor

Two component

Polyurethane Process

Polyurethane roofing is almost always a combination of:

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

Wet Mils x Solids Percentage = Dry Mils

Wet/Dry Mils

Physical Performance Characteristics

Property	Test Method	Typical Value
Tensile Strength[1]	ASTM D412	1,400 lb/in²
Water Vapor Transmission[1]	ASTM E96	0.19 perms
Low Temperature Flexibility	ASTM D522	Pass at -25°F (1/2" mandrel bend)
Tear Strength[1]	ASTM D5147	309 lbf
Water Absorption[1]	ASTM D471	0.008
Indentation Hardness	ASTM D2240	88 Shore A
Dimensional Stability[1]	ASTM D5147	< 0.1%
Volume Solids	ASTM D 2697	100%
Weight Solids	ASTM D 1644	100%
Volatile Organic Content	ASTM D3960	1 g/L (A+B mix)
Viscosity	ASTM D 2196	2,500 - 5,500 cp

Skin & Over-Coat Times
Skin Time at: 77 °F/ 50% RH 3-4 hours

Over-Coat Time at: 77 °F / 50% RH 6-7 hours

NOTE- Both skin & overcoat times are temperature-dependent. Higher temperatures will result in reduced skin/overcoat times, lower temperaturesmay result in extended skin/overcoat times

Technical Data	
Non-Volatile (ASTM D 75)	Typical 83%
Flash Point (ASTM D 93)	110°F min. (43.3°C)
Density @ 77°F (25°C) (ASTM D 2939)	10.4 lb./gal (1.2 g/m³)
Viscosity @ 77°F (25°C); 10 RPM, Brookfield RVT, #4 Spindle	9200 cP
Tear Resistance (ASTM D 624)	160 lbs./in
Elongation	320%
Tensile Strength (ASTM D 412)	2100 psi
Wet Film Thickness @ 2 gal./100 sq. ft. (0.82 l/m²)	32 mils (812.8 micros)
Color	Gray
Shelf Life	1 year, unopened
Coverage*	
Single-Ply	2 gal./100 sq. ft. (0.82 l/m²) seams
Modified/BUR	2 gal./100 sq. ft. (0.82 l/m²) entire roof
Metal	2 gal./100 sq. ft. (0.82 l/m²) seams
Packaging	5 gal. pail (18.9 l) 55 gal. drum (208.2 l)

Polyurethane v. Acrylic

- All acrylics and all polyurethanes are not created equal.
- Re: Data Sheet. Most manufacturers supply different numbers because they use different test methods.
- Polyurethanes Cure and Acrylics Dry.
- Acrylics have 20-30% of tensile strength that polyurethanes have.
- Acrylics typically cost less than polyurethanes and can require the same mil thicknesses.
- Acrylics are softer than polyurethanes.


Advantages

ADVANTAGES

- Seamless construction
- Ease of installation

ADVANTAGES

EASILY ADAPTABLE TO DIFFICULT APPLICATIONS:

- Ideal for confined areas
- Solves difficult details

ADVANTAGES

EASILY ADAPTABLE TO DIFFICULT APPLICATIONS:

- Accommodates odd roof shapes
- Great for roofs with a radius profile

ADVANTAGES

WATERPROOF

- Waterproofing redundancy can be built in

ADVANTAGES

- No flame/no torch
- The higher performing systems can provide excellent chemical resistance.

ADVANTAGES

- Ideal for high-rise construction

ADVANTAGES

SUSTAINABLE

- High SRI is possible – potential energy savings
- Many are inherently white
- Restorable
- Maintain the existing roof as a substrate

ADVANTAGES

MULTICOLORED

- Multiple colors available

ADVANTAGES

Health Safety and Welfare

- Encapsulation
- FM/UL approved systems
- Class A systems


Disadvantages

DISADVANTAGES

- Applications can be temperature sensitive
- Materials are temperature sensitive

DISADVANTAGES

- Thickness control
  - Blisters
  - Loss of adhesion
  - Pin-holing
  - Improper cure

DISADVANTAGES

- Certain types of membranes are soft
- Can be difficult to repair (IRMA / PRMA)


Cost

COST

Economical in terms of restoration:

- Between 33% to 50% of the cost of replacement.
- Less materials sent to landfills.
- Existing insulation is re-used.
- Minimum disturbance to ongoing activities.
- Contractor-friendly.
- Can be made highly reflective.
- Long term warranties available.
- A restoration project may be deductible.
- If existing insulation is not exposed, R-Value does not need to be increased to meet current IECC standard.

THIS CONCLUDES THE

FLUID-APPLIED ROOFING SYSTEM PRESENTATION

TREMCO®

Roofing Systems & Assemblies:

Know your options

J157

Learning Objectives:

At the end of the program, participants will be able to:

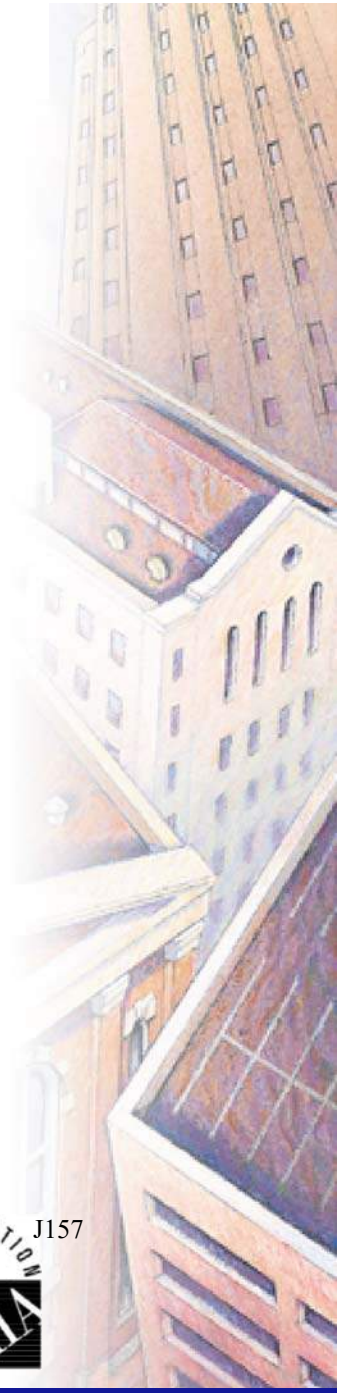
- **Identify different roof membranes**
- **Identify different roofing components**
- **Have an understanding of each systems' strengths and weaknesses**

Roof \'rüf\n: the cover of a building

- **Life Expectancy**
  - 20 years?
- **Deliver Extraordinary Performance**
  - Keep water out
- **Aesthetics**

Where do you begin?

- **Environmental Issues**
- **Building Codes**
- **Insurer Regulations**
- **Budget**



Options

- **Built-Up Roofs**
- **Single Ply Membranes**
- **Modified Membranes**
- **Fluid Applied Membranes**
- **Metal Roofing**
- **Sprayed Polyurethane Foam**

Option 1 - Built-Up Roofs

- **Traditional Layered Roofing**
- **Plies-Bitumen-Surfacing**
- **Hot or Cold Systems**

Hot Built-Up Roofs

- **History**
- **Hot asphalt**
  (375º - 450ºF)
- **Tar (Coal Tar Pitch) rarely used today**
  (355º- 375ºF)


JUL 15 2003


AUG 20 2003


AUG 22 2003

Pros & Cons of Hot BUR

Pros

- Ply Redundancy
- Abuse Tolerant
- Low life cycle cost
- Proven / Long history
- Maintainable

Cons

- Hot kettles
- Odor
- Adhesion
- Disruption
- Limited Cold Weather Flex.

Cold Built-Up Roofs

- **No hot kettles**
- **Spray applied or squeegee**
- **Low odor**

- **Excellent for sensitive environments**

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AUG 28 2003

Pros & Cons of Cold BUR

Pros

- No kettles
- Minimized Hazards
- Low odors
- Forgiving application
- Not temperature dependant
- Ideal for limited roof access

Cons

- Higher initial costs

Option 2 - Single Ply

- Rubber or Plastic
- One ply with seams
- Usually loose-laid, fastened or glued to insulation
- Black or White

Single Ply Roofs

Membrane Types

- EPDM - ethylene propylene diene monomer
- CPE - chlorinated polyethylene
- CSPE - chlorosulfonated polyethylene
- PVC - polyvinyl chloride
- PIB - polyisobutylene
- TPO - thermoplastic polyolefins
- TPA - tri-polymer alloy

Pros & Cons of Single Ply

Pros

- Low initial cost
- Quick installation
- Elastomeric

Cons

- No ply redundancy
- Thin Systems
- Shrinkage/Embrittlement
- Seam problems
- Abuse intolerant
- Pond intolerant

Option 3-Modified Bitumens

- U.S. Introduction - early 80's
- SBS/APP Modified Asphalt
- Reinforced – fiberglass/polyester/both
- Underlayment
  - 1 or 2 ply
- Hot or cold


CENTRAL GRAPHIC ARTS BUILDING
NEWARK PENN STATION

Pros & Cons of MBs

Pros

- Factory surfacing
- Factory controlled thickness
- High abuse tolerance
- Low temperature flex (SBS –30ºF)

Cons

- Higher initial costs
- Lap integrity
- Torches – APP
- Low temp. flex APP +8ºF to 32ºF

Option 4 - Fluid Applied

- PRMA/IRMA
- One or two-part Urethanes
- SBS/SEBS modified asphalt
- Acrylic systems

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CONTINUING EDUCATION AIA

Pros & Cons of Fluid Applied

Pros

- Seamless waterproofing
- Cost effective
- Elastomeric
- Excellent on high-rise construction

Cons

- Thickness control
- Difficult to repair (IRMA / PRMA)

Option 5 - Metal Roofing

- History
- Medieval - lead/copper
- Modern - steel and aluminum
- Life extending developments
  - Panel production
  - Corrosion protection
  - Sealant technology
  - The Floating Roof Concept


SPEED
LIMIT
15
M. P. H.

Pros & Cons of Metal

Pros

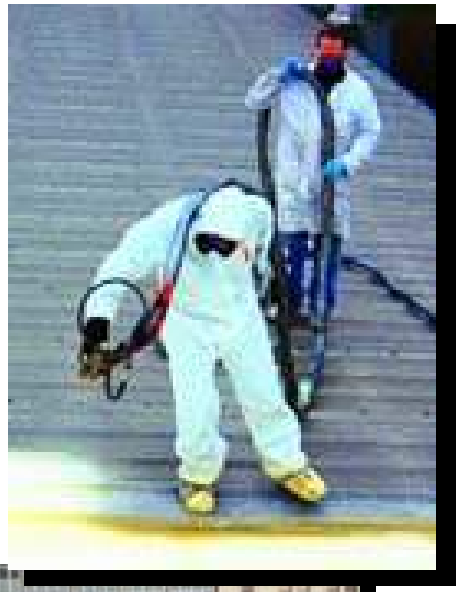
- Maintainable
- Attractive
- Low life-cycle costs

Cons

- Flashing difficulties
- High installed costs
- Span limitations

Option 6 – Spray Polyurethane Foam(SPF)

- **Introduced in 1960's**
- **Spray applied**
- **Coated**
- **Reroofing/New construction**



Pros & Cons of Spray Foam

Pros

- Low installed costs
- Inexpensive “R” increase
- Very conforming
- Lightweight

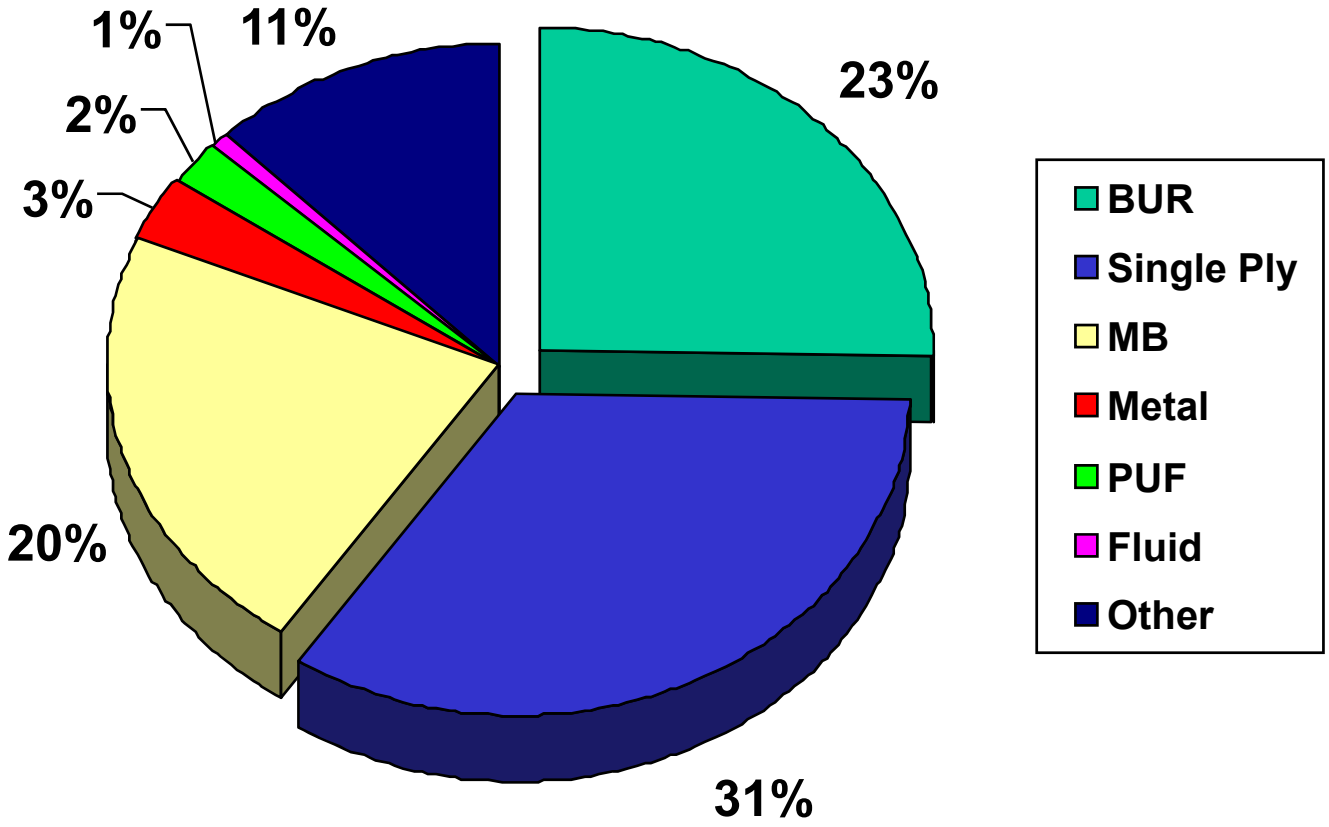
Cons

- Application sensitivity
- Puncture resistance
- Blister problems
- Poor track record
- High maintenance
- Not UV stable

The following slides depict surveys comparing some of the previously mentioned roofing systems and other important aspects of the commercial roofing industry

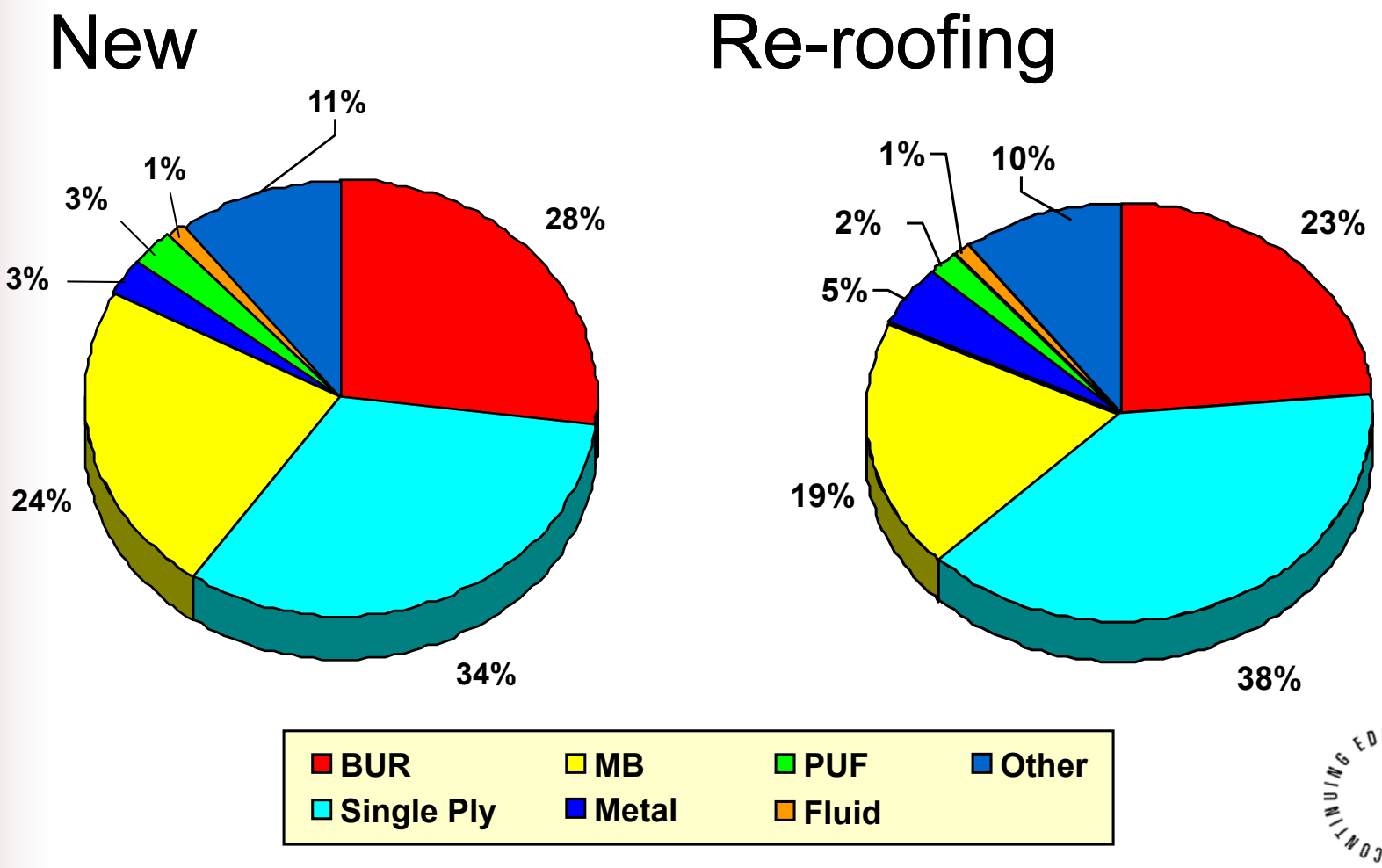
J157

Percentage of low-slope roofing systems



*2012 NRCA Market Survey

Products installed by average contractor, 2013



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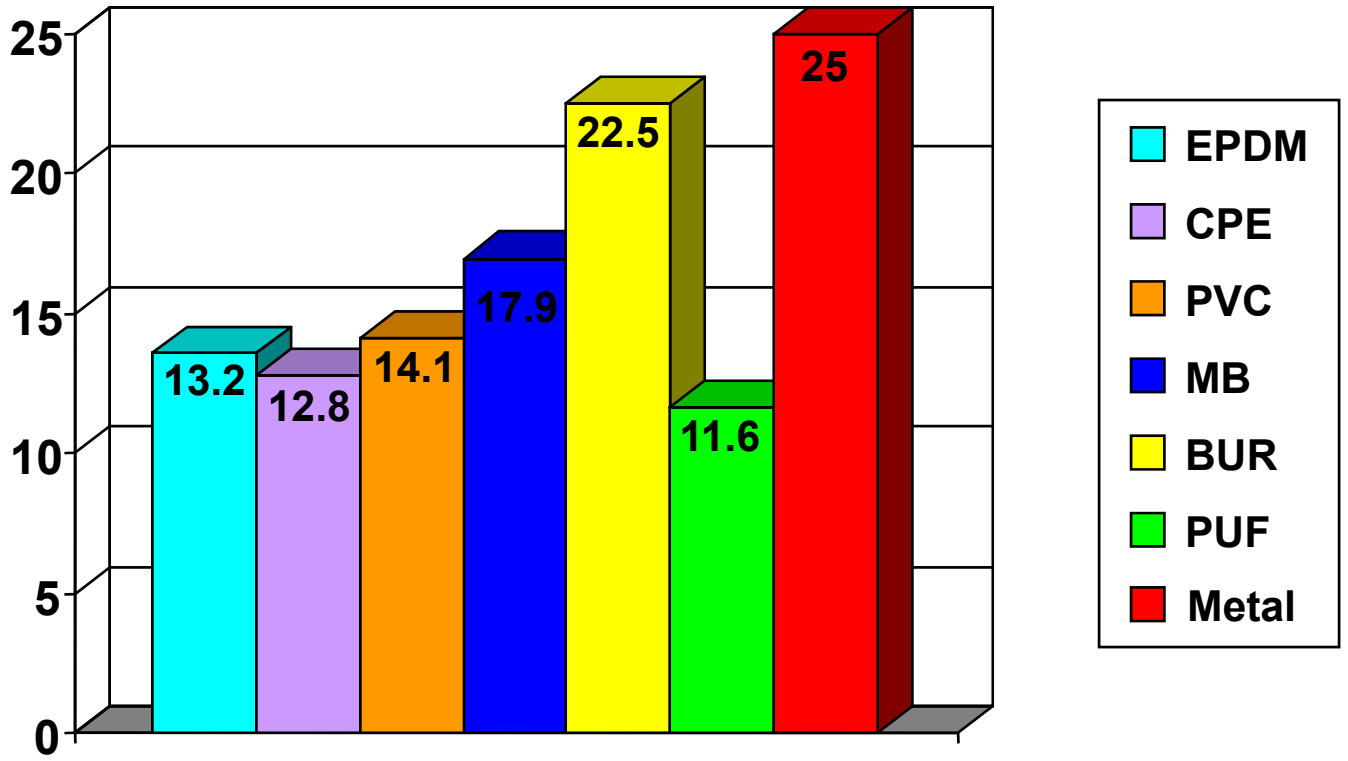
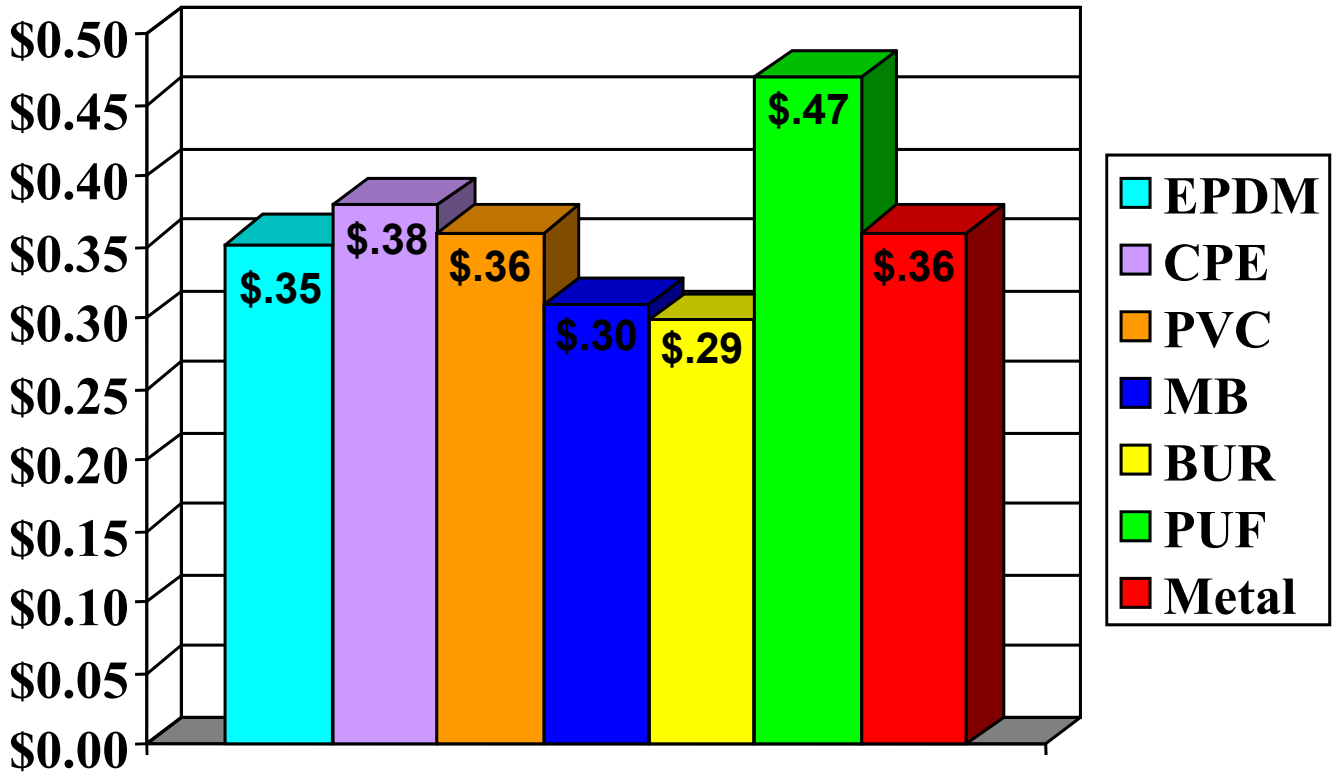
Average Life



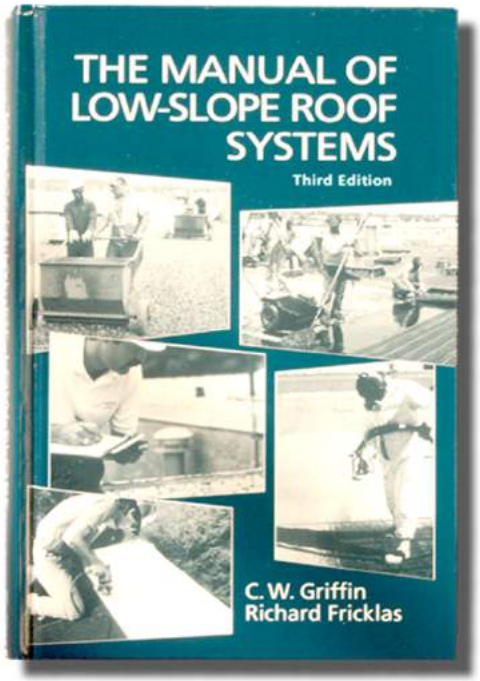
Life Cycle Cost: $/(ft² x year)



Most Common Problems Associated with All Roofing

Flashings

Flashings



"Flashings, the most common source of roof problems, are also the most often slighted aspect of roof design and normally the most difficult."

Source: The Manual of Low Slope Roof Systems, Third Edition, pg. 325

Some Questions to Ask

- **Environmental Conditions**
- **Wind, fire insurance, code requirements**
- **Cost / Budget**
- **Manufacturer history**

- **DO NOT BASE DECISION ON…..**

A WARRANTY!

The selection can be confusing

- **Over 130 manufacturers, according to NRCA**
- **Many choices**
- **Guarantees with coverages and exclusions**
- **All have success stories and failures**

Make an Educated Choice

- **Built-Up Roofs**
- **Single Ply Membranes**
- **Modified Membranes**
- **Fluid Applied Membranes**
- **Metal Roofing**
- **Sprayed Polyurethane Foam**

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Providing
roofing *and*
weatherproofing
peace *of*
mind

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