Tremco Roofing and Building Maintenance

HFMSNJ
Educational Presentation

Chuck Zagorskie
Mid-Atlantic Healthcare Manager
TREMCRO ROOFING AND BUILDING MAINTENANCE
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)

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
Roof Restoration
Part 1: Roof Diagnostics
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
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
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
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.
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

<table>
<thead>
<tr>
<th>Measurements</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sp1</td>
<td>70.4 °F</td>
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<table>
<thead>
<tr>
<th>Parameters</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissivity</td>
<td>0.95</td>
</tr>
<tr>
<td>Refl. temp.</td>
<td>68 °F</td>
</tr>
<tr>
<td>Distance</td>
<td>6.6 ft</td>
</tr>
<tr>
<td>Atmospheric temp.</td>
<td>68 °F</td>
</tr>
<tr>
<td>Ext. optics temp.</td>
<td>68 °F</td>
</tr>
<tr>
<td>Ext. optics trans.</td>
<td>1</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>77 %</td>
</tr>
</tbody>
</table>

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

- Multi-component - Chemical Cure
- Full reinforcement
- Used in restoration and liquid applied flashing applications
- SRI solution possible
Polymers of methyl methacrylate (MMA) and its derivatives are widely used in various applications due to their unique properties. One such polymer family is Polyurethane methyl methacrylates (PUMAs).

**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**
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

<table>
<thead>
<tr>
<th>Type</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture-cured</td>
<td>Heavily influenced by relative humidity, releases carbon dioxide, typically applied in multiple thin layers, requires moisture for the entire curing process.</td>
</tr>
<tr>
<td>Moisture-triggered</td>
<td>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.</td>
</tr>
<tr>
<td>Catalyst-triggered</td>
<td>Requires a catalyst (such as a polyol) to initiate the curing process, short pot life, very low odor, two component.</td>
</tr>
</tbody>
</table>

- Requires moisture for the entire curing process.
- Requires a catalyst (such as a polyol) to initiate the curing 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 × Solids Percentage = Dry Mils

### Physical Performance Characteristics

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>ASTM D412</td>
<td>1,400 lb/in²</td>
</tr>
<tr>
<td>Water Vapor Transmission</td>
<td>ASTM E96</td>
<td>0.19 perms</td>
</tr>
<tr>
<td>Low Temperature Flexibility</td>
<td>ASTM D522</td>
<td>Pass at -25°F (1/2&quot; mandrel bend)</td>
</tr>
<tr>
<td>Tear Strength</td>
<td>ASTM D5147</td>
<td>309 lbf</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>ASTM D471</td>
<td>0.008</td>
</tr>
<tr>
<td>Indentation Hardness</td>
<td>ASTM D2240</td>
<td>88 Shore A</td>
</tr>
<tr>
<td>Dimensional Stability</td>
<td>ASTM D5147</td>
<td>&lt; 0.1%</td>
</tr>
<tr>
<td><strong>Volume Solids</strong></td>
<td>ASTM D 2697</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Volume Solids**

| Non-Volatile                  | Typical 83%          |
| Flash Point                   | 110°F min. (43.3°C)   |
| Density                       | 10.4 lb./gal (1.2 g/m³) |
| Viscosity                     | 9200 cP               |
| Tear Resistance               | 160 lbs./in           |
| Elongation                    | 320%                  |
| Tensile Strength              | 2100 psi              |
| Wet Film Thickness            | 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)        |                       |

### 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 temperatures may result in extended skin/overcoat times.
• 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
EASILY ADAPTABLE TO DIFFICULT APPLICATIONS:

- Ideal for confined areas
- Solves difficult details
EASILY ADAPTABLE TO DIFFICULT APPLICATIONS:

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

• Waterproofing redundancy can be built in
• No flame/no torch
• The higher performing systems can provide excellent chemical resistance.
ADVANTAGES

- Ideal for high-rise construction
AD VANTAGES

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
Roofing Systems & Assemblies: Know your options
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 \(\text{ˈruːf}\): 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
  (375° - 450°F)
- Tar (Coal Tar Pitch)
  rarely used today
  (355° - 375°F)
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
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
Pros & Cons of MBs

**Pros**
- Factory surfacing
- Factory controlled thickness
- High abuse tolerance
- Low temperature flex (SBS –30°F)

**Cons**
- Higher initial costs
- Lap integrity
- Torches – APP
- Low temp. flex APP +8°F to 32°F
Option 4 - Fluid Applied

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

<table>
<thead>
<tr>
<th><strong>Pros</strong></th>
<th><strong>Cons</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low installed costs</td>
<td>Application sensitivity</td>
</tr>
<tr>
<td>Inexpensive “R” increase</td>
<td>Puncture resistance</td>
</tr>
<tr>
<td>Very conforming</td>
<td>Blister problems</td>
</tr>
<tr>
<td>Lightweight</td>
<td>Poor track record</td>
</tr>
<tr>
<td></td>
<td>High maintenance</td>
</tr>
<tr>
<td></td>
<td>Not UV stable</td>
</tr>
</tbody>
</table>
The following slides depict surveys comparing some of the previously mentioned roofing systems and other important aspects of the commercial roofing industry.
Percentage of low-slope roofing systems

- BUR: 23%
- Single Ply: 31%
- Metal: 11%
- MB: 2%
- PUF: 3%
- Fluid: 1%
- Other: 20%

*2012 NRCA Market Survey
Products installed by average contractor, 2013

New

- BUR: 28%
- Metal: 34%
- Single Ply: 3%
- PUF: 3%
- Fluid: 1%
- Other: 1%

Re-roofing

- BUR: 38%
- Metal: 23%
- Single Ply: 2%
- PUF: 19%
- Fluid: 10%
- Other: 1%
Average Life

Fourth International Symposium on Roof Technology - Carl Cash Study
Life Cycle Cost: $/(ft^2 \times \text{year})

- EPDM: $0.35
- CPE: $0.38
- PVC: $0.36
- MB: $0.30
- BUR: $0.29
- PUF: $0.36
- Metal: $0.47

Fourth International Symposium on Roof Technology - Carl Cash Study
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.”

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
Providing roofing and weatherproofing peace of mind