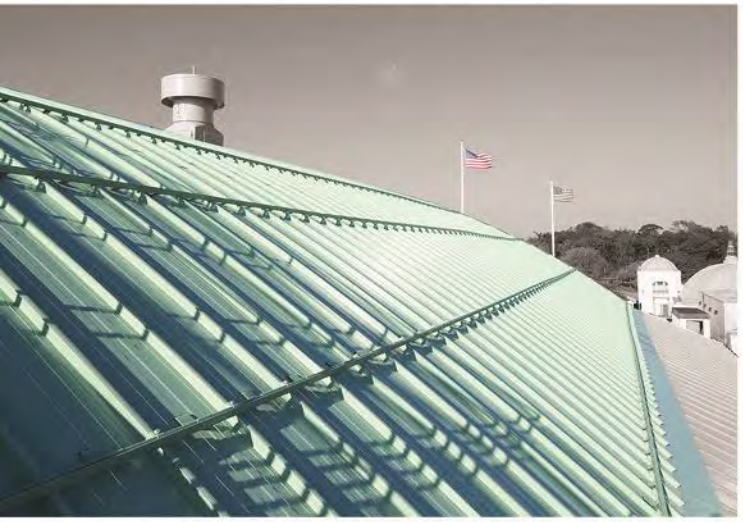






GARLAND INDUSTRIES, INC.

AIA PRESENTATION

CONTINUING EDUCATION AIA

GARLAND®

since 1895

FLUID-APPLIED ROOF SYSTEMS

Program #0520 FRS

LEARNING OBJECTIVES

- Define Fluid-Applied Roofing Systems and the Differences Compared to Maintenance/Surface Coatings
- Advantages of Fluid-Applied Roofing Compared to Conventional Roofing
- Qualification and Installation of Fluid-Applied Roofing/Waterproofing Systems
- Other Applications for Fluid-Applied Systems

EVOLUTION OF LOW-SLOPE ROOF SYSTEMS

HISTORY OF ROOFING

- **Built-Up Roofing**
  - Hot Coal Tar Pitch BUR 1850-1950+)
  - Hot Asphalt BUR (1950-1970+)

MODERN ROOFING TRENDS

- Single-Ply Roofing (1970)
- Hot-Applied Modified Bitumen (1980)
- Modern Metal Roof Systems (1990)
- Cold-Applied Modified Bitumen/BUR (1990)

MODERN ROOFING TRENDS

- Fluid-Applied Restoration Systems (2000)
- Hybrid Roofing Systems (2010)

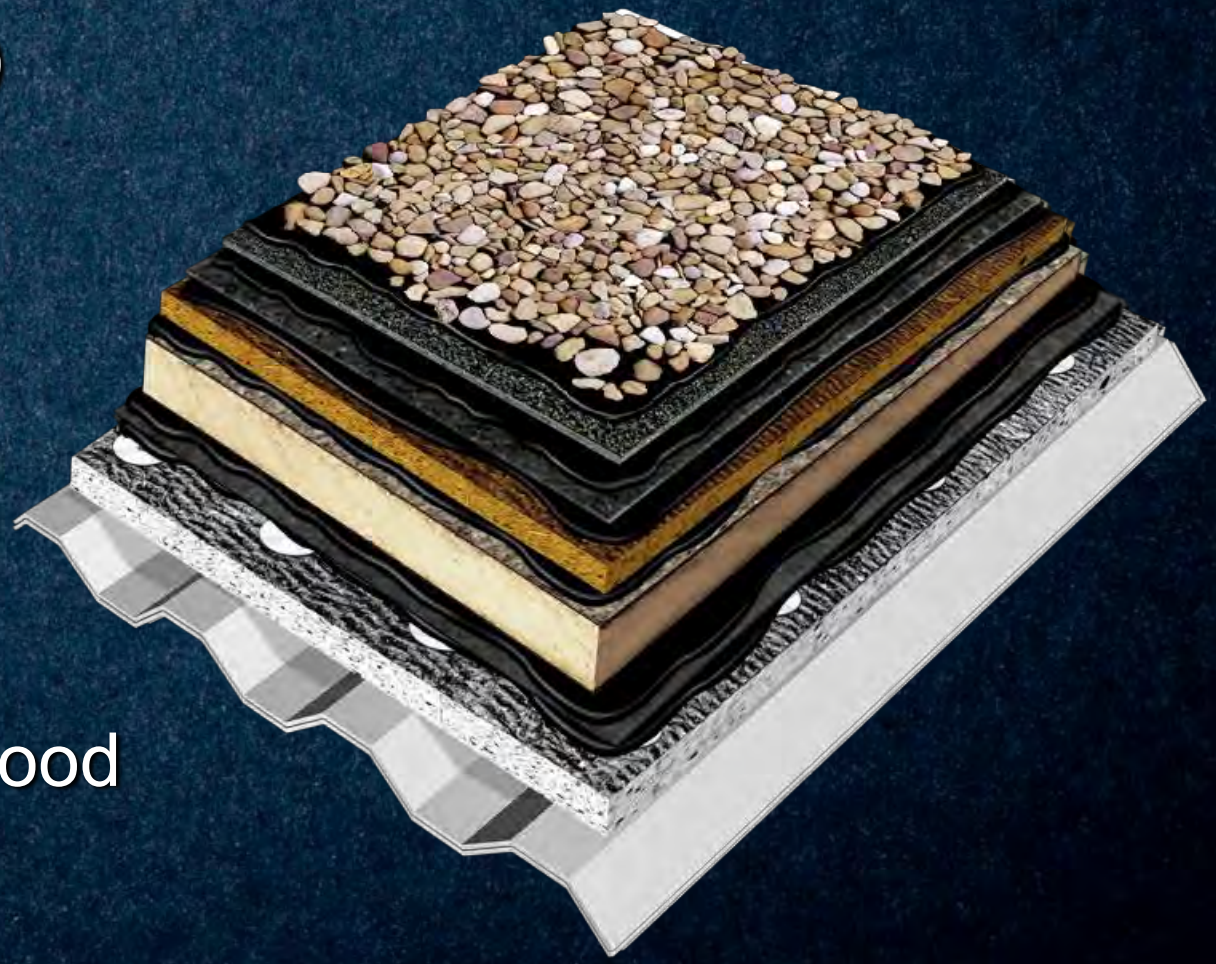
CONVENTIONAL ROOF SYSTEMS AND MAINTENANCE COATINGS

CONVENTIONAL ROOF SYSTEMS

- Combination of Factory Produced Rolled Goods Adhered With Hot or Cold Adhesives
- Rolled Good Membrane Typically Provides the Waterproofing

CONVENTIONAL ROOF SYSTEM - MODBIT

- Deck
- Vapor Barrier (When Applicable)
- Insulation
- Recovery Board
- Asphalt/Coal Tar/Adhesive
- Felts/Base Sheet(s)
- Asphalt/Coal Tar/Adhesive
- Cap Sheet
- Surfacing (Mineral, Coated or Flood Coat with Gravel)



MAINTENANCE ROOF COATING

- A Coating Applied to a Roof Surface to Provide Weather Protection
- 22-40 Mil Dry Film Thickness
- Not a Waterproof Coating
- Recoating is Necessary to Retain the Desired Properties
- System Components:
  - Primer (if required)
  - Coating

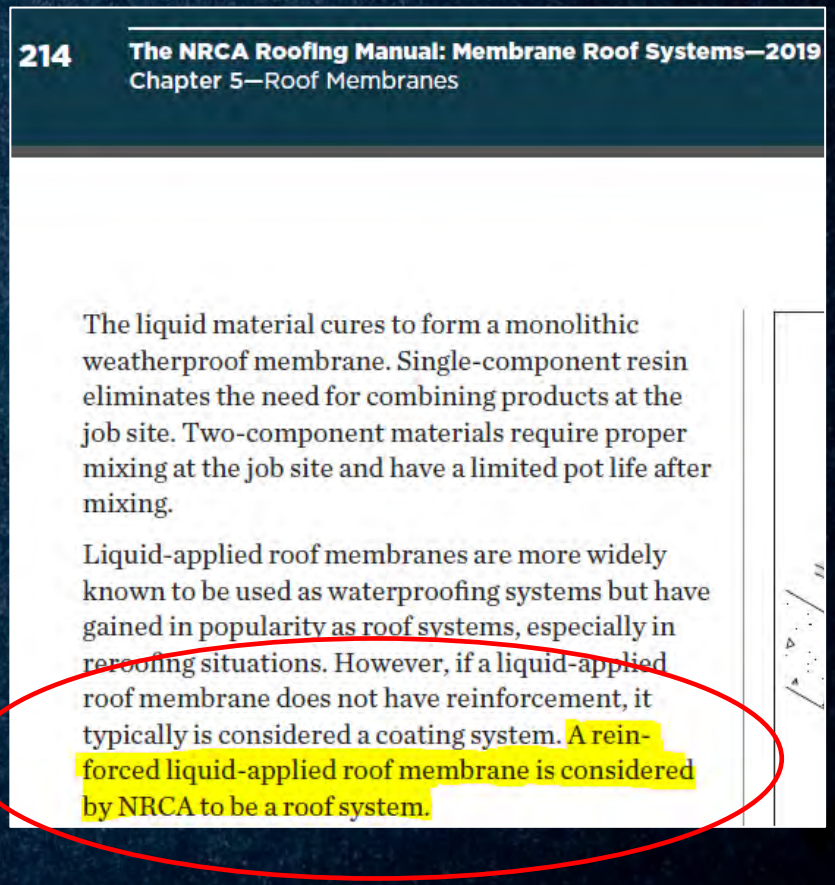
FLUID-APPLIED ROOF SYSTEMS

FLUID-APPLIED ROOF SYSTEMS

- Combination of High-Performance Fluid Materials and Fabric Reinforcement Seamlessly Constructed on the Project
- Fluid Product Provides the Waterproofing and Most of the Performance Attributes of the Roof System

FLUID-APPLIED **ROOF SYSTEM**

- Not Just a Coating – A Waterproofing System!
- 80-100 Mil Dry Film Thickness (All Waterproofing!)
- Passes ASTM D7281 – Water Leakage Resistance Testing
- 2nd Fastest Growing Roof System Type
  - >$1B Market
- System Components:
  - Liquid Resin
  - Reinforcement
  - Accessories



214 The NRCA Roofing Manual: Membrane Roof Systems—2019
Chapter 5—Roof Membranes

The liquid material cures to form a monolithic weatherproof membrane. Single-component resin eliminates the need for combining products at the job site. Two-component materials require proper mixing at the job site and have a limited pot life after mixing.

Liquid-applied roof membranes are more widely known to be used as waterproofing systems but have gained in popularity as roof systems, especially in reroofing situations. However, if a liquid-applied roof membrane does not have reinforcement, it typically is considered a coating system. A reinforced liquid-applied roof membrane is considered by NRCA to be a roof system.

FLUID-APPLIED VS. MAINTENANCE COATING

Fluid-Applied Roof System	Maintenance Coating
80-100 mils Cured Film	20-40 mils cured film
Fabric Reinforced	Not reinforced
Waterproofing	Water Resistant
Long life cycle (10-20 plus years)	5-10 Years (Avg.) Life Cycle
Roof System per NRCA	Protective Coating
Restoration Waterproofing Warranty	Material Only Warranty
E.G. Polyurethane, Polyurea, PMMA	E.G. Acrylic, Aluminum, Silicone

FLUID-APPLIED ROOF SYSTEM

Benefits:

- Seamless and Monolithic
- UV Resistant & Reflective Energy Saving Surfacing Options
- Excellent Strength Properties
- Chemical Resistant Formulas
- Durable
- High Impact Resistant Formulas
- Identical Field and Flashing Membrane
- Long-Term Warranties Available
- Superior Waterproofing
- Sustainable & Maintainable

FLUID-APPLIED PHYSICAL PROPERTIES

- Fluid-Applied Roof Systems vs. Single-Ply Systems

	High-Performance Fluid-Applied System	EPDM Single-Ply	TPO Single-Ply
Mil Thickness	80-100	60	60
Load Strain (toughness)	35,000	14,400	5,625
Tensile Strength	2,300 psi	1,200 psi	225 psi
Reinforcement	Polyester	Polyester	Polyester
Elongation	350%	200%	25%
Reflectivity (white)	85%	12%	80%
Chemical Resistance	Excellent	Poor	Poor
Puncture Resistance	34.8 Joules	32.5 Joules	25 Joules
Low Temperature Flexibility	-60°F (-51.5°C)	Not Published	Not Published
Water Leakage Resistance	Pass	Not Published	Not Published

FLUID-APPLIED ROOF SYSTEM APPLICATIONS

- Restoration of Functional Aged Roofs
- New/Reroof Insulated Hybrid Roof Systems
- Concrete Waterproofing/Surface Protection

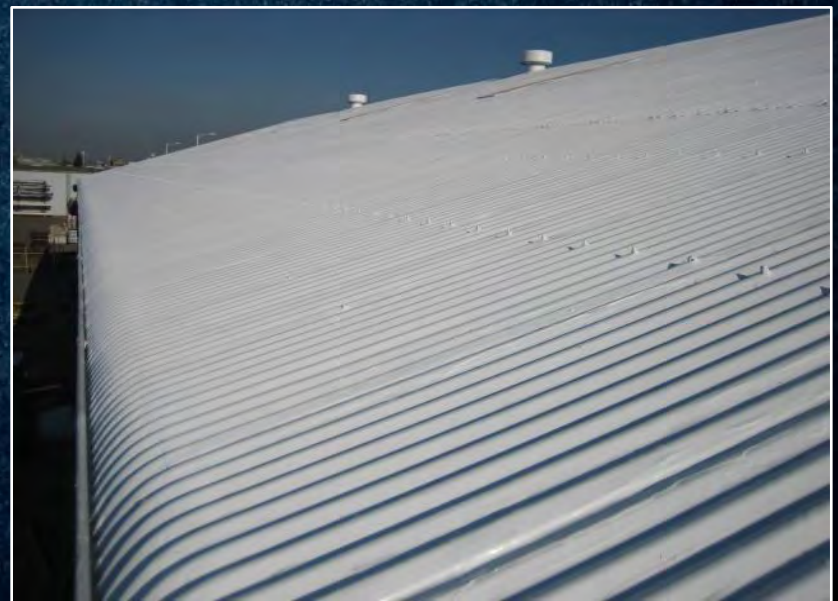
FLUID-APPLIED ROOF *RESTORATION* SYSTEMS

FLUID-APPLIED ROOF *RESTORATION* SYSTEMS

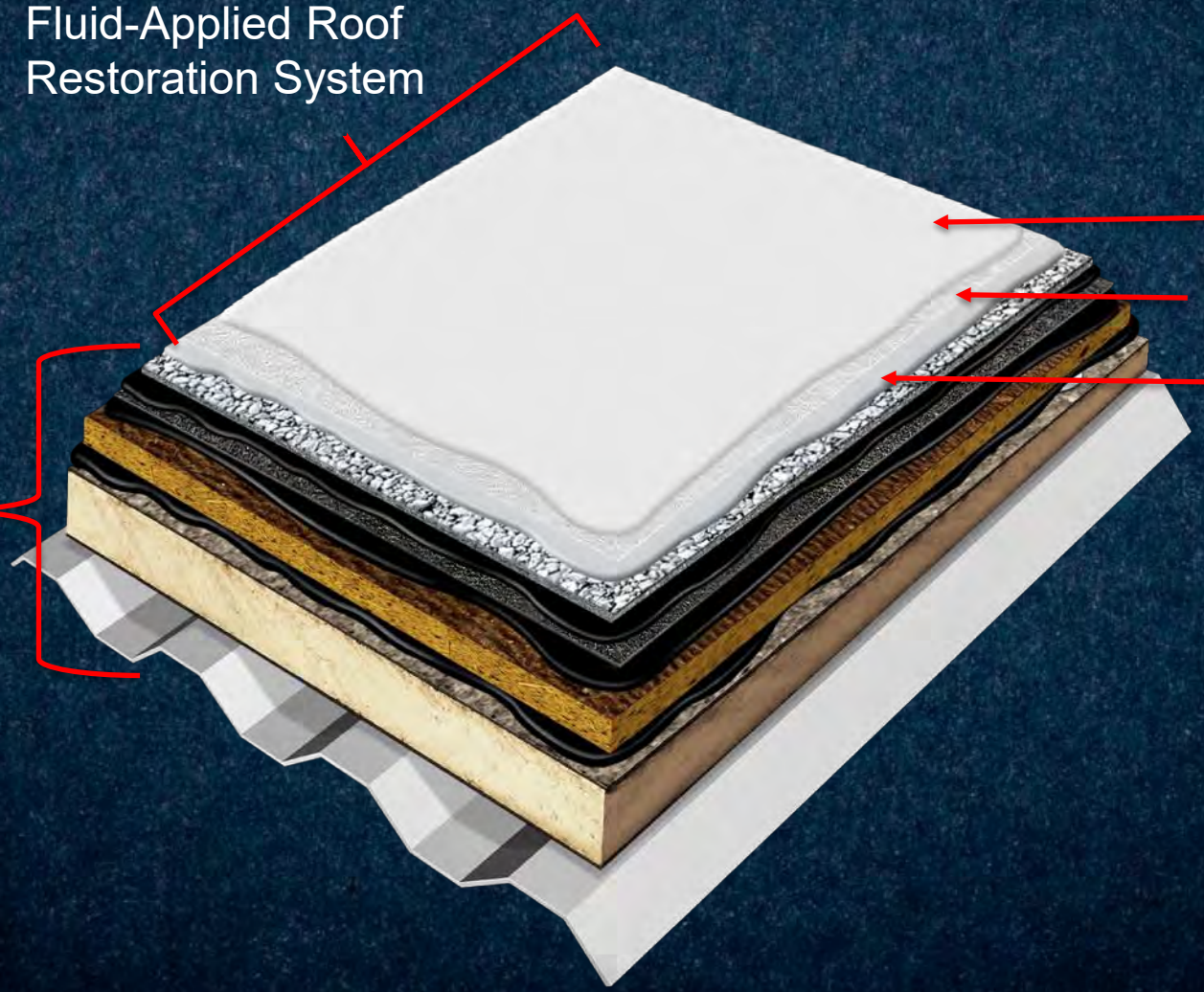
- Restoration of Aged Modified Bitumen, Smooth BUR, Single-Ply and Metal Roofs
  - Roof Field & Flashing System

Modified Bitumen Roof Restoration

Metal Roof Restoration



FLUID-APPLIED *MODIFIED BITUMEN* RESTORATION SYSTEM



FLUID-APPLIED *RESTORATION* SYSTEM

- Extending the Roof System Life Without a Full Roof Replacement
- Making a *Good* Roof Better

RESTORATION COST SAVINGS

- Lower Installed Cost vs. Conventional Roofing
  - 1/3-1/2 Cost of New Roof System
- Faster, Less Labor
- Reutilize Existing System Components That Are in Good Condition; i.e. Insulation, Vapor Barrier, etc.

RESTORATION ENVIRONMENTAL IMPACT

- Environmentally Responsible
  - Significantly Reduces Landfill Waste
  - Easy to Repair/Maintain
  - Lowers Carbon Footprint
  - Energy Savings/Cool Roof
  - Low VOC/Low Odor Options

RESTORATION FACILITY OPS IMPACT

- Minimal Disruption to Building Occupants vs. Tear-Off & Roof Replacement
  - Less Noise, Mess, Odor
  - Roof Deck Not Exposed to Weather
  - Asbestos Remediation Not Required

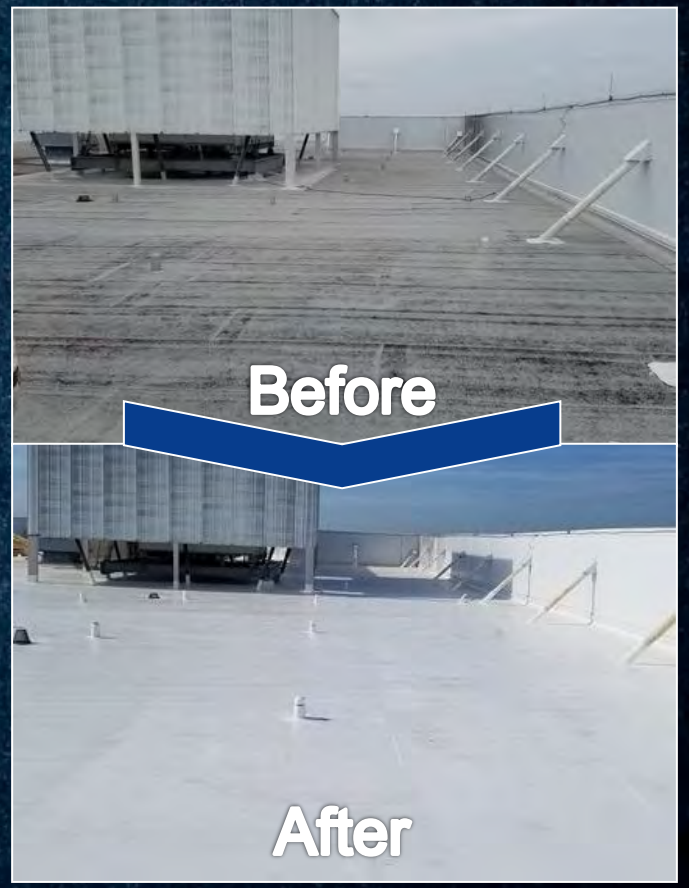
FLUID-APPLIED ROOF RESTORATION QUALIFICATION & INSTALLATION

MAKE THE OLD LIKE NEW

- Restoring a Roof to a Watertight and Energy Efficient Condition

ROOF RESTORATION PROCESS OVERVIEW

1. Qualify the Existing Roof as a Candidate for Restoration
2. Ensure Wet Roofing / Insulation is Removed
3. Make Appropriate Repairs
   - Existing Roofs Must be in a Sound Waterproof State Prior to Restoring
4. Select the Appropriate Fluid-Applied Restoration Solution Option
   - **Factors:** Budget, Compatibility, Adhesion, Roof Conditions, Warranty Length, Geography, Etc…



QUALIFYING AN AGED ROOF FOR RESTORATION

- Gather Intel
- Visual Observation
- Moisture Survey
- Adhesion Test
- Core Testing

EXISTING ROOF EVALUATION

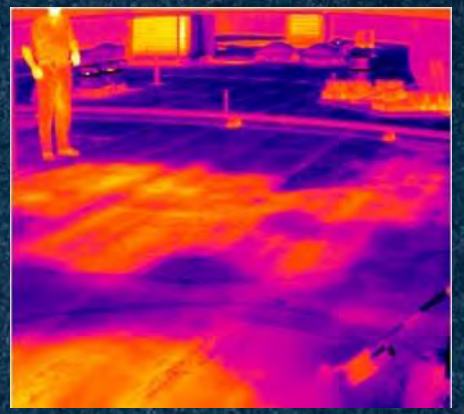
Step 1: Gather Intel on Existing Roof

Step 2: Visual Inspection

- Evaluate Roof / Deck Conditions
- Roof Surface Condition
- Determine Why the Roof Leaks to Avoid Future Issues

EXISTING ROOF EVALUATION

- **Step 3: Moisture Survey**
  - Required on Insulated Roof Systems
  - Infrared Thermography, Nuclear Scan, EFVM
  - Generally, if >25% is Wet and Needs Replacement, the Roof Is Not a Candidate
  - If <25% is Wet, then Damaged Roof Section(s) Can Be Removed and Replaced with Like Materials

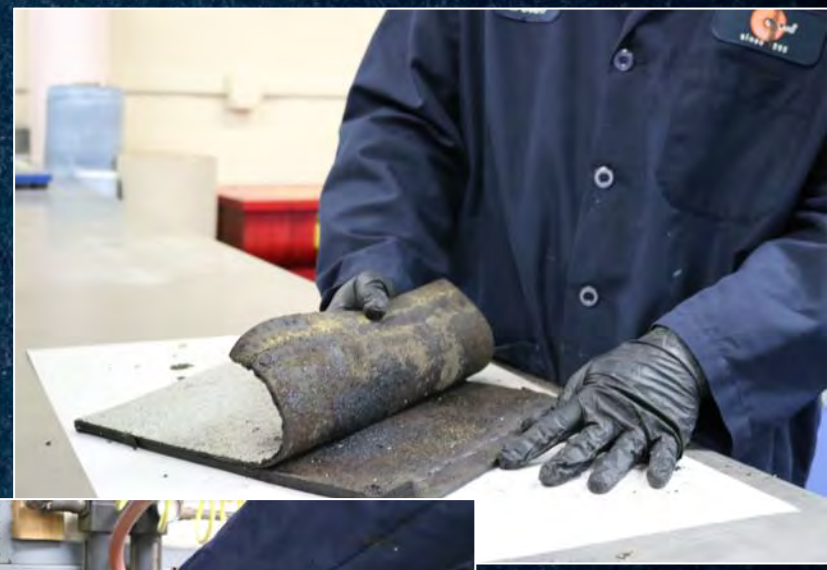


EXISTING ROOF EVALUATION

- **Step 4: Adhesion Testing**
  - Ensures Adequate Adhesion of Elastomeric Coating Candidate(s) to Substrate Under Consideration to Restore
  - Greater Than 4 Pounds per Linear Inch (pli) is Good Adhesion Strength

EXISTING ROOF EVALUATION

- **Step 5: (Optional) Existing Roof Core Analysis**
  - Aged Roof System Evaluation in Accordance With ASTM D2829
    - Strength Properties
    - Type of Roof
    - # of Plies/Type of Plies
    - Bitumen Weight/Application Rate
    - Condition of Core
    - Surface Evaluation
    - Bitumen Softening Point



ROOF RESTORATION APPLICATION PROCEDURE

- Clean
- Existing Roof Preparation
- Flashing & Field Fluid-Applied Installation

CLEAN

- Roofs Must be Clean, Dry and Free of Any Contaminants

Oscillating Pressure Washer

Pressure Wash/ Remove Loose Coating

Wet Vacuum Gravel Removal

PREPARATION

- Remove Wet Insulation/Roofing and Replace With Like Materials
- Make all Required Field and Flashing Repairs to Return to Watertight Condition
- Reinforce Existing Roof Seams Where Required





FLUID-APPLIED SYSTEM APPLICATION - FLASHINGS

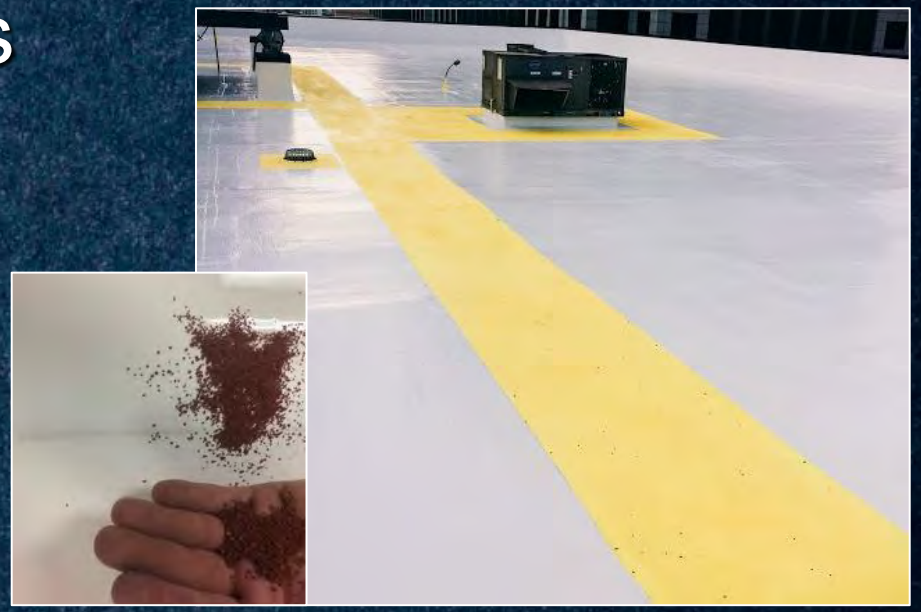
- Prime Where Required
- Self-Terminated, Seamless Flashings
  - Curbs, Walls, Penetrations, Drains, etc… are Constructed in the Same Manner as the Field Application
- Difficult Details
  - Conforms and Seals Where Roll Membrane Struggles

FLUID-APPLIED SYSTEM APPLICATION – FIELD

- Prime Where Required
- Apply Fluid Product by Spray, Squeegee or Roller and Embed Fabric Reinforcement

SURFACING OPTIONS

- Fluid-Applied Non-Skid Walkways
  - Traffic Areas
  - Equipment Work Areas
- Safety Areas
  - Roof Edge
  - Around Skylights

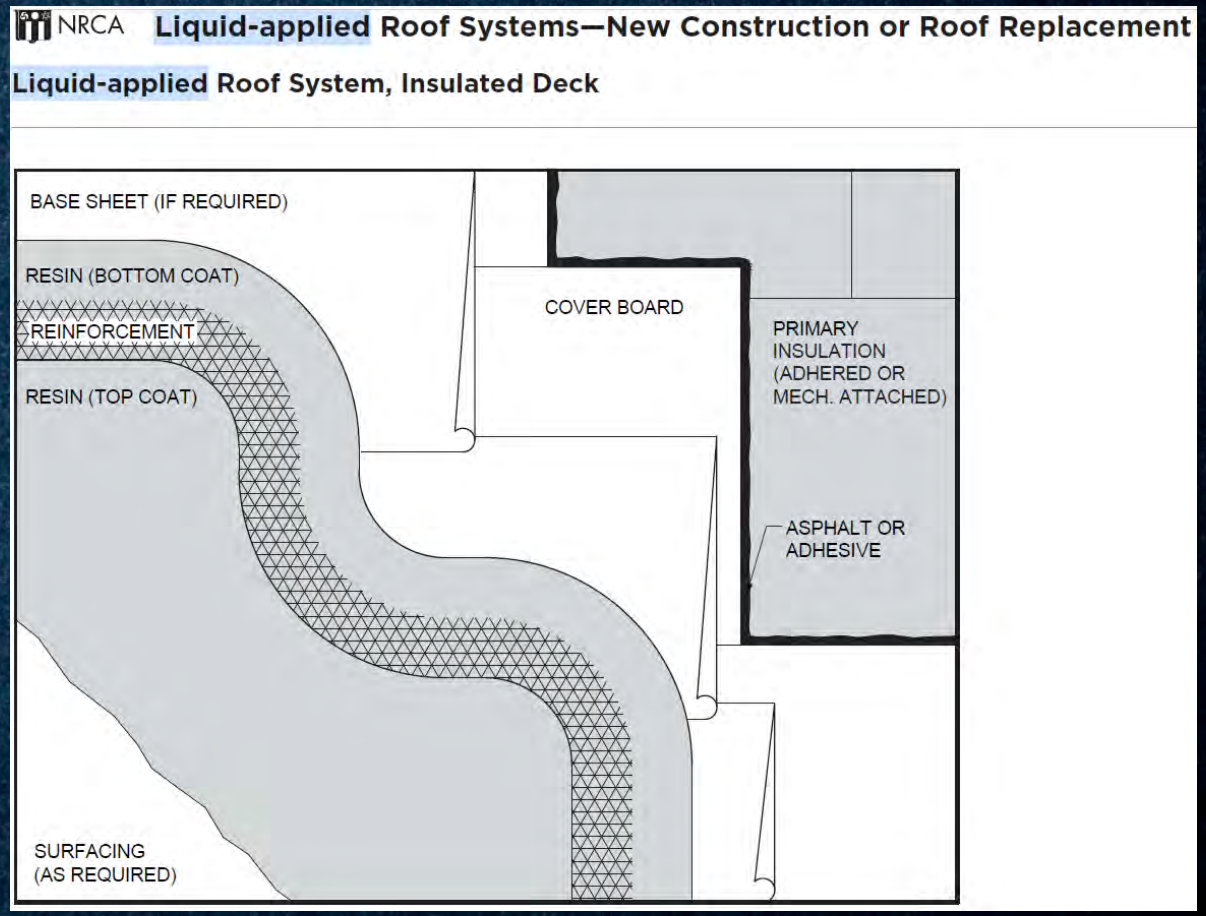


Not recommended

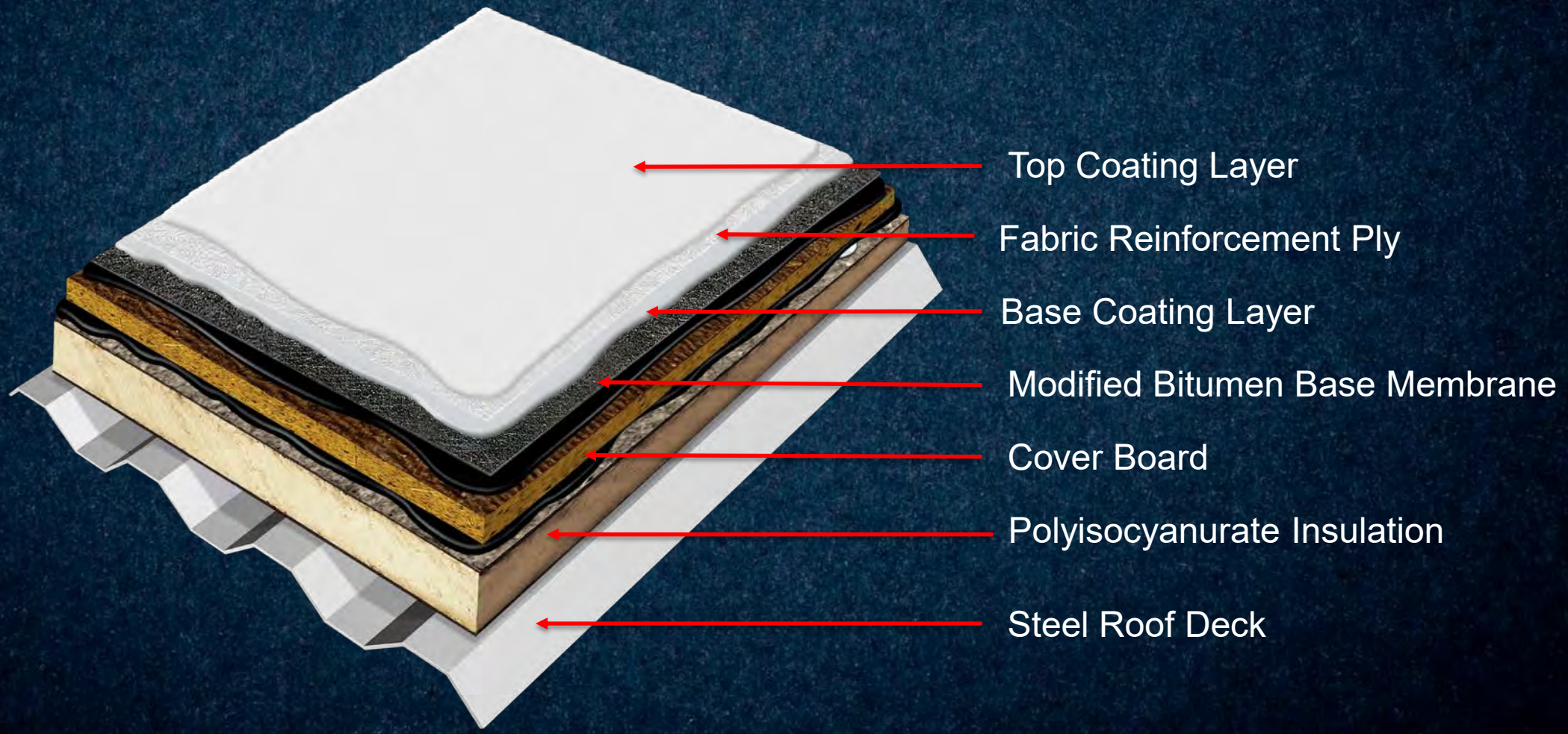
FLUID-APPLIED *HYBRID* ROOF SYSTEMS

FLUID-APPLIED *HYBRID* SYSTEM

- New, Re-Roof or Recover Fluid-Applied Hybrid Roof Assembly
  - Roof Deck
  - Insulation & Cover Board
  - Modified Bitumen Base Sheet
  - Reinforced Fluid-Applied System



FLUID-APPLIED *HYBRID* SYSTEM



FLUID-APPLIED HYBRID ROOF SYSTEMS

- Ideal Locations
  - Hospitals/Schools
  - Urban Locations
  - Difficult Access
  - Severe Hail Zone Regions
  - Roofs Housing Large Equipment/Multiple Penetrations

FLUID-APPLIED HYBRID ROOF SYSTEM

Best of Both Worlds

- Factory Manufactured Modified Bitumen Base Membrane With Field-Applied, Fluid-Applied Waterproofing System
- Sustainable/Maintainable
- UV Stable Throughout Majority of System
- Chemical, Fats and Oil Resistant
- Naturally Root Resistant and no Exposed Seams
- No Plasticizers to Migrate Out and Weaken Waterproofing Membrane
- High Hail/Impact Protection
- Increased Waterproofing Content Compared to Conventional Roofing Assemblies

HAIL/IMPACT RESISTANCE

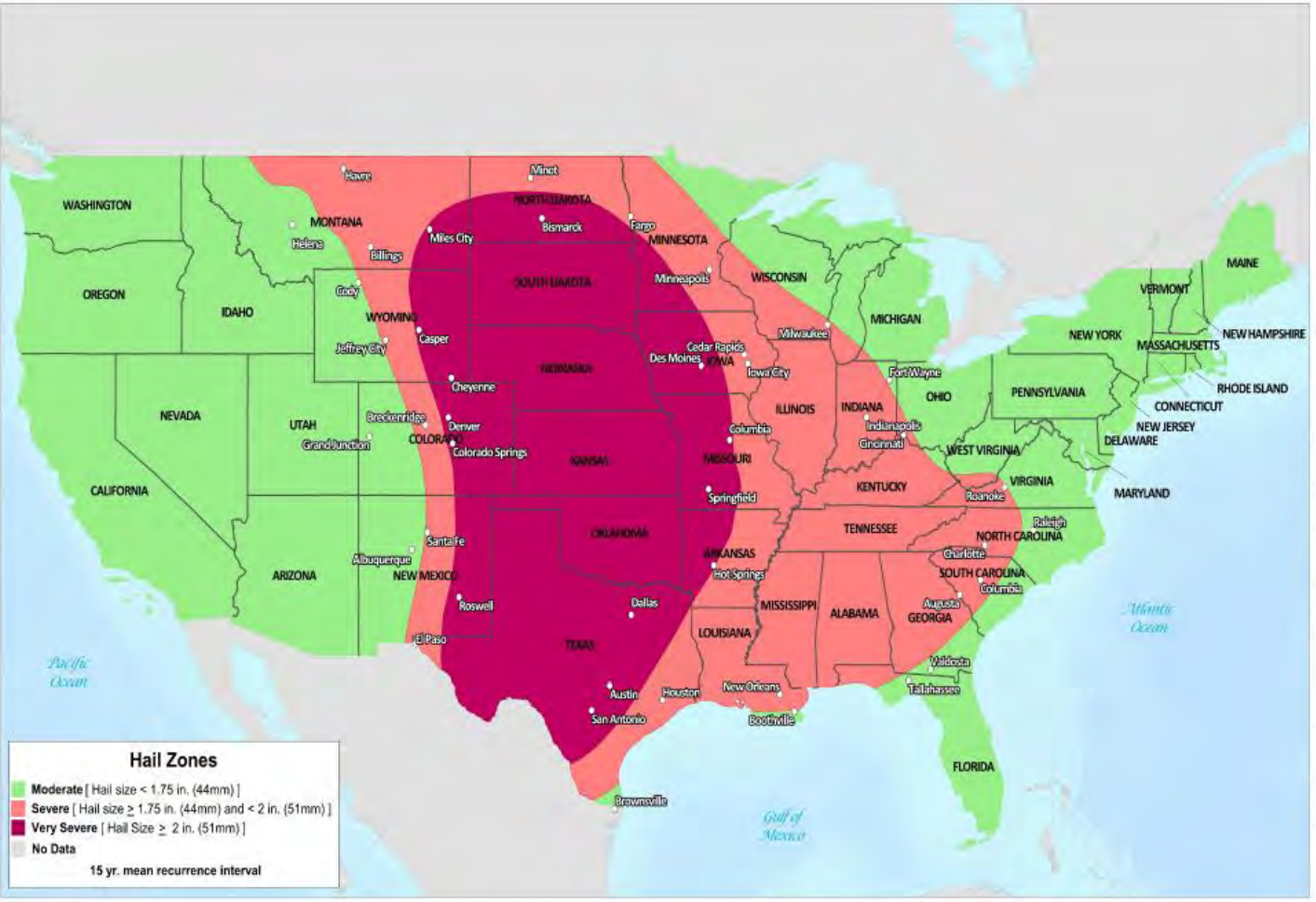


Fig.C-1. Hailstorm hazard map for the contiguous United States (ρ= 0.7g/cm^3)

Fig. 3.1.1-1.Single-ply membrane roof 0.045 in. (1.1 mm) thick cut by hail

Fig. 3.1.1-2. Close-up of roof in Figure 3.1.1-1

HAIL/IMPACT RESISTANCE

WATERPROOFING PERFORMANCE

- Fluid-Applied Systems Provide Increased Waterproofing Content Compared to Conventional Roofing Assemblies
  - High Performance, High Solids, Fluid-Applied
    - e.g. Polyurea, Polyurethanes, PMMA

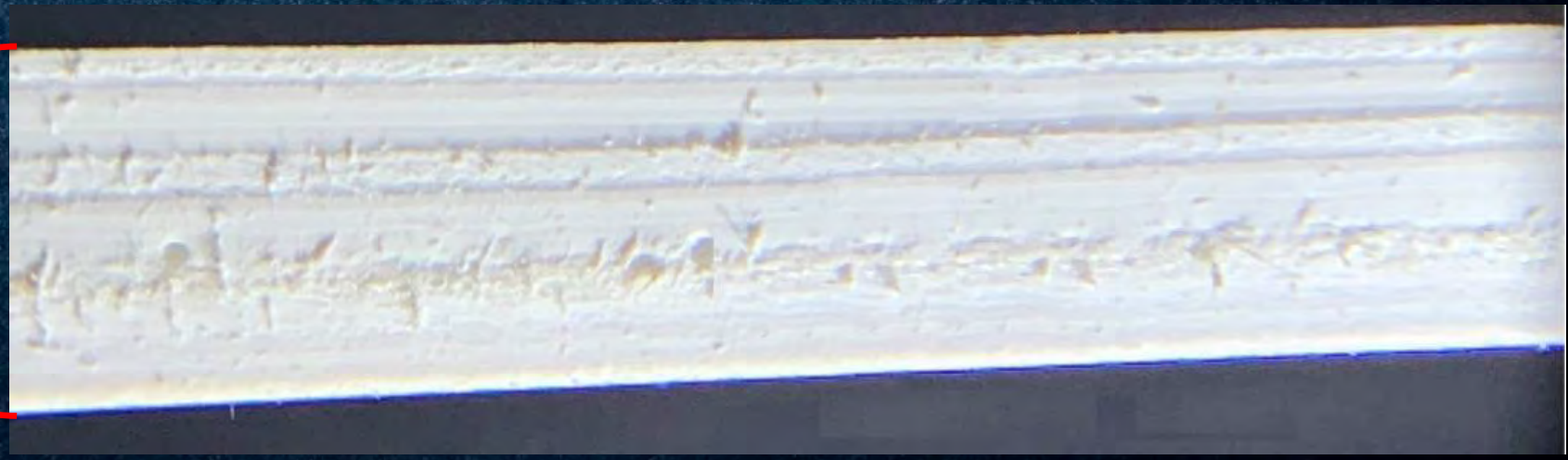
WEATHERING/WATERPROOFING PROFILE (CROSS-SECTION)

Single Ply Roof Membrane:

- Reinforcement is not saturated with compound
- Weathering protection is only within the thin section above the reinforcement

Fluid-Applied Roof Membrane:

- Reinforcement is fully saturated with compound
- Weathering protection is throughout the entire fluid-applied membrane



WEATHERING/WATERPROOFING SYSTEM COMPARISON

Product	Membrane Thickness	Weathering (UV Stable) Thickness
Aliphatic Fluid-Applied Hybrid System	190 mils	150 mils
TPO	39 mils	12 mils
PVC	45 mils (Type II and III) 36 mils (Type IV)	16 mils (all types)

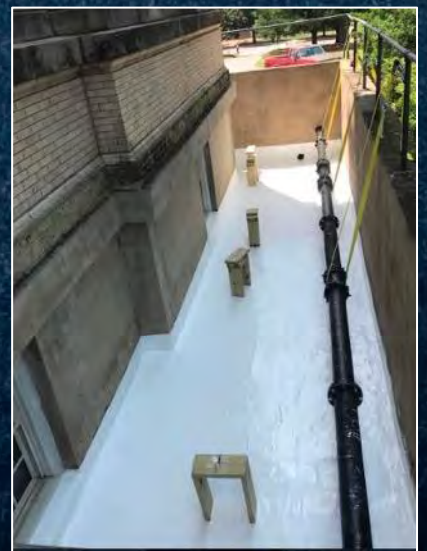
Weathering Effects

- Single Ply Membrane – Exposed Reinforcement

FLUID-APPLIED CONCRETE APPLICATIONS

CONCRETE DECK SYSTEMS

- Exposed New or Aged Concrete Deck Coating Systems
- Ideal for Difficult Access Locations
- Commonly Specified in Urban Environments
- Reduced Labor Installation



DECK COATING SYSTEM

Top Coating Layer

Fabric Reinforcement Ply

Base Coating Layer

Epoxy Primer

Concrete Deck

VERSATILITY OF FLUID-APPLIED SYSTEMS

- Building Eyebrows
- Balconies
- Planters
- Fountains
- Vegetative Roofing
- Mechanical Rooms
- Plaza Decks
- Split Slab
- Fluid-Applied Flashing Details

RECAP

- Versatility
  - Aged Roof Restoration, Hybrid Roof System, Concrete Waterproofing
- Not a Maintenance Coating
- Growing Market Share
- Advancements in Liquid-Polymer Technology
- Qualification and Installation Techniques are Critical

Acknowledgements

- National Roofing Contractors Association
- Roof Coating Manufacturing Association
- FM Global & Factory Mutual Insurance Company

QUESTIONS