

# PMMA Technology

Presented by  
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Provider Number: J396  
Course Number: SIPPMMMA2021  
1 AIA LU/HSW & IIBEC CEH

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## Learning Units



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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

## Course Description

This course includes a 50-minute presentation with a 10-minute Q&A portion. The presentation includes the science of polymethyl methacrylate (PMMA) used in liquid-applied roofing and waterproofing systems. The discussion includes development history, system design, the role of the liquid-applied system in a successful roof assembly and parking deck application.

## Learning Objectives

- 1 A review of the development of PMMA for roofing and waterproofing applications will give attendees the proper background for understanding the system's properties.
- 3 Attendees will hear a broad overview of circumstances where liquid-applied systems offer a practical, efficient option as compared to traditional sheet materials.

- 2 A comparison of key properties of common liquid-applied systems will provide attendees with information on options available.
- 4 A review of system design for flashing, roofing, and waterproofing applications will provide attendees with the background to make design decisions based on the specialized requirements of a given project.

## Liquid Applied Options

**Asphaltic**

**STP**

PMMA

Epoxy

**Acrylic**

Urethane

## Liquid Applied Options

CHEMISTRY

Asphaltic

STP

**PMMA**

EPOXY

Acrylic

URETHANE

# Polymethyl Methacrylate (PMMA) Resin

- Plexiglass.
- Road marking.
- Dental cement.
- Industrial flooring.



## Evaluating Liquid Technologies

### Parapro Roof Membrane (Flexible PMMA) (Reinforced)

- Resin: 2K flexible PMMA
  - Summer and winter grades available
- Catalyst: Organic Peroxide
  - Peroxide Exact ratios not critical
- Reinforcement:
  - 110 g/m<sup>2</sup> polyester
- Primer: PMMA-based
  - Four primers available for various substrates
- **Styrene and Isocyanate-free**

### 2K Polyurethane (PUR - Reinforced)

- Resin: 2K Polyurethane reinforced
- Catalyst: Organic Peroxide
  - Exact ratios are critical and require full kit mixtures
- Reinforcement:
  - 165 g/m<sup>2</sup> polyester
- Primer: Epoxy or acrylic based
  - Three primers available for various substrates
- Contains Isocyanate
  - **Creates health concerns**

### Moisture Triggered Polyurethane (PUR) (Reinforced)

- Resin: 1K moisture cured PU
  - Polyurethane in solvent based carrier
- No Catalyst
  - Humidity from the air triggers reaction
- Reinforcement:
  - Randomly oriented glass fiber mat
- Primer: Epoxy or acrylic based
  - Three primers available for various substrates
- Contains Isocyanate
  - **Creates health concerns**

# Evaluating Liquid Technologies

## Parapro Roof Membrane (Flexible PMMA) (Reinforced)

- Total thickness:
  - **2.3mm (90 mils)**
- Water absorption:
  - 0.8%
- Interlayer adhesion:
  - **Excellent**
- Reparability:
  - Mechanical damage can be patch-repaired using the same resin.

## 2 Component Polyurethane (PUR - Reinforced)

- Thickness:
  - **2.0mm (80 mils)**
- Water absorption:
  - <1%
- Interlayer adhesion:
  - **High risk**
- Reparability:
  - **Repairs difficult due to poor adhesion**

## Moisture Triggered Polyurethane (PUR) (Reinforced)

- Thickness:
  - **1.4mm (55 mils)**
- Water absorption:
  - **Not published**
- Interlayer adhesion:
  - **High risk**
- Reparability:
  - **Repairs difficult due to poor adhesion**

# Evaluating Liquid Technologies

## Parapro Roof Membrane (Flexible PMMA) (Reinforced)

- Rain proof at 68°F (20°C):
  - **30 minutes**
- Ready for next coat at 68°F (20°C):
  - **45 minutes**
- Ready for foot traffic at 68°F (20°C):
  - **2 hours**
- Temperature range:
  - **23°F (-5°C) – 104°F (40°C)**
- No. of layers in system: 1
  - One resin chemistry
- Minimum system completion time at 68°F (20°C):
  - **2 hours**
- Effects of humidity: **low**
  - Can be applied in **up to 97% relative humidity**

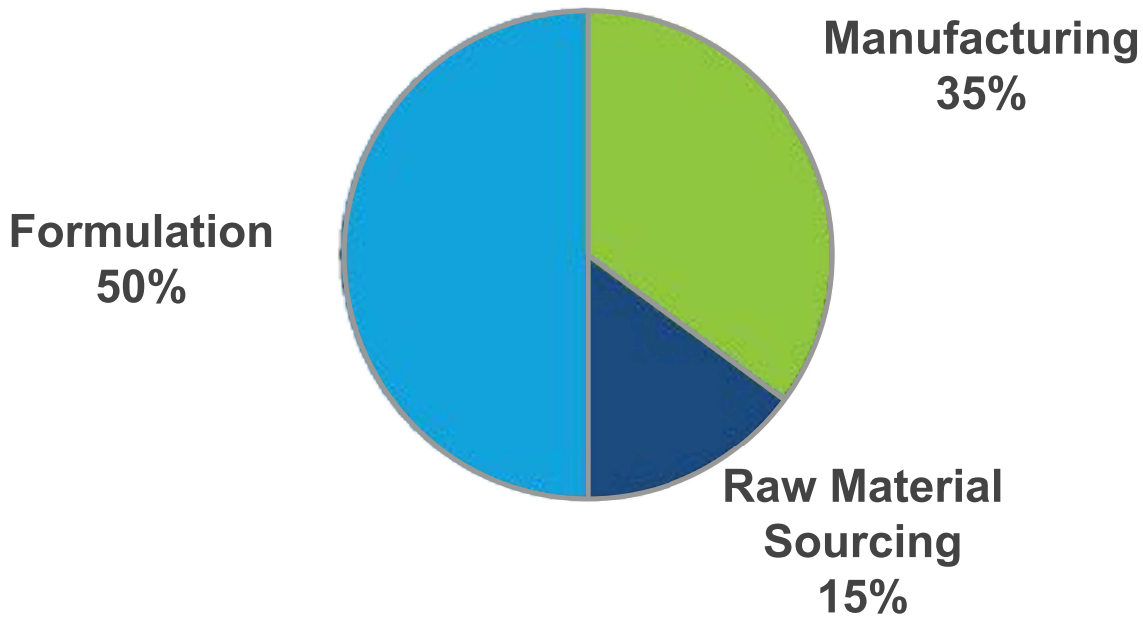
## 2 Component Polyurethane (PUR - Reinforced)

- Rain proof at 68°F (20°C):
  - 30 minutes
- Ready for next coat at 68°F (20°C):
  - **16-24 hours**
- Ready for foot traffic at 68°F (20°C):
  - **24 hours**
- Temperature range:
  - **41°F (5°C) – 90°F (32°C)**
- No. of layers in system: 1
  - One resin chemistry
- Minimum system completion time at 68°F (20°C):
  - **4 hours**
- Effects of humidity: **medium**
  - Can be applied in up to 85% relative humidity

## Moisture Triggered (PUR)(Reinforced)

- Rain proof at 68°F (20°C):
  - **Not listed**
- Ready for next coat at 68°F (20°C):
  - **Always overnight**
- Through cure at 68°F (20°C) / 50% R.H.:
  - **5 hours**
- Temperature range:
  - **36°F (2°C) – 95°F (35°C)**
- No. of layers in system: 1
  - One resin chemistry
- Minimum system completion time at 68°F / 50% R.H.:
  - **Overnight plus 5 hours**
- Effects of humidity: **medium**
  - High humidity increases drying times

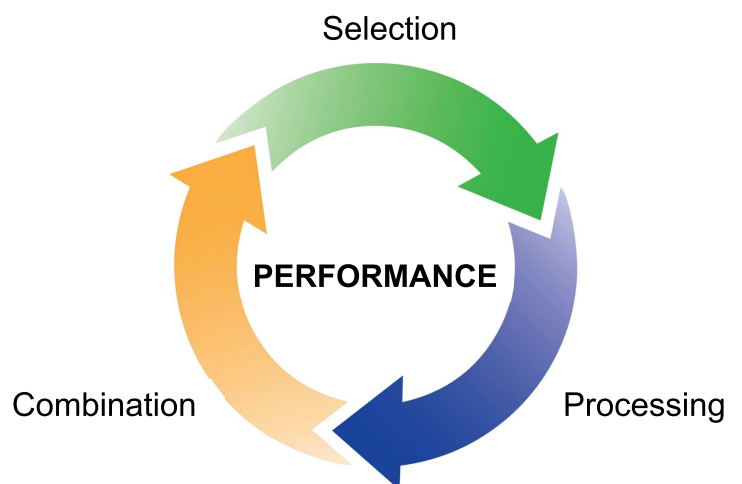
# Polymethyl Methacrylate (PMMA) Resin









## Formulation Affects Performance

• **Up to 30 components** comprising a given formulation lend to highly specialized versions of PMMA resin.

- Monomers.
- Fire retardants.
- Pigments.
- Additives.



# PMMA Resin Formulation

	Properties				
	Elongation	Hardness	Chemical Resistance	Glass Transition	Fire Rating
<b>MMA</b>			-		-
<b>Long Chain Monomers</b>					-
<b>Cross-Linkers</b>					-
<b>Fire Retardant</b>					
<b>Pigments / Additives</b>					-

	Improves Property		Reduces Property	-	Little Effect
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## PMMA Flashing Solutions

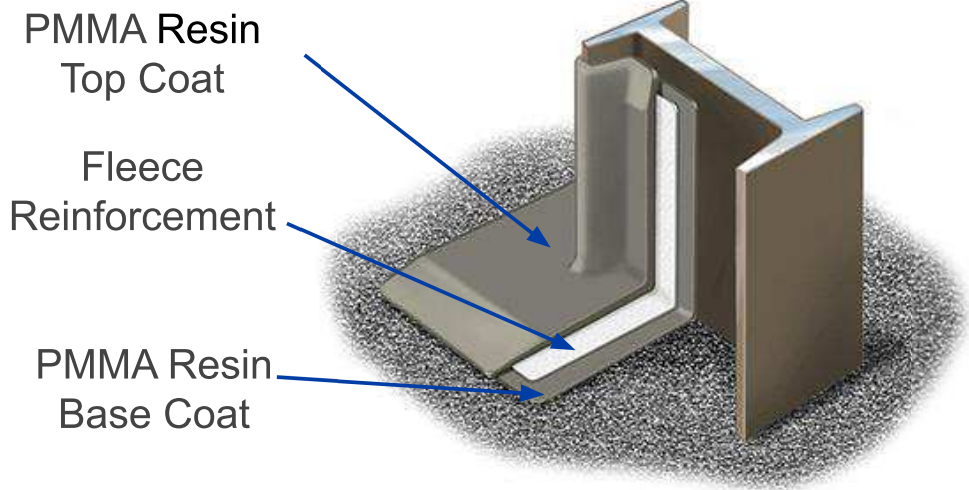
# Why Liquid Flashing?

## Traditional Flashing Details

- Excluded in guarantees
- Maintenance Items
- Common leak source
- Customer frustration



# PMMA Flashing Solutions



Creative solutions are risky solutions.

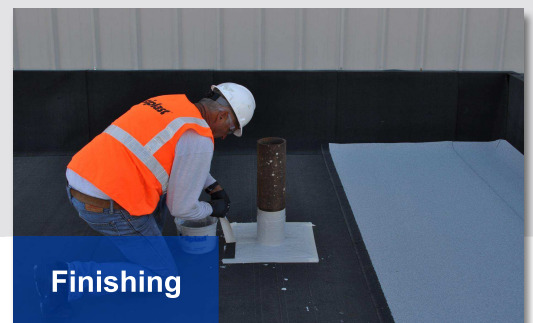


# Catalyzation

All PMMA resins must be catalyzed.



# Flashing Application



# PMMA Flashing Solutions

Repair Existing Details



⚠ Failed Sealant Pocket



Complex Details

# PMMA Flashing Solutions



Before

After

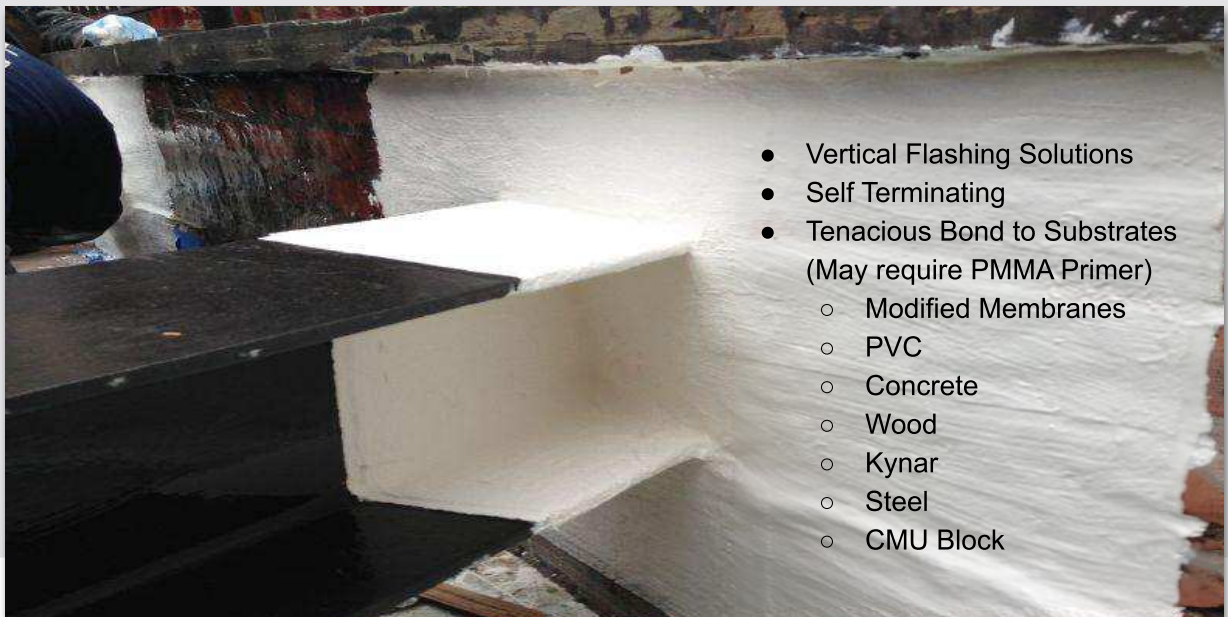


# PMMA Flashing Solutions

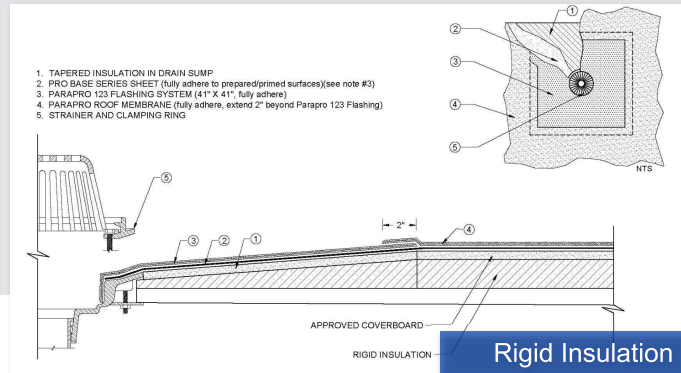
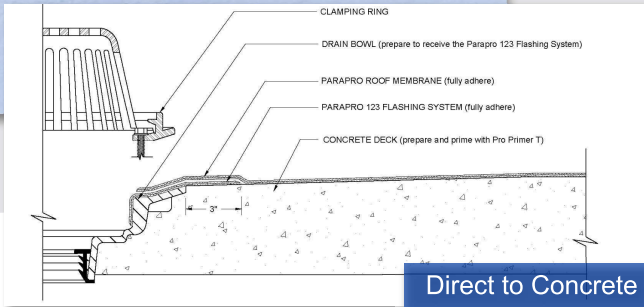
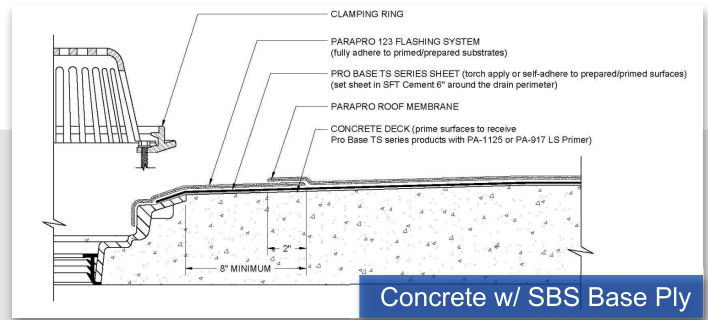
## Critical Flashing Areas



## Bonds to Difficult Building Materials



# PMMA Drain Solutions



# PMMA Roofing Solutions

# Design Decisions & Project Requirements



Hygienic Design



Flame-free Application



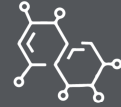
Heavy Foot Traffic



Limited Access / Low Clearance



Project Schedule



Chemicals / Vegetable Oil



Cold Temperature



Cool Roof / LEED



Ponding / Drainage



Complex Geometries & Surfaces

# PMMA Roof Membranes

Roof Design Challenges

Logistics

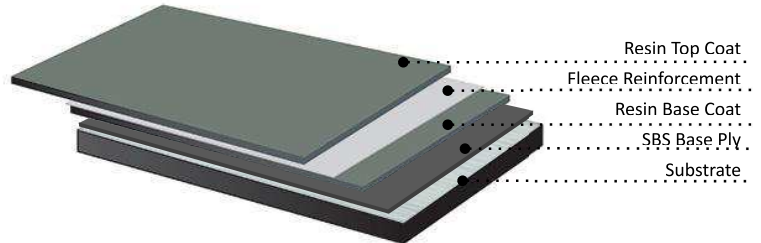
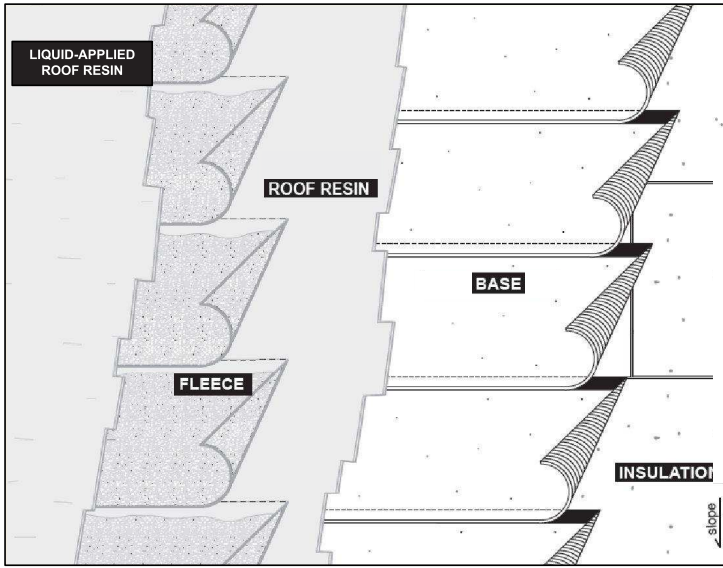
Harsh Roof Conditions

Chemical Exposure

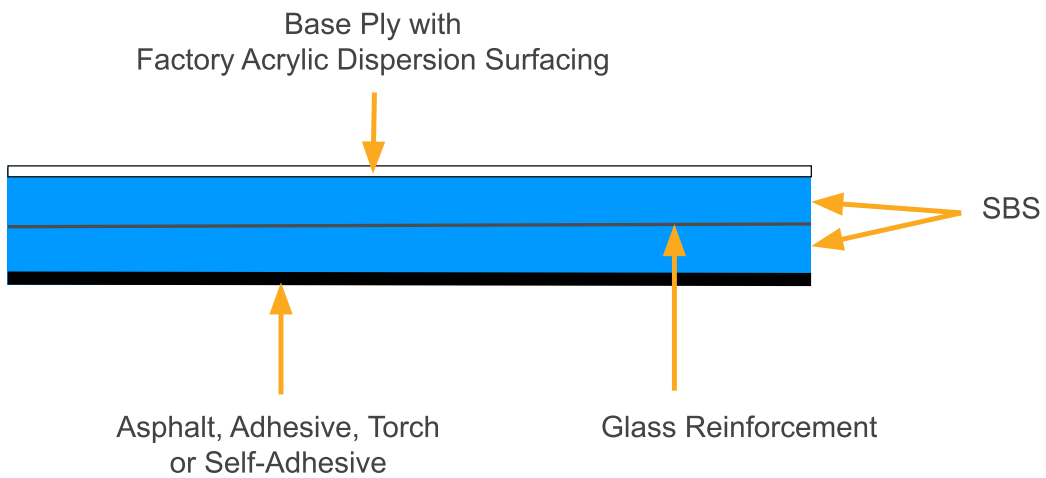
Existing Conditions



# PMMA Roof Membrane Design



# Base Ply with Factory Acrylic Dispersion Surfacing



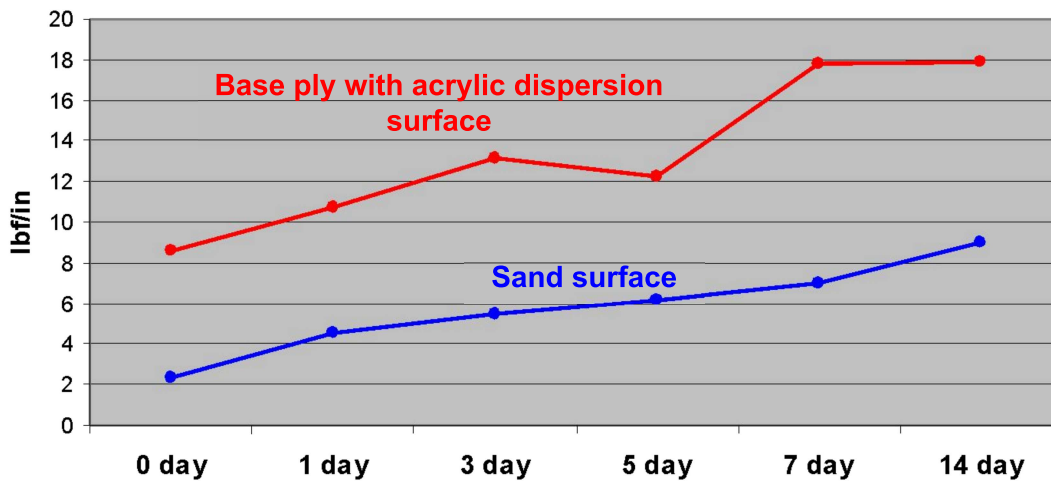
**Base Ply**  
Thickness: 2.3mm (91 mils)  
Weight: 60 lb/sq

# Factory Acrylic Dispersion Surfacing



# Factory Acrylic Dispersion Surfacing

Acrylic dispersion surface **enhances** bond strength.



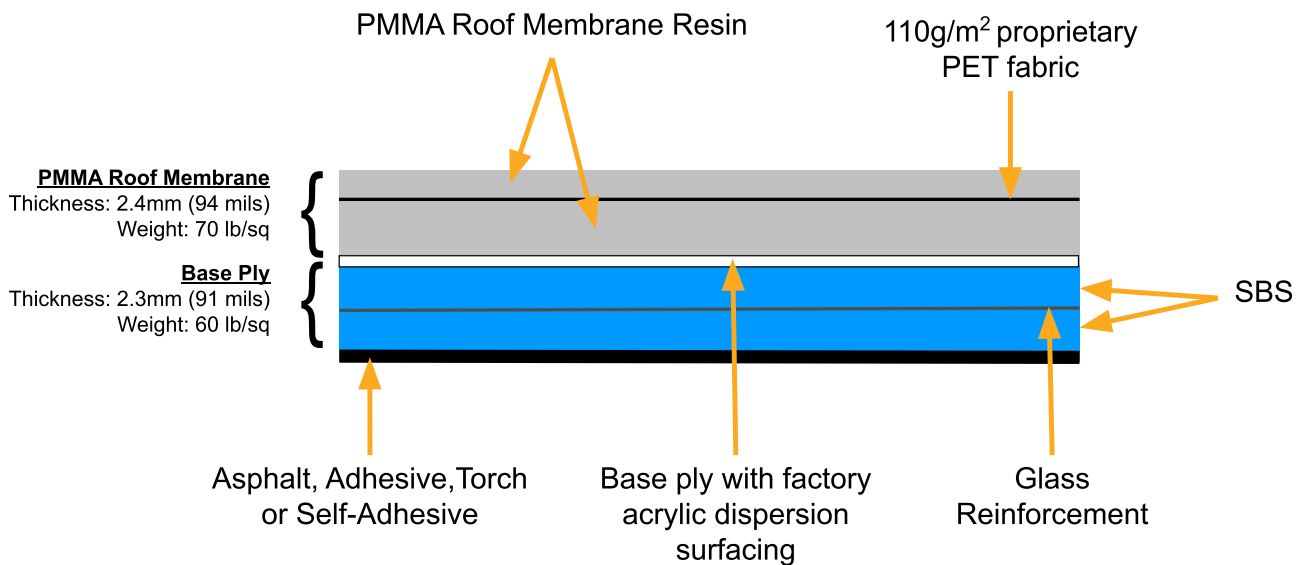
1 set: 3 peel samples tested for each data point on chart. Tests performed at 23°C.

# Factory Acrylic Dispersion Surfacing

Product	Direct Heat 250W lamps
Base Ply (sand surface)	190°F
Base Ply with Acrylic Dispersion Surfacing	155°F
<b>Differential</b>	<b>35°F</b>

Reduces heat gain due to thermal loading.

# Hybrid Roof Membrane





# Why Use a Base Ply with Liquid Roofing?

Stripping in Joints  
VS  
SBS Base Ply

\$\$

Primer cost  
could exceed  
SBS Ply Cost



Multi-ply  
reliability of  
SBS & PMMA



## PMMA Roof Membrane Installation

Base Coat



# PMMA Roof Membrane Installation



Top Coat

## Cold Weather Application

- Year Round Application
- Cleanability
- Service Life
- PMMA Waterproofing Membrane & Flashing



## Critical Facility

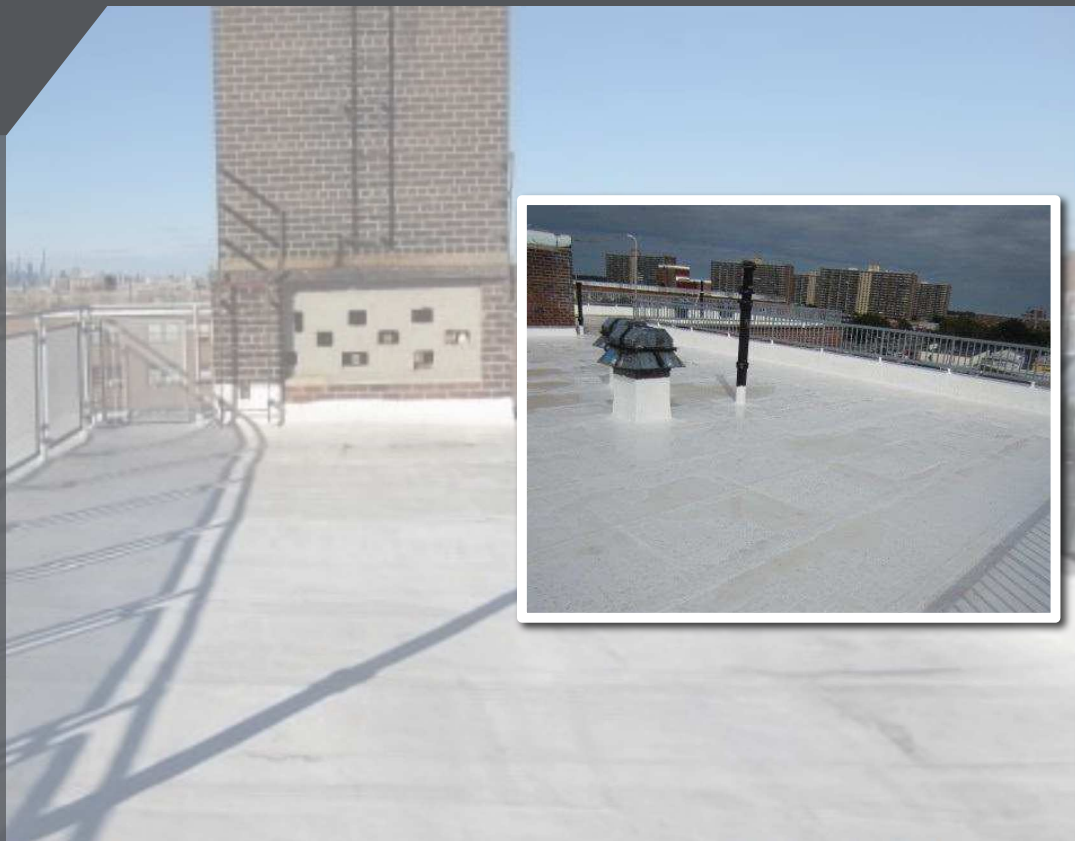
- PMMA Roof Membrane
- PMMA Skid Resistant Walk Paths
- No Interruption of Service
- Heavily Trafficked



## New York City Housing Authority (NYCHA)

### Public Housing

- PMMA Roof Membrane
- Longevity
- Cleanability
- Probable Tenant Traffic

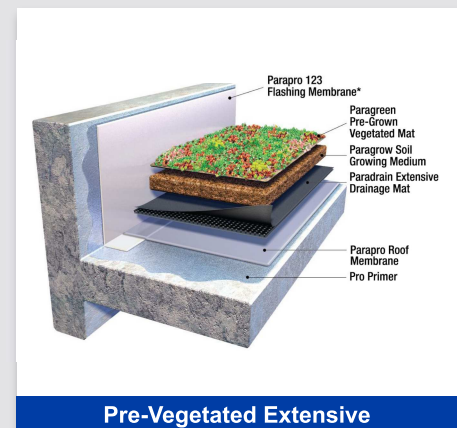


# Vegetated Waterproofing

- Monolithic PMMA Waterproofing Membrane & Flashing
- Puncture Resistance
- No Slope Limitations
- Impervious to Water



## Vegetated PMMA Roofing & Flashing Applications



# Vegetated PMMA Roofing & Flashing Applications



## Benefits

- Single-source for membrane and flashing.
- Reduces risk of lapping issues.

## Waterproofing for Traffic Decks

# Liquid-Applied Waterproofing for Traffic Decks

- Balconies
- Amenity Decks
- Walkways
- Parking Garages



Supposing is good, but finding out is better.

- Mark Twain

# Existing Substrates

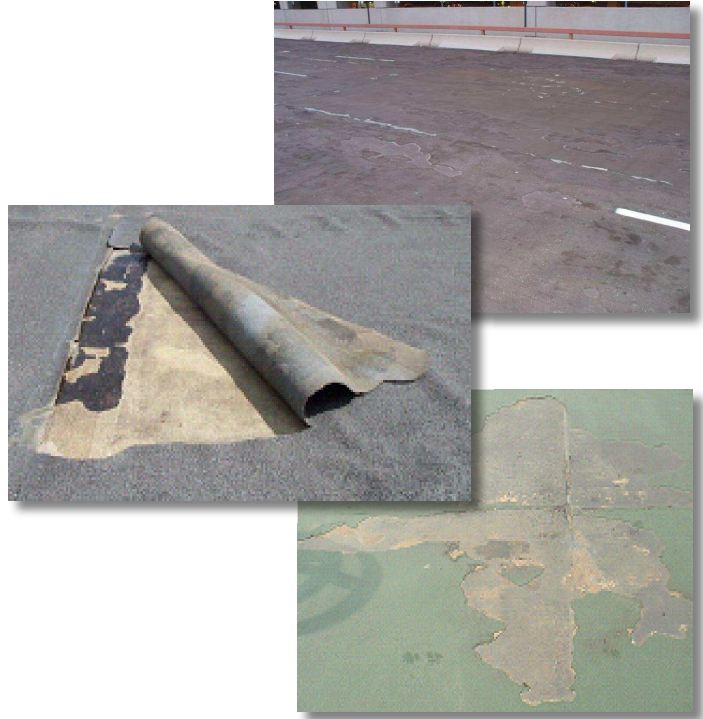
**Know Your Situation**

Current Coating Failure?

Exposure Concerns?

Environmental Issue?

History?



# Existing Substrate Core Evaluation



# Proper Preparation: Concrete Surface Profile (CSP)

Grinding  
SP2



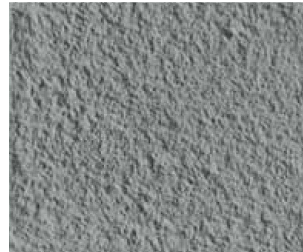
Shot Blasting  
Light  
SP3



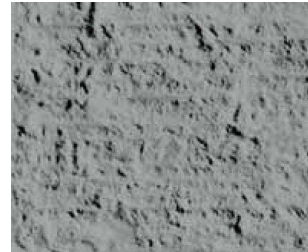
Scarifying  
Light  
SP4



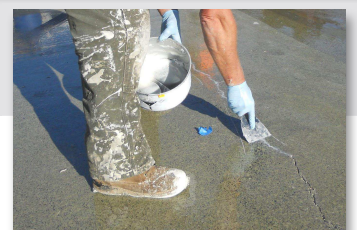
Shot Blasting  
Medium  
SP5



Scarifying  
Medium  
SP6



# Crack Prep & Treatment





# Priming



## Types of Primers

- PMMA based
- Epoxy based

# Design Decisions & Project Requirements



Occupied Space  
Conditioned Space  
Critical Facility

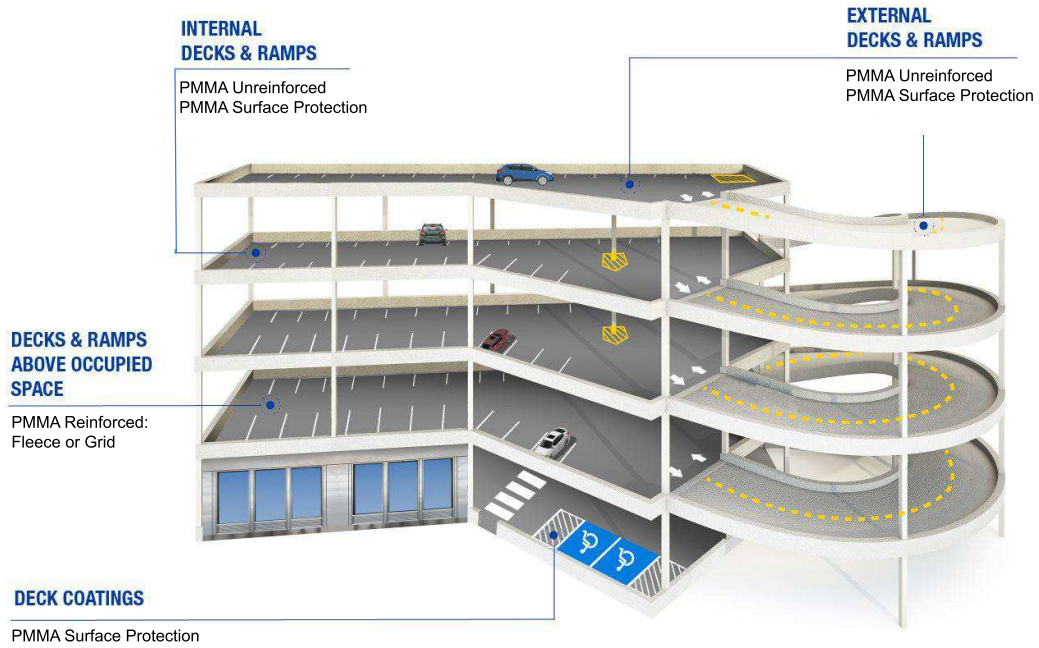


Cracking  
New Construction &  
Mitigating Risk of Future  
Cracking

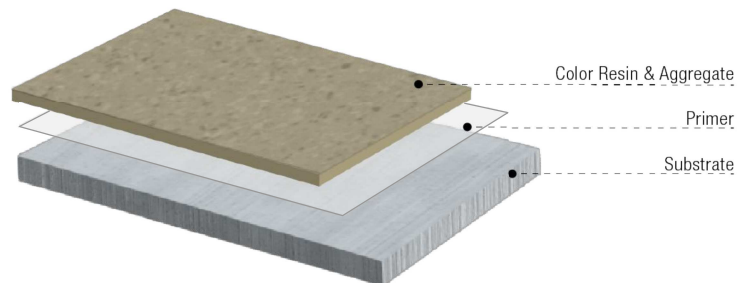


Cantilever Balcony  
Intermediate Parking Deck  
Amenity Space  
Aesthetics Only  
Skid Resistance Only

# Waterproofing vs Surface Protection

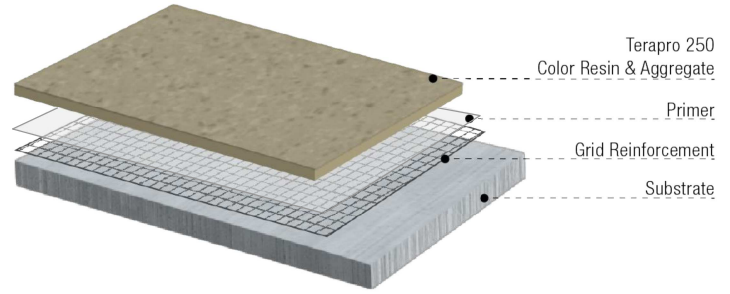


## PMMA Concrete Protection



Vehicular and pedestrian application options.

# PMMA Concrete Protection with Grid Reinforcement



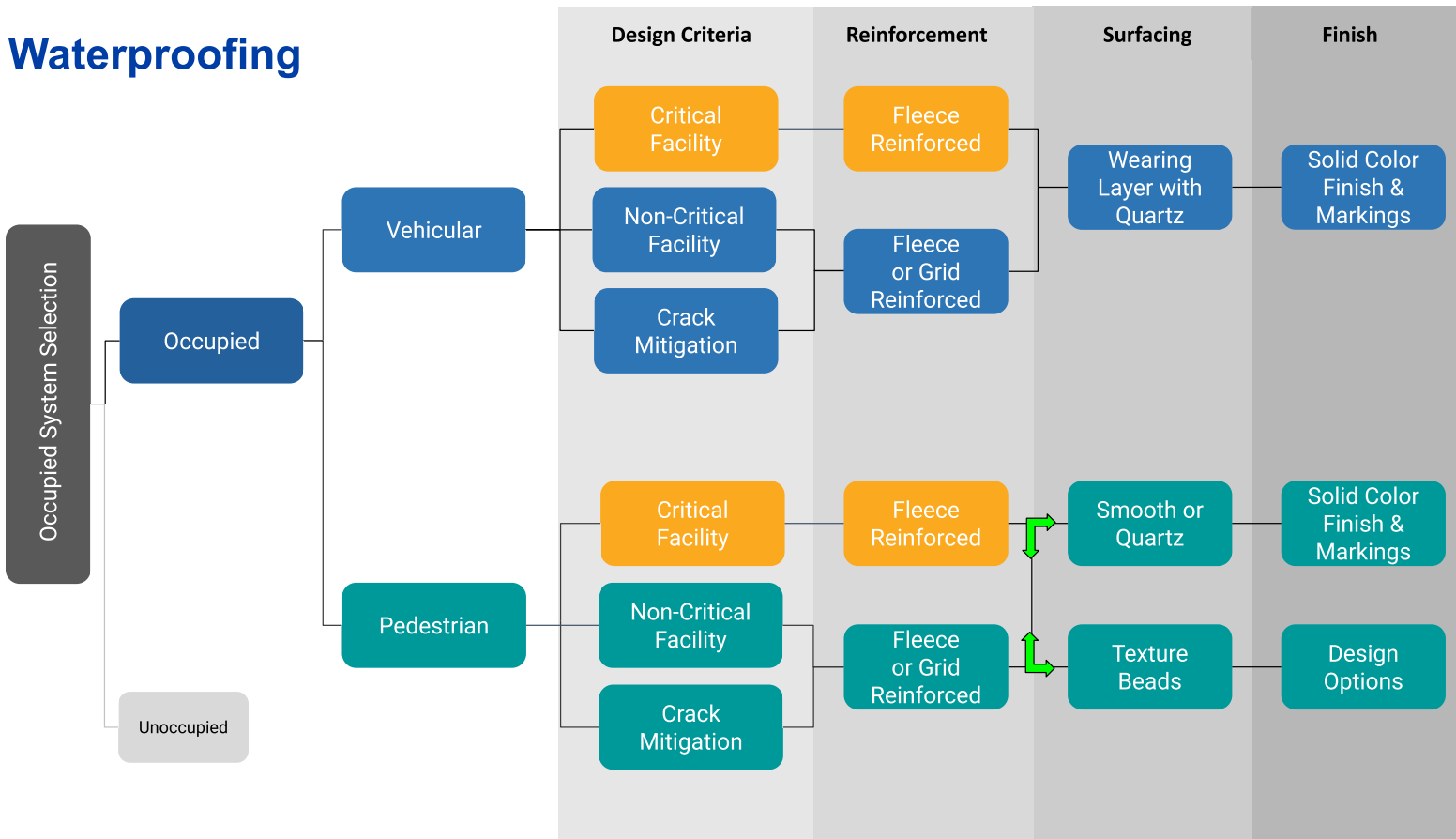
**Vehicular and pedestrian applications.**

## Garage - Oregon

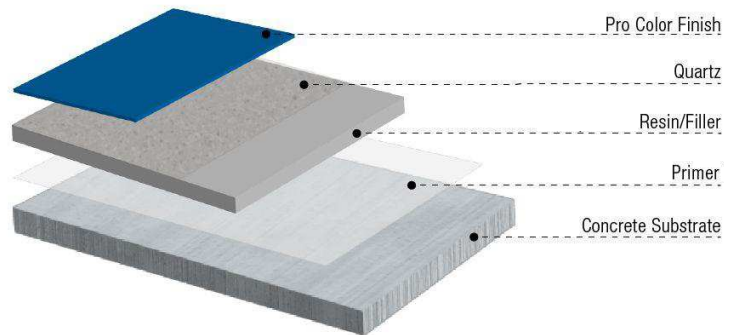
- PMMA Surface Protection
- Winter time application need
- Fast Turnaround



# Waterproofing

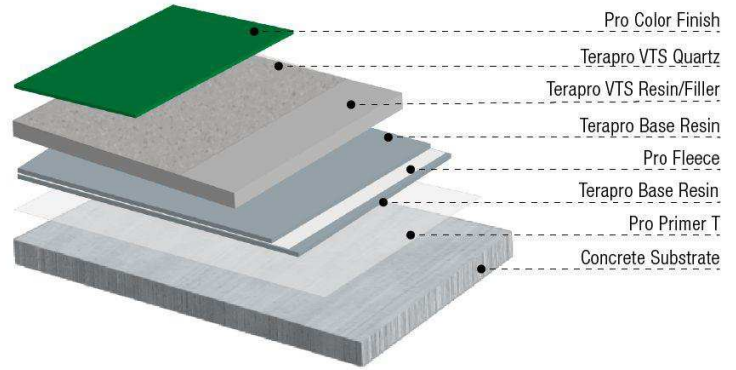


## PMMA Waterproofing Unreinforced



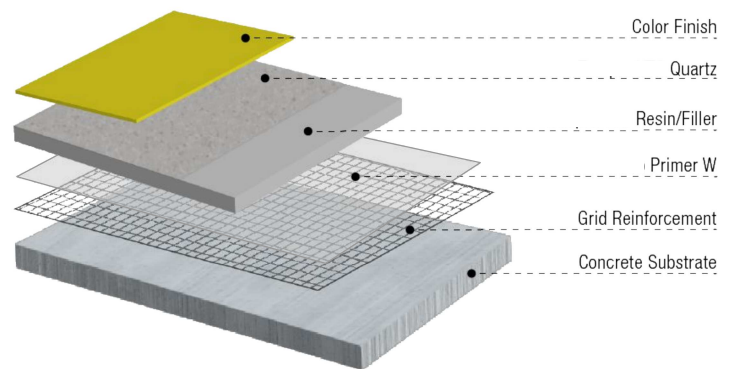
Vehicular and pedestrian applications.

# PMMA Waterproofing with Fleece Reinforcement



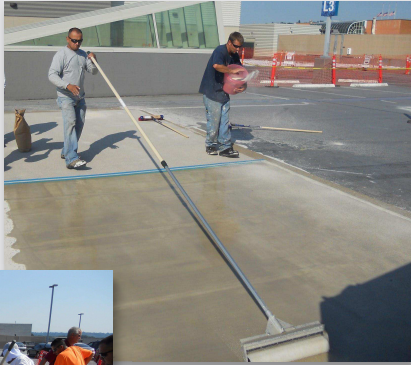
Vehicular and pedestrian applications

# PMMA Waterproofing with Grid Reinforcement

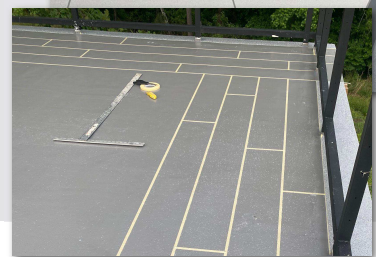
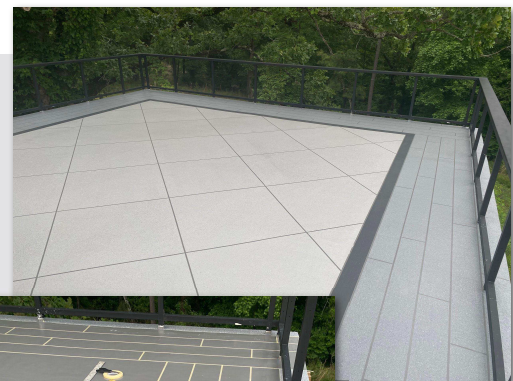


Vehicular and pedestrian applications.

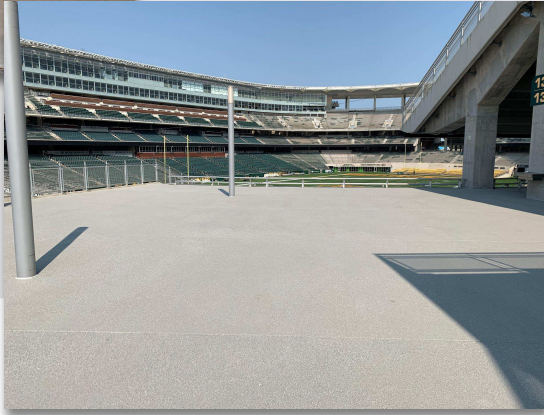
## Surfacing Options - Quartz



## Surfacing Options - Texture Beads



## Surfacing Options - Accent Chips



## Seattle Space Needle

- Observation Deck Over Occupied Space
- Contaminated Asphalt From Cores
- New Addition Concrete
- Contained Crystalline Materials
- Night Time Application
- Fast Turnaround
- Weather Conditions

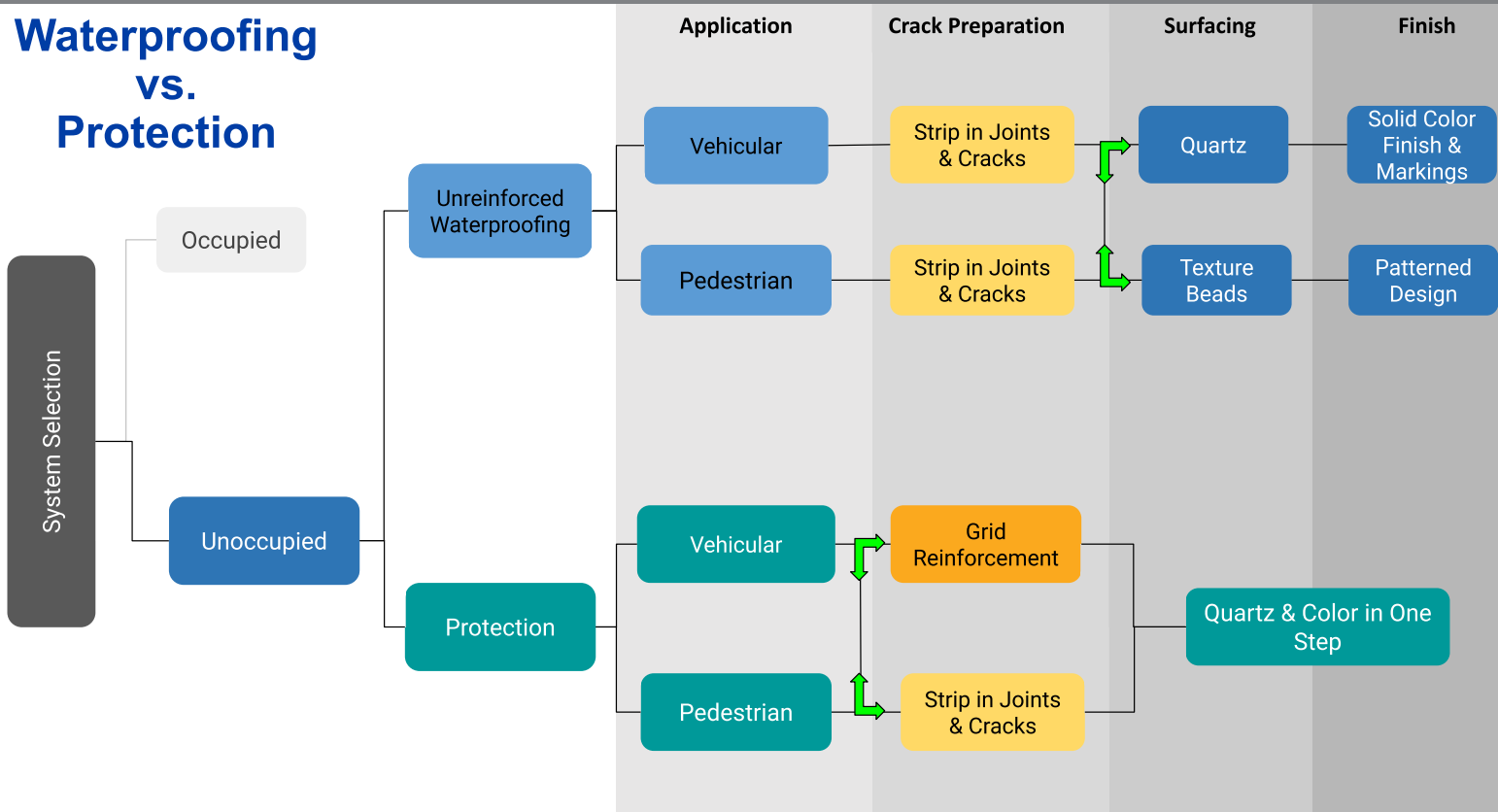








# Waterproofing vs. Protection



## Staten Island Ferry

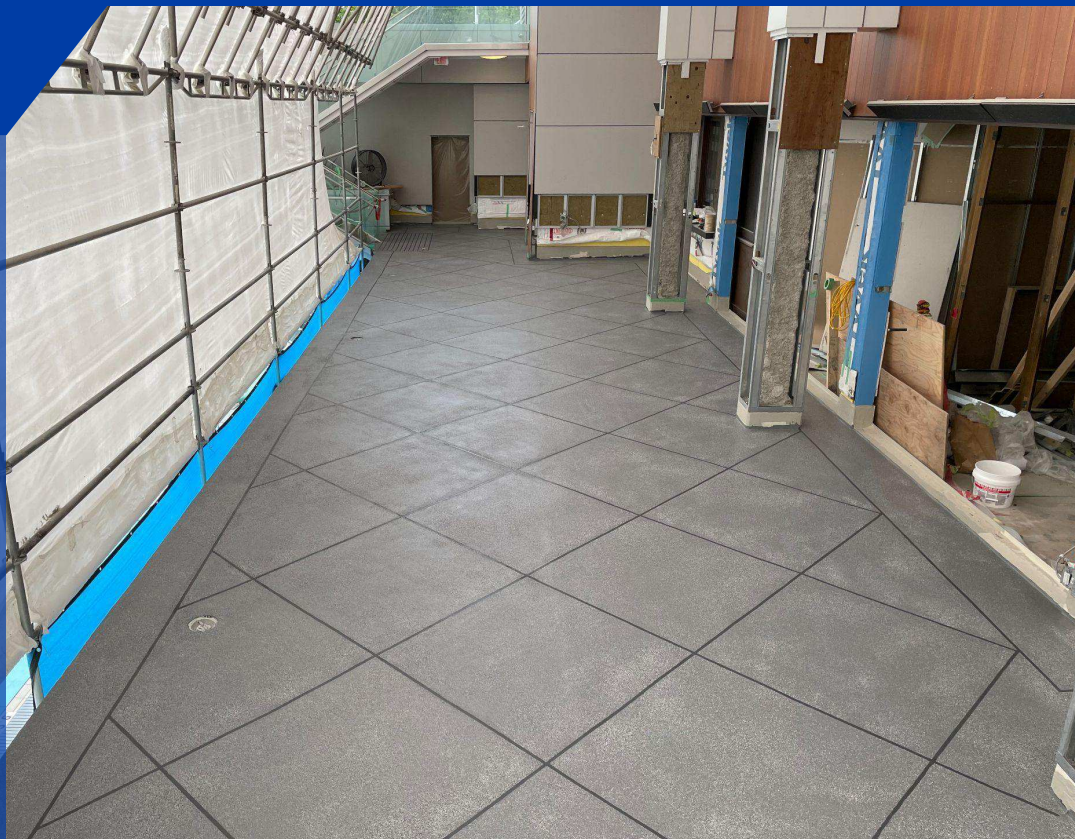
- Decks & Ramps.
- Concrete Deck Issues.
- Mitigated with Aggressive Shotblast.
- Extremely High Traffic Area.
- Difficult Logistics.
- Fast Turnaround.

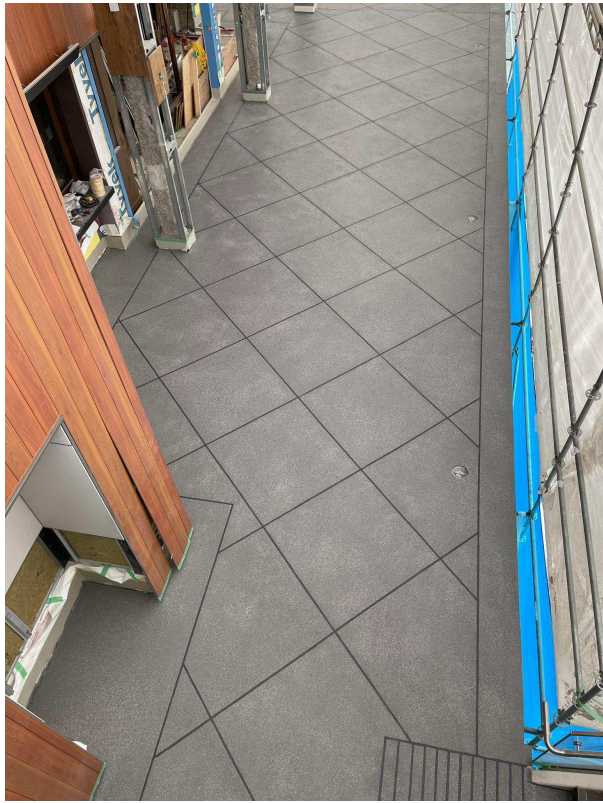




## Vancouver Lawn Bowling & Tennis Club

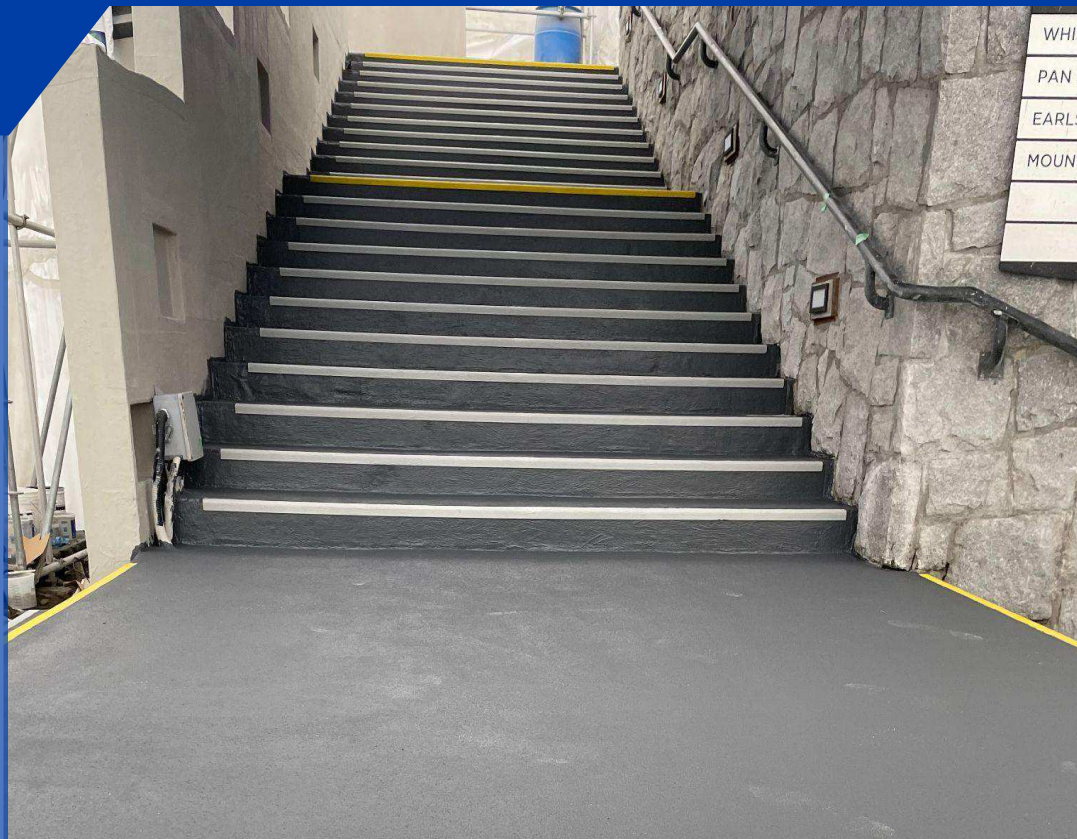
- Pub Deck
- Low flashing heights
- Pleasing Aesthetics  
Critical
- Durability Factor
- Fast Turnaround.





## Whistler Village Stairs

- High Foot Traffic
- Durability to Ski Boots and Equipment in transport
- Slip Resistant
- Metal Nosing
- Chemical Resistance







**Understand your project.  
Know your options.**



**Thank you!**

**PMMA Technology**



The learning portion of the presentation  
has concluded