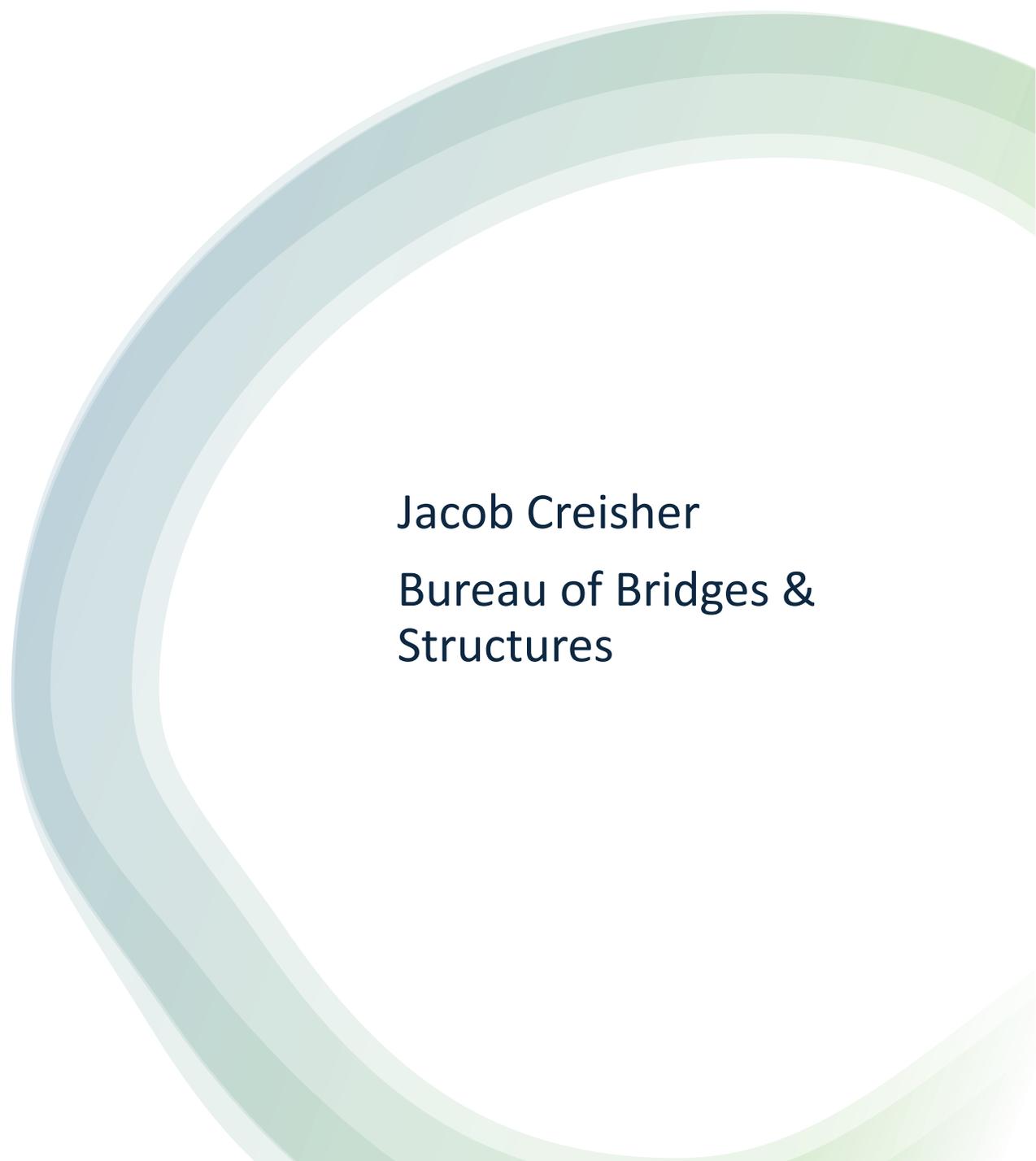


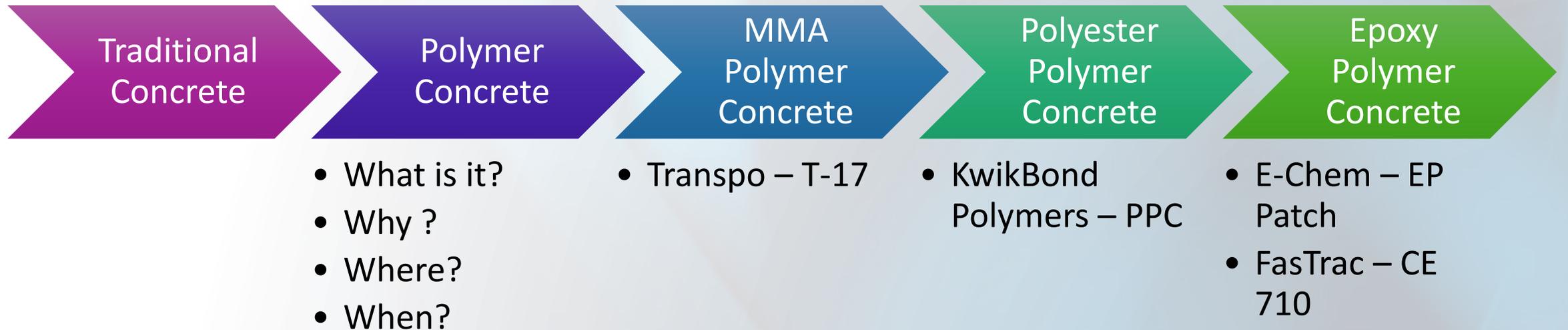


# Polymer Concrete



Jacob Creisher  
Bureau of Bridges &  
Structures

# Agenda



# Traditional Concrete

- Portland Cement
- Sand
- Aggregates
- **Water**
- Admixtures



Hydraulic Binder

# Traditional Concrete

- Note: concrete is porous due to the hydration process
- Air entrainment is used to improve its durability in freeze-thaw environments.
- Liquid enters the pores and begins damaging the concrete
- Presents of pores also reduce strength of the concrete and increases permeability.



Hydration Process leaves capillary pores

# What is Polymer Concrete? (Advanced Concrete Technology)

- Polymer mortar
- Graded / Mixed Aggregates
- Polymer Binder which is the Resin
  - Polyester
  - Epoxy
  - Methyl Methacrylate (MMA)
- Curing Agent or Hardening Additives that initiates



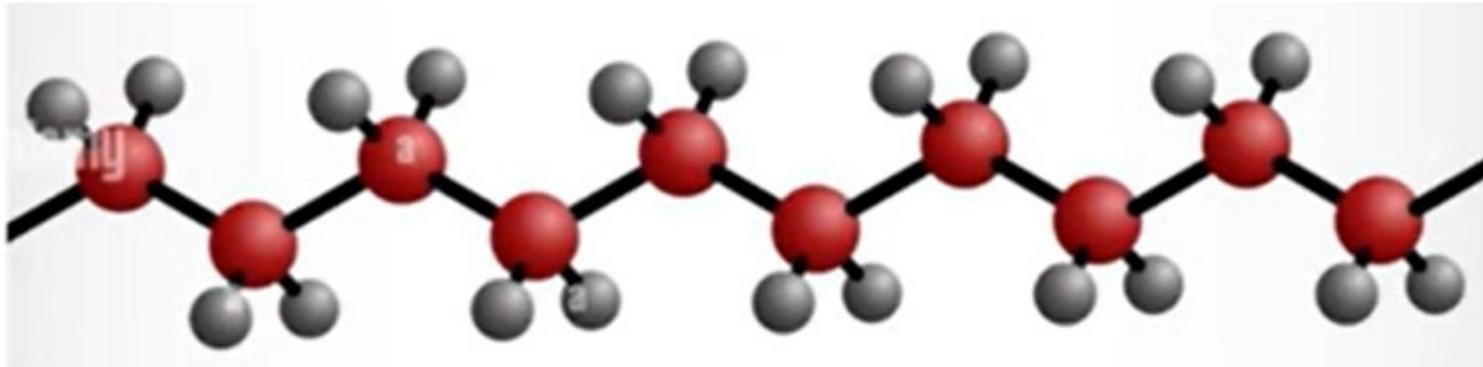
Fine Aggregate



Well graded Aggregate

# What is Polymer Concrete?

- The primary chemical reaction in polymer concrete involves polymerization - which are monomers are linked together by covalent bonds.



- Single unit molecules (monomers) are transformed into long chain molecules called (polymers).
- Use Thermosetting resins as the principal polymer component.

# Why Polymer Concrete?

- Advantages are :
  - High Strength
    - Compressive – 8000 psi or higher
    - Tensile – 2 to 4 times higher than Portland Cement
    - Flexural
  - Reduced Porosity
  - Superior Chemical Resistance
  - Excellent adhesion to most surfaces
  - Easier use in colder temperatures
  - Fast Curing Time & early return to service

# Why Polymer Concrete?

- Disadvantages are:
  - High cost
    - Up to 4 times higher than Portland Cement
  - Less Manufacturing of the products
  - Highly skilled labor to apply it – precise mixing ratios
  - The handling of resin is volatile and flammable.

# Where is Polymer Concrete used?

- Applications are :
  - Industrial Flooring
  - Repair Works
  - Marine Structures
  - Bridge Overlays and patches; parking structures

# When to use Polymer Concrete?

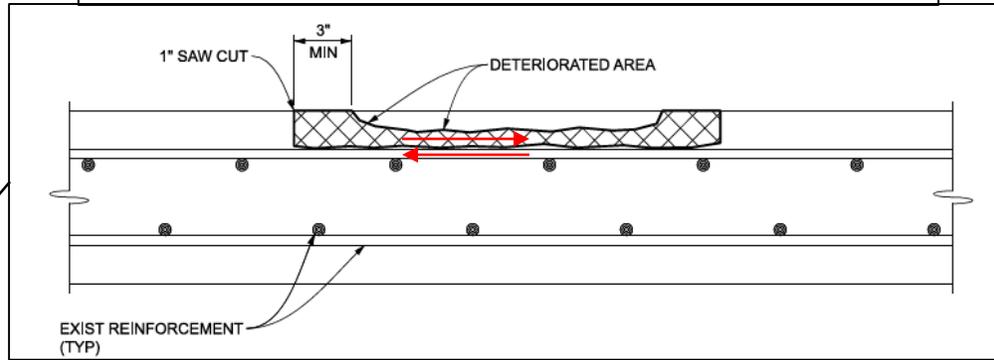


# When to use Polymer Concrete?



### 3 Types of Patches

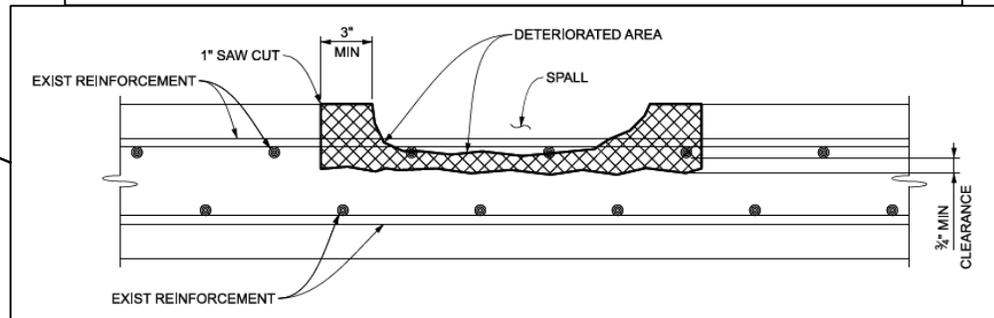
#### Shallow Patch – Above Reinforcement



Polymer (chemical)  
Concretes similar to:

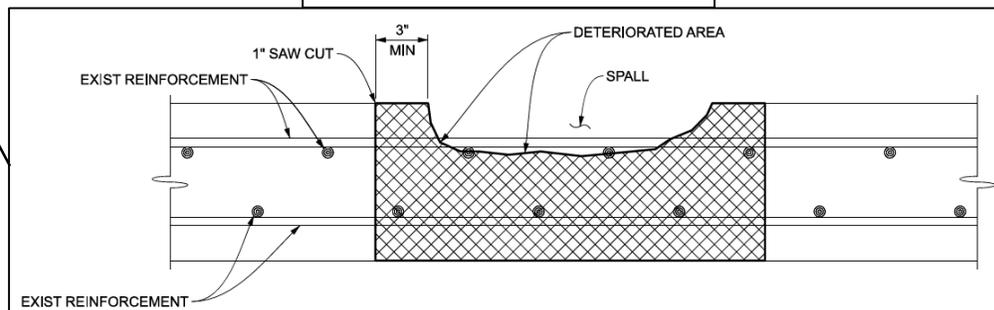
- Transpo T-17
- Kwikbond PPC
- E-Chem EP Patch

#### Deep Patch – Below Reinforcement



Do not require 28 days  
prior to sealers &  
overlays

#### Full Depth Patch



# Methyl Methacrylate Polymer

Transpo – T-17

- Rapid setting, methyl methacrylate (MMA) polymer concrete system
- Two component system for priming concrete surfaces. Superior adhesion.
- Two component system with a liquid resin and prepackaged blend of fillers.
- Compressive Strength - greater than 8,000 psi after 7 days.
- Flexural Strength – greater than 1800 psi after 7 days.
- Tensile Strength – greater than 1000 psi after 7 days.

# Patch Installation - Operation

- Saw Cutting
- Jackhammering
- Clean Patch
- Sandblasting
- Cathodic Protection
- Concrete installation
- Concrete Finishing
- Concrete Curing

# Methyl Methacrylate Polymer

Transpo – T-17 - Primer



# Methyl Methacrylate Polymer

## Transpo – T-17 – MMA Based Polymer Concrete



- Chemical Resin
- Binder Mortar Mix
- Aggregate

- **NO WATER IN CONCRETE MIX**

# Methyl Methacrylate Polymer

## Transpo – T-17 – MMA Based Polymer Concrete



- Pour
- Screed fast

- **ABOUT 20 MINUTES OF POT LIFE**

# Methyl Methacrylate Polymer

## MMA Resin Based Polymer Concrete

12DS712(P390)

MICHIGAN  
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION  
FOR  
**RAPID SETTING POLYMER CONCRETE PATCHING MATERIAL**

BAY:PJS

1 of 2

APPR:JAB:ARB:11-14-18

**a. Description.** This work consists of repairing concrete surfaces with a Methyl Methacrylate (MMA), Resin-Based, Rapid-Setting Polymer Concrete Patching Material in the locations shown on the plans and as directed by the Engineer.

**b. Materials.** Provide all materials in accordance with section 712 of the Standard Specifications for Construction, except as modified in this special provision.

Select a Methyl Methacrylate (MMA), Resin-Based, Rapid-Setting Polymer Concrete Patching Material based on the performance requirements of the components in Table 1, or as approved by the Engineer.

**Table 1: Performance Requirements of Components**

Property	Test Method	Minimum Result
Primer/Sealer		
Viscosity	Brookfield	40-60 cps
Density	ASTM D2849	8.16 lb/gal
Pot Life @ 70F (21C)	AASHTO T237	8-15 minutes

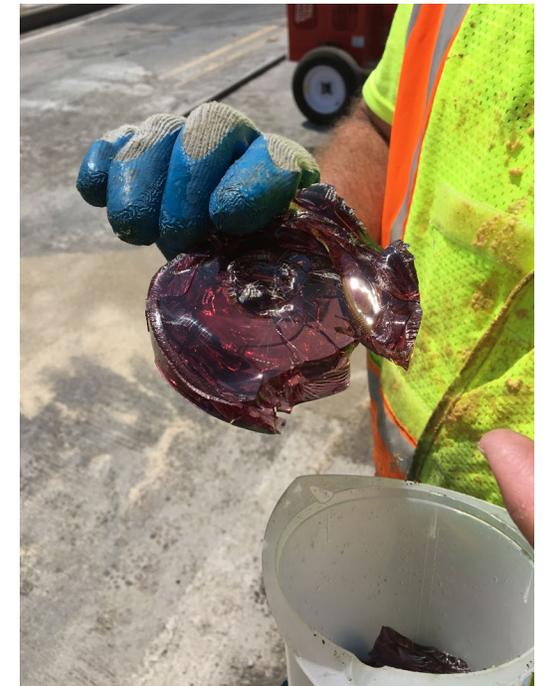
# Polyester Polymer Concrete

## KwikBond Polymers – PPC

- Rapid setting, polyester-based polymer patching concrete system
- Three component system for priming concrete surfaces. Superior adhesion
- Three component liquid resin, system with a liquid resin and prepackaged blend of fillers.
- Compressive Strength - greater than 7,000 psi.
- Tensile Strength – greater than 600 psi.

# Polyester Polymer Concrete

## KwikBond Polymers- Primer



# Polyester Polymer Concrete

## KwikBond – PPC - Polyester Polymer Concrete



- Chemical Resin, Initiator, & Accelerator
- Blended Sand
- Graded Silica-quartz Aggregate
- **NO WATER IN CONCRETE MIX**

# Polyester Polymer Concrete

## KwikBond Polymers – PPC



- Pour
- Screed fast

- **ABOUT 20 MINUTES OF POT LIFE**

# Epoxy Polymer Concrete

## E-Chem – EP Patch

- Rapid setting, Epoxy-based polymer patching concrete system
- Two component system for priming concrete surfaces. Superior adhesion
- Three component system that includes a liquid resin, a liquid hardener that you mix together. Then add aggregate to the mix.
- Compressive Strength - greater than 5,000 psi after 24 hrs.
- Has good Tensile and Flexural Strength.

# Epoxy Polymer Concrete

## E-Chem – EP Patch - Primer



# Epoxy Polymer Concrete

## E-Chem – EP Patch Epoxy Polymer Concrete



# Epoxy Polymer Concrete

## E-Chem – EP Patch Epoxy Polymer Concrete



- Epoxy Resin
- Hardener
- Blended Aggregate

• NO WATER IN  
CONCRETE MIX

# Epoxy Polymer Concrete

## E-Chem – EP Patch Epoxy Polymer Concrete



- Pour
- Screed fast
- ABOUT 35 MINUTES OF POT LIFE

# Epoxy Polymer Concrete

## FasTrac – CE 710

- Rapid setting, Epoxy-based polymer patching concrete system
- Self priming - NO PRIMER needed prior to placement.
- Three component hybrid system that includes a liquid resin, a liquid hardener that you mix together. Then add aggregate to the mix.
- Compressive Strength - greater than 5,000 psi after 24 hrs.
- Has good Tensile and Flexural Strength.
- It states that it is “Strong like concrete, Flexible like asphalt”

# Shallow Patching Material

FasTrac – CE 710



- Epoxy Resin
- Hardener
- Blended Aggregate



- **NO WATER IN CONCRETE MIX**

# Epoxy Polymer Concrete

FasTrac – CE 710



- Pour
- Screed & Place aggregate on top for better friction

