

Pennsylvania Precast Association

Membership Meeting Minutes

November 2<sup>nd</sup> – Carlisle, Pa

Meeting called to order at 9:00 AM

- 1.) Reviewed anti-trust policy  
Sign in was passed around and self-introductions done
- 2.) Reviewed financials

Current Balance-	\$47,944.73
Receivables -	\$5,700.00
Payables-	\$3,317.98
Est. reserves-	\$50,326.75
- 3.) Election of officers  
Nominated and Elected  
President- Mark Taylor  
Vice President- Phil Weber  
Secretary- Rusty Fox  
Treasurer- Tom Dixon  
Immediate Past President- Pat Holleran
- 4.) Committee Membership review
  - a.) Quality Assurance and Specifications
  - b.) Manhole Standards work group
  - c.) Membership and Marketing- Open Chair
  - d.) Septic Tank Manufacturing Committee
- 5.) Action items from September 7<sup>th</sup> meeting
  - a.) Payment for low strength concrete is still in discussion within Penn DOT.
- 6.) Membership & Marketing issues
  - a.) Please direct addresses to Hank for Precast Solutions magazine. These magazines can be sent out to engineers and other specifiers to educate them on the advantages of using precast concrete.
  - b.) Web site traffic continues to increase.
  - c.) NPCA affiliates Forum is at [www.forum.precast.org](http://www.forum.precast.org) please check it out.
  - d.) PPA is now on [Facebook](https://www.facebook.com/ppa) become a friend!
- 7.) QA Issues-
  - a.) Issues with inserts for installation of parapet attachments for box culvert. Hank will set up a meeting with BOD and box culvert producers to discuss possible solutions to these issues.
- 8.) Associate Spotlight
  - a.) Sika- Jim Preskenis on Water tight Concrete Structures, a handout was given (attached)

9.) PA DOT Topics-

- a.) Temporary changes in their section, as Bob Horwhat was moved to Disaster Relief Coordinator and Joe Bracken has been moved into Bob Horwhat's roll. This should be in place until at the latest January 1<sup>st</sup> 2012.
- b.) BARK1 and BARK2 are still on Level 2 certification.
- c.) Serge touched base on low strength concrete as this is still an open topic within Penn DOT. They are also open to a meeting with producers to help resolve this issue.
- d.) Serge also covered winter pouring and informed everyone about maintaining form temperature.
- e.) Box culvert guiderail topic was discussed. PPA is to set up a meeting between producers and Penn DOT.
- f.) There will be a few changes coming to the prestress producers
- g.) Inlet exception submittals to Penn DOT have dramatically reduced recently
- h.) Manhole standards update, this is in Mark Burkhead's hands.
- i.) Please review Bulletin 14 for aggregate suppliers as some have been removed.

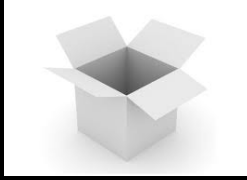
10.) Directors report

- a.) Keep your listings up to date on PPA's website.
- b.) What training or tools do you need help with? Let Hank know.
- c.) Transportation funding update and continued contact with elected officials
- d.) Note change in email addresses [info@paprecast.org](mailto:info@paprecast.org)
- e.) [Facebook](#)
- f.) [www.bettersaferroads.com](http://www.bettersaferroads.com)
- g.) A special thanks to the only retiring Executive Committee member, Jay Behney, thank you for your service.

11.) Upcoming meeting dates

- a.) January 4<sup>th</sup> - Hotel Carlisle

12.) Comments- None



## Watertight Concrete Structures

AIA Program Number : SIK710, (1 LU)



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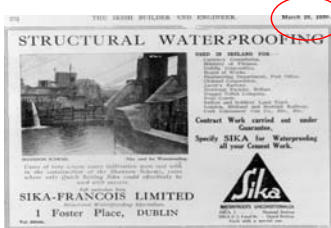
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## How it all began...

- ▲ In the early 1900's electrification of trains lead to need to waterproof tunnels
- ▲ Watertight concrete admixtures came into use



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## Penn station, NYC - 1930

- ▲ Waterproofing of tunnels



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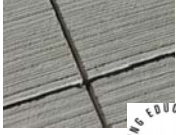
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## Integral Waterproofing System

- ▲ Watertight Concrete
 
- ▲ Watertight Joints
 




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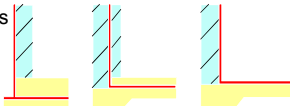
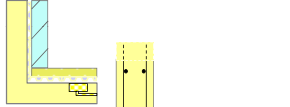
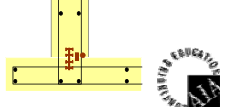
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## Types of Waterproofing systems

- ▲ Coatings & Membranes
  - Costly
  - Relatively difficult
  - Prone to damages
- ▲ Drained protection
  - Technically complicated
  - Costly
- ▲ Integral waterproofing
  - Faster construction
  - Cost effective
  - Less over-dig
  - No mechanical damage problems
  - Completely permanent




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## Watertight Concrete Where...

- ▲ Below ground structures
  - Archives
  - Basements
  - Computer Rooms
  - Libraries
  - Parking
  - Plant rooms
  - Transit Stations
  - Retail stores

- ▲ In ground structures
  - Swimming pools
  - Water tanks
  - Waste water treatment plants
- ▲ Above ground structures
  - Water management structures




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**Watertight Concrete - What is it....**  
**Concrete with reduced water permeability**

Potential sources for water penetration :

- Low concrete **density**
  - Low **watertightness** / High **absorption**
  - **Cracks**
    - Plastic
    - Drying
  - **Corrosion**
- Can be directly addressed by various admixtures
- Reduced **workability**
- Can be addressed by appropriate concrete technology




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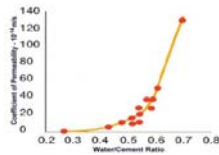
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**Watertight Concrete**  
**Concrete Density**

Type of pore	Size (µm)	Capillary Action
Micro Pores	< 0,1	NO
Capillary Pores	0.1 - 100	YES
Air Pores	>100	NO

- ▲ Water Reducing Admixtures
- Use of HRWR leads to reduces w/c ratio
  - Decrease of amount of free water
  - Reduced transportation of water through capillaries




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Without HRWR, W/C = 0.5



With HRWR, W/C = 0.35

Use of water reducing admixtures reduce need for excessive amount of "convenience" water in concrete mixture resulting in reduced size of the capillaries, which are the primary source of water transportation of water through the concrete.




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### Watertight Concrete

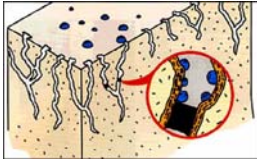
**Watertightness**

Water proofing admixtures reduce water attraction of the substrate and reduce capillary forces of the concrete

Admixture reacts with calcium hydroxide (CaOH)<sub>2</sub> to form insoluble and hydrophobic calcium stearate, which deposits on the walls of the pores and ultimately blocks the pores


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Hydrophobic capillary coating resulting in decreased rate of water permeability and Water absorption through



**Two products available**

- Sika 1+
- Sika Watertight Concrete Powder




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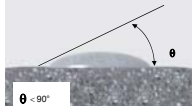
### Watertight Concrete

**Watertightness**

Hydrophilic Non Treated Concrete – Water permeates the surface




Water attraction – capillary rise

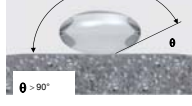


$\theta < 90^\circ$   
Surface tension > 73 mN/m


Hydrophobic Treated Concrete – Water does not permeate the surface



Water repulsion – no capillary rise



$\theta > 90^\circ$   
Surface tension < 73 mN/m




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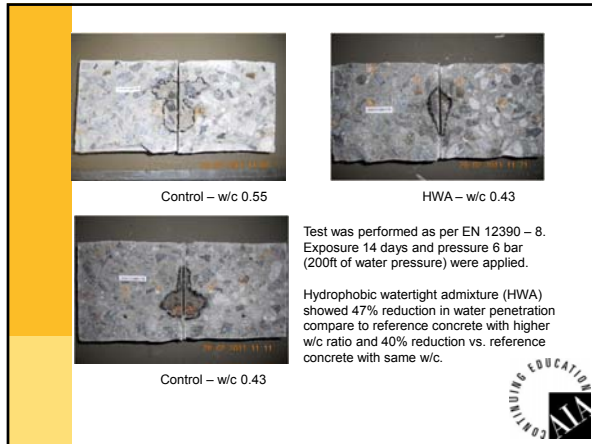
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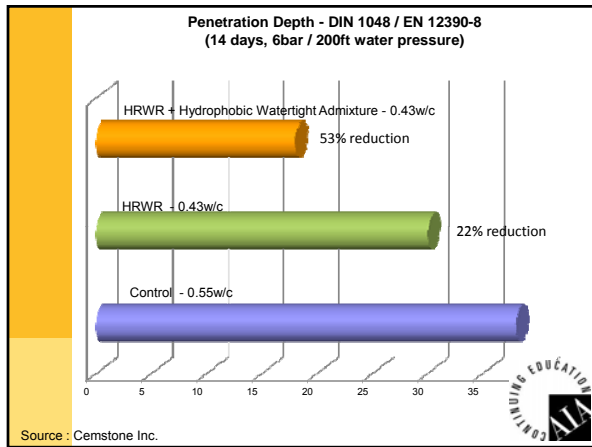
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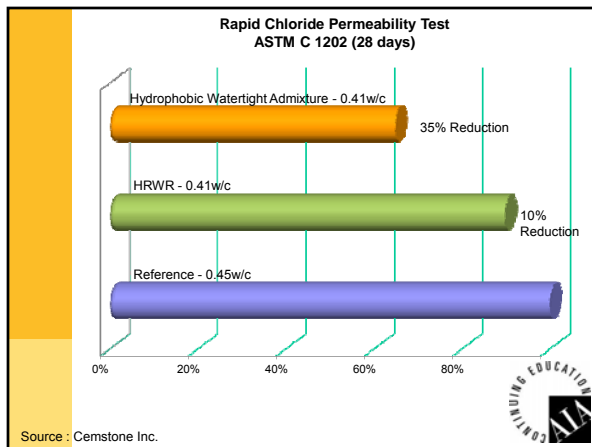
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### Watertight Concrete

**Watertightness**

#### Effect of Pore Blocking Watertight Concrete Admixtures on other concrete properties

- ▲ Prevents water and other potentially harmful compounds such as chlorides to enter structure
- ▲ No negative affect on compressive strength
- ▲ Does not effect slump retention
- ▲ No negative effect on air void quality
- ▲ Improves freeze thaw durability

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### Watertight Concrete

#### Shrinkage

Cracks are potential source for water intrusion in any concrete structure.

Prevention crack is therefore necessary to minimize this risk.

Types of cracks :

- ▲ Plastic – due to surface evaporation of water in plastic stage
  - \* plastic cracks even though are not full depth cracks can developed into full depth cracks during the drying stage. Larger risk on large exposed areas such as slabs
  - Solution – Polypropylene fibers
- ▲ Drying – due to water loss in hardened age
  - \* usually deeper to full depth cracks, not limited to slabs develop in any concrete surface
  - Solution – Shrinkage Reducing Admixture

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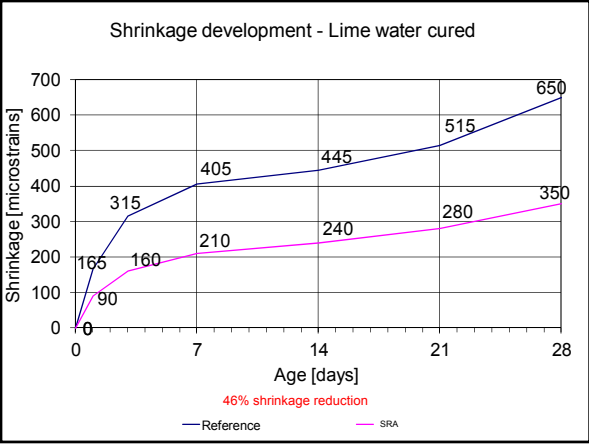
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## Watertight Concrete Corrosion

Later Age Cracking

- ▲ Subgrade movement
- ▲ Inadequate Design
- ▲ Structural Overload
- ▲ Alkali Silica Reactivity



### ▲ Corrosion




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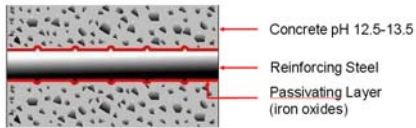
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## Watertight Concrete Protecting Concrete from corrosion

### Passivation of Steel in Concrete

Alkaline environment protects reinforcing steel from corrosion



### Conditions for Corrosion

- Breakdown of the passivating layer (Carbonation, Chlorides, Sulfates)
  - Electrolyte (Continuous pore water)
  - Oxygen (Concrete pores)




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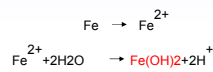
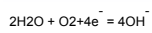
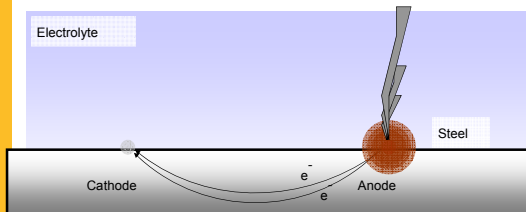
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## Corrosion cell




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## How to prevent corrosion

- Sufficient steel cover
- Low w/c ratio = lower permeability and cracking
- Addition of Microsilica
- Protective coatings
- Use of pore blockers
  
- **Corrosion inhibitors**
  - Anodic corrosion inhibitors – attach to steel and increase the protective layer of steel and prevents anode to occur – NITRITE BASED ADMIXTURES
  - Cathodic corrosion inhibitors – adsorption inhibitors, which interact with steel by forming organic an protective layer on the surface of the steel and thus protecting the rebar (MCI). Cathodic corrosion inhibi also prevent oxygen to react during cathodic reaction and therefore reduce corrosion current – AMA BASE ADMIXTURES




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### ANODIC PROTECTION

- Based on calcium Nitrite
- Proven technology
- Widely used
- ASTM C-1581
- Typical dosage of 1 gal/CY – 6 gal/CY
- Accelerated setting times
- Increased early strength

### ANODIC AND CATHODIC PROTECTION

- Blend of organic (amino alcohols) and inorganic inhibitors
- No reverse effects on concrete properties:
  - slump
  - air
  - set time
  - Finishability
- Single dosage 2gal/yd

Specimen	Weight loss [g*10 <sup>-2</sup> ]	Corrosion rate [mg/cm <sup>2</sup> day]
AMA based Corrosion Inhibitor	15.67	0.39
Calcium Nitrite based corrosion Inhibitor	28.43	0.67
Cement kiln dust	30.27	0.71
Flyash	46.30	0.97
No Corrosion Inhibitor	49.74	0.99




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## Watertight Concrete

### Reduced workability

- ▲ Improper placement of concrete can have ultimate impact on watertightness of entire structure.
  - Walls
  - Columns
  - Concrete containing reinforcing steel
  - Heavily reinforced and congested areas with limited access



Proper placement and consolidation is an absolute must in cases when watertight concrete is used.

To provide maximum watertightness, SCC is an ideal tool.




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**Watertight Concrete**  
 Reduced workability

- ▲ Use of SCC provides desired level of consolidation without necessary external vibration, ensures proper filling of formwork and tight reinforcement embedment. SCC technology significantly helps to reduce consolidation related issues.


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**Certifying Agencies**

- ▲ The BBA has created a standard for watertight concrete and certifies products that meet these standards
- ▲ Currently there are no standards in the USA


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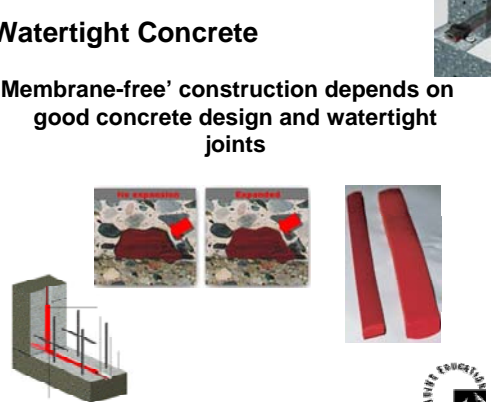

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**Watertight Concrete**

'Membrane-free' construction depends on good concrete design and watertight joints


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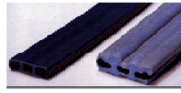
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## Jointing Materials

### Non-movement Joints

- ▲ Swellable hydrophilic products
  - Gaskets
  - Sealants
- ▲ Re-injectable hydrophilic products

### Movement Joints




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## Watertight Concrete

### Summary

- ▲ Four basic concrete properties should be addressed
  - **Density** – Water Reducing Admixtures
    - High Range – PCE Based
  - **Watertightness, Absorption, Permeability** – Waterproofing admixture
    - Hydrophobic Pore Blocking Products
  - **Shrinkage** – Polypropylene Fibers / Shrinkage Reducing Admixture
    - Plastic Shrinkage – Polypropylene Fibers
    - Drying Shrinkage – Shrinkage Reducing Admixtures
  - **Corrosion** – Corrosion inhibitors
    - Anodic
    - Cathodic
- ▲ Additionally, selection of the most appropriate concrete technology ensuring proper concrete consolidation must be considered
  - **Conventional Concrete**
  - **Self Consolidating Concrete**




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## Steps to specifying watertight concrete

- ▲ Minimum cement content - 600 lbs/cyd
  - ▲ Maximum water/cement ratio - 0.42
  - ▲ High Range Water Reducing Admixture
  - ▲ Hydrophobic Watertight Admixture/Powder
  - ▲ Appropriate Jointing material
- } Minimum recommendation
- ▲ Self Consolidating Concrete
  - ▲ Shrinkage Controlling Measures
  - ▲ Corrosion Controlling Measures
- } Additional measures for more critical structures




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## Conclusions

- Watertight concrete can eliminate the need for external membranes
- Use of hydrophobic watertight admixtures help protect structure from water penetration.
- Corrosion control and shrinkage reduces risks of cracks thus making structure more watertight.
- Use of self consolidating concrete helps to insure concrete is fully consolidated and free of bug
- Watertight concrete requires proper joint design.



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## Thank you....



... stay dry!



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## Sika - leading the technology edge



QUESTIONS?

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