IPA®

Systeme für Bautenschutz und Bausanierung

IPANEX®

The Decision for High Performance Concrete

Time Tested
for the 21st Century

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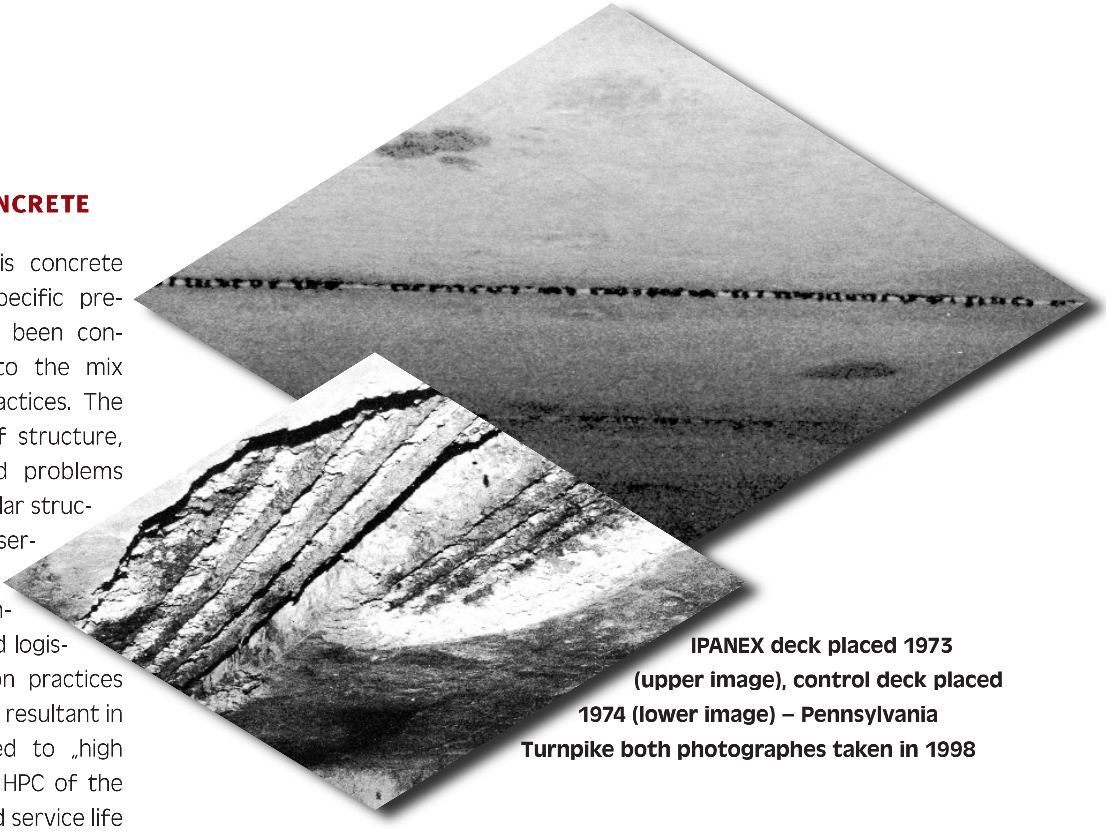


IPANEX deck placed 1973 (upper image), control deck placed 1974 (lower image) – Pennsylvania Turnpike both photographes taken in 1998

High Performance Concrete

High performance concrete is concrete designed and placed with specific predetermined objectives having been considered and incorporated into the mix design, placing and curing practices. The considerations include type of structure, environmental exposure, and problems commonly associated with similar structures previously built and observed over time. Cement and aggregates available to the construction site, admixtures, field logistics, weather and construction practices are all important factors to the resultant in place HPC. HPC is not limited to „high strength" as often perceived. HPC of the 21st century has an anticipated service life significantly greater than similar existing structures considered. HPC of the 21st century will have physical properties tailored to the particular needs of each project.

Benefits

- Track Record Since 1972
- Creates Watertight Mass
- Eliminates Membrane
- Reduces Alkali Silica Reaction
- Excellent Freeze/Thaw Resistance
- Reduces Efflorescence
- Inorganic
- Characteristics Unchanged Over Time
- Increased Resistance to Chloride Ion Penetration
- Cannot Wear Off Like a Coating
- Cost Effective
- Improved Durability
- Protects Reinforcing Steel
- Contractor Friendly

Ipanex Modified High Performance Concrete

IPANEX modified high performance concrete may be specified with confidence in the following applications:

- Below grade foundation walls and slabs, water parks, water storage tanks, swimming pools, reservoirs or other locations where impermeability of water under hydrostatic pressure is critical.
- Parking garages, bridges and other structures where electrochemical corrosion of reinforcing steel and freeze thaw cycles are anticipated.
- Industrial, chemical and treatment plants – to provide optimum concrete substrate conditions for areas known to be in direct contact with aggressive chemicals -those areas where corrosion resistant coatings must be specified.

Physical Properties (Typical)

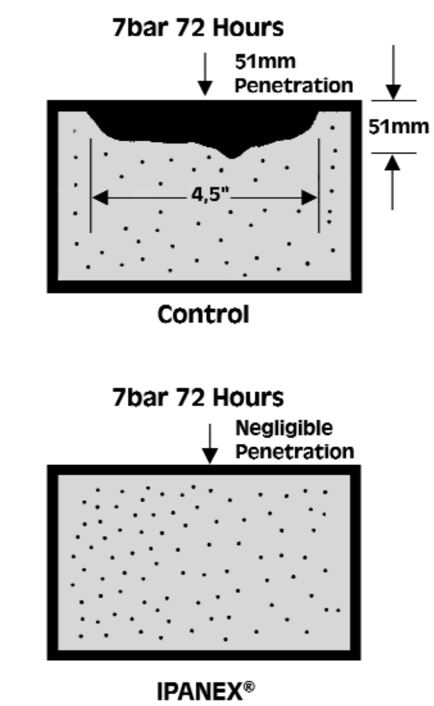
- Compressive Strength 108% of control (ASTM C 39)
- Freeze Thaw Durability 101% of control at 300 cycles Durability factor 98 (AASHTOT161)
- Flexural Strength 102% of control (ASTM C 78)
- Length Change 26% less than control (ASTM C 157)
- Heat of Hydration 13% less than control (ASTM C 186)
- Expansion due to Alkali Silica Reaction 47% less than control (ASTM C441)
- Bond Strength Comparison 105% of control (ASTM C 234)

Typical Applications

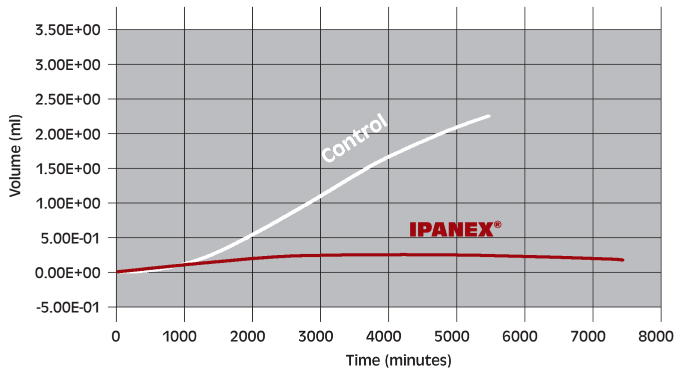
• Parking Structures • Below Grade Walls and Floors • Access Tunnels and Subway Systems • Bridges • Water and Sewage Treatment Plants • Dams and Power Plants • Swimming Pools and Water Parks • Water Containment Vessels • Precast and Prestressed Units

Ipanex-Integrally watertight Concrete

Ipanex is a chloride free, water based inorganic complex alkaline earth silicate. It reacts chemically with portland cement to density the paste content of portland cement concrete, reducing the permeability and ingress of chlorides from deicing chemicals, sea water and salt spray as determined by test methods AASHTO T 259 and T 260. The addition of this admixture enhances workability, physical properties, watertightness (CRD C 48) and has little effect on set time (ASTM C 403). This admixture has been used in combination with other admixtures (ASTM C 494), fly ash (ASTM C 618), silica fume (ASTM C 1240), ground granulated blast-furnace slag (ASTM C 989), Type K Cement (ASTM C 878), and air-entraining admixtures (ASTM C 260). Dosage of 0,9L per 100 kg of cement (ASTM C 150) are normally specified. Ipanex can be added at the batch plant or jobsite.



Water Permeabilitity Control vs. IPANEX



Permeability and Chloride Ion Penetration of Ipanex Concrete

1. AASHTO Designation: T259-78 Resistance of Concrete to Chloride Ion Penetration; AASHTO Designation: T 260-78 Sampling and Testing for Total Chloride Ion in Concrete. These tests involve the ponding of a 3% sodium chloride solution 14mm deep for 90 days. Samples are then taken from depths of 1,6 to 14mm and 14 mm to 28mm. The average concentration of chloride ion is then determined. Concentrations at these two levels are compared from slabs with and without IPANEX.
When IPANEX was added to concrete, chloride ion penetration was reduced by 23% at the 1,6 to 14mm depth and 75% at 14 mm to 28mm depth for 90 days. Samples are then taken from depths of 1,6 to 14mm depth. This test was developed to measure resistance to penetration by saltwater into concrete.
2. CRD Designation: CRD-C 48-55 (Modified) Method of Test for Water Permeability of Concrete. The test was conducted to compare the permeability of IPANEX Concrete to control concrete. 152mm diameter cylinders were cast using a six sack 28N/mm^2 mix design. The tops of the concrete cylinders were exposed to a point source of blue dyed water at a pressure of 7bar for a period of 72 hours. The cylinders were then split down the middle and inspected. The procedure was repeated. The following results were obtained.

Penetration

Test No.	Control	Ipanex	Reduction
1	2" (50.8mm)	1/2" (12.7mm)	75%
2	1 3/4" (44.4mm)	1/8" (3.2mm)	93%

Middle 84%

When IPANEX was added to concrete the depth of penetration by water was reduced by 84%.
However, the volume of concrete penetrated by the dyed water was reduced by more than 98%.

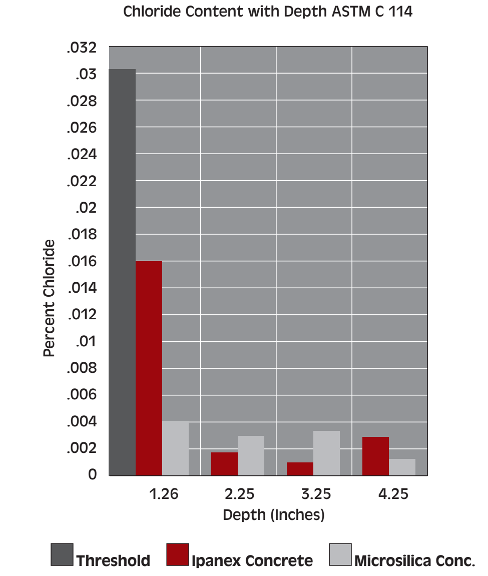
Macrocell Corrosion Test

Ipanex Concrete compared to Microsilica Concrete

Concrete specimens with identical mix designs, using the same aggregates, cement and water are fabricated under controlled conditions. The specimens are 305mm x 305mm x 178mm thick reinforced concrete slabs. The NaCl solution is ponded on the slabs continuously for four days. After four days, the solution is vacuumed off and the slabs are rinsed and maintained at a constant temperature of 100°F for three days. This repeating cycle of ponding with salt water and air drying.

When IPANEX and microsilica concretes were compared for forty eight weeks. Neither concrete mix showed test data that exceeded established corrosion thresholds. This was supported by demolition and inspection at the end of the test. No corrosion could be determined by visual inspection.

Macrocell Corrosion Test (SCAT)



If your requirements for High Performance Concrete involve: Waterproofing • Reduction of Corrosion of Steel • Freeze Thaw Durability • Optimum Concrete Substrates. Contact: Engineering Department – for information about IPANEX Modified HPC.

The most critical decisions in the design and construction of many structures relate to proportioning and placing durable concrete. Proven past performance may be the most important factor in assisting decision makers as they proceed today with design of concrete structures that will serve the publics needs well into the 21st century. For the past quarter century, IPA has been building and documenting a track record that enables us to assist todays decision makers with the design and placement of Ipanex Modified High Performance Concrete.

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How does IPANEX work?

Ipanex reacts to form insoluble crystals which density the cement paste, by precipitating into the pore structure and capillaries. The pore structure in Ipanex Concrete, as compared to control concrete, differs in the following way: pores are smaller and more evenly spaced throughout the Ipanex cement paste. This greatly reduces the tendency for pores to link together and form a pathway for water to enter. The above, combined with the reduction of chloride ion penetration and water permeability, preserves the concretes positive protective environment for the reinforcing steel.

Independent field and laboratory testing has demonstrated the durability of Ipanex treated concrete is substantially increased, including physical testing of highway bridge structures incorporating this admixture that were built in 1973 and have been subjected to more than two decades of environmental exposure, including application of deicing salts.

A bibliography of test reports, state, county and city approvals is available upon request.