

## **CHEMICAL RESISTANCE**

### ***ASTM C 267-77 “Chemical Resistance of Mortars”, Pacific Testing Labs, Seattle, USA***

*CHEM-100*

Xypex-treated cylinders and untreated cylinders were exposed to hydrochloric acid, caustic soda, toluene, mineral oil, ethylene glycol, pool chlorine and brake fluid and other chemicals. Results indicated that chemical exposure did not have any detrimental effects on the Xypex coating. Following chemical exposure, the Xypex treated specimens had measured an average 17% higher compressive strength over the untreated control samples.

### ***“Evaluation of Resistance to Acid Attack”, Japan Atomic Energy Research Institute, Tokyo, Japan***

*CHEM-101*

Xypex treated samples and untreated samples were subjected to a 5% H<sub>2</sub>SO<sub>4</sub> solution for 100 days. A measurement of the “corrosion ratio” (ie. ratio of final to initial mass) for the treated sample was 11.7%, while the untreated sample was 21.0%.

### ***IWATE University Technical Report “Resistance to Acid Attack” Morioka, Japan***

*CHEM-102*

Xypex Concentrate treated mortar and untreated mortar were measured for acid resistance after exposure to a 5% H<sub>2</sub>SO<sub>4</sub> solution for 100 days. Xypex suppressed concrete erosion to 1/8 of the reference samples.

### ***“Chemical Durability Test”, C.R.S. (Central Research Laboratory), Tokyo, Japan***

*CHEM-103*

Concrete mortar samples containing 5% Xypex Admix were tested against containing other admixtures, and untreated control samples to determine resistance to corrosion (ie. mass loss) and deterioration caused by contact with aggressive chemicals. All samples were soaked in a 5% sulfuric acid solution at 20° C for six months. Various evaluations and measurements were assessed every month during the test period, including: visual comparison, relative dynamic modulus of elasticity, change in length, weight and flexural rigidity. Although the Xypex Admix sample was subjected to acid conditions well outside its published range, the results found that Xypex had the best performance among the samples tested.

***“Sulfuric Acid Resistance Test”, Aviles Engineering Corporation, Houston, USA***

*CHEM-104*

Concrete samples containing Xypex Admix at different dosage rates (3%, 5% and 7%) were tested against untreated control samples for sulfuric acid resistance. After immersion in the sulfuric acid, each sample was tested for weight loss on a daily basis until a weight loss of 50% was obtained. The weight loss of the samples containing Xypex Admix was significantly lower than the control samples.

***“Sulphate Resistance Test” Taywood Engineering Ltd., Perth, Australia***

*CHEM-105*

Xypex Admix-treated concrete samples were immersed in an ammonium-sulphate solution and tested for “resistance in a harsh environment”. The performance of the Xypex-Crystalline-Technology was compared with five other concretes, including one containing a sulphate-resistant cement and one containing silica fume. Each of the test samples was cured for seven days and then placed in an ammonium-sulphate solution (132 g/l) for 180 days. The rate of deterioration was determined by measuring weight loss and length change (bulk expansion) on a weekly basis. The Xypex crystalline technology substantially improved concrete performance as compared to the reference concrete(s) and in particular provided the highest level of protection as measured by lowest relative length gain.

***“Evaluation of Chloride Ion Penetration into Concrete” Mahaffey Associates Pty. Ltd, Rydalmere, Australia***

*CHEM-107*

Five concrete 150 mm cylinders containing the Xypex Admix were cast along with similar cylinders with no Admix and other cylinders with a pore blocking additive. All samples were exposed to a varied regime of exposure to a salt water bath. Samples were also tested for compressive strength, flexural strength and drying shrinkage. Samples from each of the cylinders were cycled in and out of salt water every 24 hours for 28 days, 90 days and 180 days immediately after casting. Other samples were water cured for 7 days then cycled in and out of salt water every 24 hours for 83 days. Other samples were water cured for 56 days then cycled in and out of salt water every 24 hours for 28 days (ie most common form of diffusion testing). Following immersion, each cylinder sample’s face was ground down to remove increments of 2 mm depth of concrete dust. The dust samples were then tested for chloride ion content.

Results of this chloride ion testing regime clearly indicate that the Xypex treated samples reduce the amount of chloride ion penetration significantly especially if concrete is allowed to cure for 7 days prior to immersion. Based on this regime the amount of chloride diffusion ( $\text{m}^2/\text{s} \times 10^{-12}$ ) was 11.1 for the untreated concrete sample, 16.4 for the concrete containing the pore blocker and 8.1 for the Xypex Admix sample.

***“Chloride Ion Penetration & Chloride Diffusion Analysis”, Building Research Centre (BRC), University of New South Wales, Sydney, Australia CHEM-108***

Precast concrete slabs containing Xypex Admix were exposed to a severe marine environment for four years, then were evaluated and tested for chloride ion penetration. A slab that had been manufactured at the same time, but had not been installed and therefore not exposed to the marine environment was used for comparison purposes. Visual observation indicated that the concrete pre-cast planks showed no signs of deterioration as a result of exposure to this harsh marine environment. Concrete powder samples were taken from each slab at four depths (5-15 mm, 15-25 mm, 25-35 mm & 35-45 mm). The powder samples were analyzed for chloride ion contents. Test results of the samples containing the Xypex Admix, showed that the chloride content was relatively low and drops rapidly with an increase in the slab depth. A “Half-Cell Potential Survey” was also performed and a contour map of the deck slab was undertaken to plot any pattern of surface corrosion on the slabs exposed to the marine environment. The results indicated a few minor spots of active corrosion reactions.