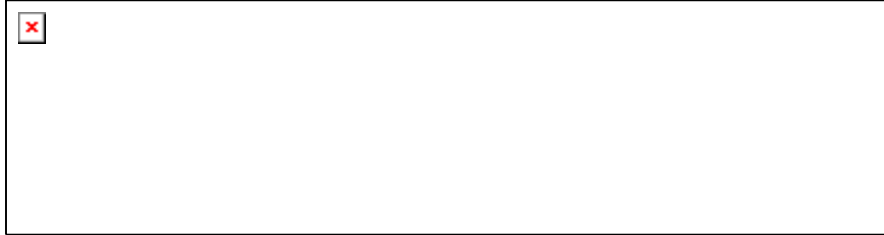


chemcial and resistance tests (1)



Client: ICS/Penetron International Ltd., C/o All Island Testing Labs.

Project: Information of Client

Subject: Laboratory Testing of Penetron Material for Chemical Resistance

Report No. **93-3981** Date **10/19/93**

At the request of the Client, laboratory tests were performed to determine the chemical resistance of Penetron treated concrete.

Experimental Design

The concrete used for the study had a design strength $f'c = 4000$ psi. The concrete mix proportions are presented on Attachment 1.

The concrete specimens used were saw-cut from 6 x 12 inch concrete cylinders. The specimens were 2 inches thick and 6 inches in diameter. At the time of the study, the concrete was 28 days old.

The Penetron material (which was received in powder form in a sealed bag) was mixed with water into a slurry. The ratios were:

- 2 parts Penetron
- 0.8 parts water

The slurry was then applied on all surfaces of the concrete specimens by brushing. After the final setting of Penetron the surfaces of the specimens were moistened and placed in a regular concrete curing room for 14 days at 73 OF and 100% relative humidity. At the end of 14 days, the specimens were removed from the curing room and placed in various chemical solutions which provided a wide range of pH levels and corrosive conditions.

Test Results

SAMPLE NO.	SAMPLE TYPE	TYPE OF TREATMENT	pH	OBSERVATIONS	
				7 DAY	28 DAY
1A	Penetron	Dilute Hcl	3	No Effect	No Effect

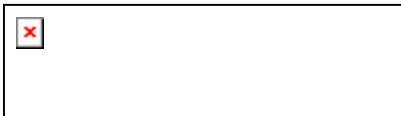
1B	Treated No Penetron	Dilute Hcl	3	No Effect	Surface Weathered
2A	Penetron Treated	Dilute H ₂ SO ₄	3	No Effect	No Effect
2B	No Penetron	Dilute H ₂ SO ₄	3	No Effect	Surface Weathered
3A	Penetron Treated	Rain Water	4	No Effect	No Effect
3B	No Penetron	Rain Water	4	No Effect	Surface Weathered
4A	Penetron Treated	CaCl ₂	7	No Effect	No Effect
4B	No Penetron	CaCl ₂	7	No Effect	Slight Effect
5A	Penetron Treated	NaOH	11	No Effect	No Effect
5B	No Penetron	NaOH	11	No Effect	No Effect

CONCLUSIONS

Based on these test results, the following conclusions were drawn:

1. The Penetron treated concrete was found to be resistant to acidic and alkaline conditions ranging between pH values of 3 to 11. Also, chloride containing solutions did not have any measurable effect on the Penetron concrete.

2. The untreated concrete (control samples) had surface weathering when exposed to pH of 3, rain water chlorides and sulfate solutions.



KS/smdcc: (1) Client
Doug Quick

ATTACHMENT I

CONCRETE MIX DESIGN USED FOR THE PENETRON TREATMENT TESTS

MATERIALS	AMOUNTS PER CUBIC YARD
Portland Cement, Sacks	6.0
Portland Cement, Lbs	564
*Sand, Lbs	1450
*Coarse Aggregate	1860
Water, Ga	36.3
Water, Lbs	302.4
W/C Ratio	0.54
Slump	4.0

Entrapped Air, %
(* SSD basis

1.8