

Concrete Scaling

SIDEWALK

CLOSED

Henry B. Prenger, P.E.



Surface Deterioration

- Pop Outs
- Mortar flaking
- Scaling

Pop Outs





Mortar Flaking



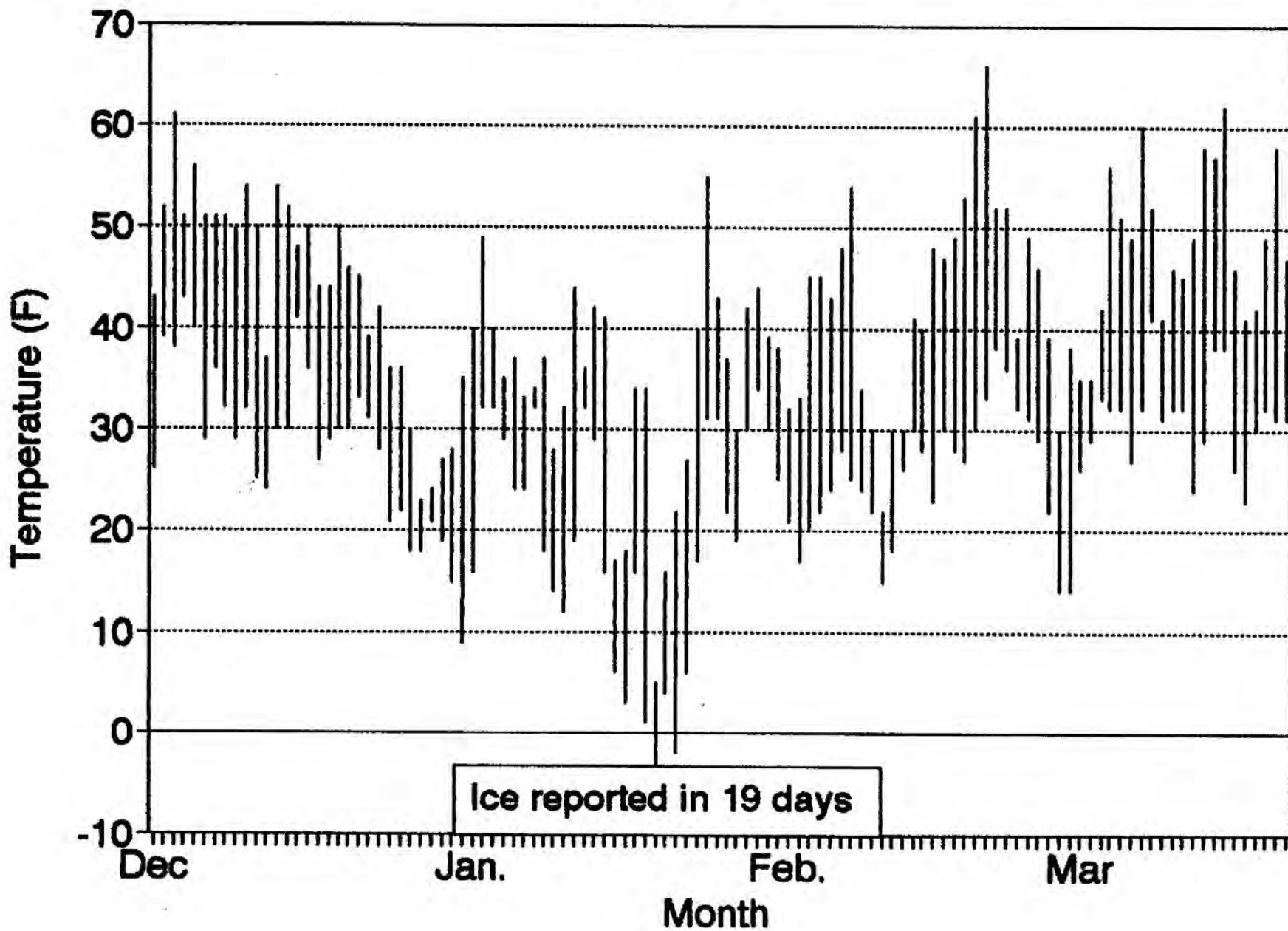
Factors Affecting Scaling

- Permeable and poor-quality concrete due to:
 - High water-cementitious material ratio
 - Excessive slump for prevailing job conditions
 - Overworking of wet concrete
 - Premature finishing operations
 - Inadequate curing
 - Low compressive strength at the surface
- Inadequate air content for concrete exposed to freeze and thawing
- Deicing Salts





Recorded Temperature 1993-94 High & Lows









I've been posting my letters in the dog poo box for TWO YEARS



DOIT BOX: Council workers put a bin nearby (see page 10) where Alf posted his letters

ALF, 91, CONFUSES DISPOSAL BIN FOR NEARBY POSTBOX

WITH about eight pensions, Alf Spence suffered from his local postman to send a card, he hoped he hadn't missed the last collection.

After he prepared the letter, through the door into a rooming property behind an old bus garage.

Shaming

Alf Spence, 91, of 10, St. James Street, Southport, Merseyside, said he had been shamed by the council when he was caught posting his letters in the dog waste bin.

By Neil Docherty

Alf Spence, 91, said he had been shamed by the council when he was caught posting his letters in the dog waste bin. He said he had been shamed by the council when he was caught posting his letters in the dog waste bin. He said he had been shamed by the council when he was caught posting his letters in the dog waste bin.

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Empty

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WANTED TRAINEE Sport JOURNO

Wanted: Trainee Sport Journalist. Must be aged 18-25, have a good command of English, and be able to write clearly and concisely. Applications should be sent to the Editor, The Daily Mirror, 20, Whitehall, London SW1A 2DY. Closing date: 15th August 2000.

For scaling resistance, you need:

- A good mix design (4000 psi / .45 wcr)
- Good plastic properties (slump and air)
- Proper inspection
- Good finishing practices
- Proper curing
- To seal the concrete
- To place concrete at the proper time of the year

Mix Design

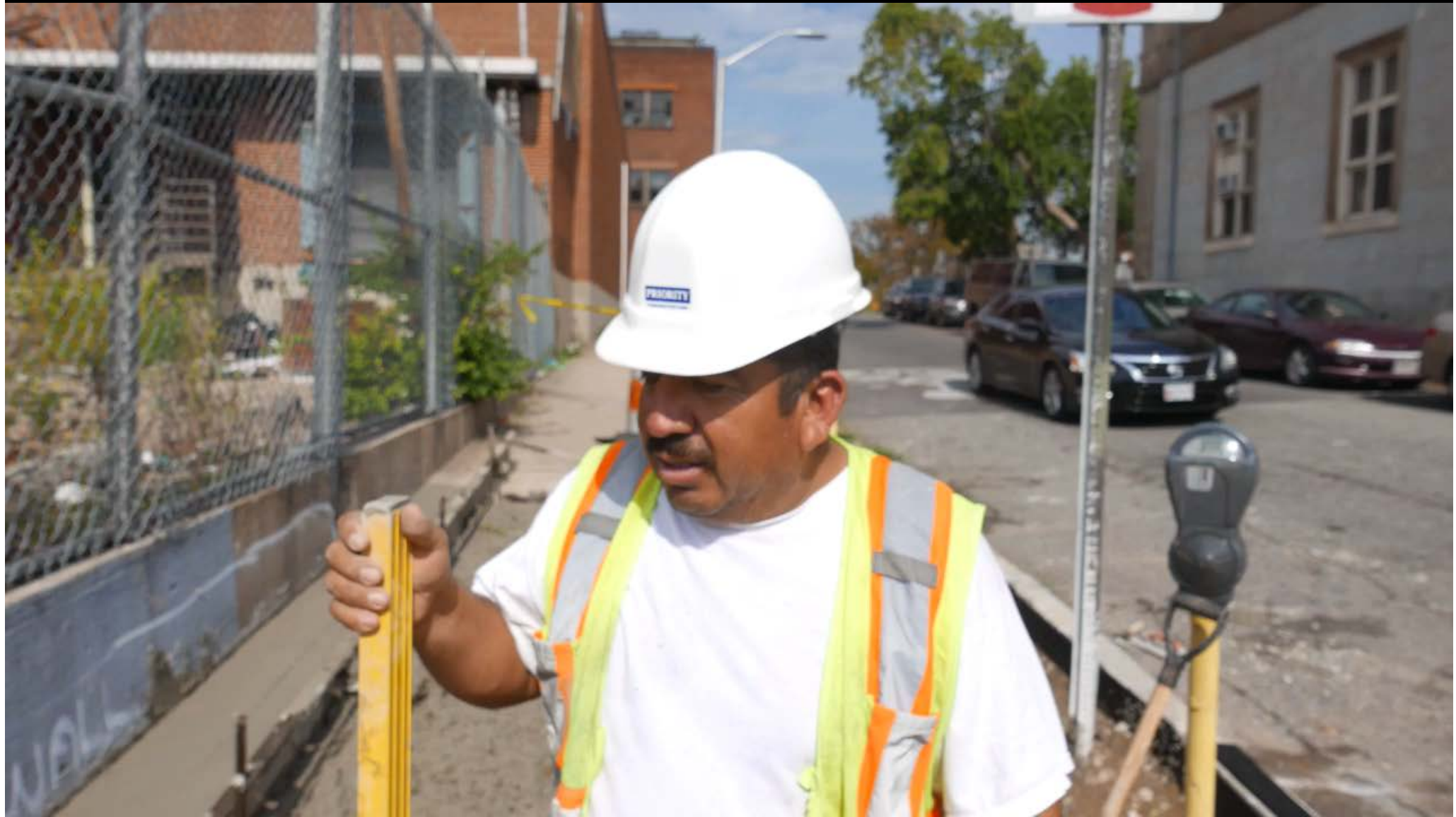
ACI 301

ACI 318

ACI 332

NRMCA

Suggested Mixture Design Modified Maryland SHA Mix 6	
Strength (psi)	4000
Wcr (max)	0.45
Cementitious Factor (lbs.)	615
Air (%)	5-8
Slump (in.)	3-5
Coarse Aggregate Size (ASTM C33)	57 / 67
Concrete Temperature (°F)	50-95
Max Slag Cement Replacement (%)	50
Min / Max Fly Ash Replacement (%)	15-25
Admixtures: Air Entraining, Normal Water Reducing, Retarding, Non-Chloride Accelerating, High Range Water Reducing	



Inspection



Slump and Air

























Sealing











Slag Cement, Fly Ash and De-Icing Salts



South Dakota
Department of Transportation
Office of Research



U.S. Department
of Transportation
Federal Highway
Administration

SD2002-01-X
TPF-5(042)-X



The Deleterious Chemical Effects of Concentrated Deicing Solutions on Portland Cement Concrete

Study SD2002-01
Executive Summary

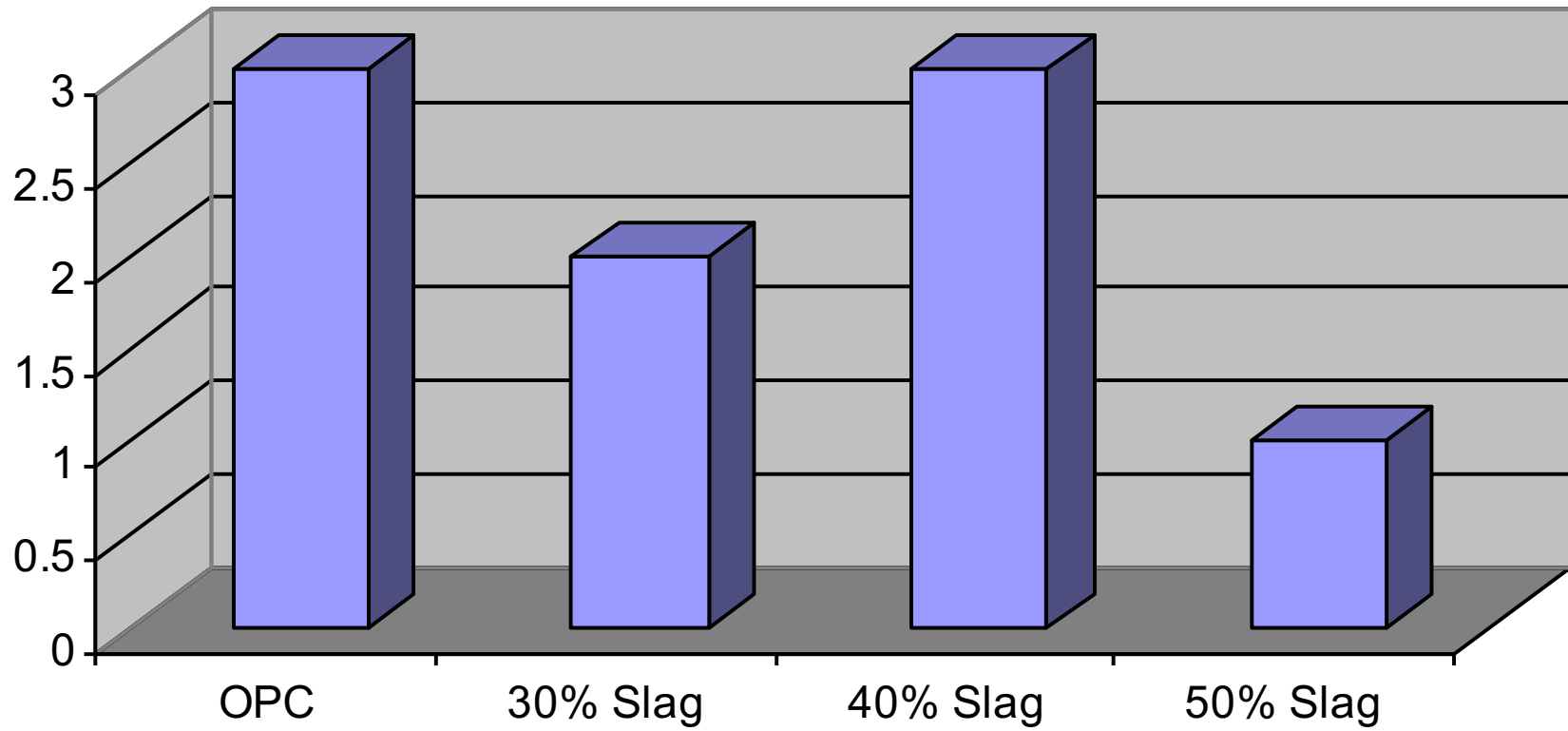
Prepared by
Michigan Tech Transportation Institute
1400 Townsend Drive
Houghton, MI

April 2008



De-Icer Scaling

ASTM 672













Inadequate Air Void System

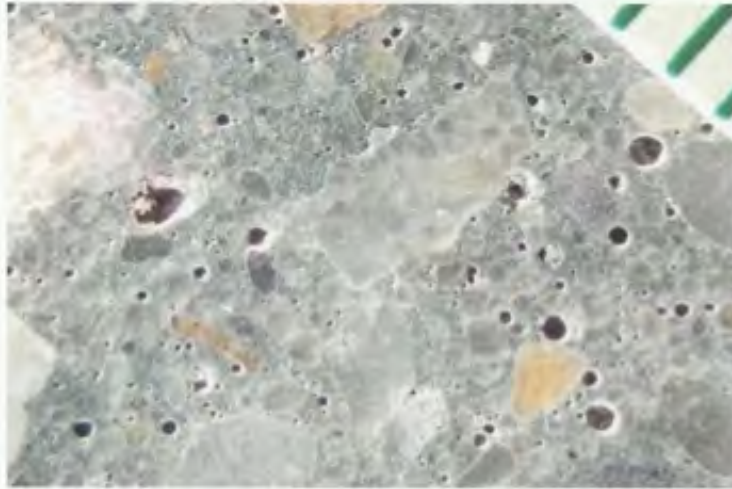
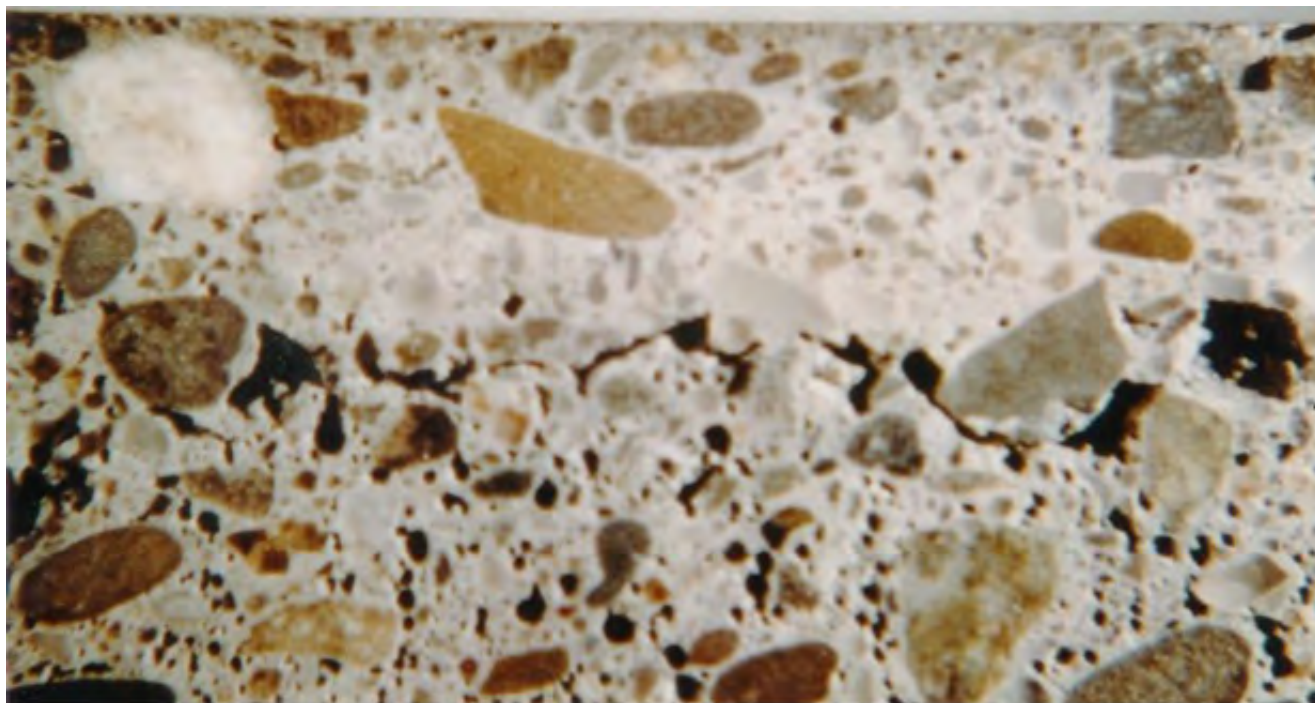
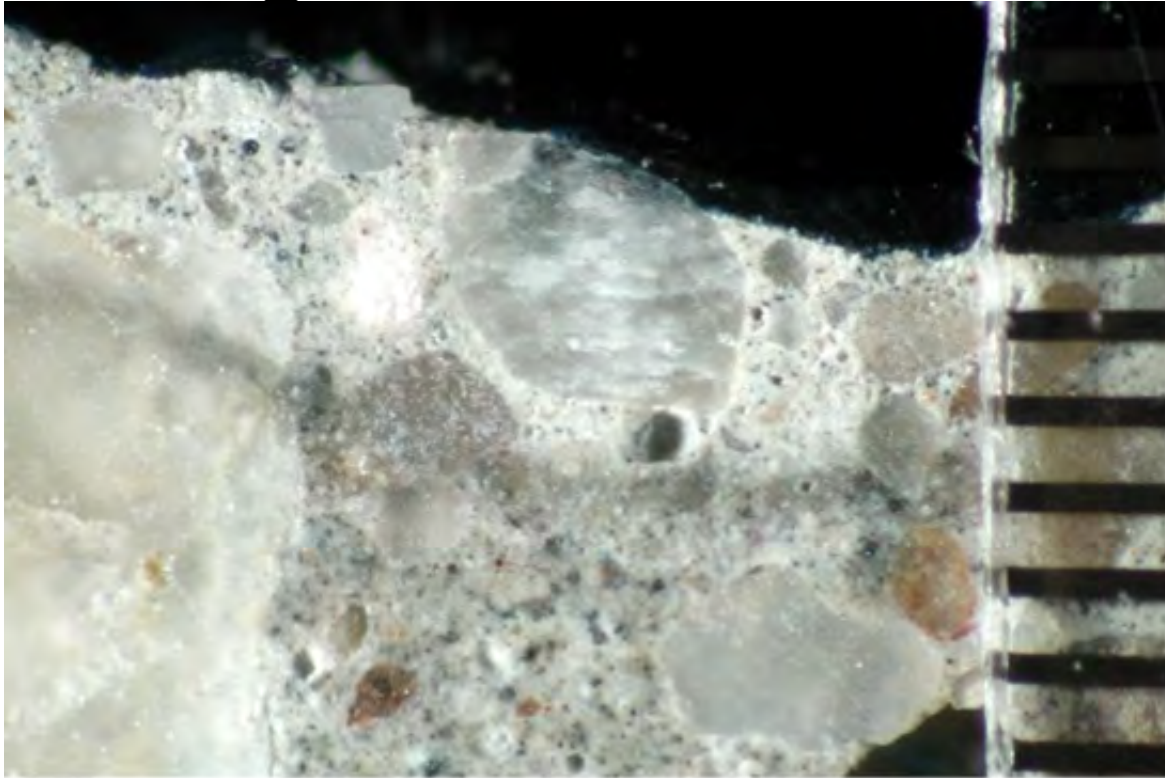


Fig. 3 Representative area of concrete in Core Sample M7OLS ASE 7/29 Lot 7959-B showing the air-void system; millimeter scale.

Bleed Water Finished into Surface



High WCR in Surface of Concrete



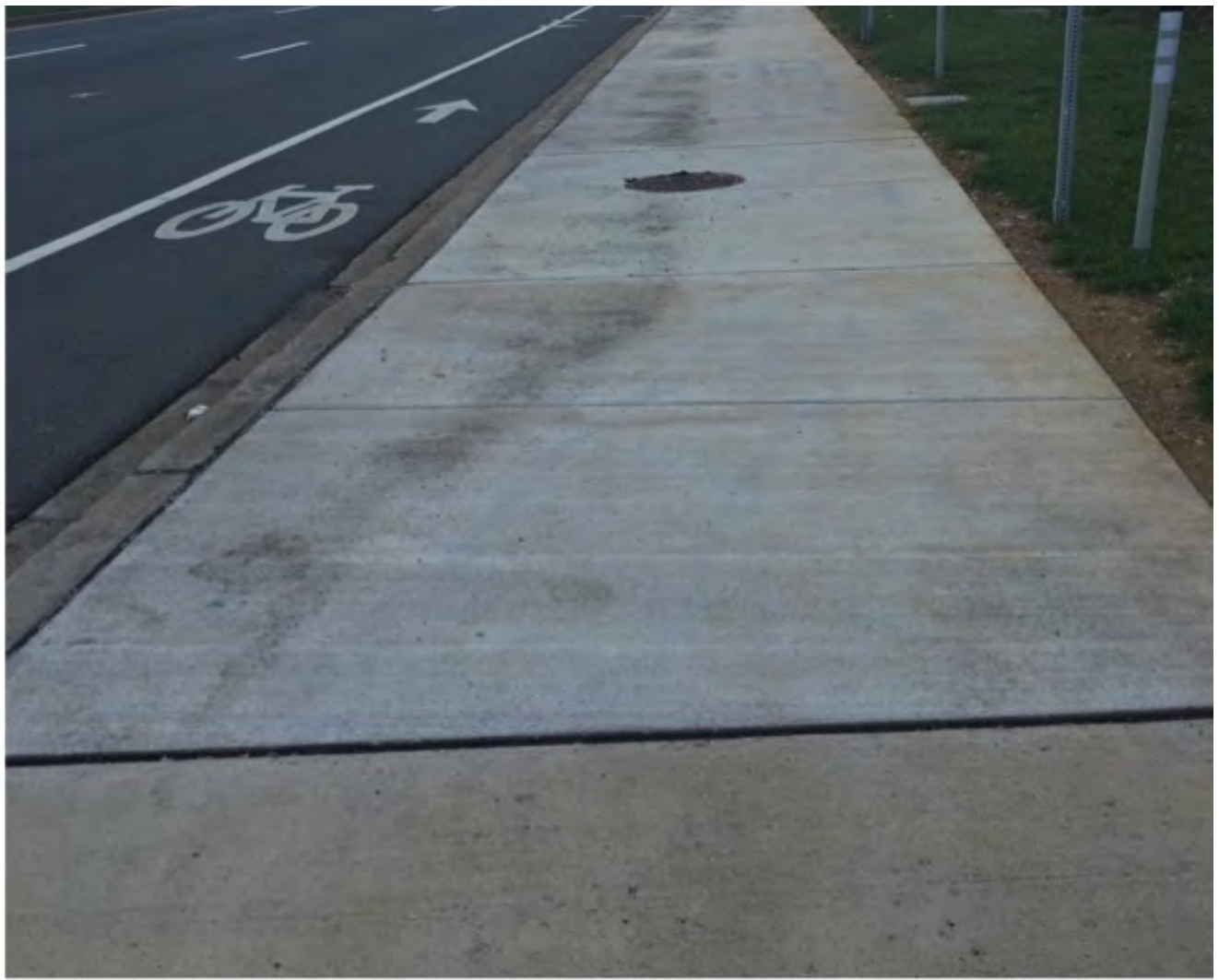
No Air in Top Surface











Where do we go from here?



Best Practices for Exterior Flatwork Finishing



ADMINISTERED BY THE NRMCA

Finishers



Inspectors



Deliverables

- Booklet in plain simple terms on important factors in finishing exterior concrete
- Keep it simple and focused on what causes scaling
- Straight forward test (one for finishers and one for inspectors)
- Should there be a prerequisite for years of experience
- Have a practical part where participants can see the effect of water on concrete
- Spanish and English





Safety



















Bleed Water and S









Jointing















Challenges

- Spanish translation
 - Work with finishers, utilize Spanish speakers in industry
- Finding suitable sites for practical
 - NRMCA
 - Partner with Ready Mix
 - Use actual sites
- Finding suitable sites for presentation and testing
- How many people on a crew need to be certified
- Losing certification for improper finishing (legal issues)

Thanks to:

- Swope and Associates (Sika)
- Bluegrass Materials
- Vulcan Materials
- LafargeHolcim
- Priority Construction



