Assessing Pour-Back Durability: Beyond Pull-off Testing

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THE OHIO STATE UNIVERSITY
Department of Civil, Environmental, and Geodetic Engineering

Structural Stewardship Laboratory Group

Research Objective

Investigate the effects of **surface preparation** and **material choice** on the **durability** of concrete-grout interfaces.

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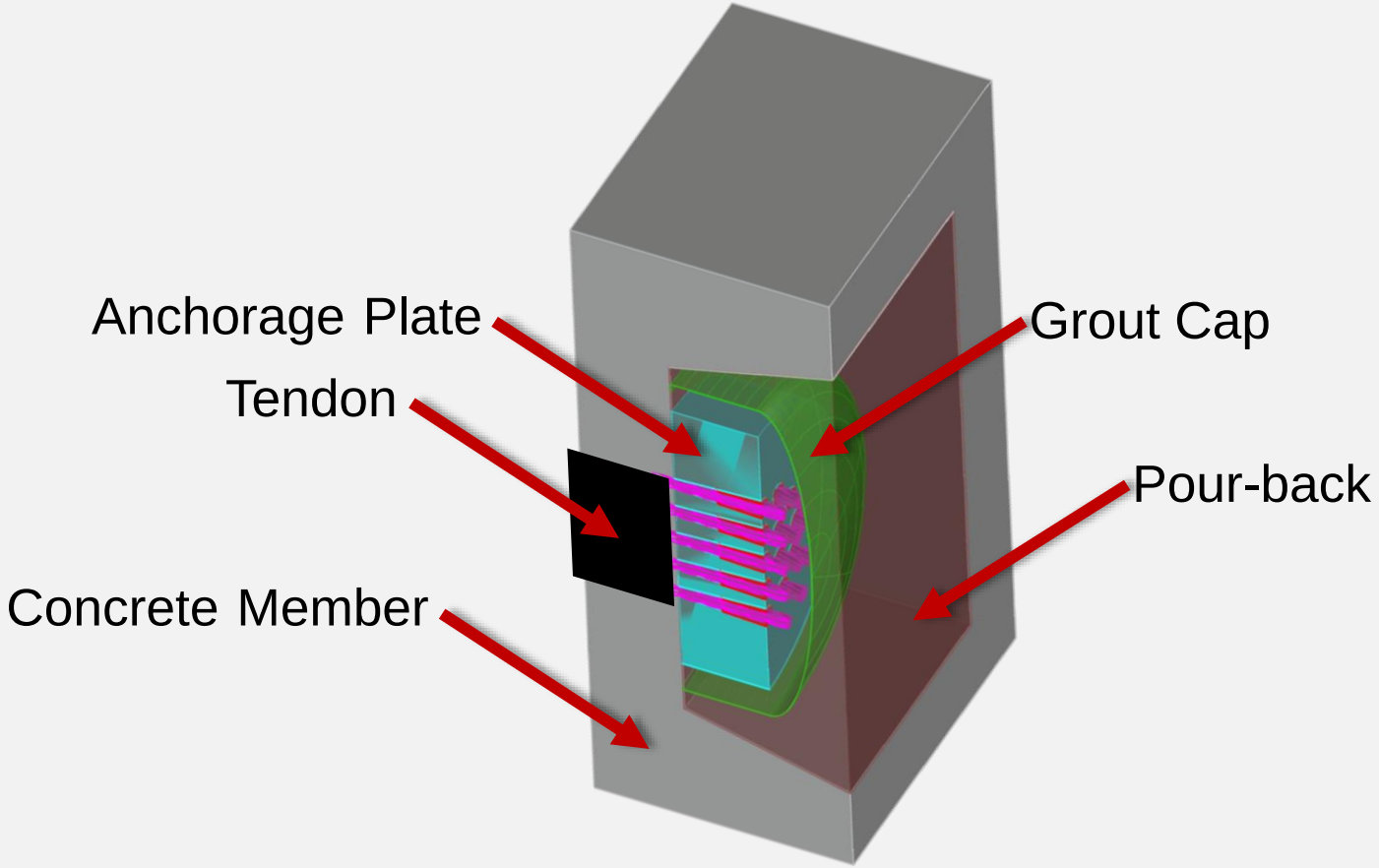

Post-Tensioning Anchorage Zone Cross-Section

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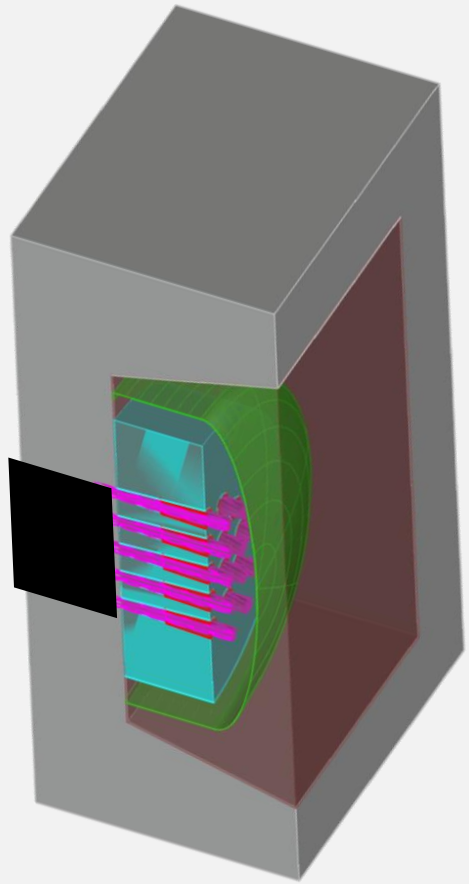

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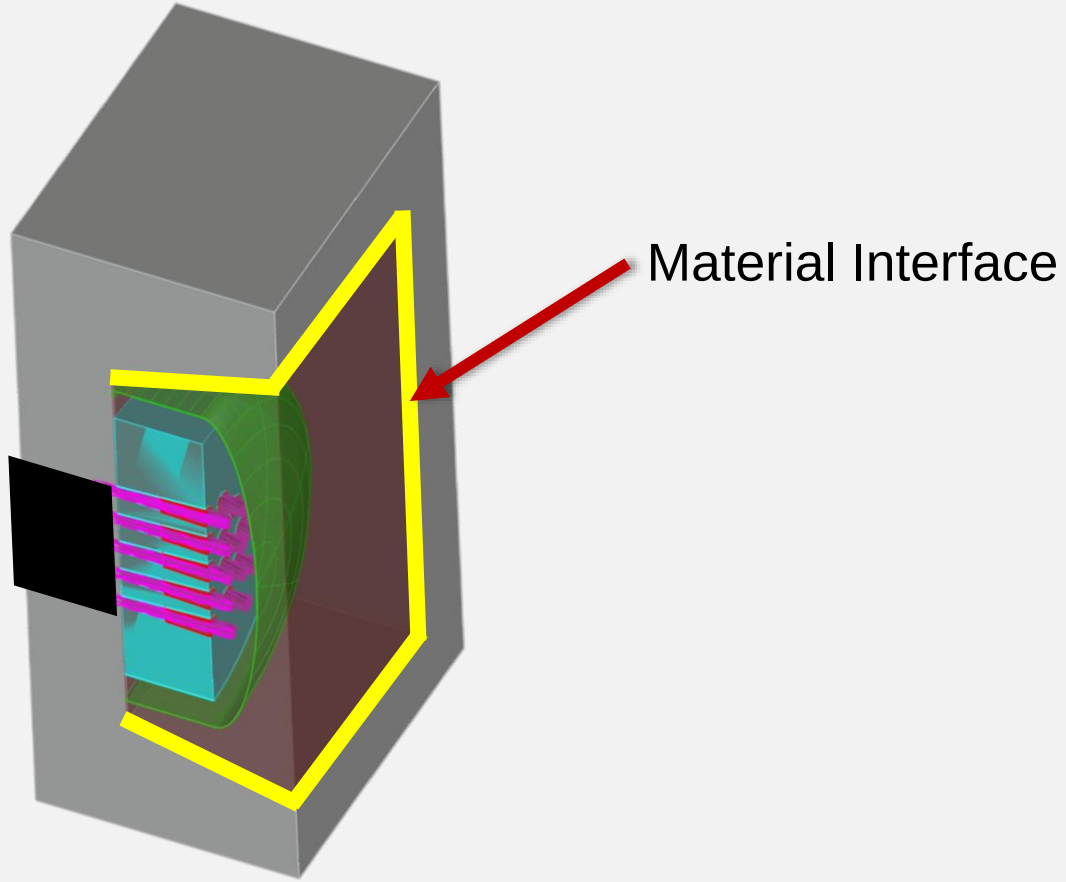


Post-Tensioning Anchorage Zone Cross-Section

Note:

Study framed from a post-tensioned concrete perspective, but the results could be applied anywhere material interfaces are used for corrosion protection in concrete structures

Defining Durability

Pour-back durability is a function of:

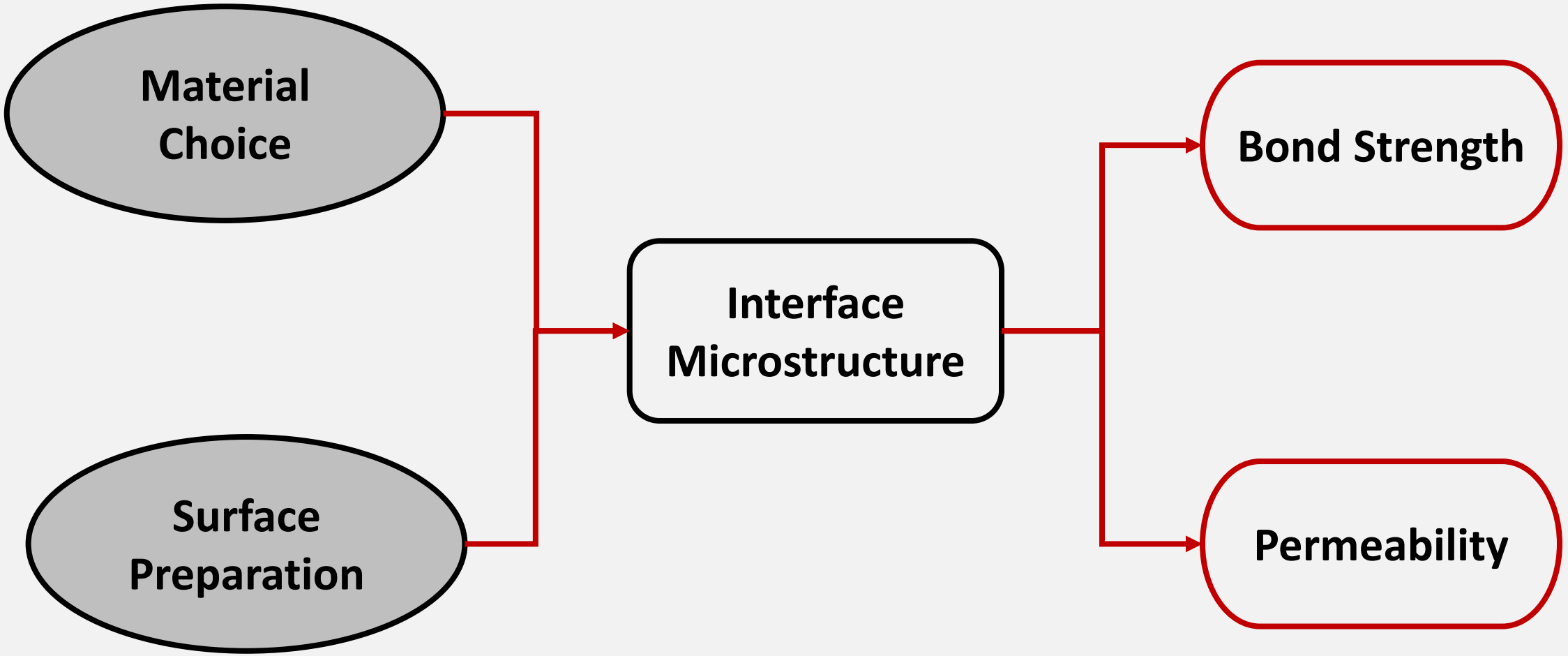
Dimensional Stability

Bond Strength

Permeability

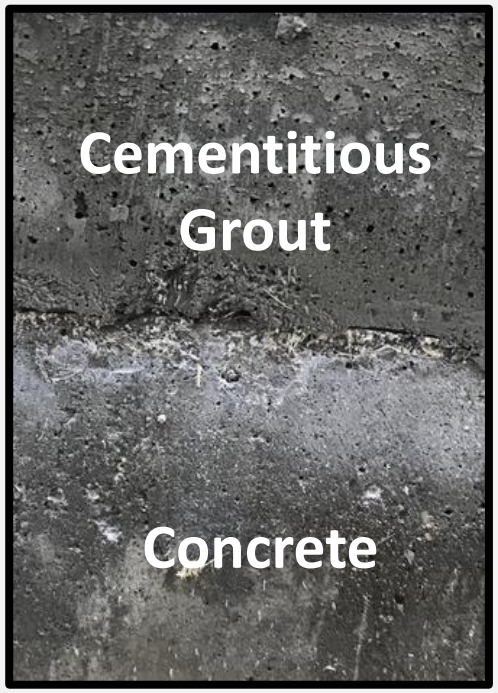
Defining Durability

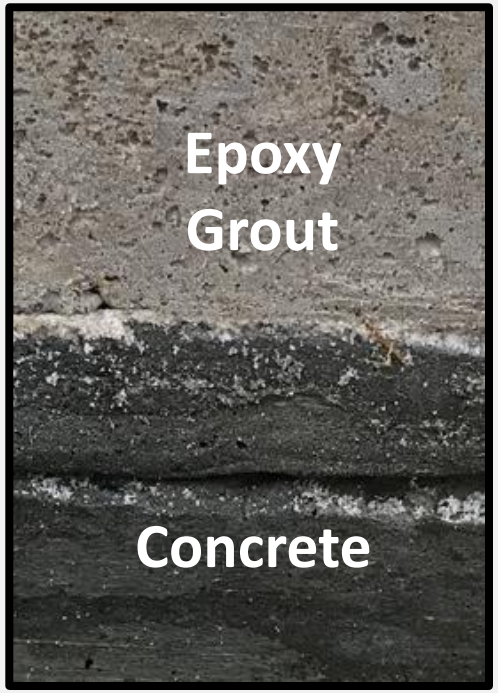
Defining Durability



Experimental Protocol

Material Choice





Surface Preparation

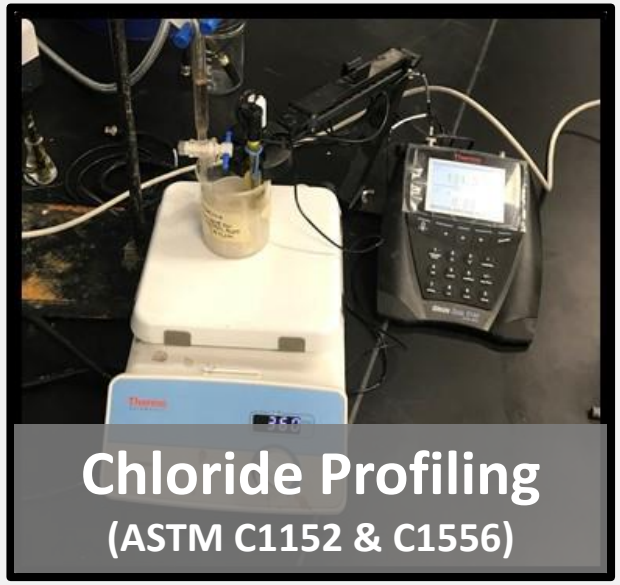
No Prep

Experimental Protocol

Bond Strength

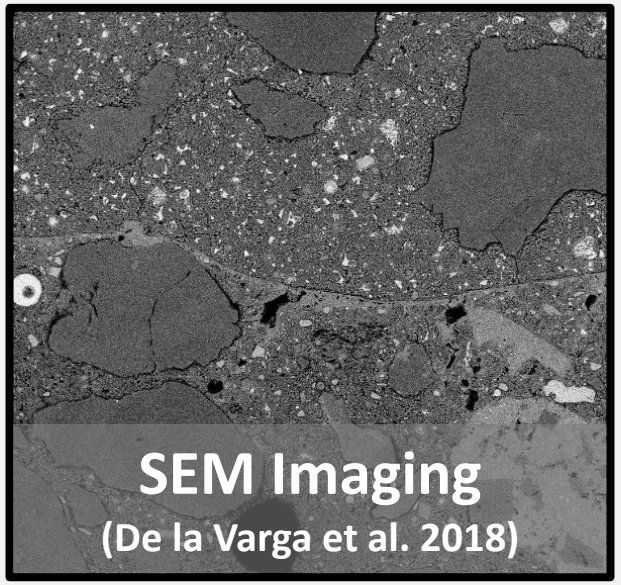
Pull-off test
(ASTM C1583)

Permeability



Chloride Profiling
(ASTM C1152 & C1556)

Interface Microstructure

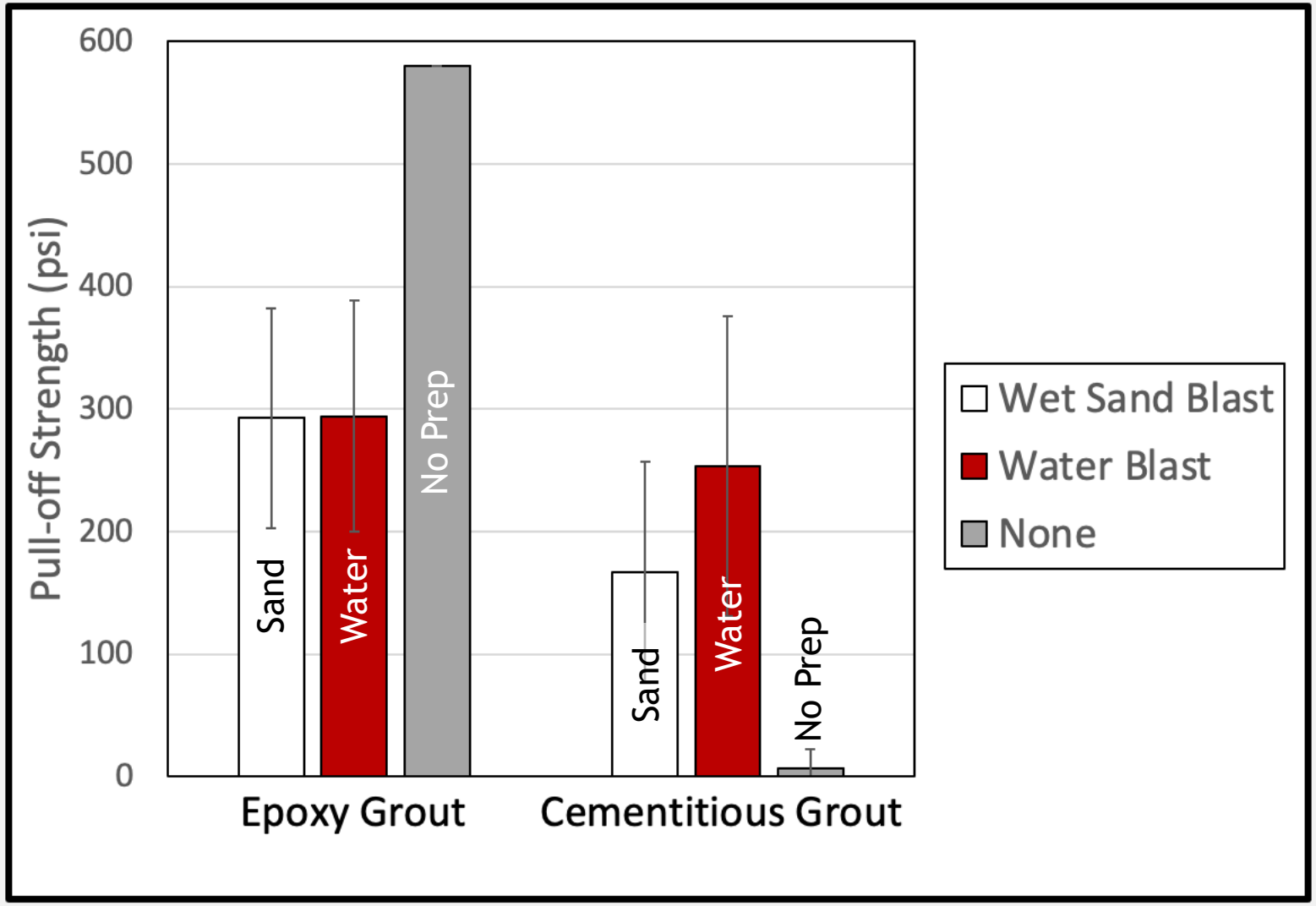


SEM Imaging
(De la Varga et al. 2018)

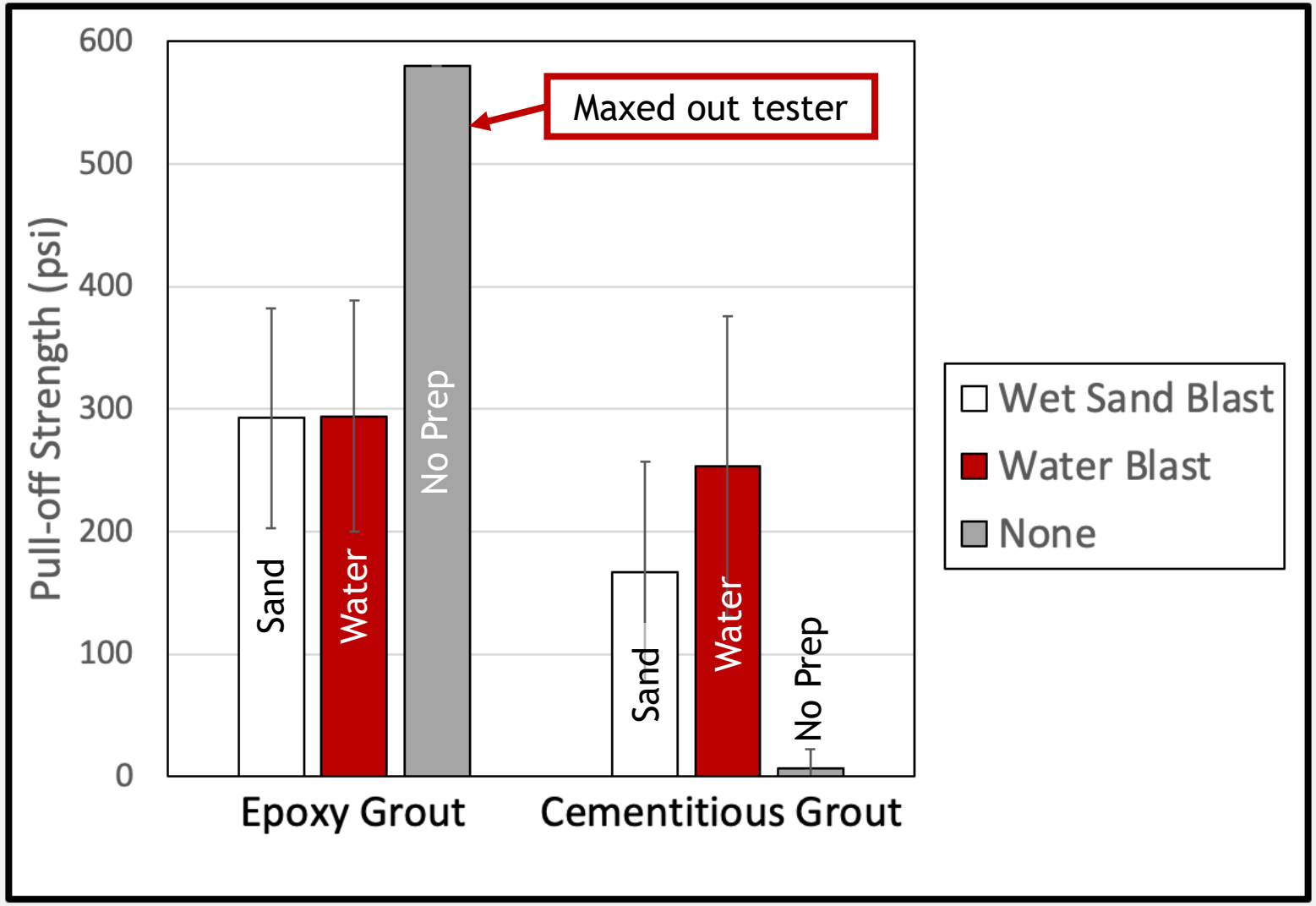
Initial Results

Testing is ongoing to validate initial data and provide a more comprehensive picture of interface behavior.

Initial Results – Bond Strength



Initial Results – Bond Strength



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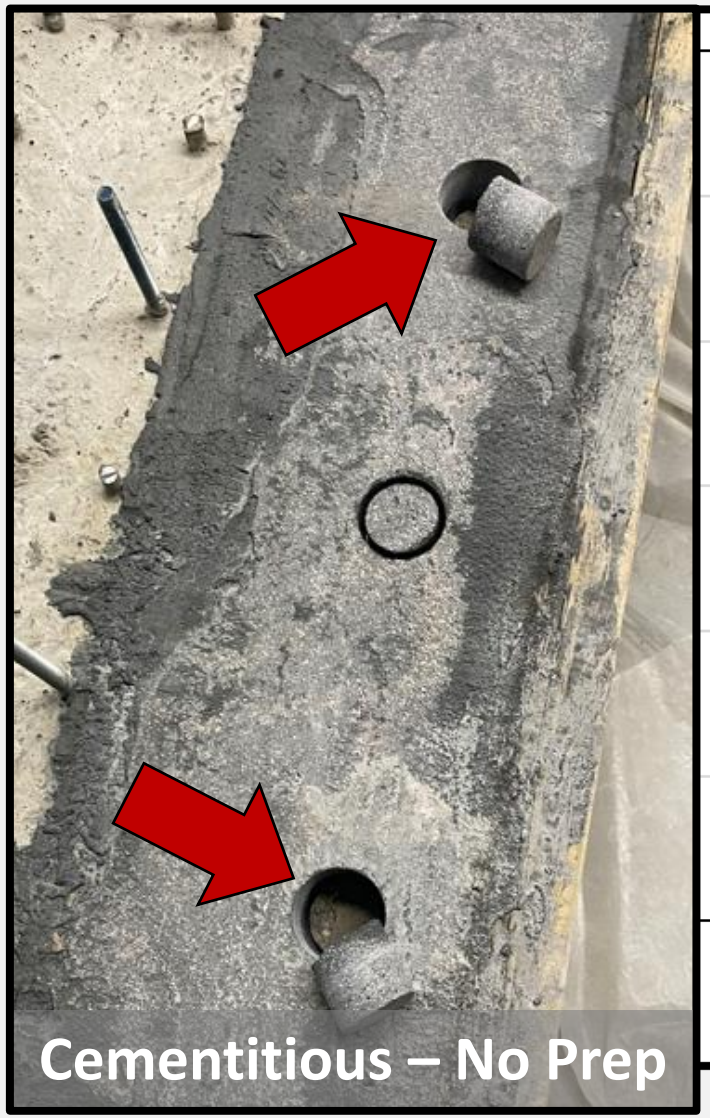
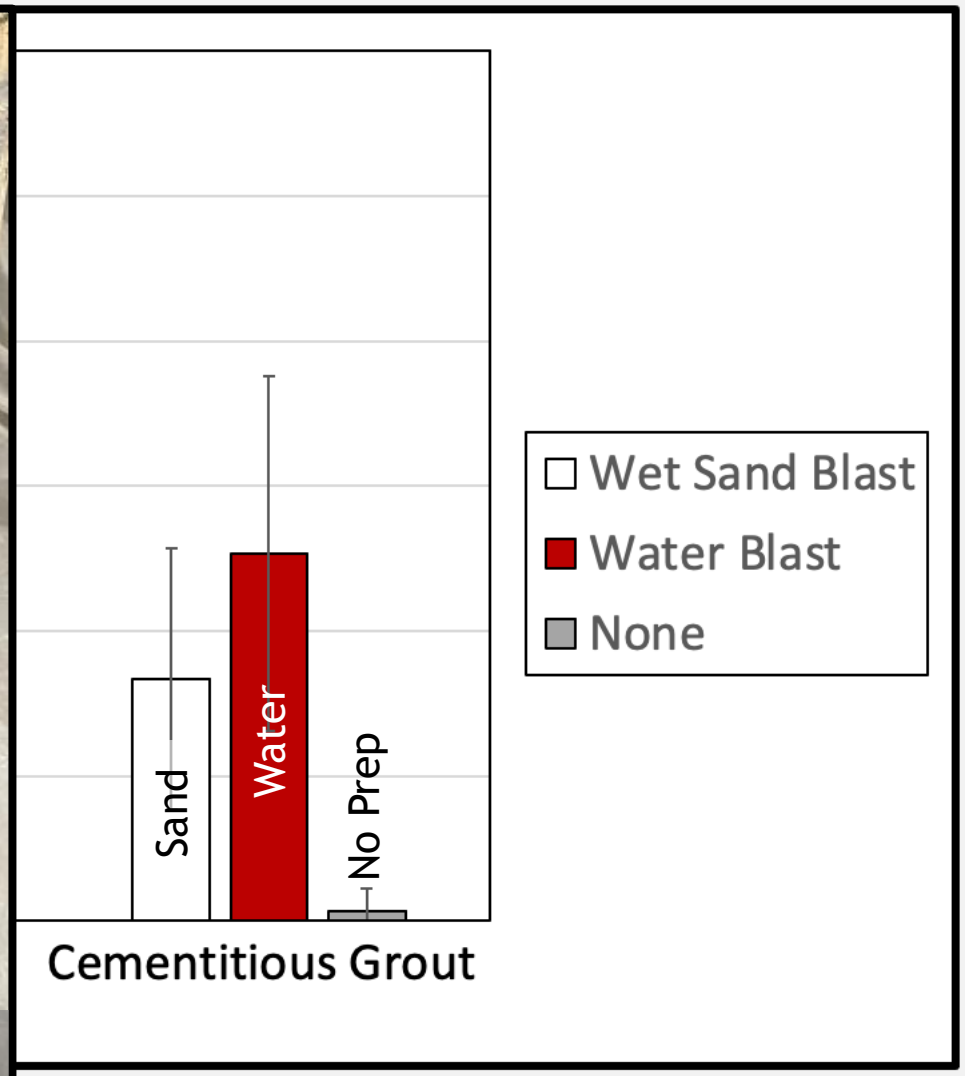
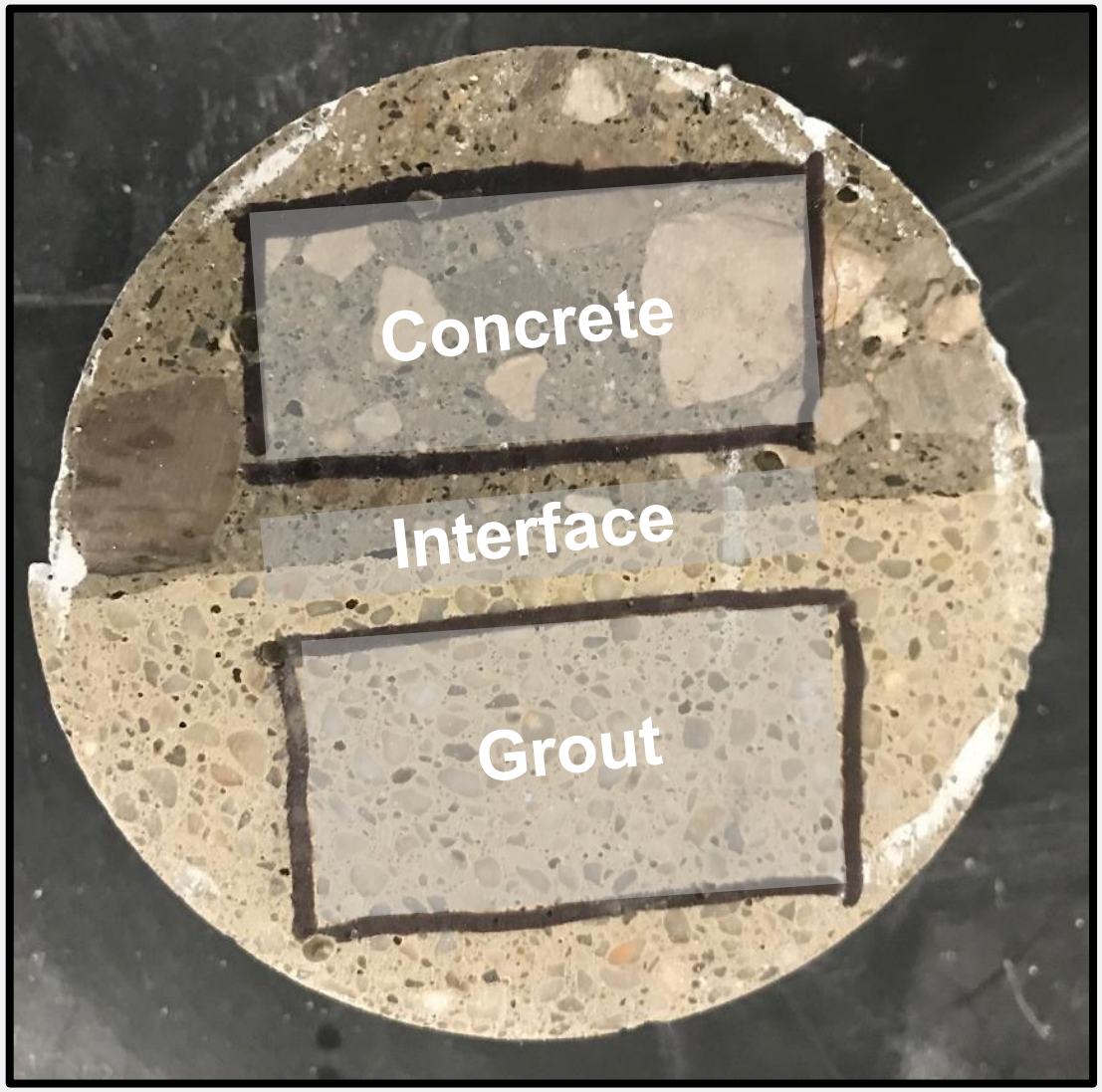
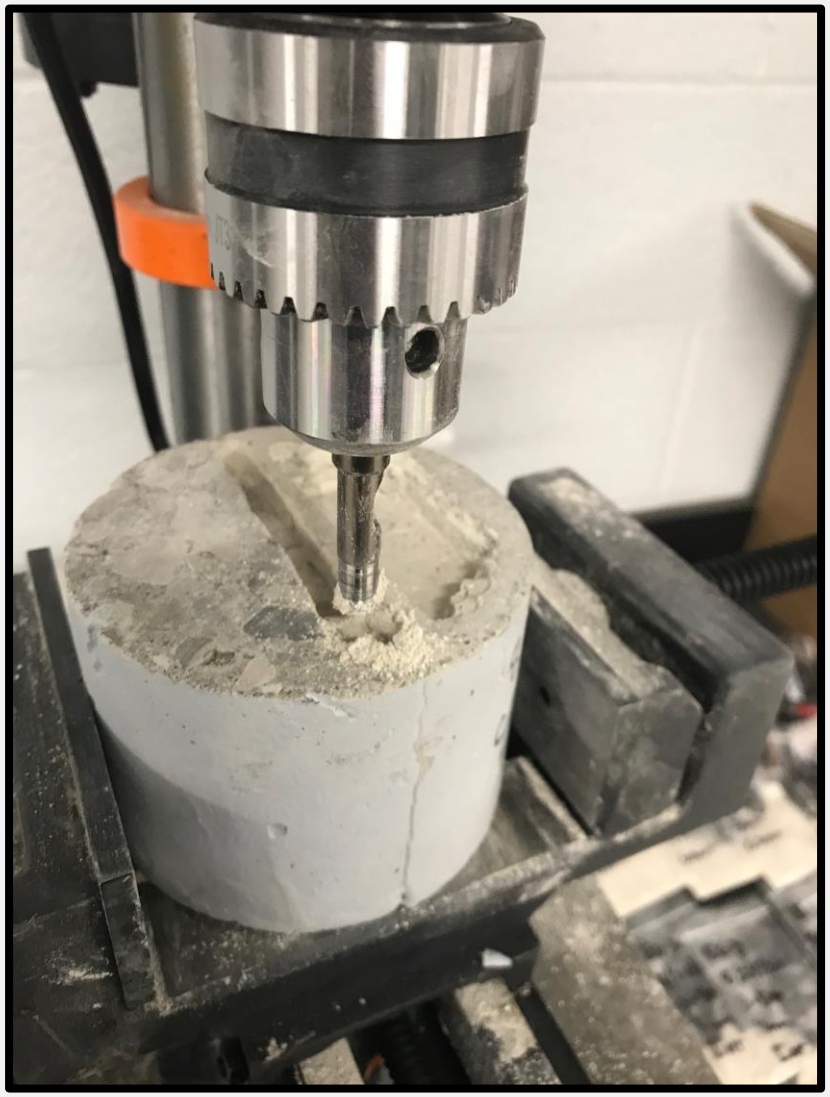




Initial Results – Chloride Profiling





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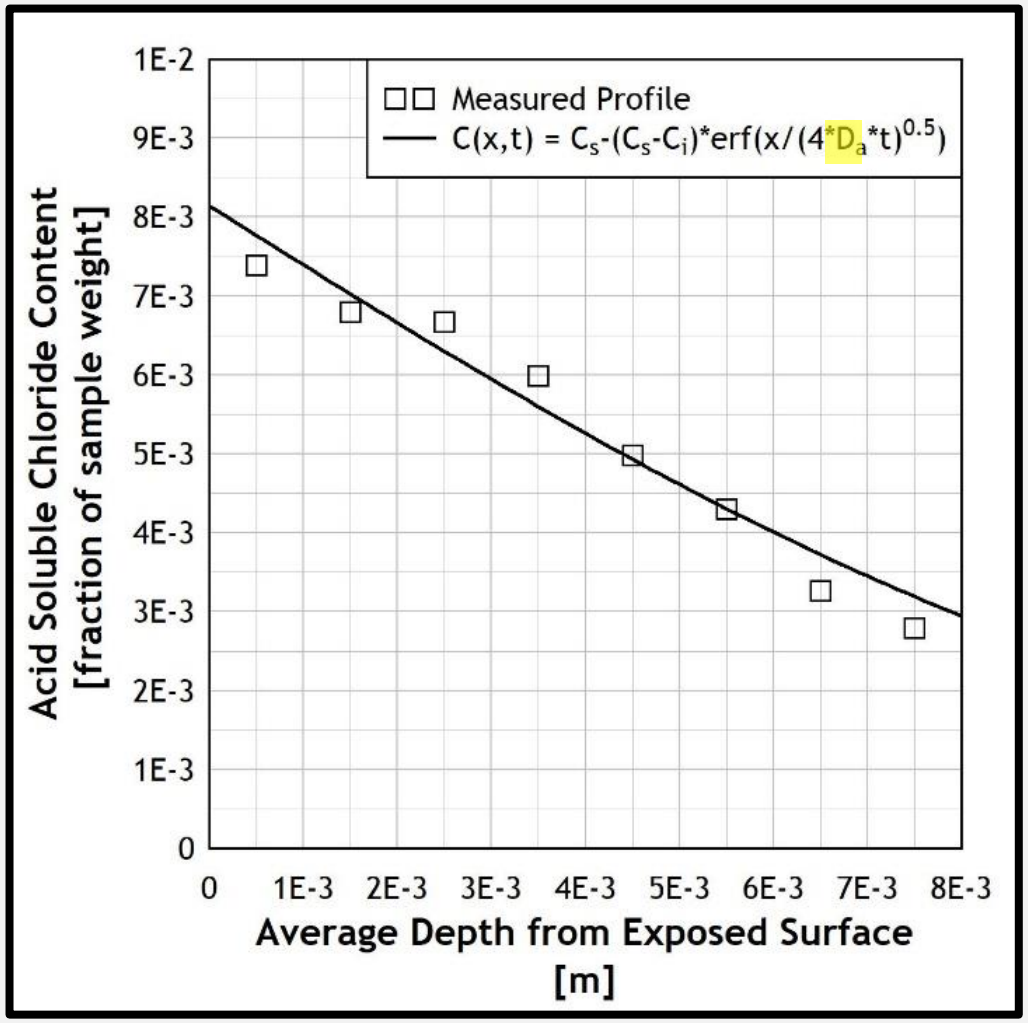


Chloride Profile of Cementitious Grout

C(x,t) = chloride content at depth 'x' at time 't'

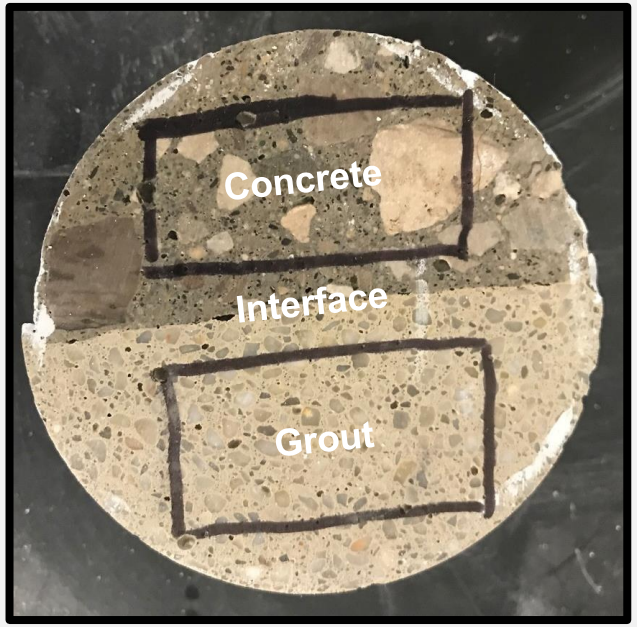
Cs = Chloride content at surface of specimen

Ci = Initial chloride content

x = depth from surface

Da = diffusion coefficient

t = time of exposure



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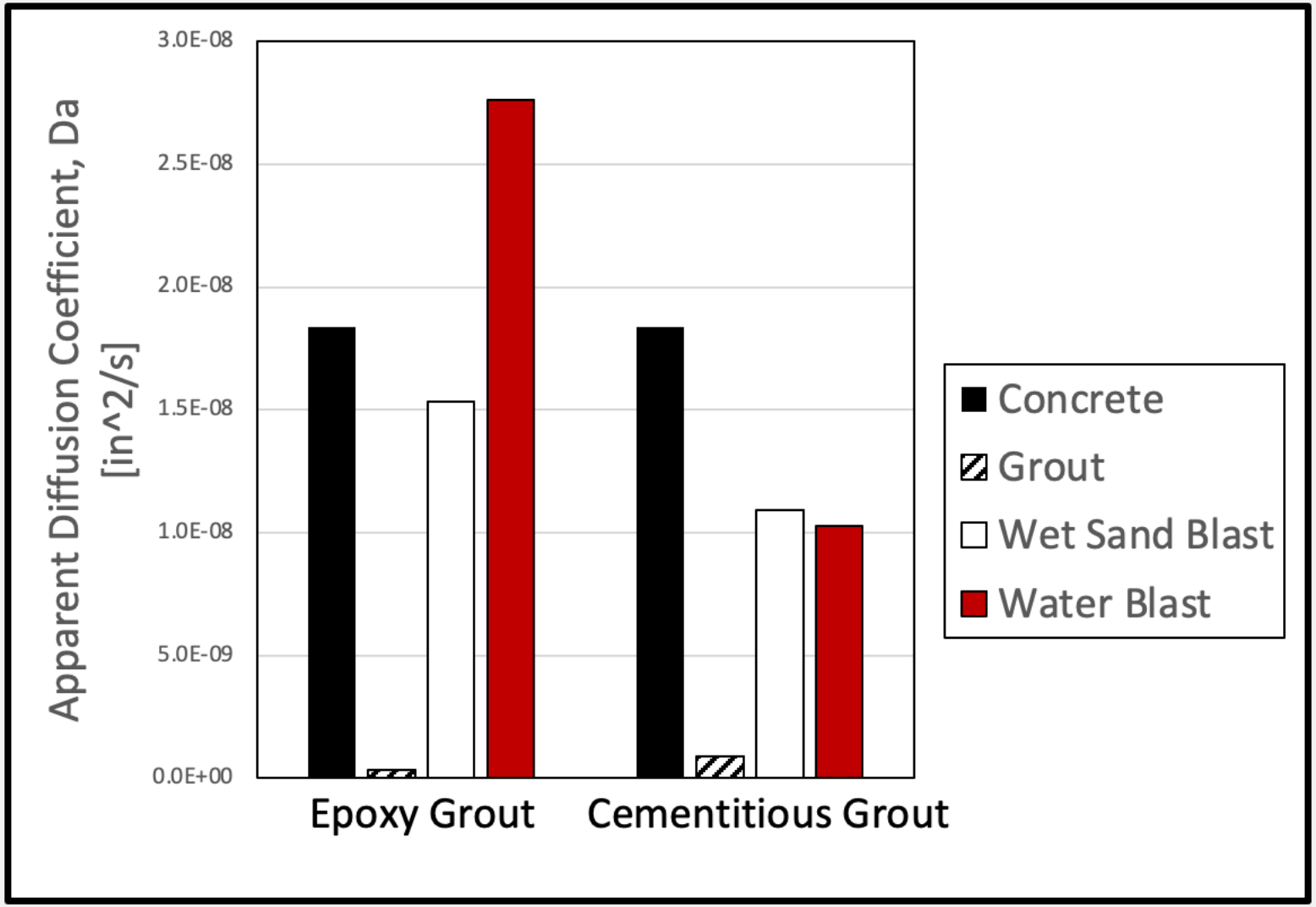
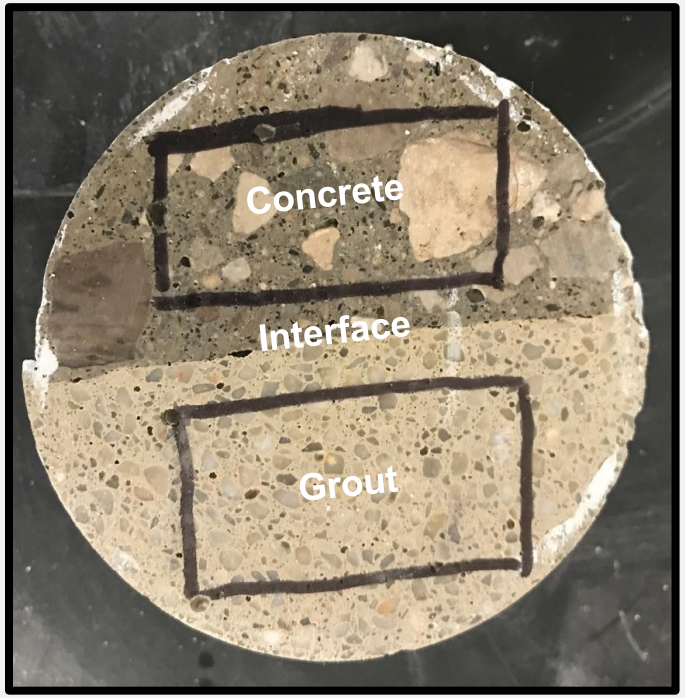
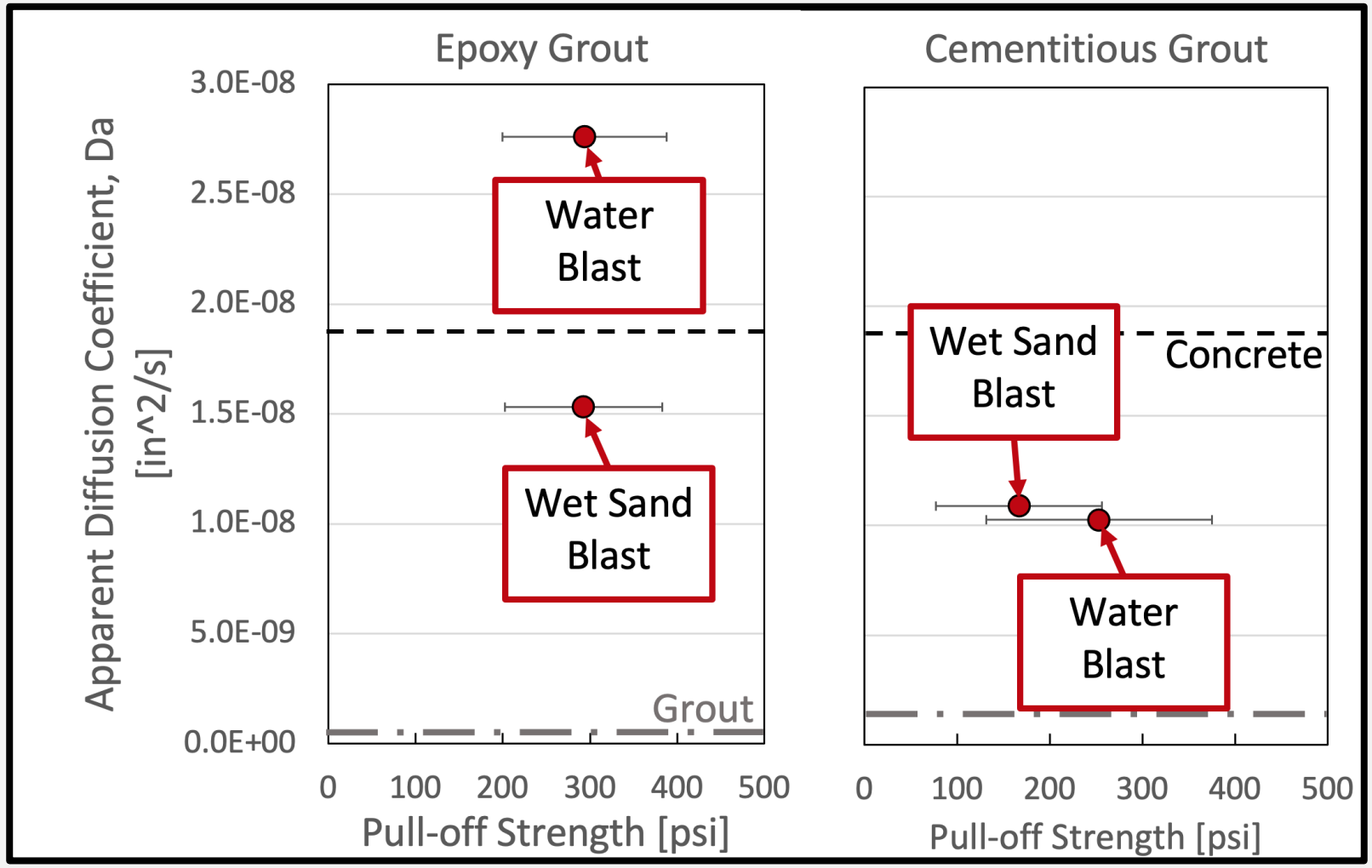




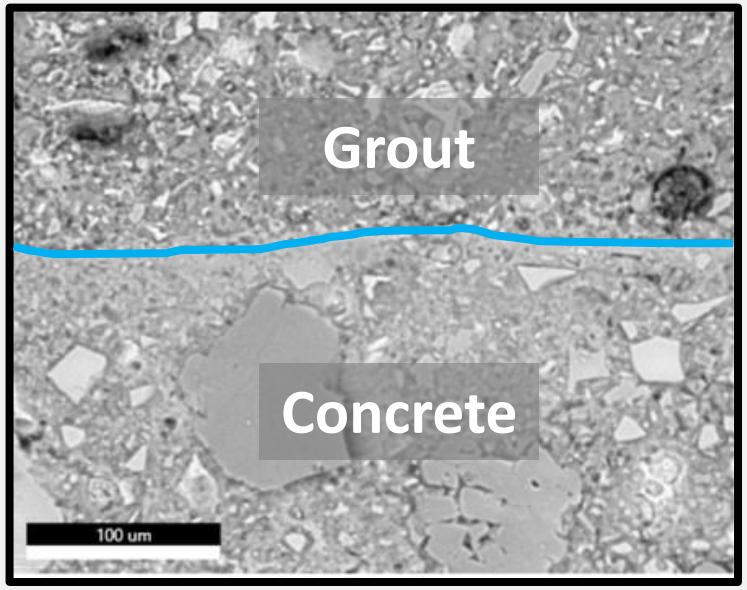
No prep interface results forthcoming

Chloride Diffusion Coefficient vs Pull-off Strength

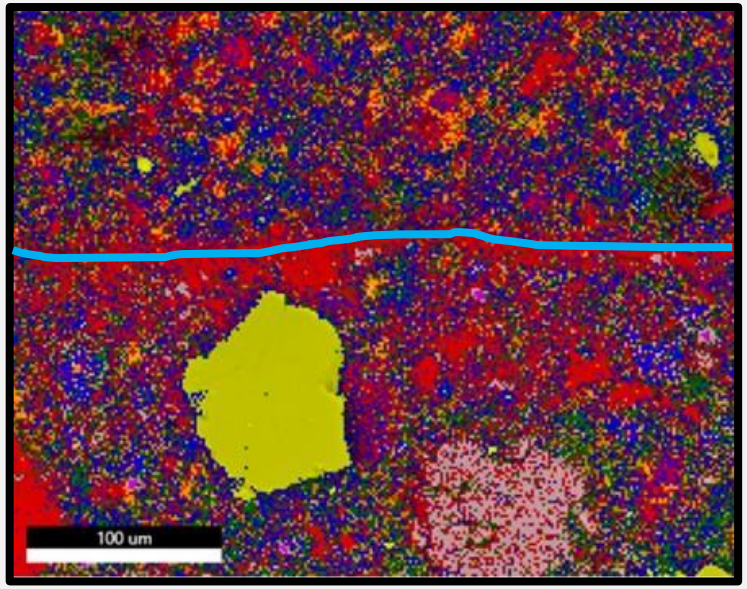


Initial Results – SEM Imaging

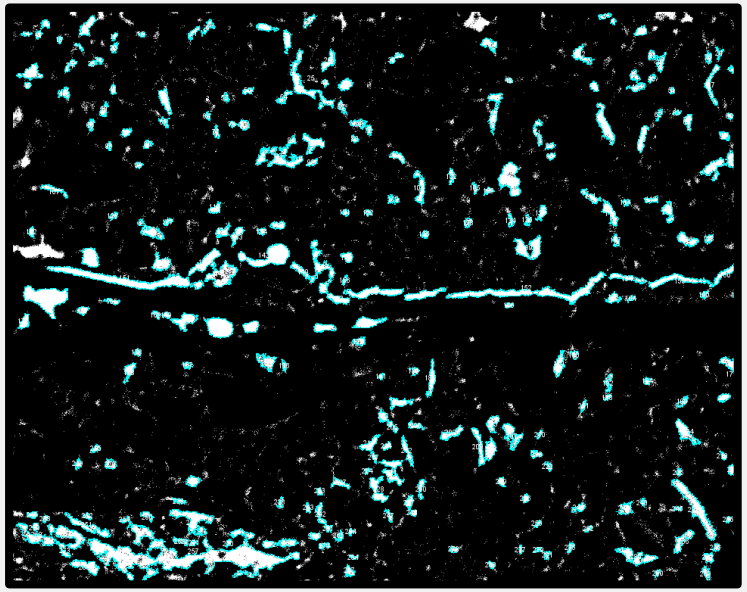
Topography



Composition

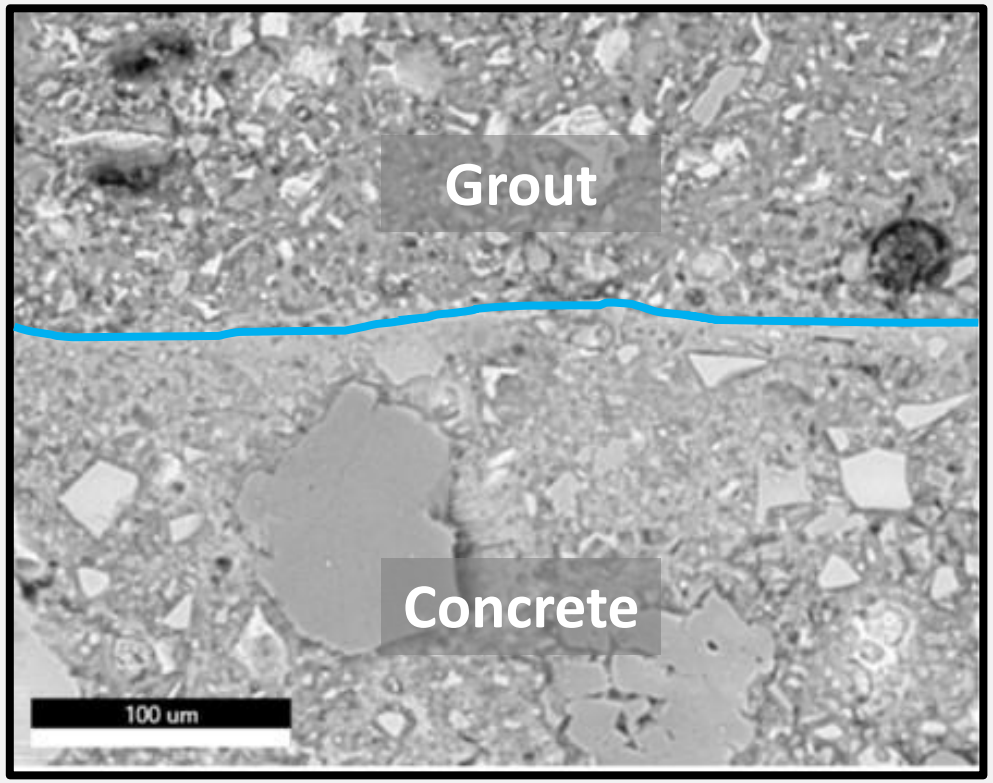


Porosity

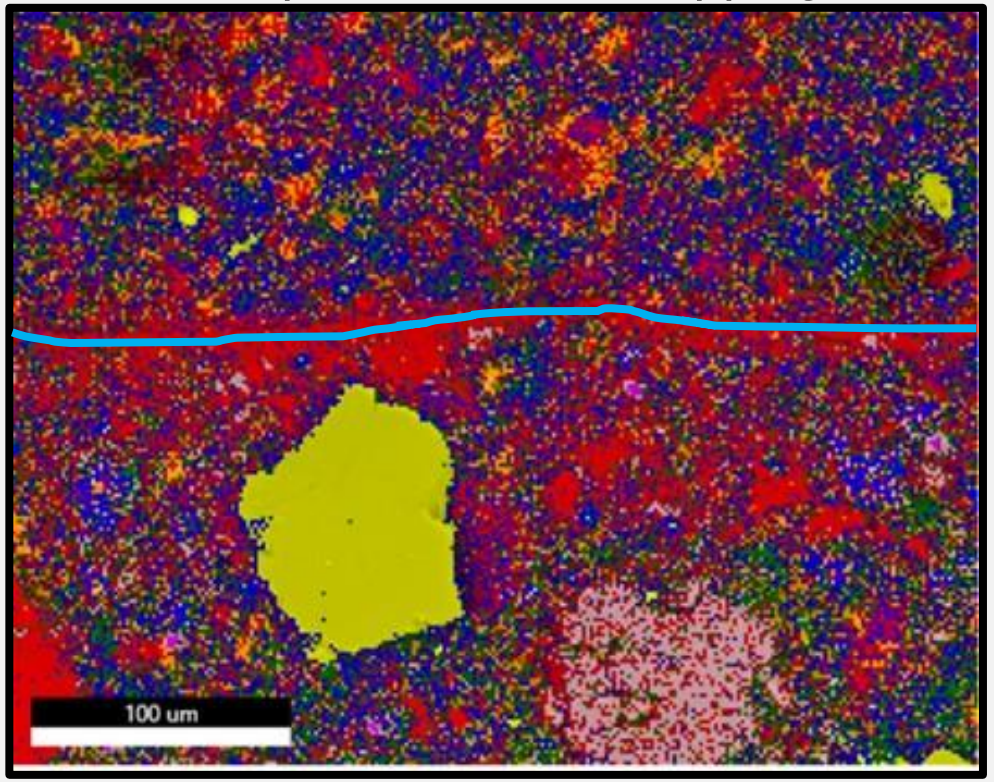


Initial Results – SEM Imaging

Topography: BSE Imaging

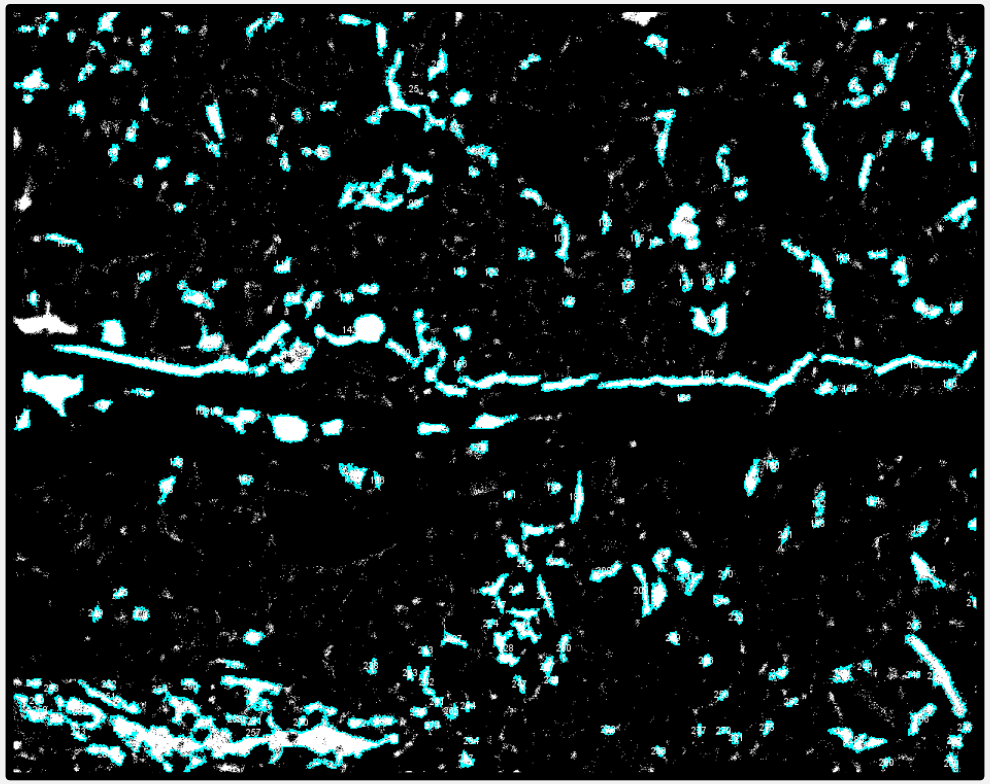


Composition: EDS Mapping



Initial Results – SEM Imaging

Porosity: Void Segmentation



Preliminary Conclusions

Investigate the effects of **surface preparation** and **material choice** on the **durability** of concrete-grout interfaces.

1. Surface preparation DOES largely affect chloride diffusion at epoxy grout interfaces
2. Surface preparation does NOT largely affect chloride diffusion at cementitious grout interfaces
3. Bond strength does not directly correlate with permeability
4. More abrasive surface preparation is generally desirable, especially for epoxy grout
5. Properly constructed interfaces can be just as durable as their constitutive materials

Ongoing Work

1. Interface microstructure characterization via SEM imaging
2. Continued pull-off and chloride profiling testing
3. Efforts towards developing “durable pour-back” criteria

Thank you!

Questions?

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