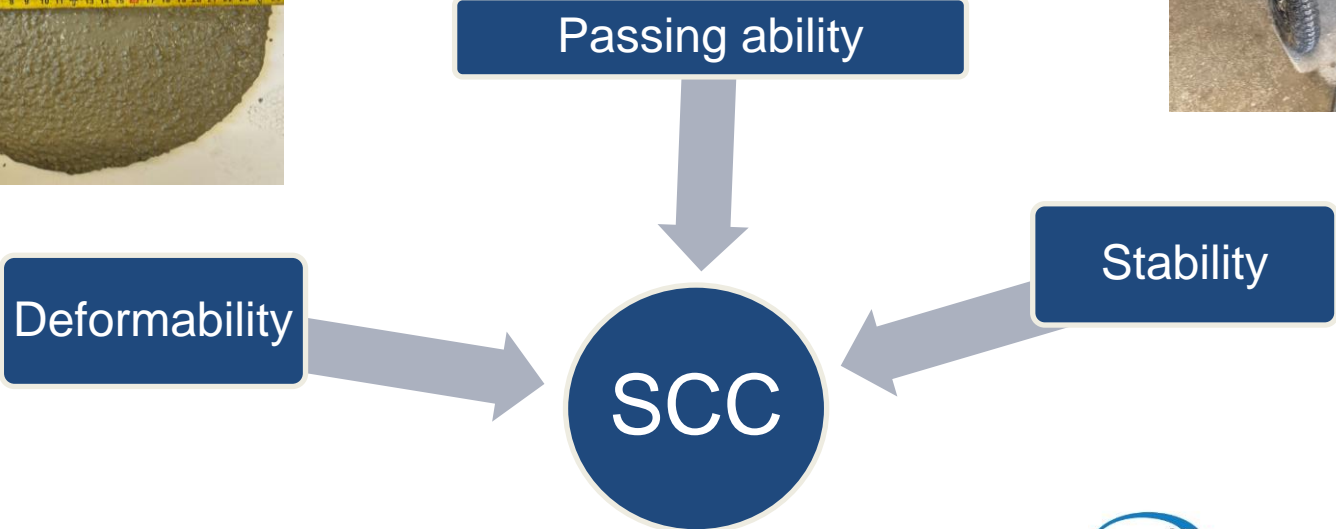
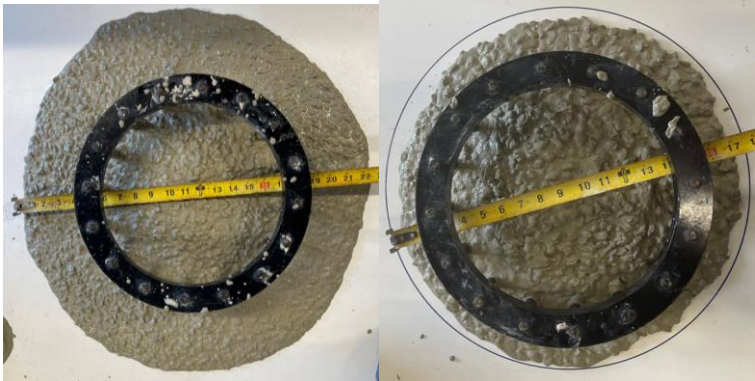


Development of BCSA Cement Self-Consolidating Concrete (BCSA SCC) for Structural Repair

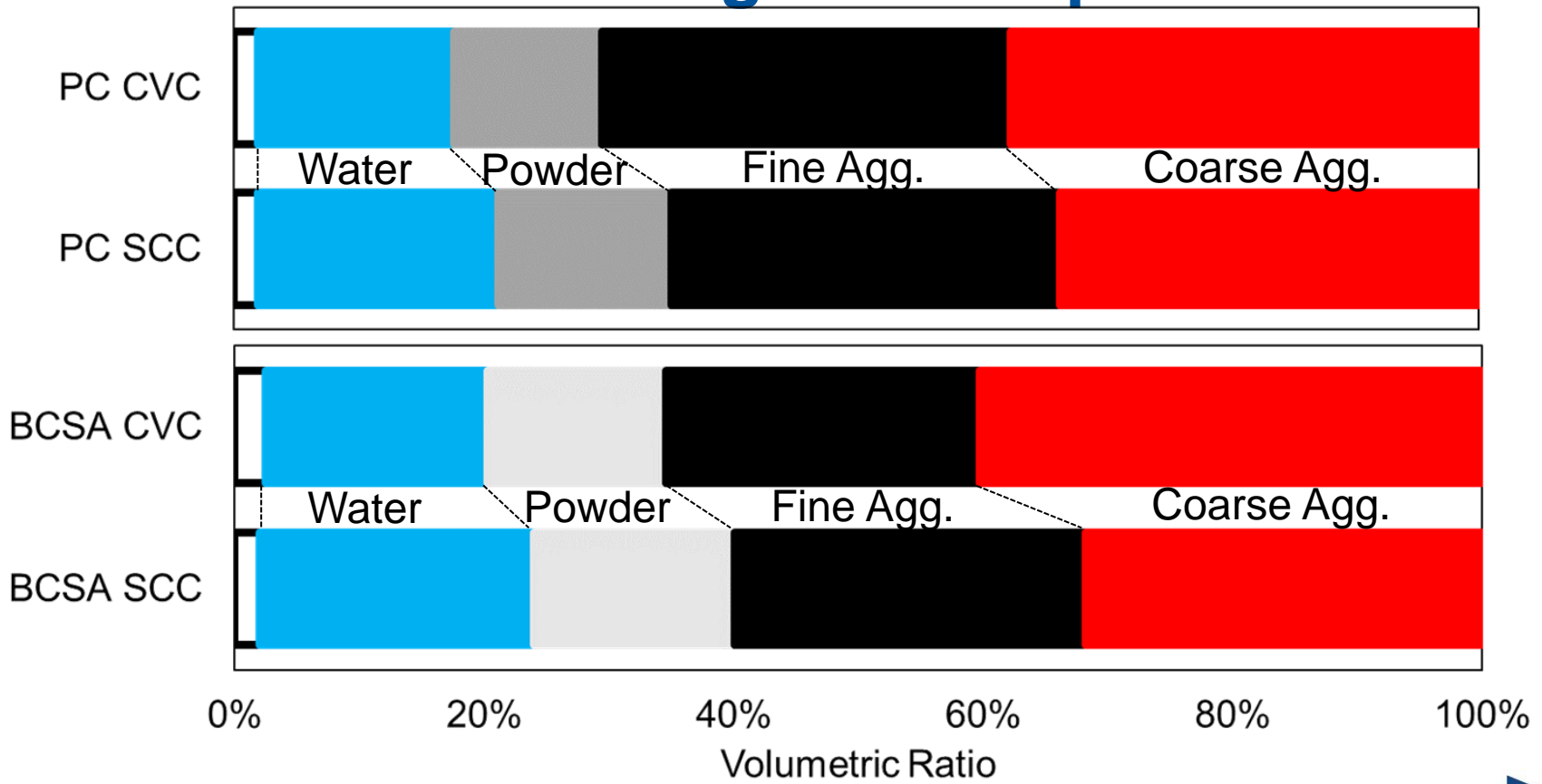
Elizabeth (Bette) Poblete
PI: Cameron Murray Ph.D, PE
University of Arkansas



SCC Background



Mix Design Development



BCSA SCC Mix Design

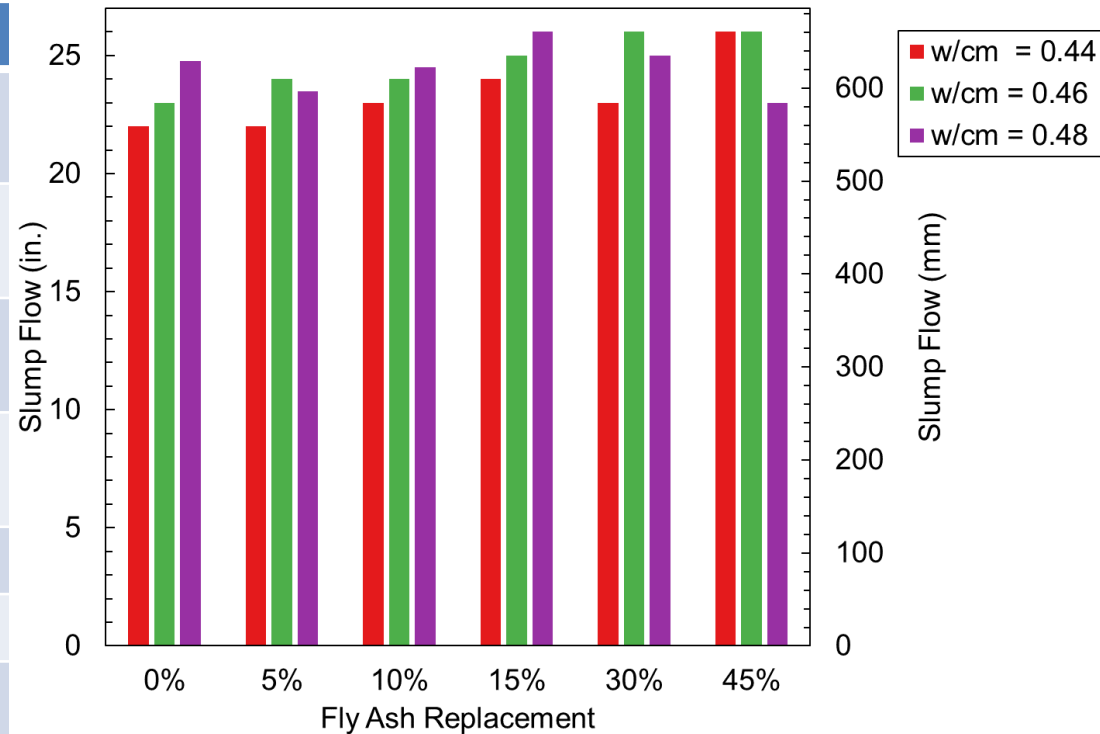
	BCSA	PC
Cement (lb/yd ³)	792-841	851
Coarse Agg. (lb/yd ³)	1400-1430	1400
Fine Agg. (lb/yd ³)	1203-1255	1414
Water (lb/yd ³)	370-380	315
w/cm	0.44-0.48	0.37
Fly Ash Replacement (%)	0-45	-
HRWR (fl. oz/cwt)	4	4
Citric Acid soln. (fl. oz/cwt)	5	-

Why BCSA SCC?

- Rapid hardening
- High early age compressive strength
- Shrinkage neutral

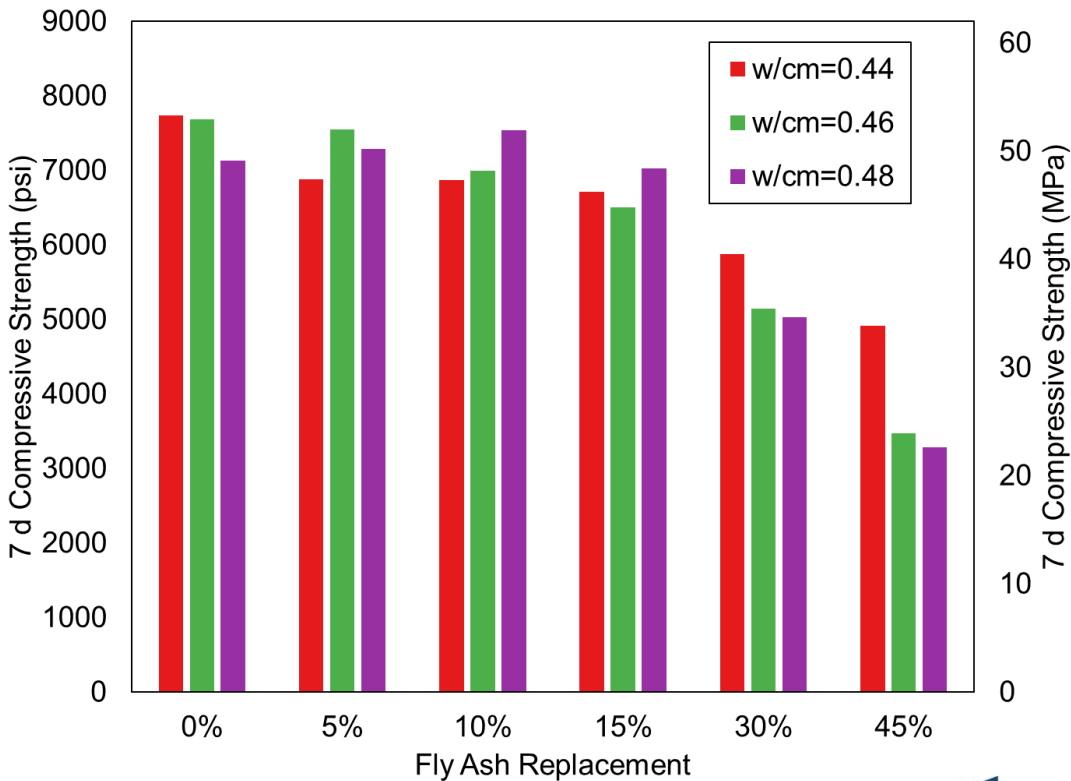
Fresh Properties

	Ranges
Cement (lb/yd ³)	792-841
Coarse Agg. (lb/yd ³)	1400-1430
Fine Agg. (lb/yd ³)	1203-1255
Water (lb/yd ³)	370-380
w/cm	0.44-0.48
Fly Ash Replacement (%)	0-45
HRWR (fl. oz/cwt)	4
Citric Acid soln. (fl. oz/cwt)	5



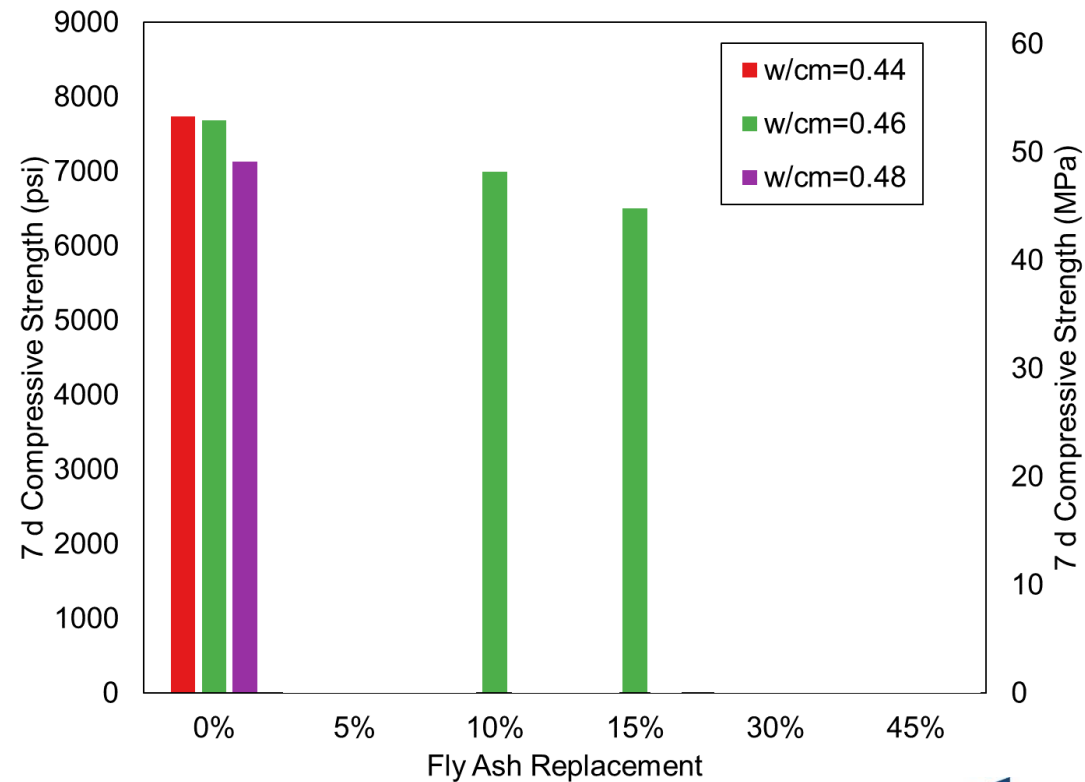
Hardened Properties

	Ranges
Cement (lb/yd ³)	792-841
Coarse Agg. (lb/yd ³)	1400-1430
Fine Agg. (lb/yd ³)	1203-1255
Water (lb/yd ³)	370-380
w/cm	0.44-0.48
Fly Ash Replacement (%)	0-45
HRWR (fl. oz/cwt)	4
Citric Acid soln. (fl. oz/cwt)	5

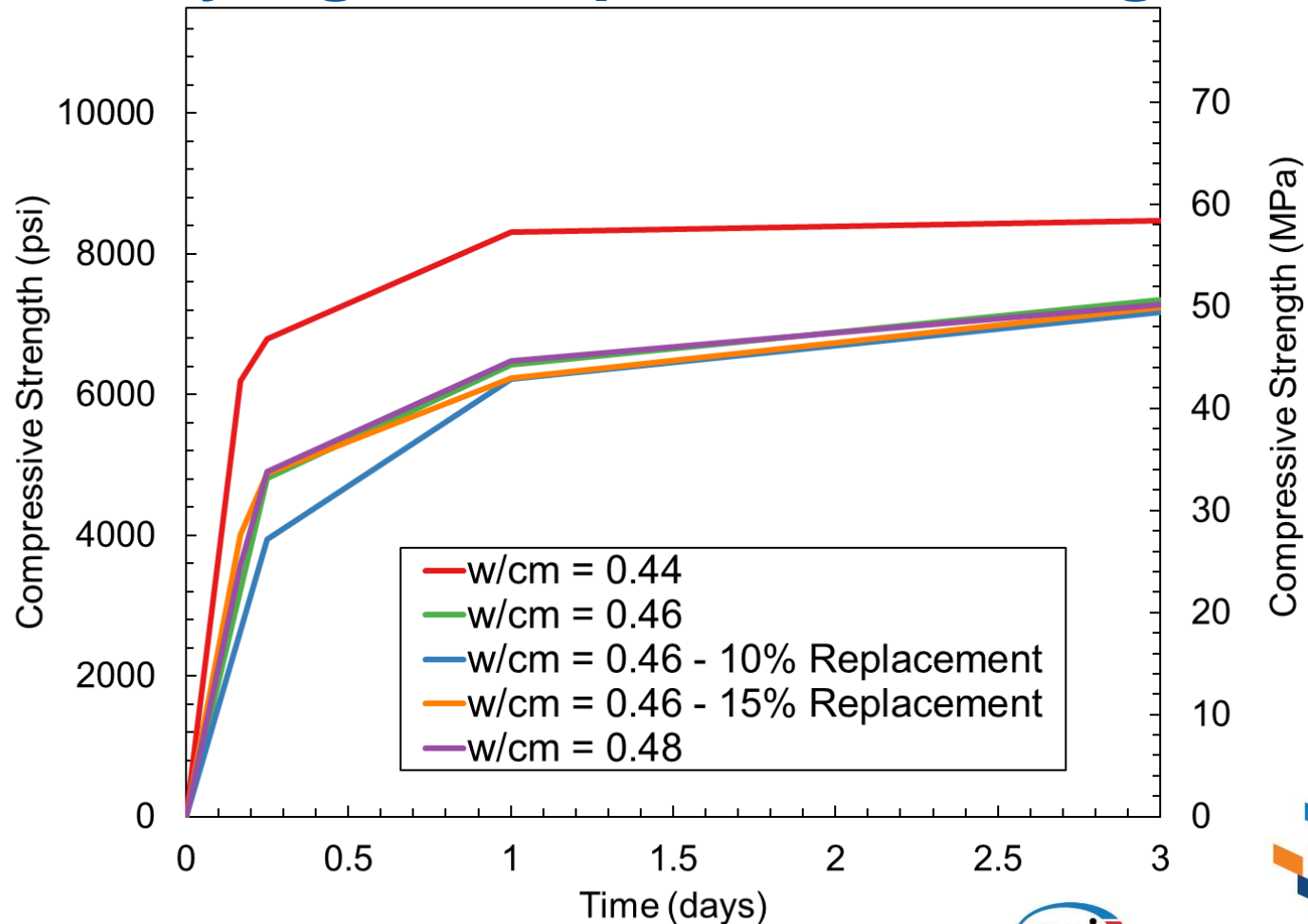


Hardened Properties

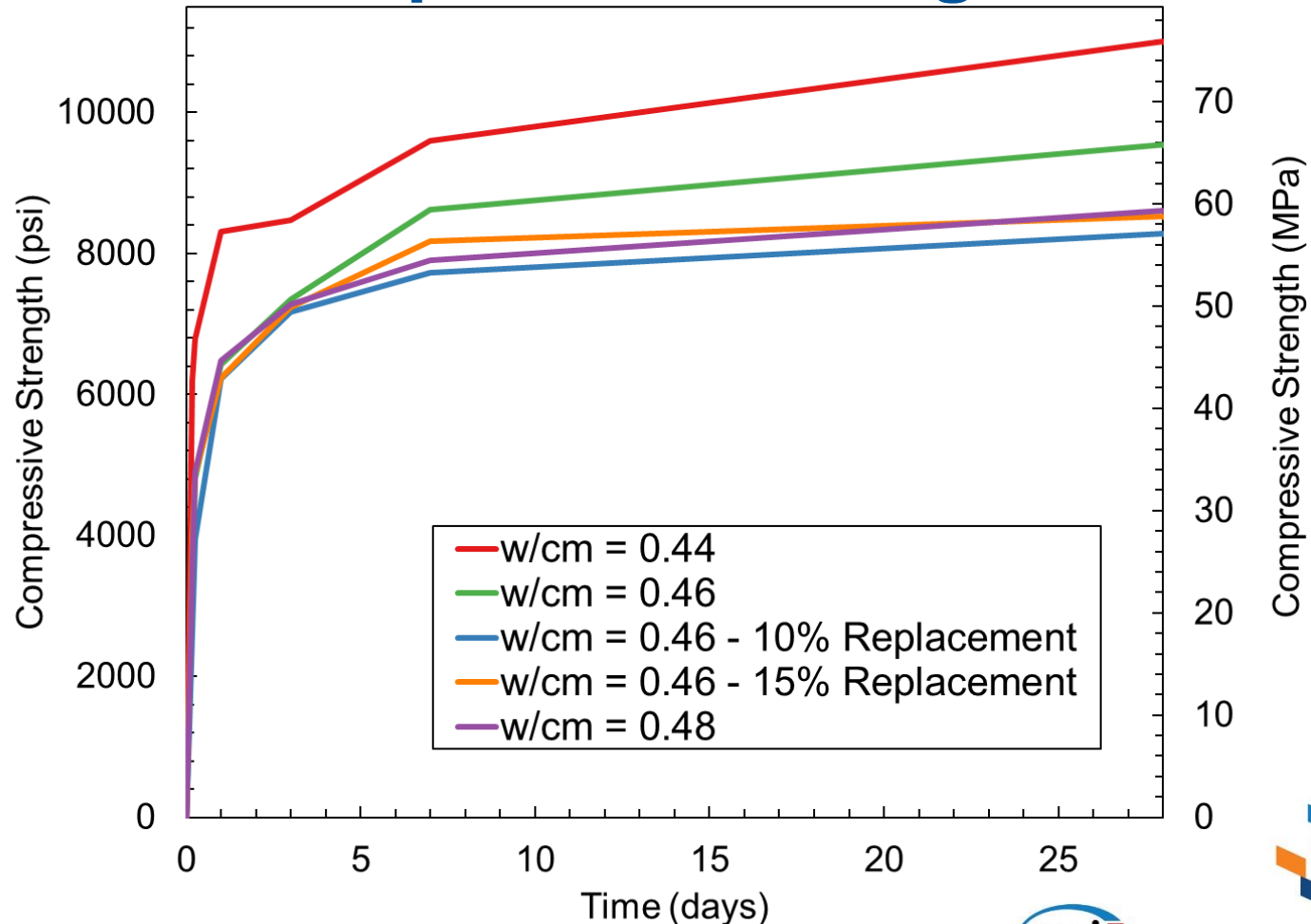
	Ranges
Cement (lb/yd ³)	792-841
Coarse Agg. (lb/yd ³)	1400-1430
Fine Agg. (lb/yd ³)	1203-1255
Water (lb/yd ³)	370-380
w/cm	0.44-0.48
Fly Ash Replacement (%)	0-15
HRWR (fl. oz/cwt)	4
Citric Acid soln. (fl. oz/cwt)	5



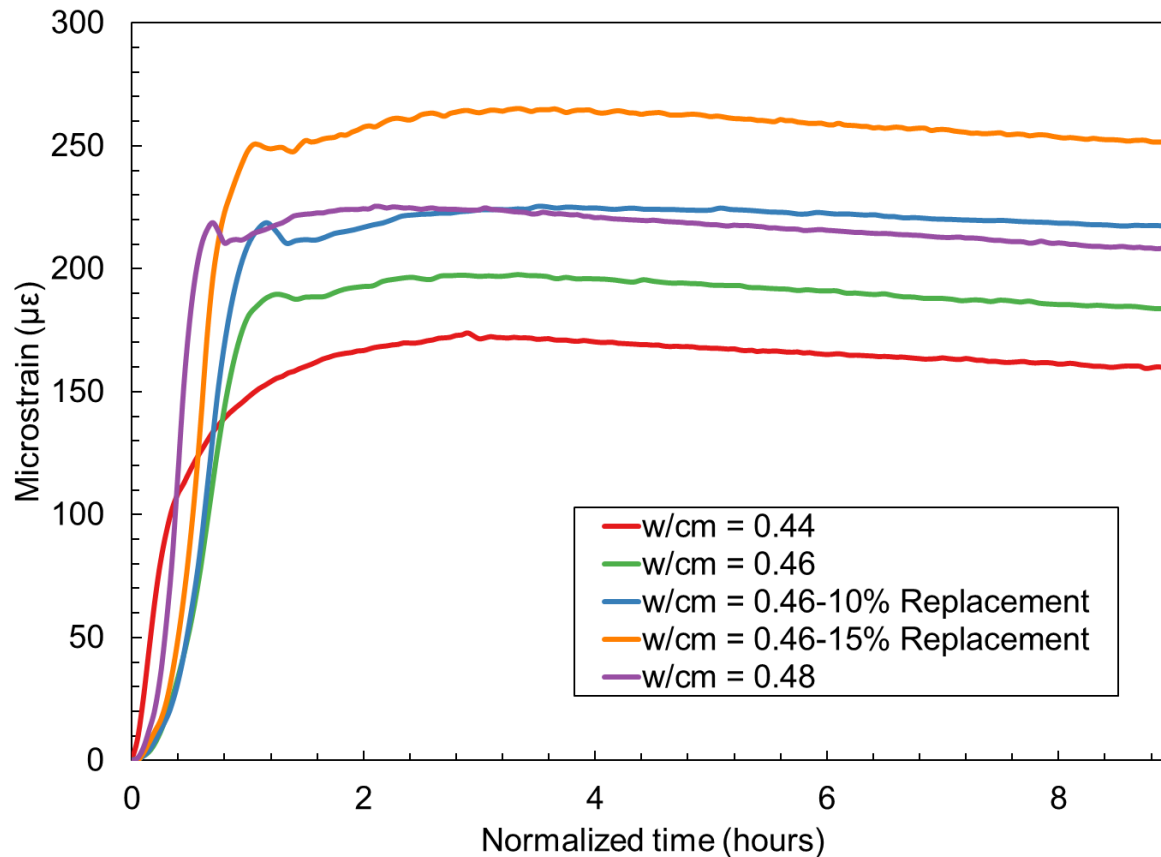
Results of Development Early Age Compressive Strength



Results of Development Compressive Strength

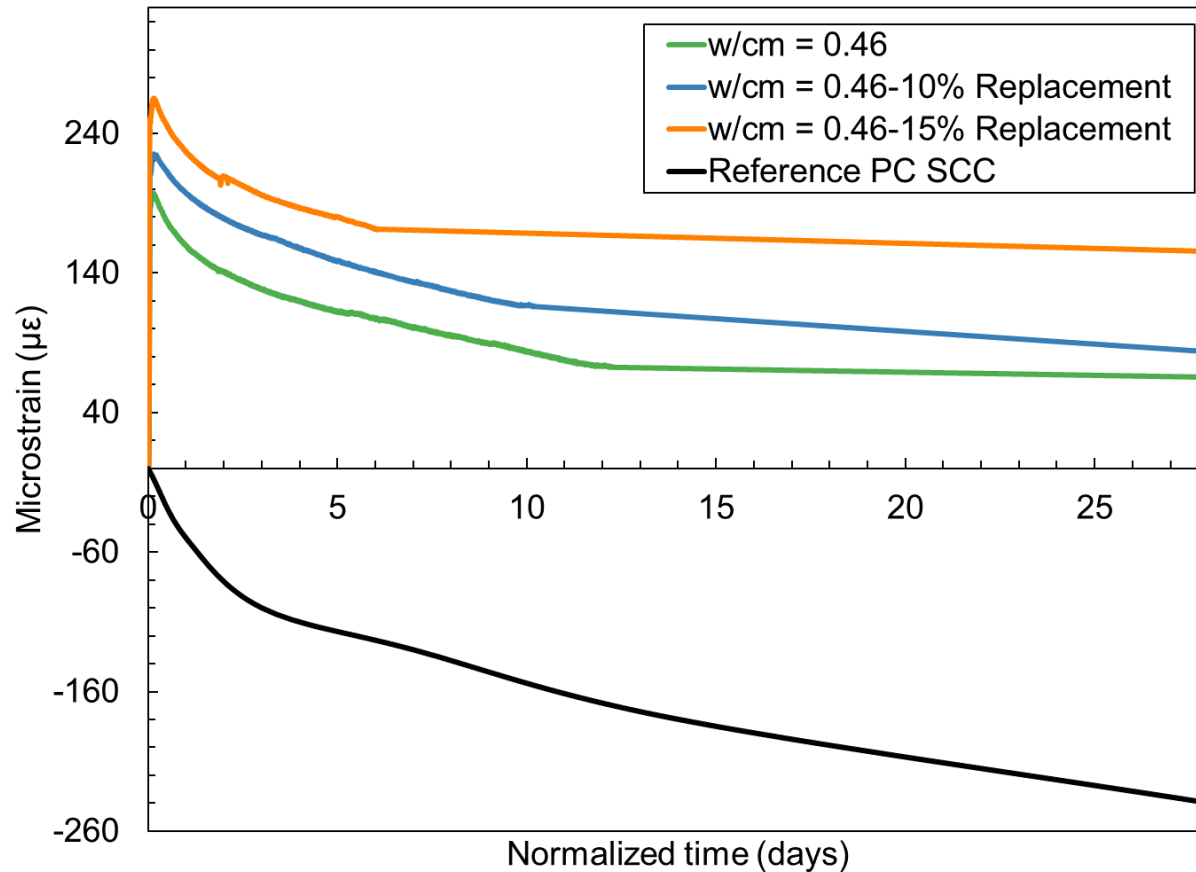


Results of Development Early Age Drying Shrinkage



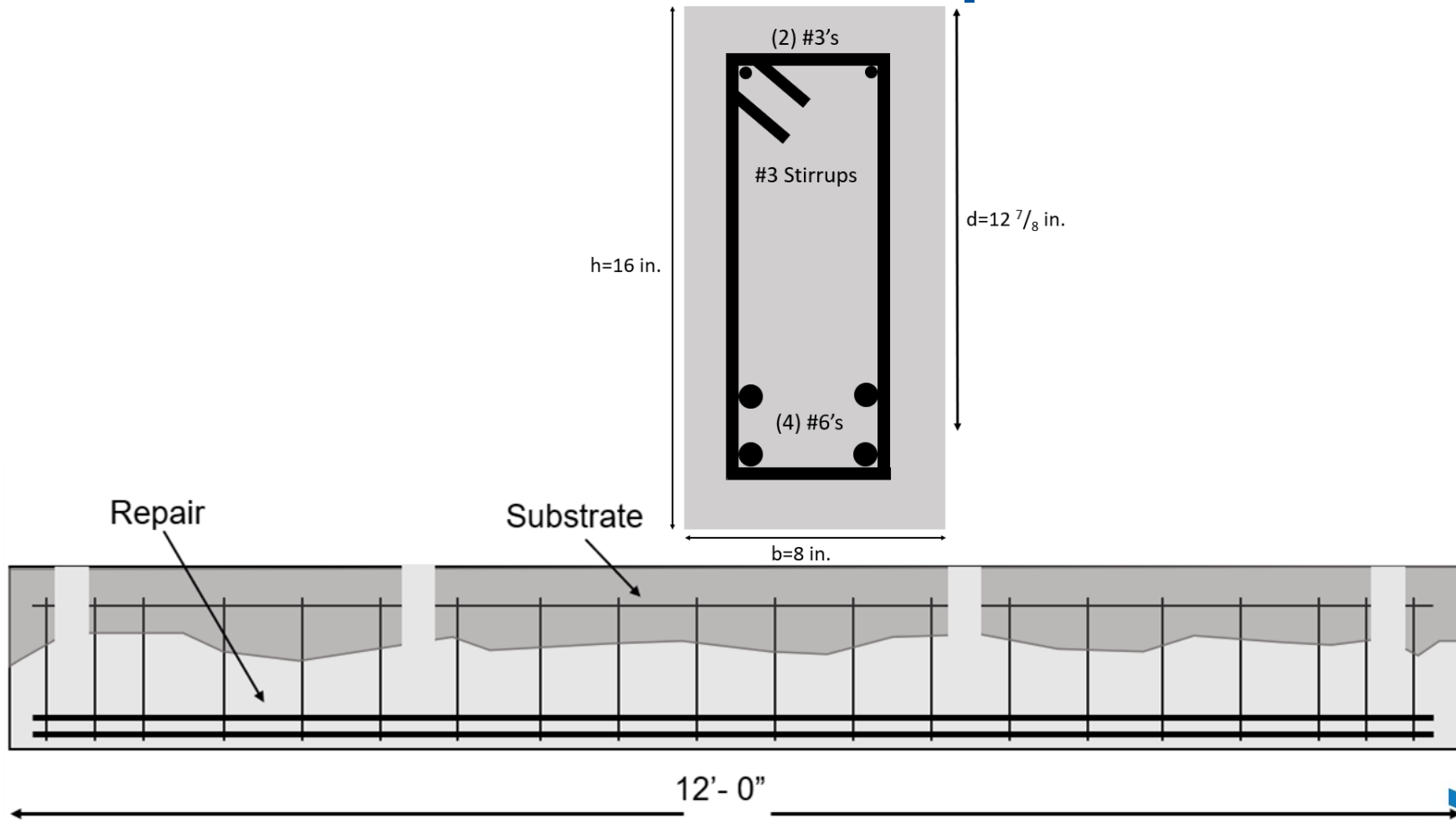
- (+) $\mu\epsilon$ indicates expansion

Results of Development Drying Shrinkage

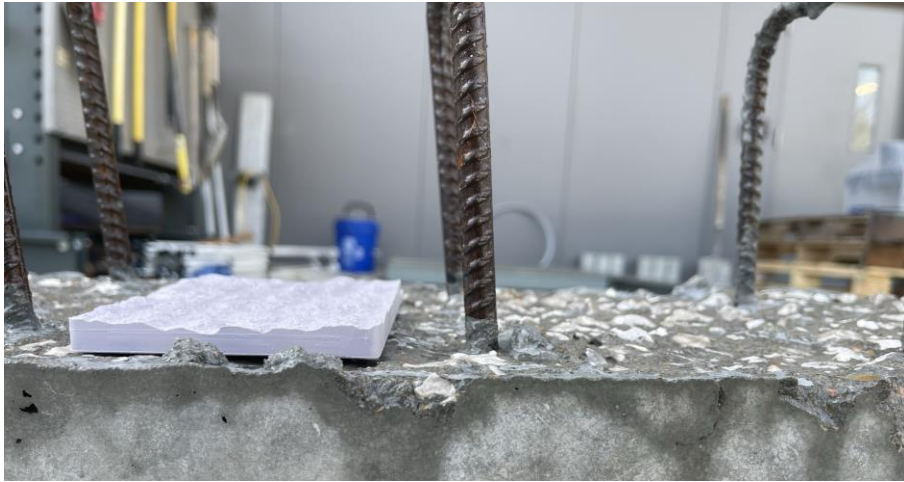


- (+) $\mu\epsilon$ indicates expansion
- (-) $\mu\epsilon$ indicates expansion

Structural Repairs



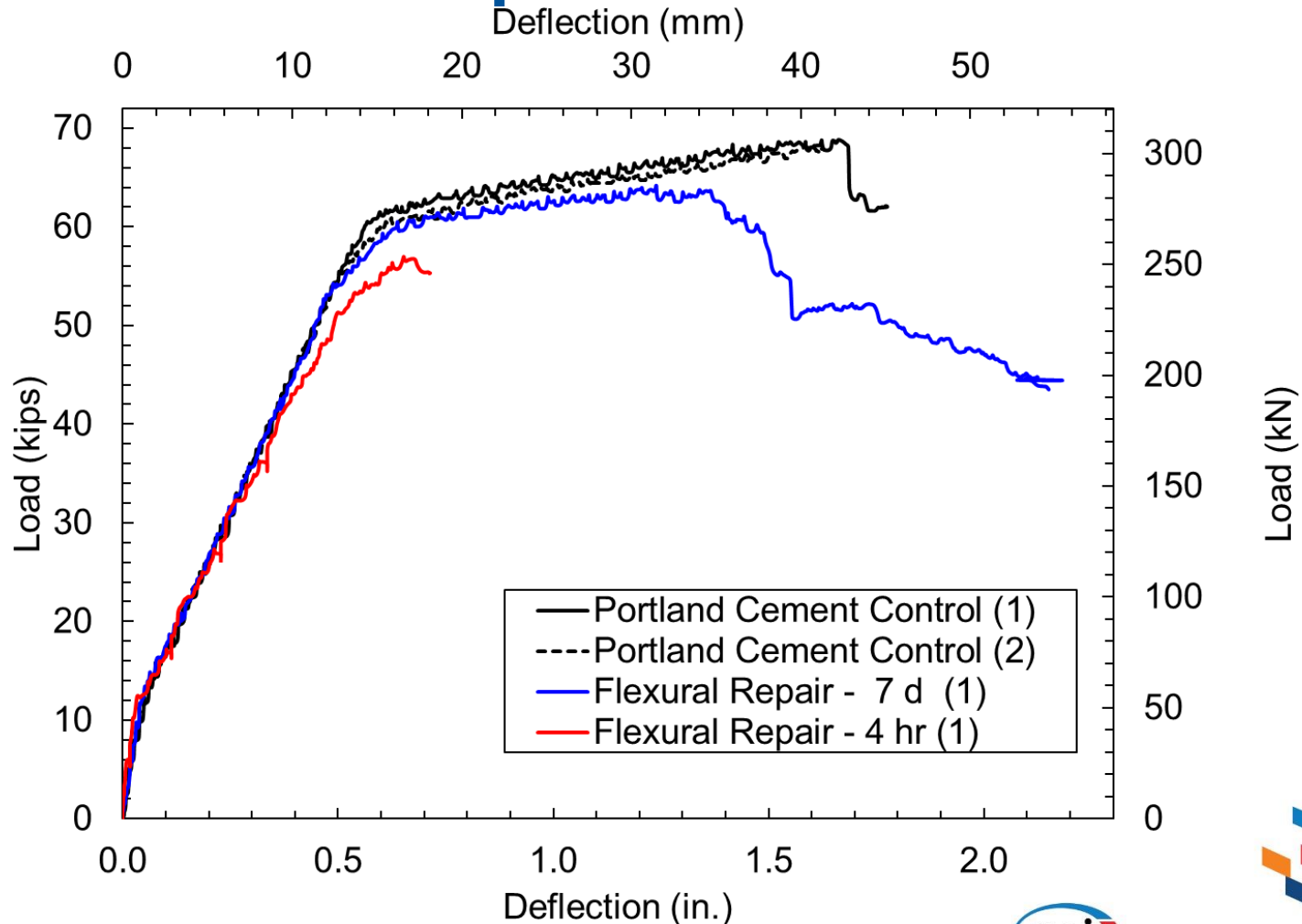
Preparation of Repairs



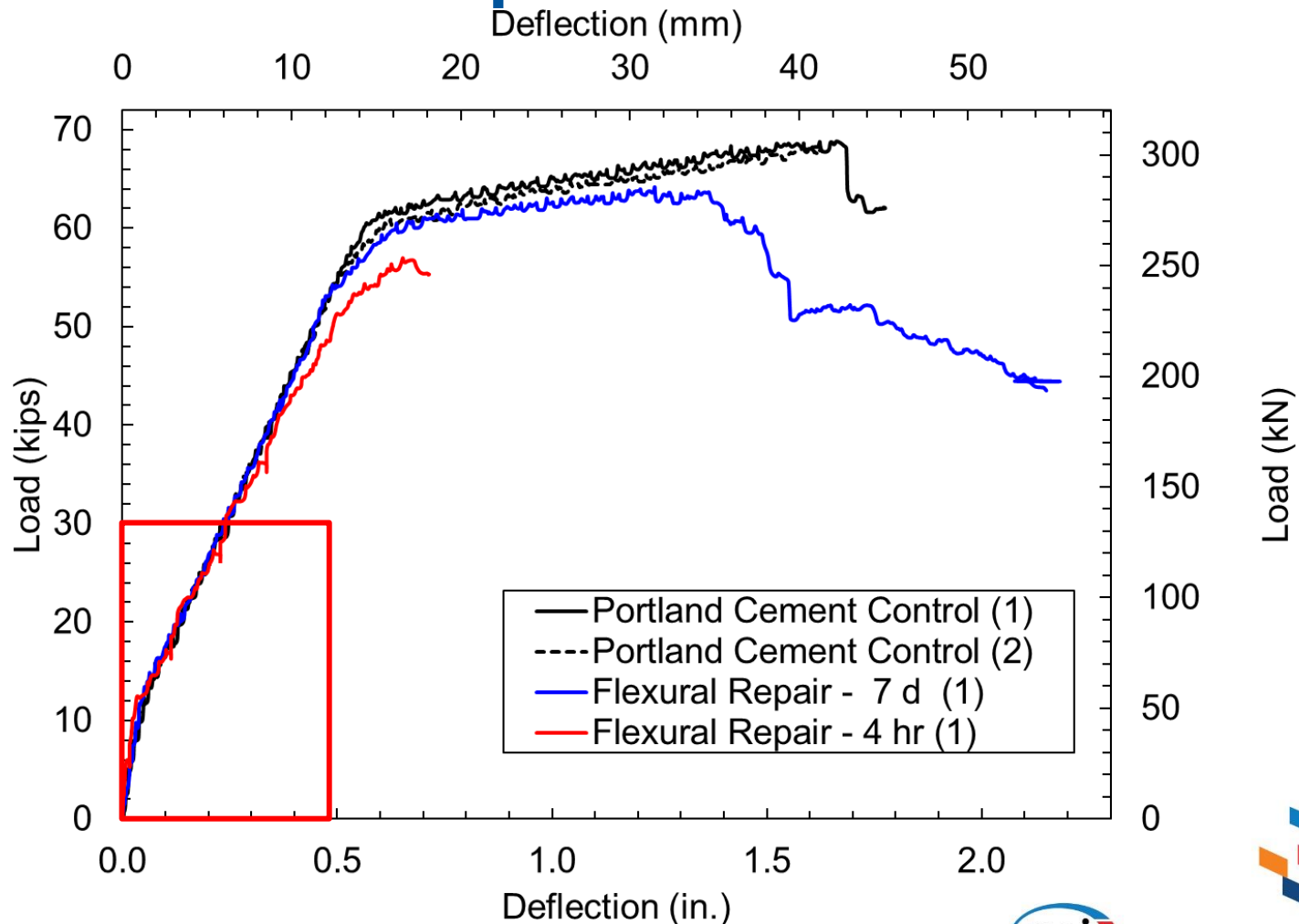
Placement of Repair



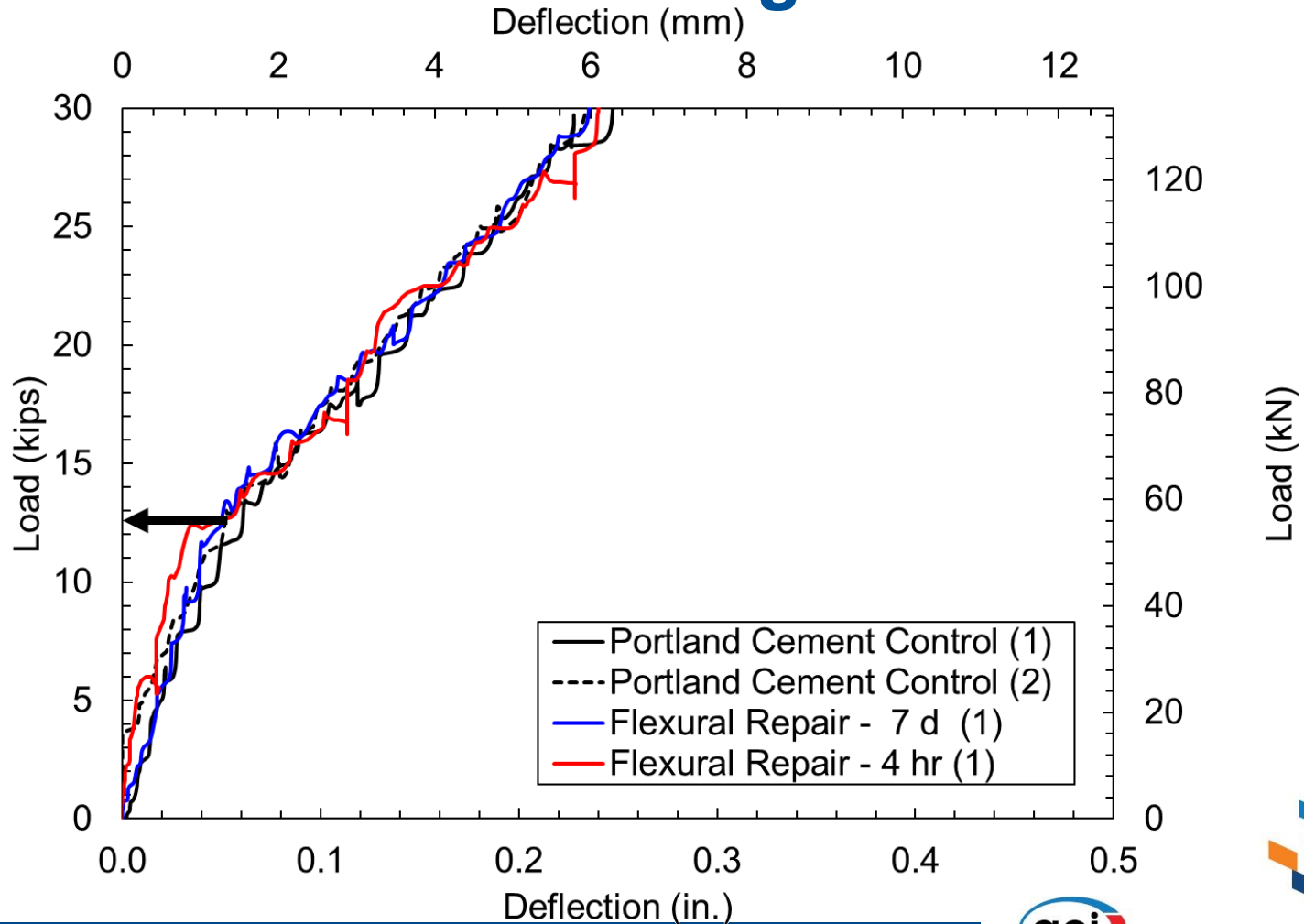
Repair Results



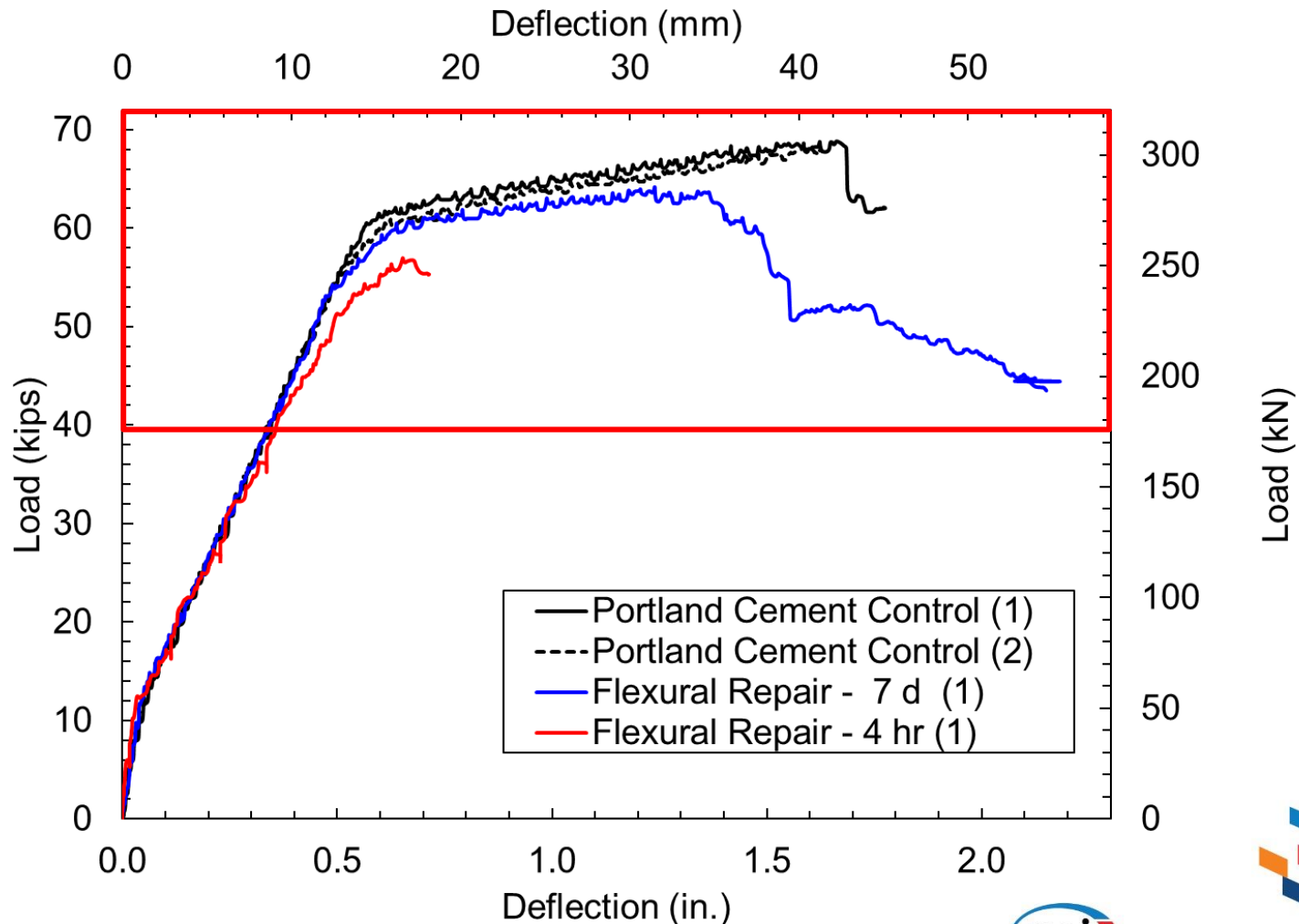
Repair Results



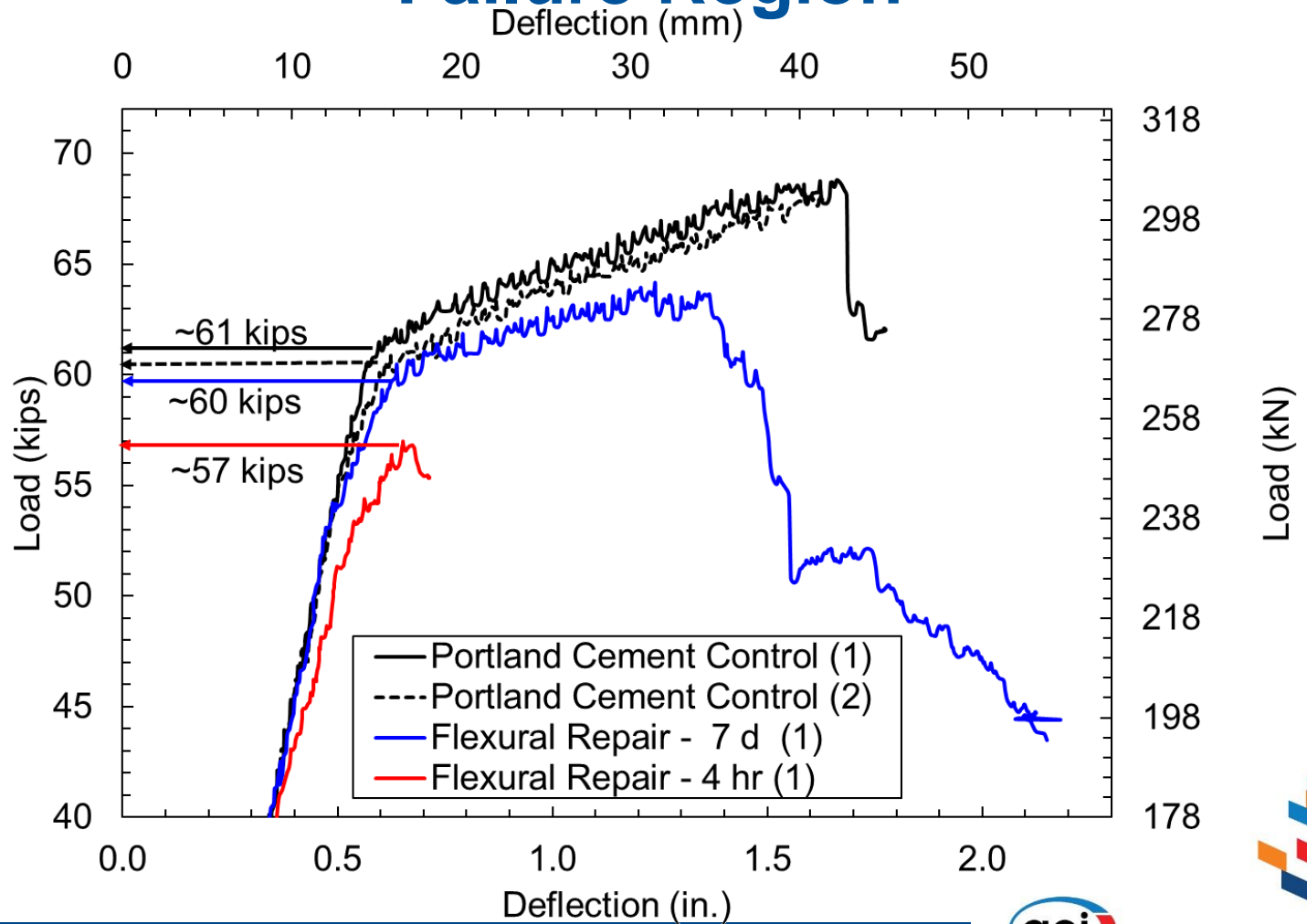
Repair Results Elastic Region



Repair Results



Repair Results Failure Region



Repair Results – BCSA SCC 7 d vs Portland Cement Control 28 d



Flexural cracks



Repair Results – BCSA SCC 7 d vs Portland Cement Control 28 d



Flexural failure ending
with concrete crushing

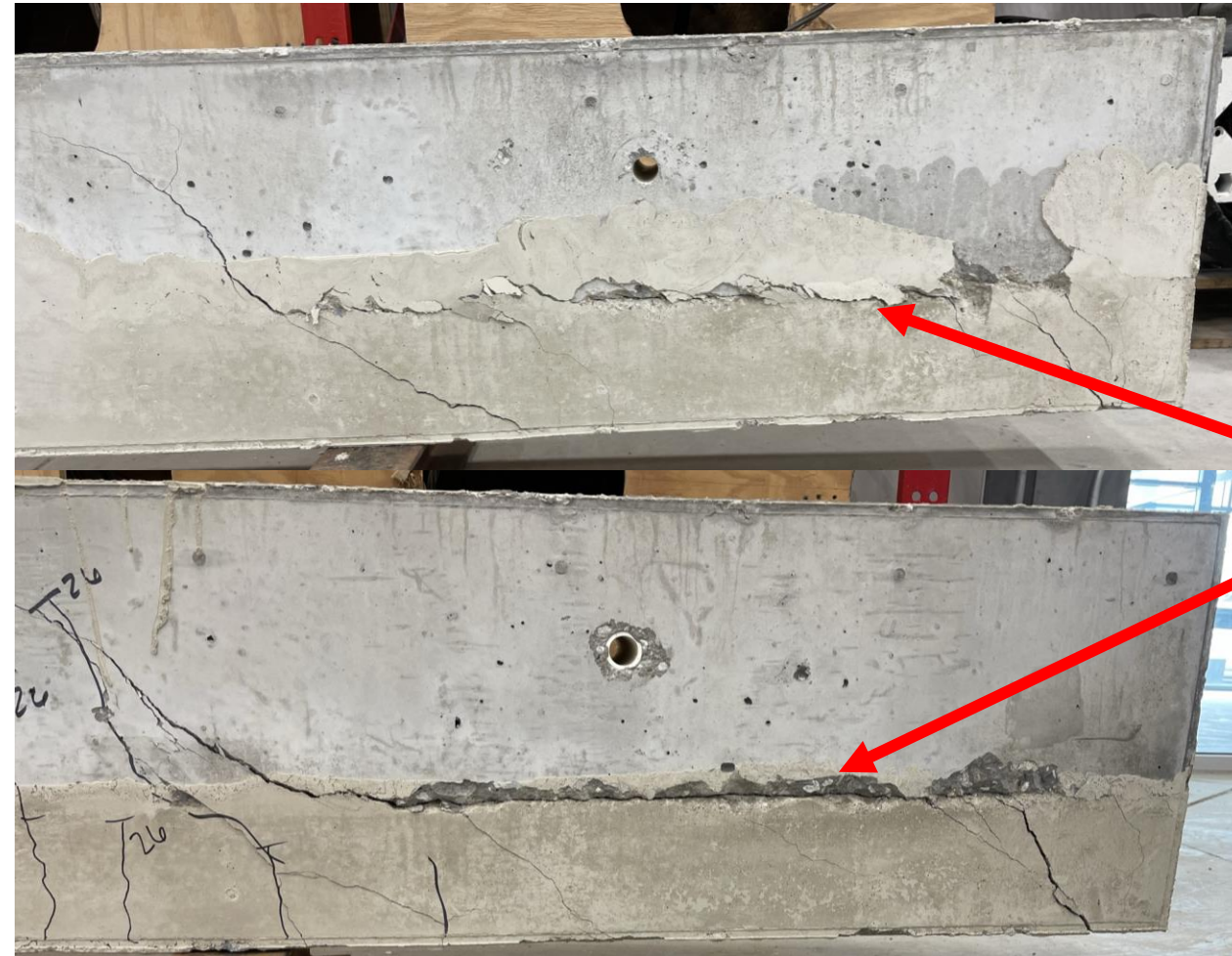
Repair Results – BCSA SCC 4 hr



Diagonal tension cracks start at support locations



Repair Results – BCSA SCC 4 hr



Cracks continue along interface (max shear)

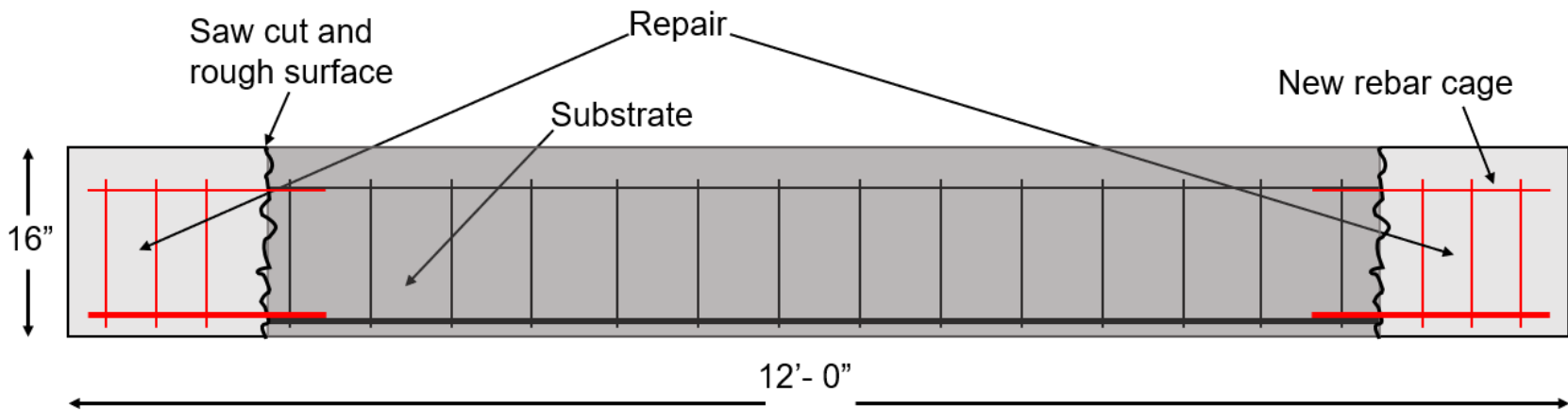
Repair Results – BCSA SCC 4 hr



Cracks eventually continue into substrate

Continued Research on BCSA SCC Repairs

- Other ages of flexural repairs
- End replacement repairs
- MOR, MOE, UPV, bulk resistivity



Questions?

espoblet@uark.edu

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