

Lafayette Consolidated Government: Internal Curing Adoption in Lafayette, LA

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Outline

- Background
- Pilot projects
- Specifications
- Lafayette Consolidated Government Bridges
- Acknowledgements

Background

- Reduced autogenous shrinkage
- Reduced cracking
- Reduced risk of cracking
- Reduce or eliminate plastic shrinkage cracking
- Reduce potential for thermal cracking
 - Due to lower modulus and increased stress relaxation
- Longer life and lower life-cycle costs
- Reduced chloride ingress

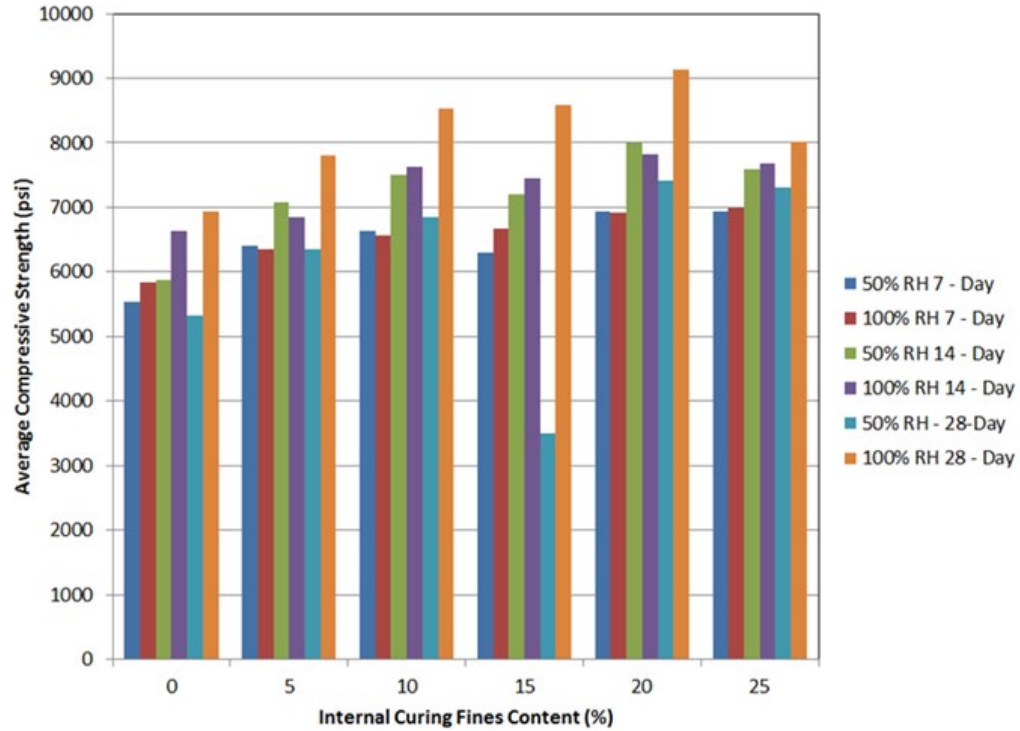
Background

- LTRC research project
 - 12-4C started in 2012 and completed in 2016
 - Contained laboratory and field pilot projects
 - https://www.ltrc.lsu.edu/pdf/2016/FR_569.pdf
 - https://www.ltrc.lsu.edu/pdf/2016/ts_569.pdf

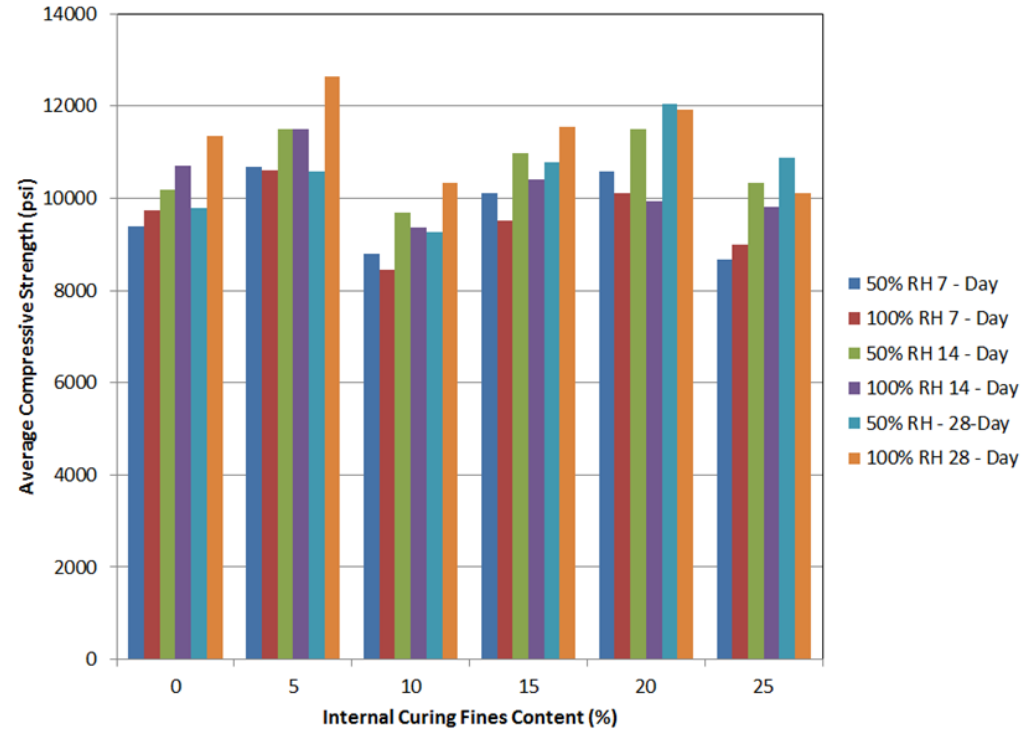
Laboratory Results

LTRC Lab #	Description	Slump (in.)	Air (%)	Unit Weight (pcf)	Initial Set Time (hours)	Final Set Time (hours)
C-4061	0.45 control	3.00	2.2	150	3.87	5.13
C-4062	0.45 5% LW	1.00	2.0	148	3.47	4.78
C-4124	0.45 10% LW	6.50	2.6	147	4.47	5.82
C-4125	0.45 15% LW	2.50	2.5	143	2.62	3.78
C-4126	0.45 20% LW	2.00	2.3	141	3.30	4.80
C-4127	0.45 25% LW	1.00	2.2	139	3.30	4.63
C-4128	0.35 Control	0.50	2.9	151	3.33	4.62
C-4129	0.35 5% LW	3.50	2.3	151	3.88	5.53
C-4130	0.35 10% LW	1.75	2.7	149	2.95	5.72
C-4131	0.35 15% LW	0.50	2.8	147	3.08	5.02
C-4133	0.35 20% LW	0.25	2.3	146	2.02	4.73
C-4134	0.35 25% LW	0.25	2.7	140	1.10	3.47

Laboratory Results

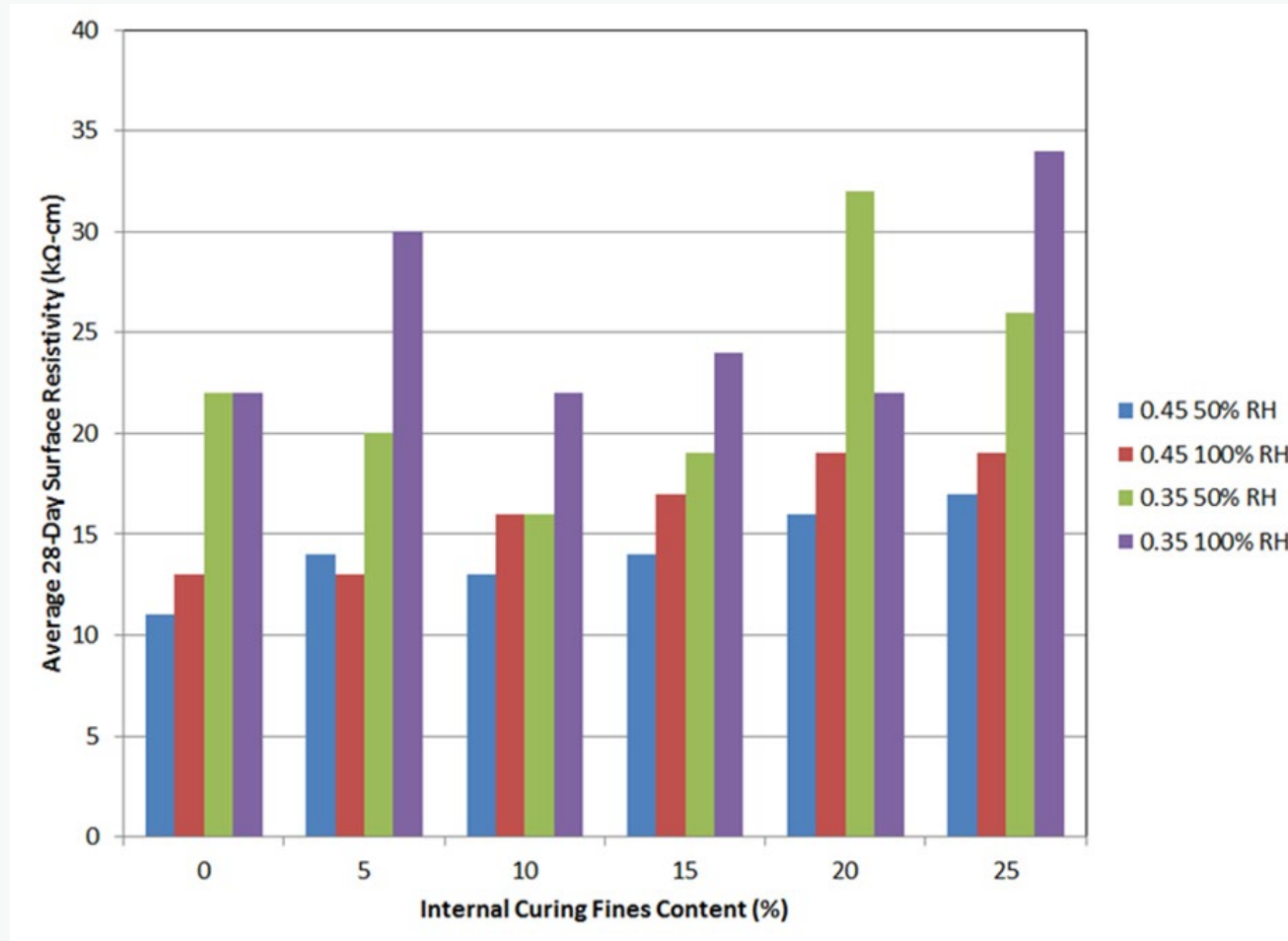


0.45 w/cm



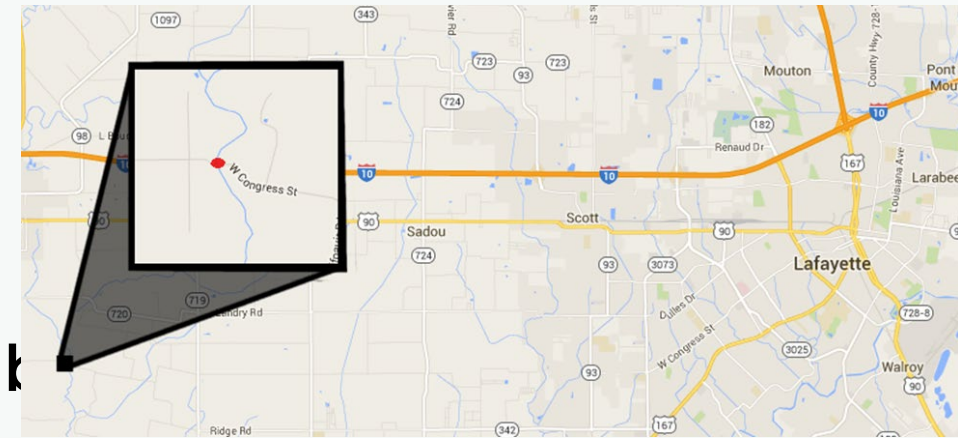
0.35 w/cm

Laboratory Results



Pilot Project – West Congress St.

- Recall No. 030462
- Structure No. 032800000030462
- Internally cured items
 - Deck span #2, East approach slab, all k
- @ 1 year – reduced cracking
- Contractor remark – “It looks, feels, and places just like regular concrete!”



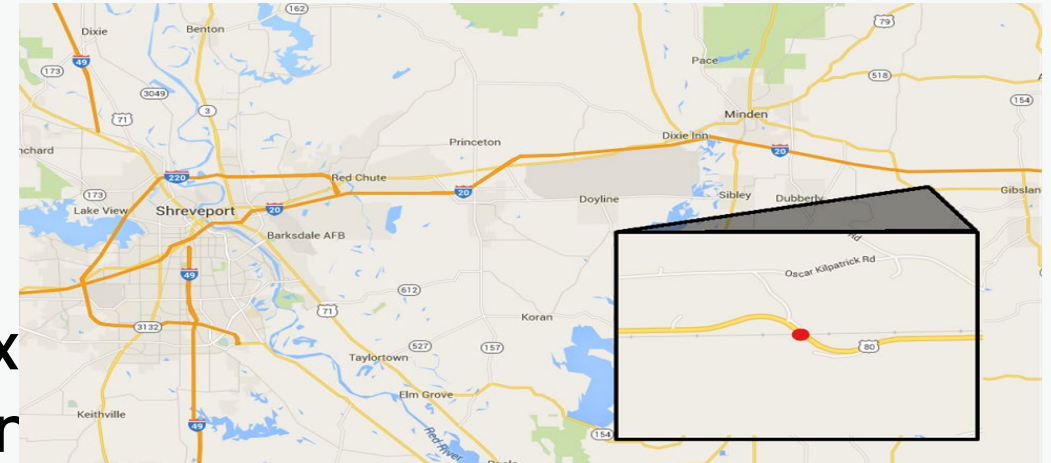
Pilot Project – West Congress St.

- 100 cuyd ICC used
- Mixture proportions
 - 519 cement
 - 92 class C fly ash
 - 847 sand
 - 1711 river gravel
 - 285 lightweight expanded cl
 - 0.40 w/cm
- Reduced cracking in the ICC sections compared to the control sections

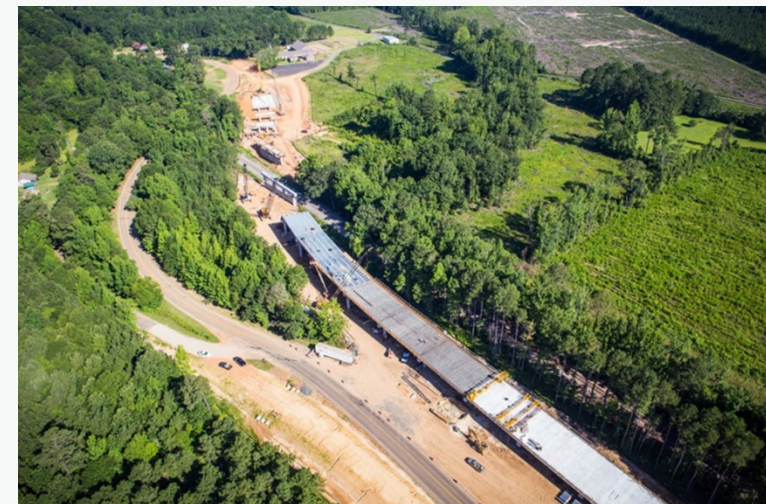


Pilot Project – US 80 at Ada, LA

- Two ICC mixtures
 - 150 pcy expanded clay
 - 300 pcy expanded clay
 - 350 cuyd placement for each mix
 - Fresh concrete properties were ur the control mixture

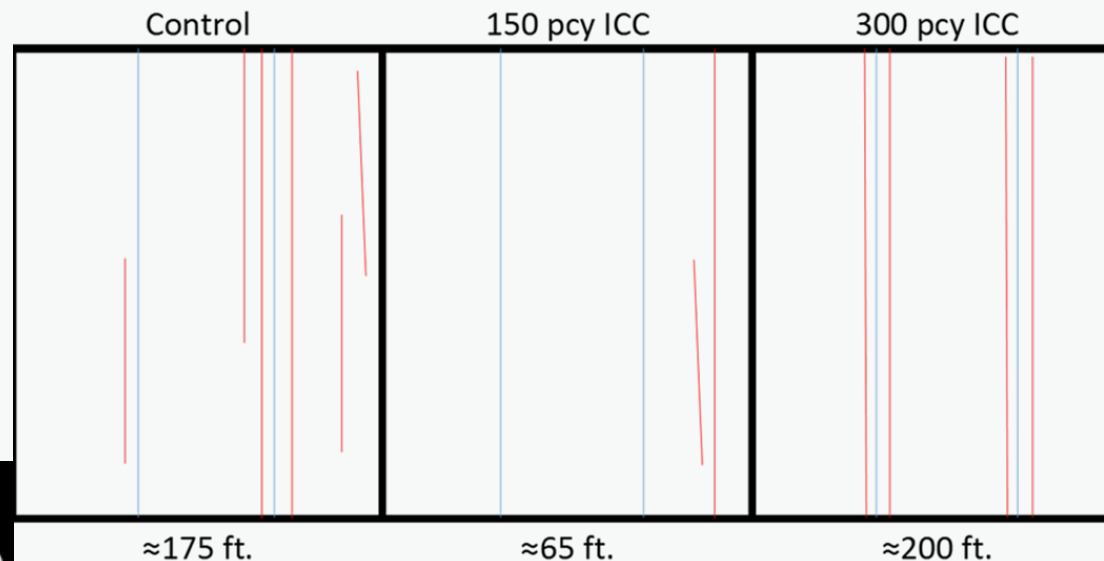


Description	#57 Gravel (lbs)	Sand (lbs)	Expanded Clay (lbs)	Type I/II Cement (lbs)	Class F Fly Ash (lbs)	w/cm
Control	1750	1113	--	553	98	0.44
150 PCY ICC	1748	870	150	553	98	0.44
300 PCY ICC	1550	810	300	553	98	0.44



Pilot Project – US 80 at Ada, LA

- Compressive strengths performed equal to or better than control mixtures
- Resistivity increased with increased quantity of lightweight IC aggregate
- Cracking reduced



Lafayette Consolidated Government Bridges

- LCG personnel reviewed LTRC research results alongside pilot projects
 - Adopted ICC for future projects
- 6 additional bridges have been constructed

LCG Specifications

All concrete used to construct approach slabs, barrier rails, bridge decks and caps, when precast, shall be Class IC(P) concrete and have a minimum 28-day compressive strength of 4,500 psi. All concrete used to construct approach slabs, barrier rails, bridge decks and caps, when cast-in-place, shall be Class IC(A)(M) concrete and have a minimum 28-day compressive strength of 4,500 psi. Refer to Sections 805, 901, and 1003 for further details related to Internally Cured (IC) Concrete.

Internally Cured (IC) concrete is concrete that contains sufficient water within the mixture to cure the concrete from the inside out. IC concrete incorporates saturated lightweight aggregate as a portion of the fine aggregate volume within the concrete. The absorbed water within the saturated lightweight fine aggregate, which is not part of the mixing water, provides internal moisture that is slowly released to the hydrating cement within the past matrix of the placed concrete. IC concrete is intended to inhibit autogenous shrinkage and early age cracking of the placed concrete.

LCG Specifications

- Minimum 564 pcy cement
- Maximum w/cm – 0.53
- Resistivity at 56-days = 22 k Ω -cm

(4) Lightweight Fine Aggregate: Lightweight fine aggregate shall be an expanded clay meeting the requirements of ASTM C1761. The lightweight fine aggregate shall be a fine aggregate from an expanded clay lightweight aggregate source listed in the AML. The lightweight expanded clay shall meet the gradation for the fine aggregate gradation listed in Section 1003.02(b)(4).

Replace the fine aggregate (sand) portion of the mixture with 250 – 300 pounds of saturated lightweight fine aggregate on a pound for pound basis. Adjust the aggregate portion of the mixture accordingly to account for changes in volume.

1003.02 AGGREGATES FOR PORTLAND CEMENT CONCRETE AND MORTAR. All aggregates for use in portland cement concrete shall comply with the requirements of Subsection 1003.01. Aggregates for use in Types B, D and X pavement concrete shall also conform to the requirements of Subsection 1003.02(c). Aggregates for use in Internally Cured Concrete shall be a fine aggregate from an expanded clay lightweight aggregate source listed in the LA DOTD AML. The lightweight expanded clay shall meet the gradation for the fine aggregate gradation listed in ASTM C 1761, Table 1.

LCG Bridges

- LeBlanc Road
 - Built over Coulee Granges Lateral 1
 - Recall No. 03523
 - Structure No. 032800000030523
 - ICC elements
 - caps, decks, and barrier rails
 - Contractor – Gray Construction Corp
 - Producer – Baldwin Redi-Mix



LCG Bridges

- **West Congress St.**
 - Built over Indian Bayou
 - Recall No. 000171
 - Structure No. 0328000000000
 - ICC elements
 - caps, decks, and barrier rails
 - Contractor – Diamond B Construction Co.
 - Producer – Baldwin Redi-Mix



LCG Bridges

- Facile Rd.
 - Built over Coulee Iles Des Cannes Lateral 10F
 - Recall No. 030029
 - Structure No. 032800000030029
 - ICC elements
 - decks, caps, rails, and approach sl
 - Contractor – L&R Construction
 - Precaster – Waskey
 - Producer – PAI Ready Mix



LCG Bridges

- **Gazette Rd.**
 - Built over Bayou Queue De Tortue
 - Recall No. 000057
 - Structure No. 03280000000005
 - ICC elements
 - caps, decks, barrier rails, and approach slabs
 - Contractor – Diamond B Construction
 - Producer – Baldwin Redi-Mix



LCG Bridges

- **Elias G.**
 - Built over Coulee Ile Des Cannes Lateral 4
 - Recall No. 030003
 - Structure No. 032800000030003
 - ICC elements
 - caps, decks, barrier rails, and approach slabs
 - Contractor – Merrick, LLC
 - Producer – PAI Ready Mix



LCG Bridges

- Lajaunie Rd.
 - Built over Vermillion River
 - Recall No. 030504
 - Structure No. 032800000030504
 - Quad beam bridge
 - ICC elements
 - deck, barrier rails, and approach slabs
 - Contractor – Guinn Construction
 - Producer – Baldwin Redi-Mix



LCG Bridge Takeaways

- 6 bridges over a 3 year period after adoption
- 5 others since then
- 5 different contractors
- 3 different producers
- Specifications are excellent
- Reduced cracking in all elements that contain ICC
- Mitch Wyble – “LCG plans to continue use of ICC because reduced cracking leads to longer service life.”
- Contractors – “Wow, it looks and acts like regular concrete.”

LCG Bridge Takeaways

- Excellent case where research was applied quickly in field conditions
- LCG is now asking why DOTD has not adopted and/or required the use of ICC statewide
- Research was applied and adopted due the following:
 - Open minded engineers, contractors, and producers
 - Communication between research team and LCG team
 - Willingness to change

Acknowledgements

- LCG Contractors, engineers and producers
- Laboratory technicians
 - Greg Tullier, Norris Rosser, Craig Johnson, Austin Gueho
- Research Engineers
 - Patrick Icenogle, Amar Raghavendra,
- Funding
 - FHWA, DOTD, LTRC
- Materials
 - Arcosa Lightweight

Question and Answer

