



# Purdue University School of Civil Engineering

## Internal Curing: Benefits, Current State, & Directions

Prepared by

Jason Weiss, [wjweiss@purdue.edu](mailto:wjweiss@purdue.edu)

Prepared for  
NCC 2015



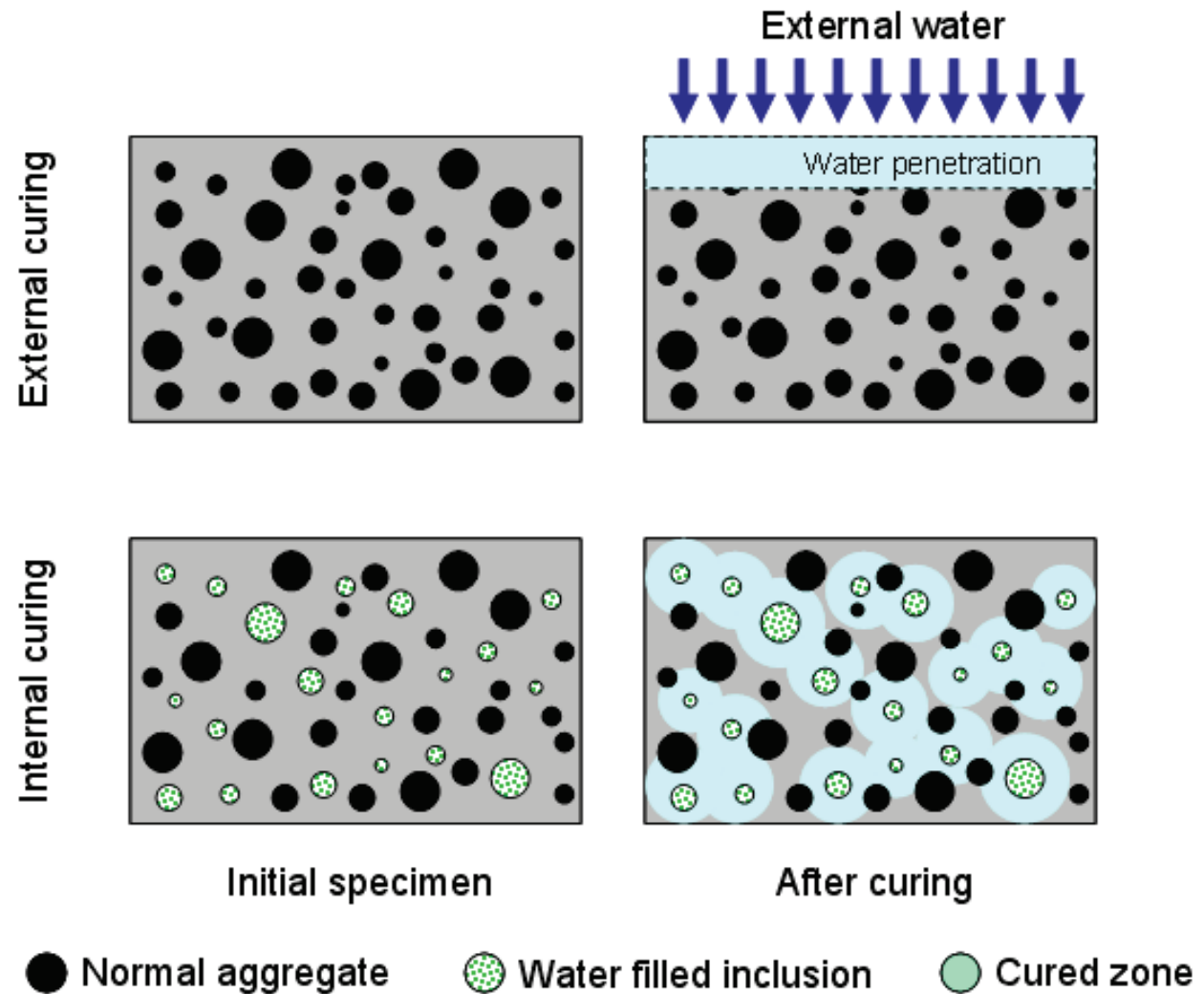
# Internal Curing – The Bullet

- Lots of research on internal curing:
  - Reduce the potential for cracking
  - Reduce chloride ingress and delay corrosion
  - Improve construction robustness (plastic cracking, thermal cracking etc)
  - Simple technology (replace some of fine aggregate with fine lightweight aggregate)





# Internal and External Curing





# Comments on What I Heard this AM

- FLWA better than CLWA (InDOT; CoDOT)
- Technically spacing without too much extra water is the reason for this
- Expanded clay, shale, slate, slag all have shown potential to use (ASTM 1761)
- Value in decks, repairs ... a lot of research is already done and ready
- INDOT, NYDOT – benefits of ICHPC
- CRCP pavement research in progress and we are focused on curl with what we think are some innovative measures



# General IC observations

- Similar or higher strength (increased hyd)
- Reduced Chloride Diffusion (Note the IC will be higher  $C_s$  at surface lower  $D$ )
- Lower modulus ... this is good
- Freeze thaw shows good performance
- **SUBSTANTIAL REDUCTIONS IN CRACKING AND WARPING**
- New testing for aggregate moisture content (Centrifuge) and desorption (simple test)
- Reduced corrosion, reduced corrosion at cracks (This is a game changer)



# 2010 – 2 bridges; 2013 – 4 ICHPC 2014 – 1/2; 2015 1 INDOT; 3 County

Special Thanks

Tommy Nantung

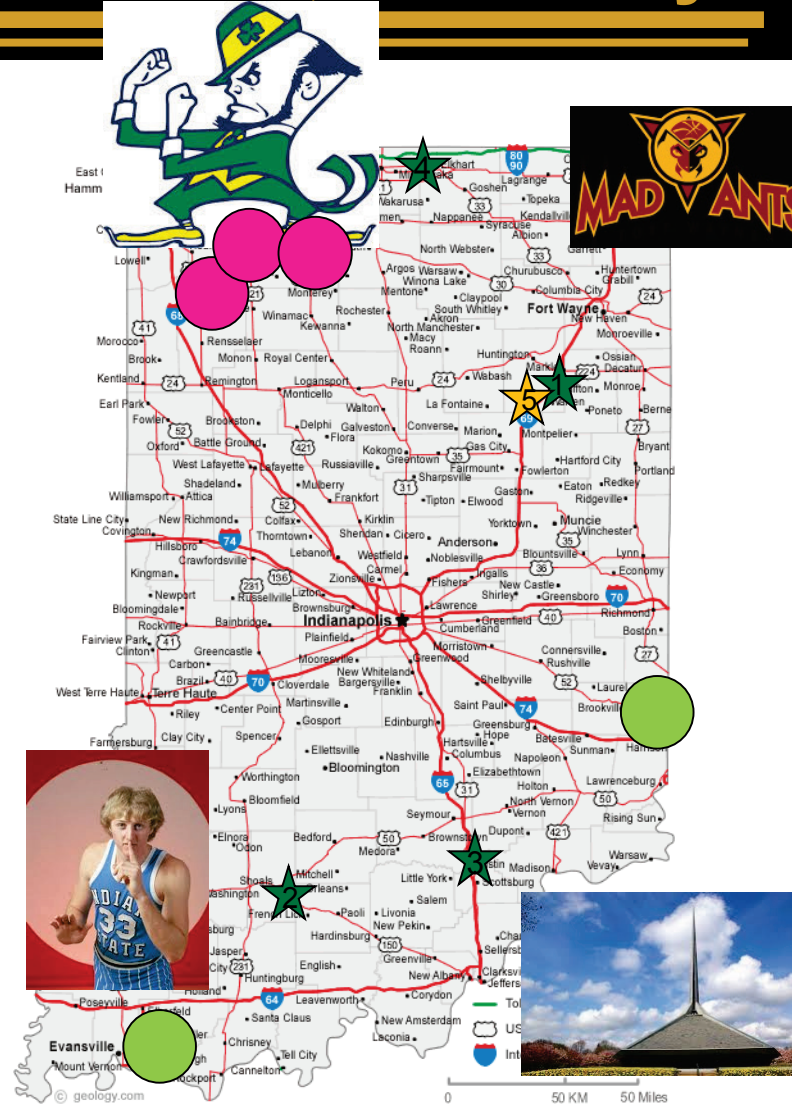
Tony Zander  
and the team

Ron Walker

Contractors

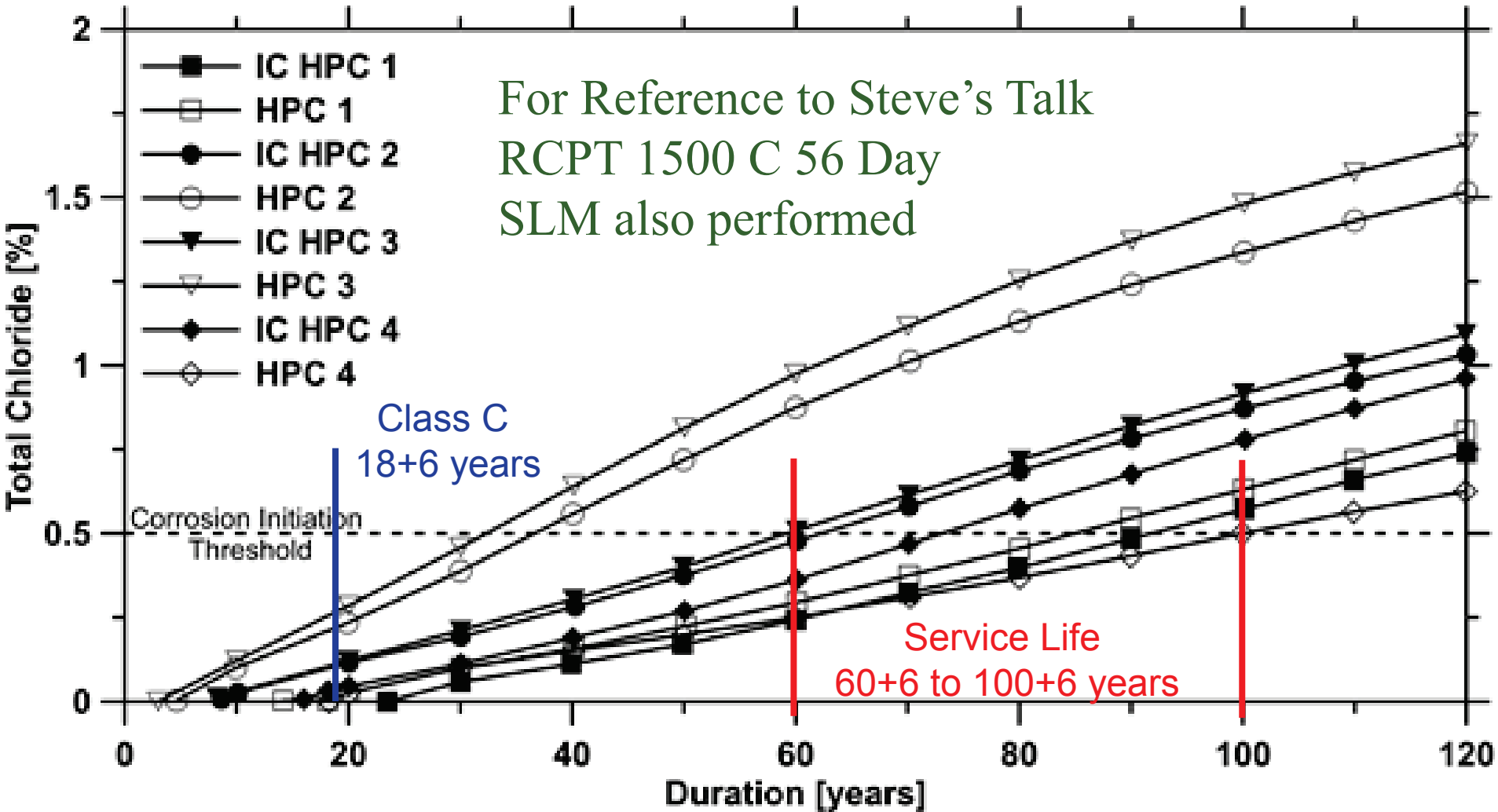
Ready Mix  
Producers

Ryan Hekensiefken, Javier Castro  
Tim Barrett and Albert Miller  
Cameron Wilson, Nate Todd





# Service Life Improvement





# Current State From My Perspective

- Proven Technology – Reduces cracking and ICHPC is ‘golden’ ... ready, set, implement
- Requires training of contractors, inspectors
- Right now specification is the ‘Cadillac’  
There are also ‘Chevettes’ as well (recipe)
- Centrifuge test provides moisture/spreadsheets
- Glad to help ‘implement’ and track
- **ESCSI training modules on line; papers**
- **May benefit from the ‘summary book’ on how to**
- ICHPC ... really beneficial 5% gets you 300%
- SAP may be coming .... Will be interesting
- **Would like to develop a system to track**