







- Thought process is that the base mixture (0.42 w/c) can be modified to obtain similar early age strengths to satisfy contractor concerns
- As a result lower water to cement ratios will be tested with 1:1 FA volume replacement
- However we are questioning the true need for many of these high early strength requirements











- w/c 0.42 and w/c -0.3 40% ash have equivalent 1 day strength but have a 40% reduction in CO<sub>2</sub> per yd<sup>3</sup> of concrete
- w/c 0.42 and w/c -0.3 60% ash have equivalent
   7 day strength but have a 60% reduction in CO<sub>2</sub> per yd<sup>3</sup> of concrete
- Does not even consider improvements in other properties like reduced transport











P	0%	20%	40%	60%	80%
0.45		x	х	x	x
0.42			x	х	x
0.36				x	x
0.30					1











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w/cm





**Dual Ring Test** Both expansion and shrinkage stresses are assessed in restrained conditions Temperature control through water bath and insulation chamber Residual stress developed over time reduces reserved stress or cracking capacity Less residual stress developed in internally cured fly ash samples





## Summary Examining HVFA mixtures to reduce CO<sub>2</sub> per cubic yard of concrete Concerns over low strength addressed with low w/c to more efficiently use the cement Higher internal RH in fly ash systems. Fly ash systems have less <u>initial</u> autogenous shrinkage but this increases at <u>later</u> ages Internal curing can reduce autogenous shrinkage and cracking

• Additional IC benefits due to reduced transport

ACI WEB SESSIONS

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## Acknowledgment

- Federal Highway Administration, FHWA.
- Indiana Department of Transportation, INDOT.
- Expanded Shale, Clay and Slate Institute, ESCSI.
- Pankow Laboratory at Purdue University.