Second International Interactive Symposium on Ultra-High Performance Concrete
Extended Abstract (no paper submission)

A Comparison of Existing Analytical Methods to Predict the Flexural Capacity of Ultra High Performance Concrete (UHPC) Beams

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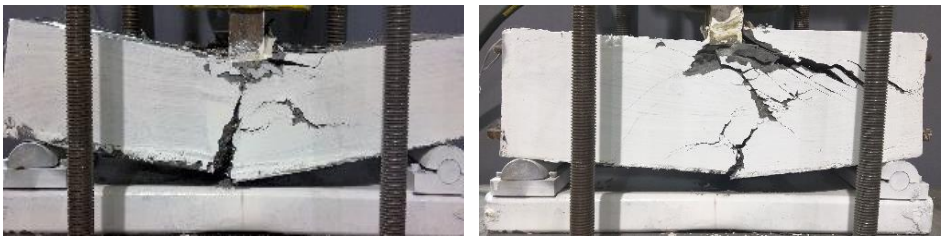
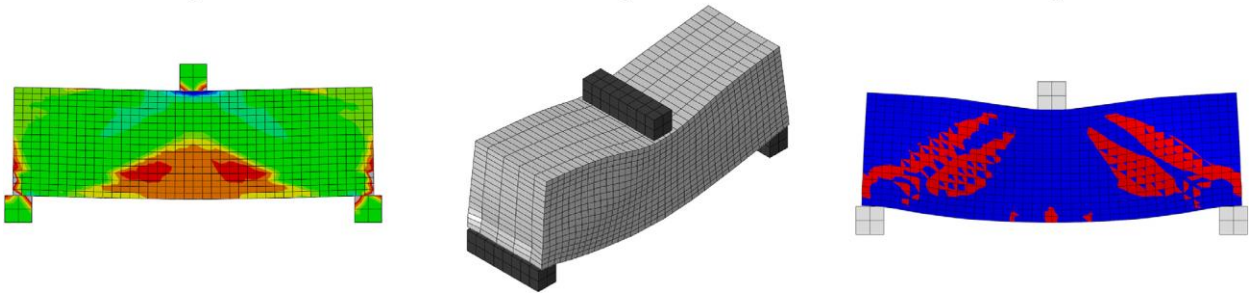
Extended Abstract

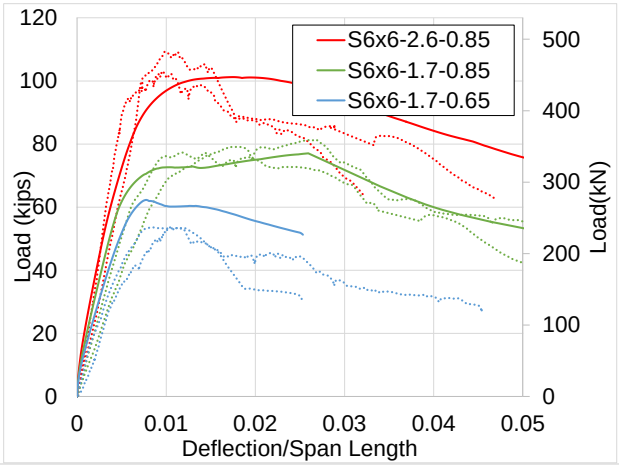
Many researchers have performed experimental studies on the structural behavior of the UHPC beams to establish a reliable analytical method to calculate the flexural capacity of the section. Most of these studies were performed through limited specimens due to the high cost of UHPC. The objective of this research is to compare the accuracy of well-known existing methods to calculate the moment capacity of a reinforced UHPC beam through a parametric study. To that aim, several small-scale beams were constructed and tested to evaluate the flexural behavior and ultimate moment capacity of the UHPC beams. The performance of the tested specimens is discussed regarding the moment capacity, load-deflection curves, crack development and the modes of failure.

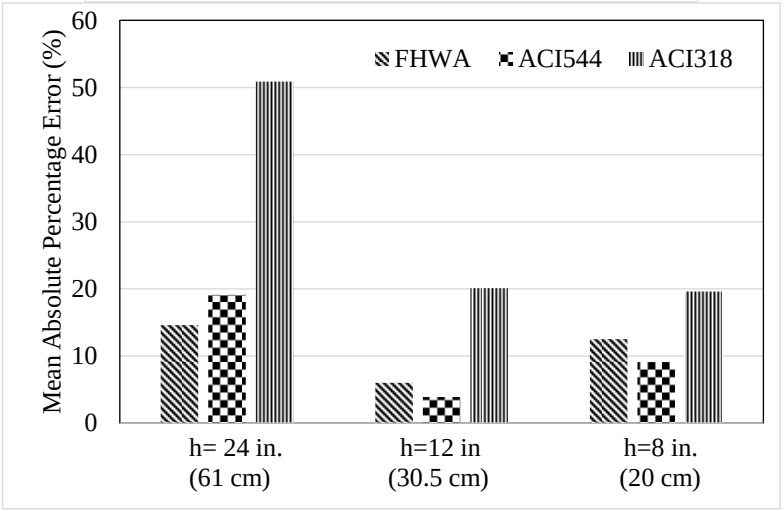
The obtained results through the experiments were, then, used to validate the Finite Element (FE) model. Comparing the numerical and experimental results indicates that generally, the proposed numerical model can predict the structural behavior of the UHPC beams reasonably. Hence, the validated FE model was employed as a reference point to evaluate the existing analytical approaches to calculate moment capacity of UHPC beams. A series of large-scale beams with different geometries and reinforcing details were numerically simulated, and the results were compared with the results obtained through the analytical methods. Comparing the results of these methods showed that ACI544 and FHWA methods can predict the ultimate moment capacity of UHPC beams with a maximum error of 12%. Furthermore, using ACI318, suggested for normal strength concrete, leads to overdesign results.



a) b) c)




S6x6-2.6-0.85
S6x6-1.7-0.85
S6x6-1.7-0.65
Load (kips)
Load(kN)
Deflection/Span Length
0
20
40
60
80
100
120
0
100
200
300
400
500
0
0.01
0.02
0.03
0.04
0.05


FHWA
ACI544
ACI318
Mean Absolute Percentage Error (%)
0
10
20
30
40
50
60
h= 24 in.
(61 cm)
h=12 in
(30.5 cm)
h=8 in.
(20 cm)