Interaction Diagrams for UHPC Columns Compared to Conventional Concrete

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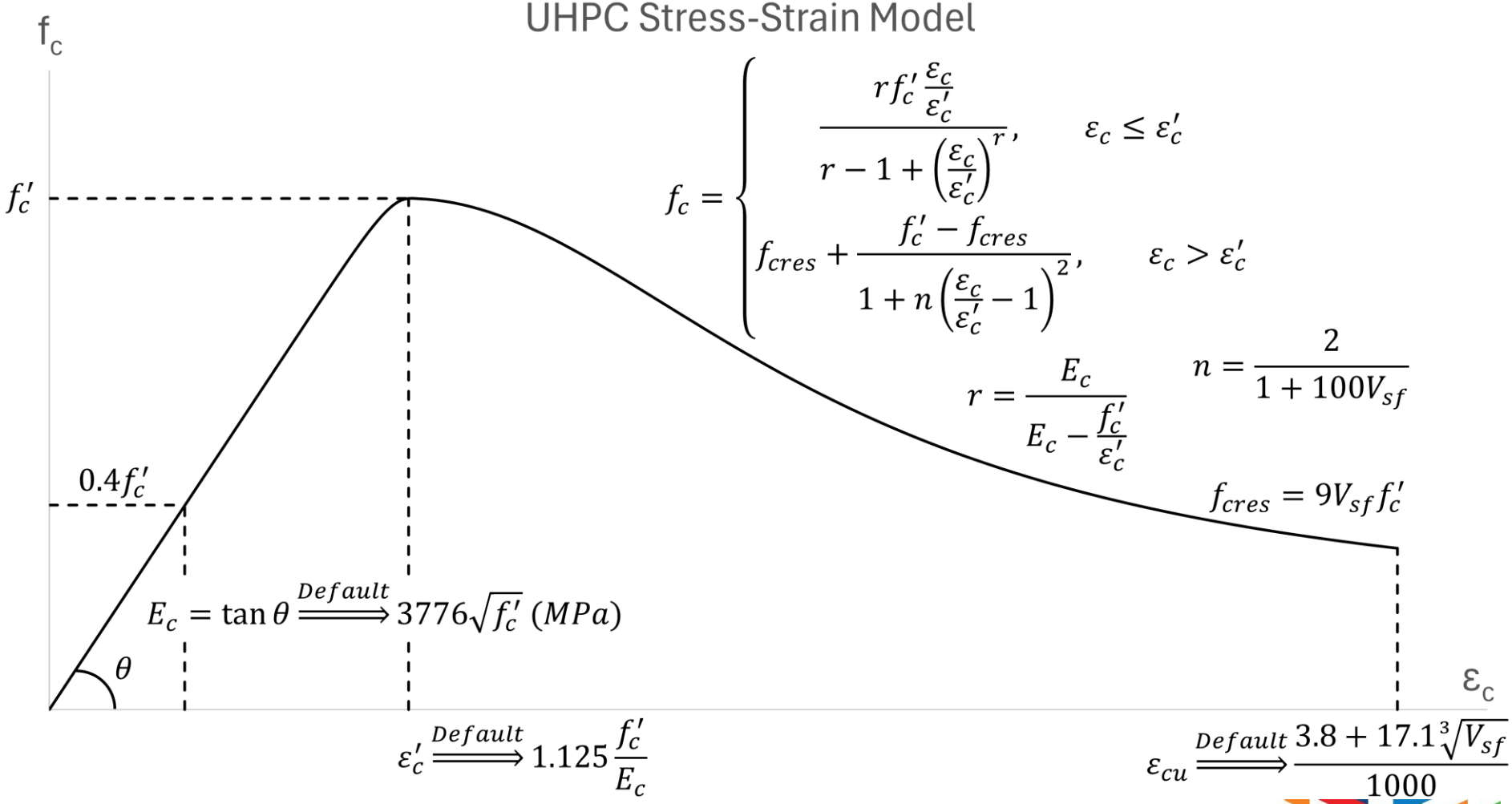
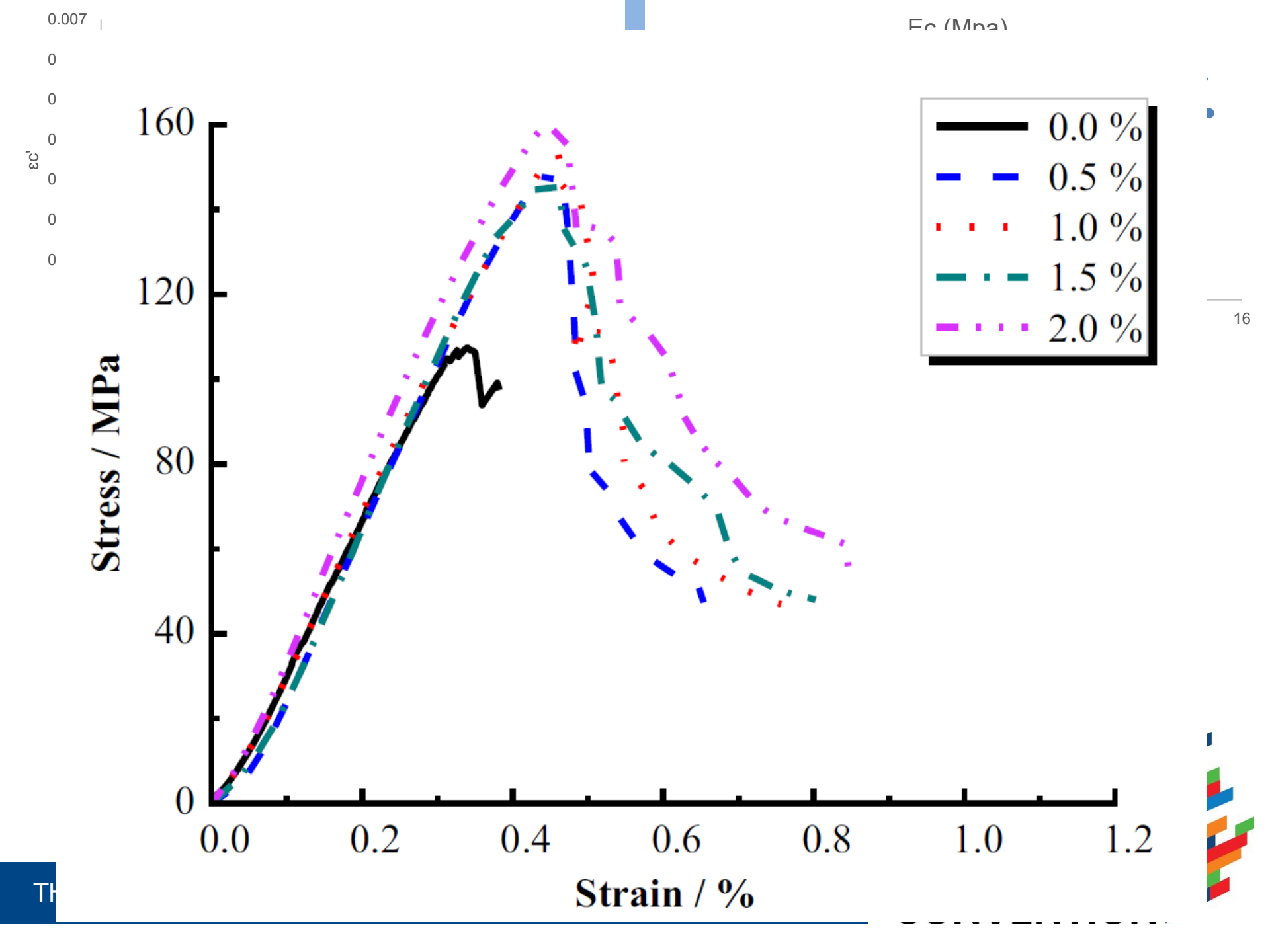
Outline

- Material Model
- Mechanical Properties of UHPC
- Interaction Diagrams for UHPC
- Strength Reduction Factor
- Extreme Concrete Fiber
- Comparison with Experiments
- UHPC vs Conventional Concrete
- UHPC Column Software Package

UHPC Stress-Strain Model

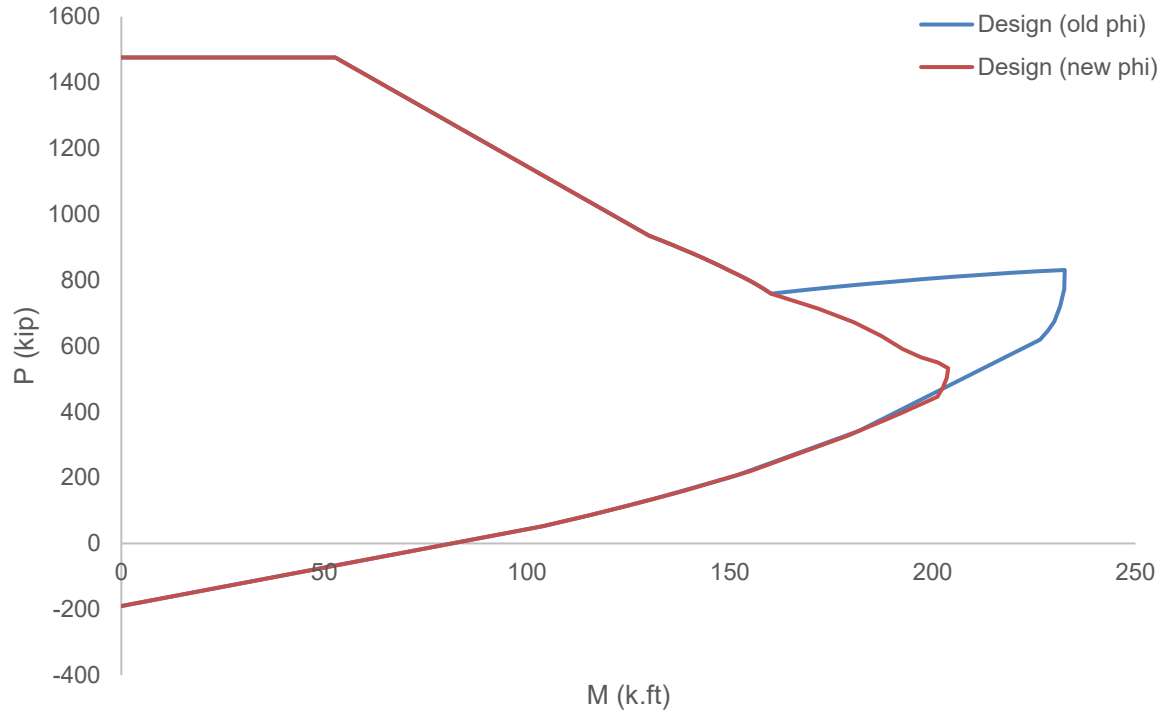


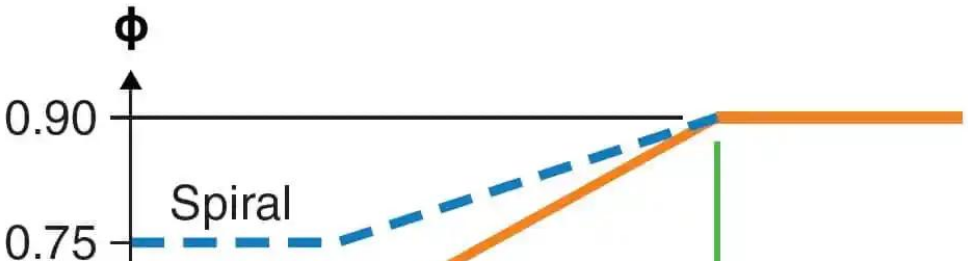

0.007
0
0
0
0
0
0
εc'
Ec (Mpa)
160
120
80
40
0
Stress / MPa
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Strain / %
0.0 %
0.5 %
1.0 %
1.5 %
2.0 %

Biaxial Interaction Diagrams

- Similar procedures to conventional concrete with fe

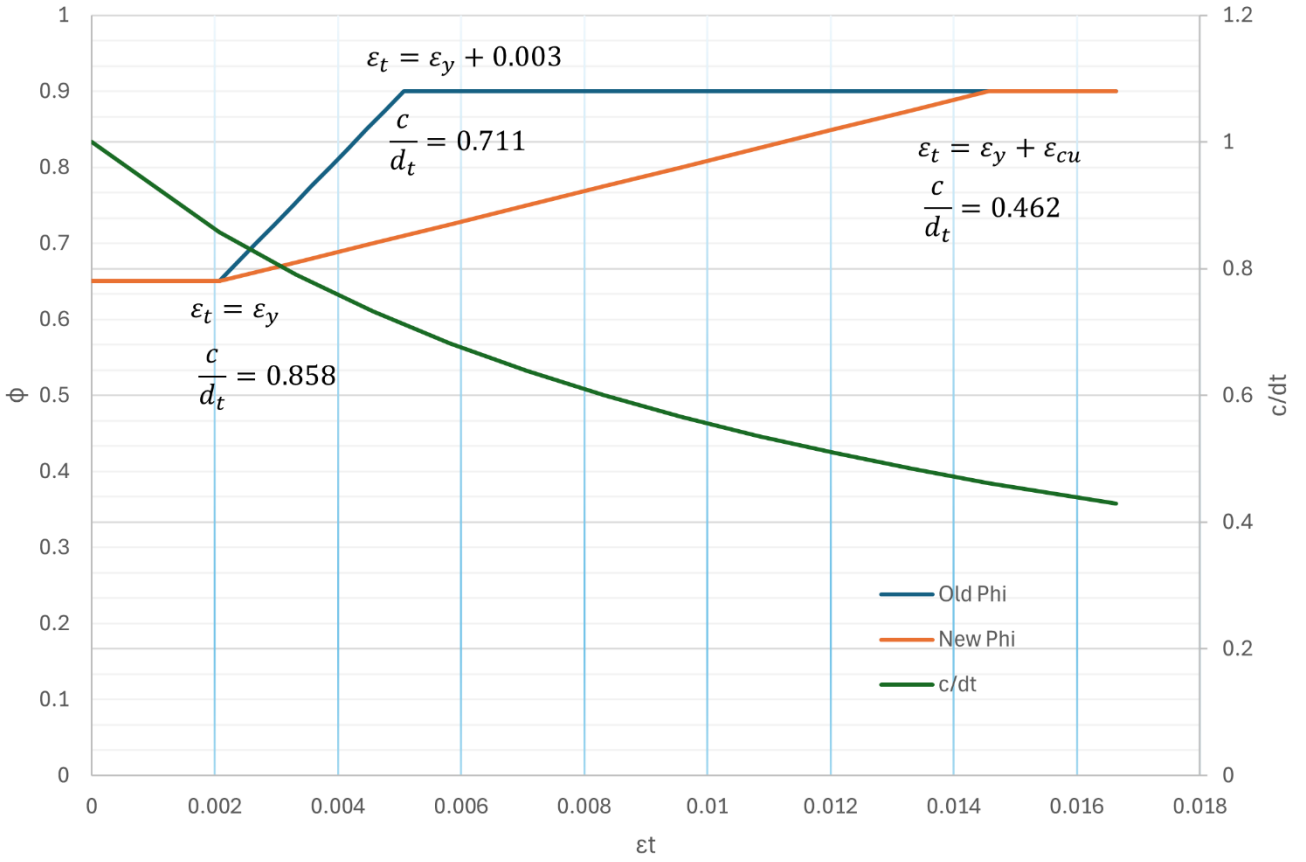
Strength Reduction Factor





n Factor

Compressior
controlled —



0.002)(50)

$_t$ - 0.002)(250/3)

Tension
controlled

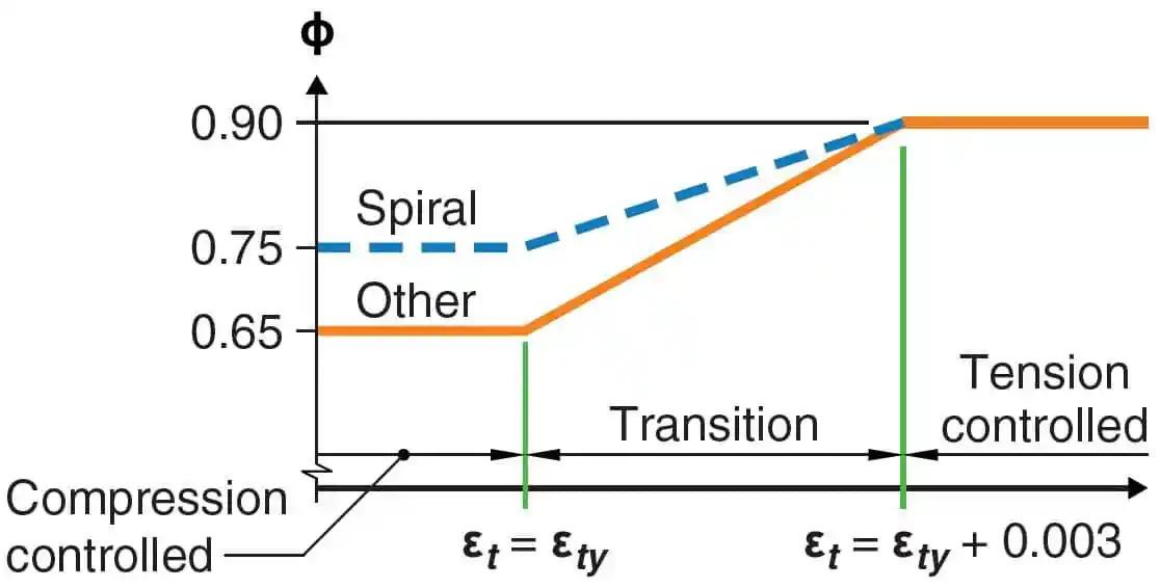
005

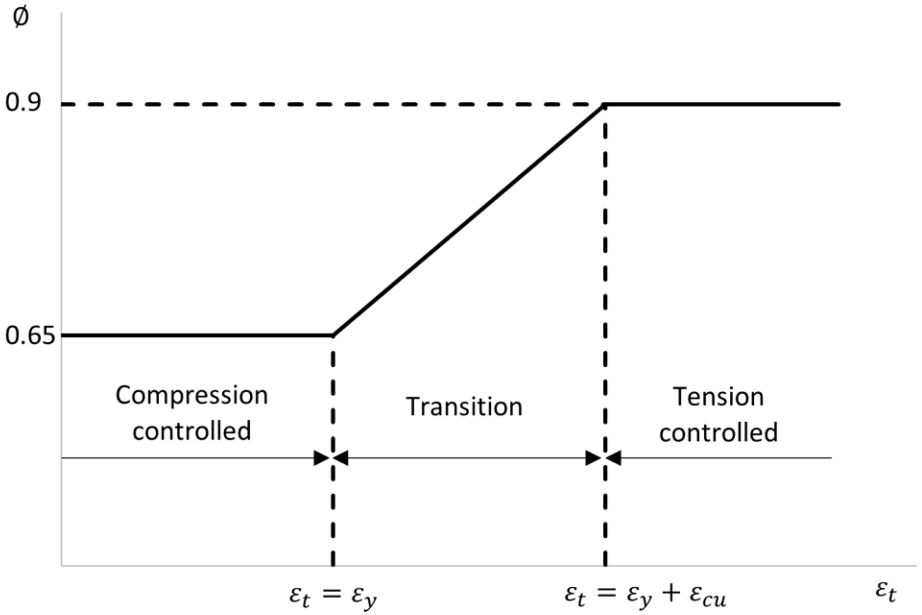
375

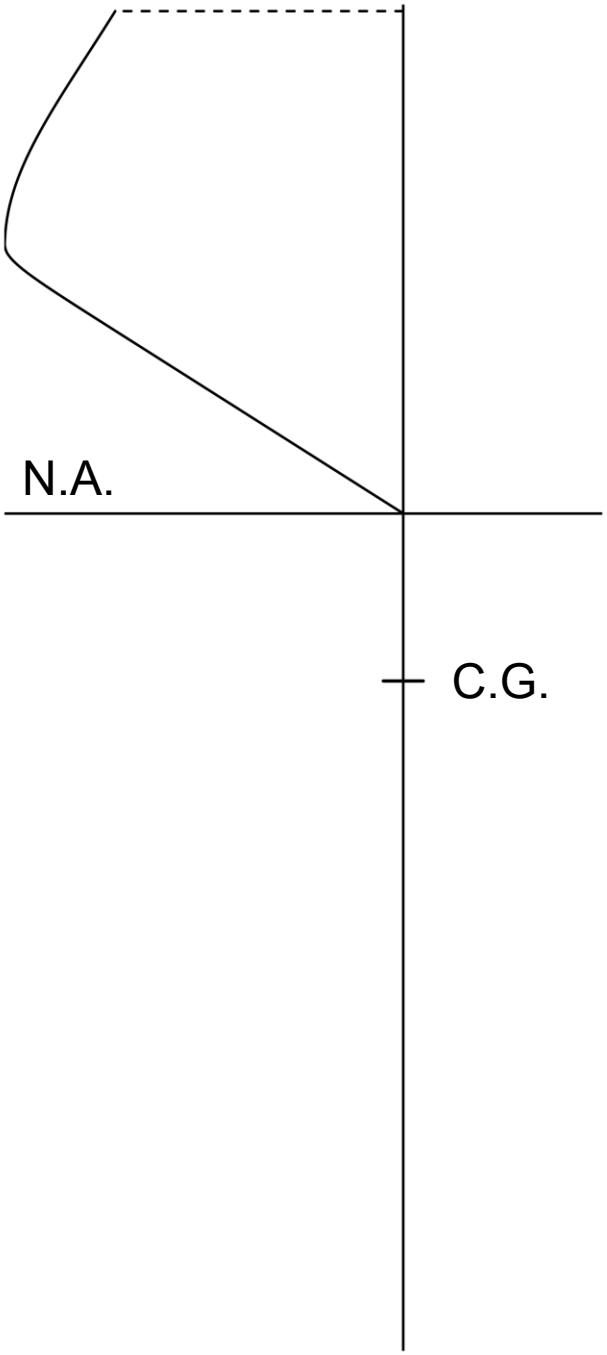
Interpolation on c/d_t: Spiral $\phi = 0.75 + 0.15[(1/c/d_t) - (5/3)]$
Other $\phi = 0.65 + 0.25[(1/c/d_t) - (5/3)]$

Fig. R9.3.2—Variation of ϕ with net tensile strain in extreme tension steel, ε_t, and c/d_t for Grade 420 reinforcement and for prestressing steel.

n Factor


ϕ
0.90
0.75
0.65
Spiral
Other
Transition
Tension controlled
Compression controlled
$\varepsilon_t = \varepsilon_{ty}$
$\varepsilon_t = \varepsilon_{ty} + 0.003$


ø
0.9
0.65
Compression controlled
Transition
Tension controlled
$\varepsilon_t = \varepsilon_y$
$\varepsilon_t = \varepsilon_y + \varepsilon_{cu}$
ε_t

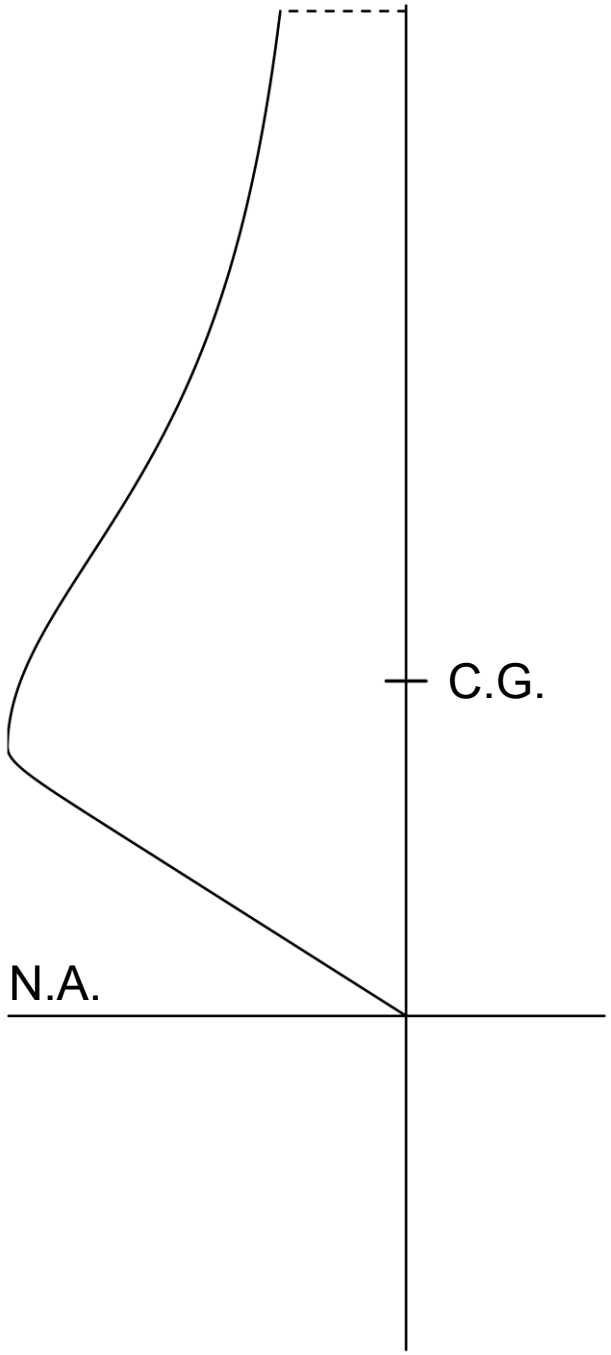


erac

0.005

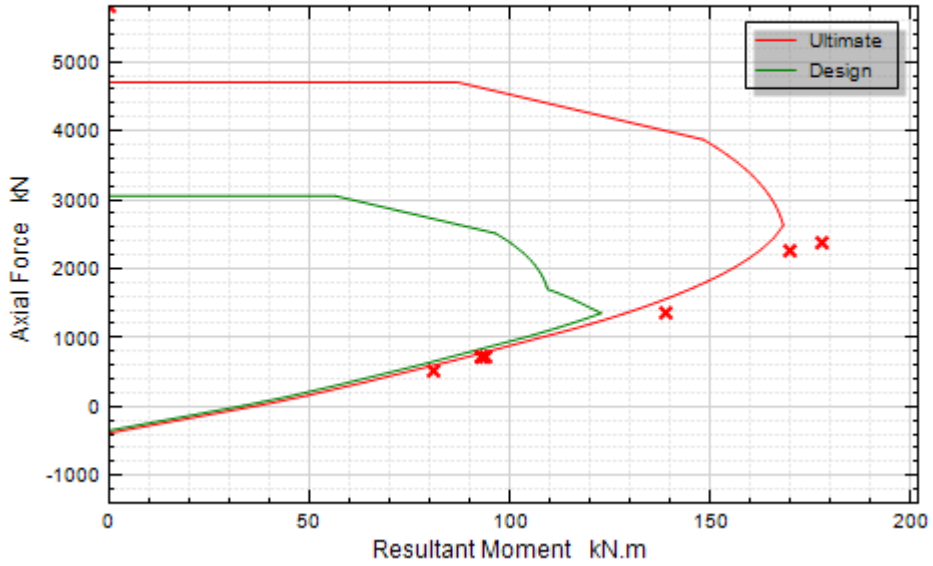
500

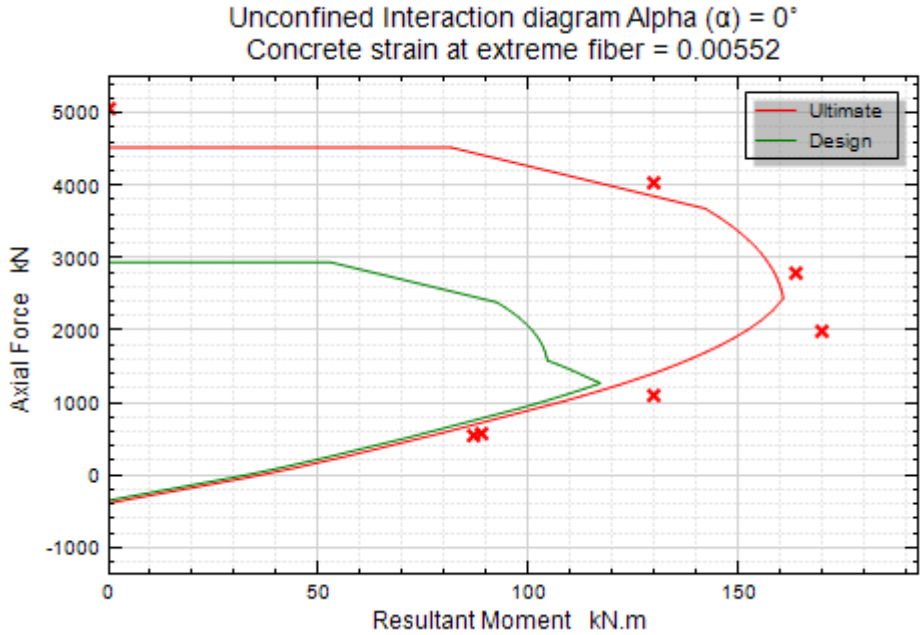
M (k.ft)

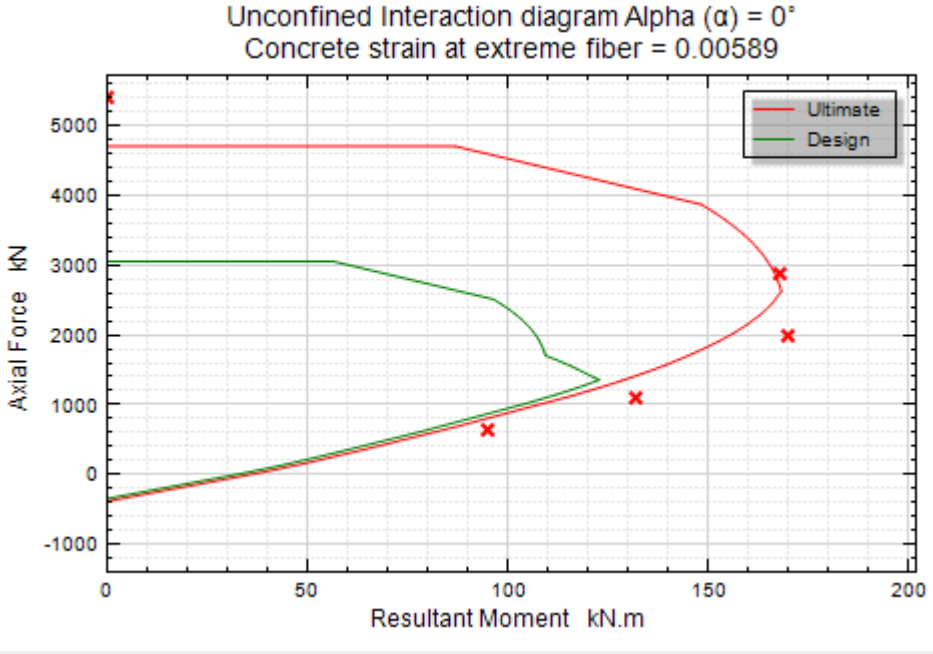


THE

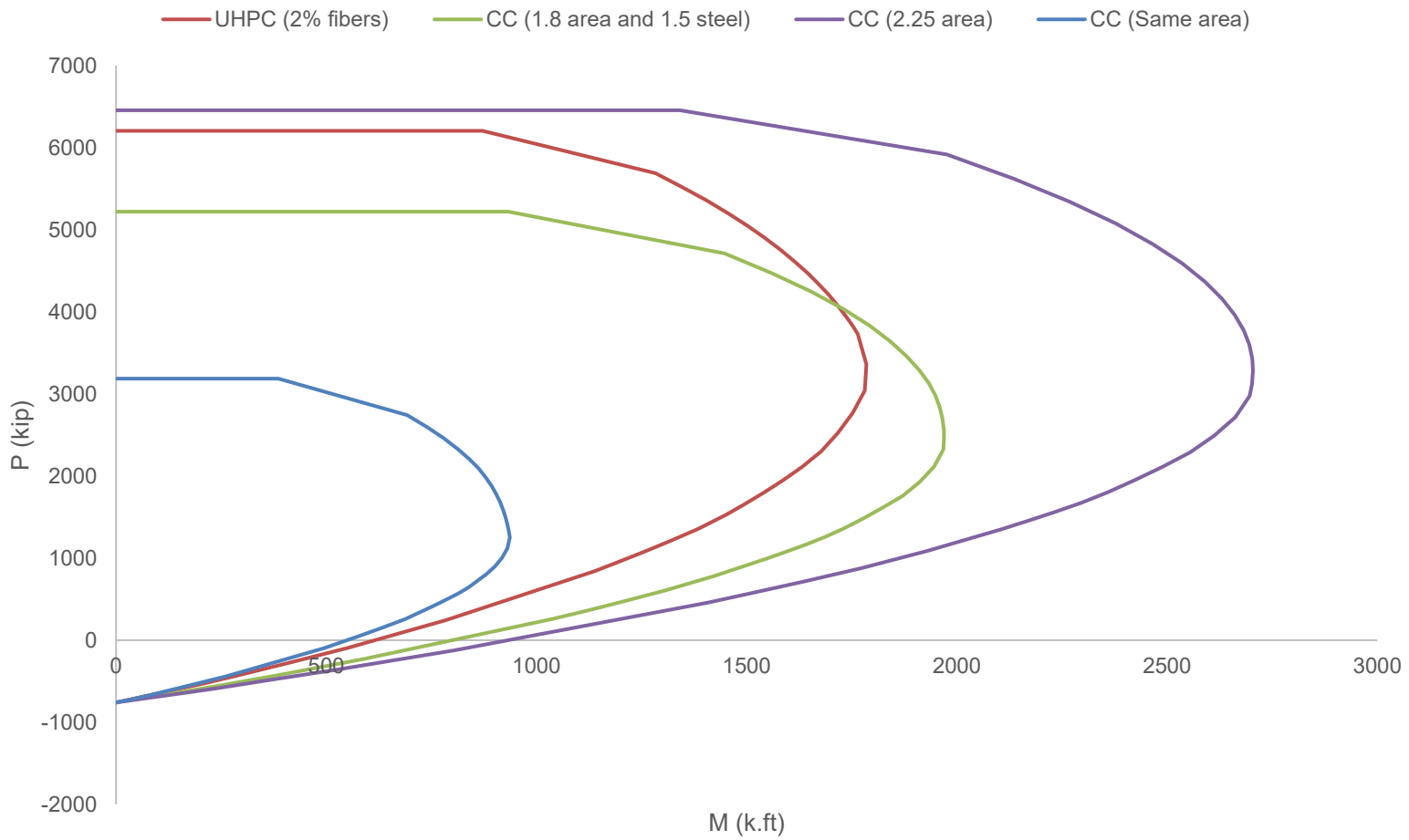
NG CONCR

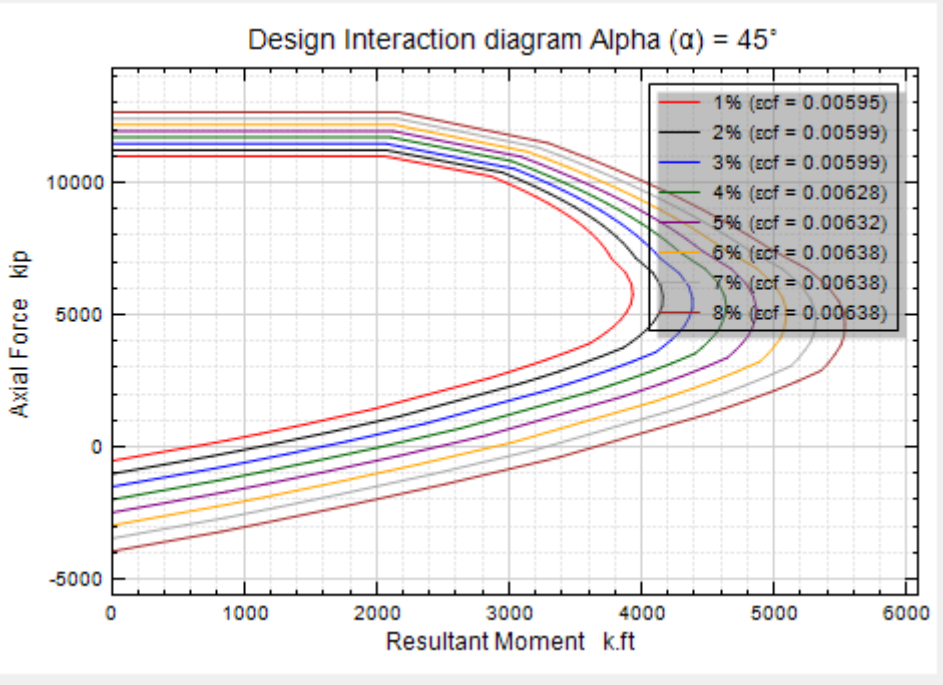

Unconfined Interaction diagram Alpha (α) = 0°
Concrete strain at extreme fiber = 0.00589
Ultimate
Design
Axial Force kN
Resultant Moment kN.m
5000
4000
3000
2000
1000
0
-1000
0
50
100
150
200


Unconfined Interaction diagram Alpha (α) = 0°
Concrete strain at extreme fiber = 0.00552
Ultimate
Design
Axial Force kN
Resultant Moment kN.m
5000
4000
3000
2000
1000
0
-1000
0
50
100
150

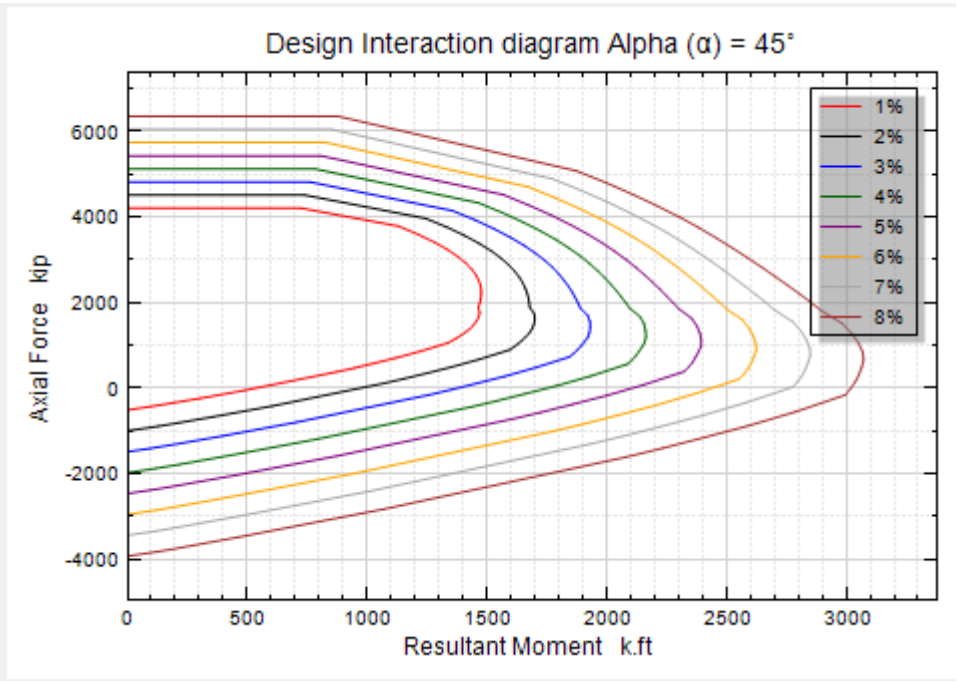

Unconfined Interaction diagram Alpha (α) = 0°
Concrete strain at extreme fiber = 0.00589
Ultimate
Design
Axial Force kN
Resultant Moment kN.m
5000
4000
3000
2000
1000
0
-1000
0
50
100
150
200

UHPC vs Conventional Concrete





tional Concrete



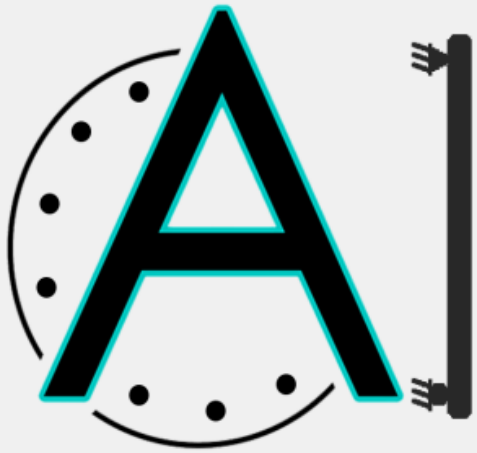
UHPC Column Analysis

File

Start

Clear

Exit



UHPC COLUMN ANALYSIS

AEDA LLC
Advanced Engineering Design Apps

CONVENTION